Nominal and Clausal Event Predicates

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1. Introduction

Davidson (1967) has proposed that PPs like *in the morning* as in (1)a. and adverbs like *slowly* as in (1)b. are to be analysed as predicates of events. These events are primitive entities and occupy an additional argument place of the verb.

(1)a. John ate in the morning.
    b. John ate slowly.

On this account, (1)a. and (1)b. are analysed as (2)a. and (2)b., respectively.

(2)a. $\exists e$ (eat(e, John) & in(e, the morning) & PAST(e))
    b. $\exists e$ (eat(e, John) & slowly(e) & PAST(e))

In this paper, I argue that not only PPs and adverbs can act as predicates of the event argument of the verb, but certain NPs and certain clauses can, as well. I will give syntactic and semantic arguments that NPs that are cognate objects and clauses of (at least some) nonbridge verbs are optional predicates of the event argument of the verb. With respect to clauses, I will argue that for independent reasons the meaning of both independent and embedded sentences can be construed as event-properties, namely as properties of intentional events.

2. Cognate Objects as Event Predicates

In the following, I will discuss the properties of 'true' cognate objects, as exemplified in (3). They differ in the relevant properties from the cognate objects as in (4), which behave as arguments of the verb rather than as cognate objects in the narrow sense (cf. Jones 1988).

(3) a. John died a painful death.
    b. John screamed a terrifying scream.
(4) a. Mary danced this dance very often.
    b. Mary said these words.

I claim that the cognate objects in (3) are optional predicates of the event argument of the verb. On this account, (3)a. is semantically represented as in (3').

(3') $\exists e$ (die(e, John) & painful death(e) & PAST(e))

Two types of evidence support this analysis. Cognate objects exhibit characteristic properties of adjuncts on the one hand and characteristic properties of predicates on the other hand.
    As adjuncts, cognate objects are in general optional, as the correlates of (3) in (5) show.

(5) a. John died.

     b. John screamed.

   Furthermore, cognate objects disallow passivization (noted in Jones 1988).

(6)a. *A painful death was died by John.
    b. *A terrifying scream was screamed by John.

   Finally, cognate objects do not affect the *have/be* alternation in a language such as German. Cognate objects in German bear accusative Case. Direct objects in German require the auxiliary have. Therefore if cognate objects were arguments, they would require the auxiliary *have* rather than *be* . But, as (7) shows, the presence of cognate objects allows auxiliary *be* if *be* is the auxiliary selected by the verb, and it is incompatible with auxiliary *have* if *have* is not selected by the verb.

(7)a. Hans ist/*hat gestorben.
       'John   is/ has died.'
    b. Hans ist/*hat einen qualvollen Tod gestorben.
       'John is a painful   death died.'
    c. Maria ist/*hat gesprungen.
       'Mary is/ has jumped.'
    d. Maria ist/*hat einen weiten Sprung gesprungen.
       'Mary is/has   a   wide   jump   jumped.'
    e. Maria hat/*ist geweint.
       'Mary has/is wept.'
    f. Maria hat/*ist ein paar Traenen geweint.
       'Mary has/is a few   tears   wept.'

These data are immediately explained if cognate objects are taken as adjuncts rather than arguments of the verb.
   The predicative status of cognate objects is most notably shown by the fact that cognate objects exhibit the indefiniteness effect.

(8)a.*A death occurred today in this clinic. It was John who died that death.
    b.*John screamed this scream/every scream we heard today.

   The predicative status of cognate objects might also be related to the impossibility of topicalization. Notice that certain adverbial event predicates such as *slowly* and obligatory controlled clauses cannot be topicalized either (the latter has been noted by Safir (1986), Footnote 3, chap.3.).

(9)a. *A painful death, John died t.
    b. *A shrill scream, John screamed t.
     c. This man, John saw t today.
(10)a. *Slowly, John ate the cake.
     b. *Beautifully, Mary sang the song
(11)a. *PRO to go to school, John intends.
     b. *PRO to study Linguistics, John persuaded Mary.

Syntactic predication (Williams 1980) requires that subjects c-command their predicate. The data in (9) and (11) might indicate that in English the predication relation (in the sense of Williams 1980) must hold even after topicalization (though not after wh-movement). Thus, *John* does not c-command PRO *to go to school* in (11)a.

But how can predication explain (10)? What is the subject of an adverbial event predicate or a cognate object? From the point of view of Davidsonian event-semantics the answer is obvious. If adverbial event predicates or cognate objects are predicated over the event argument of the verb, then the verb is the subject in the relevant semantic sense, since the event argument is not expressed syntactically by any other constituent. Therefore in order to satisfy conditions on predication, the verb must c-command an adverbial event predicate and the cognate object. Since *died* in (10)a. does not c-command *a painful death ,* (10)a. is ruled out by predication theory.

Note that certain adverbials that have been taken as event predicates do not generally have to obey syntactic conditions of predication. These adverbials can be freely preposed, as shown in (12).

(12)a. In the kitchen, John ate.
     b. When John was tired, he ate.

However, there is evidence that these adverbials are in fact not event predicates , but rather predicates of situations, where situations are described by the entire sentence, whereas events are only designated by the verb. Consider (13).

(13)a. On a stormy day, everybody came to work late.
     b. Everybody came to work late on a stormy day.
     c. When it started raining everybody rushed home.
     d. Everybody rushed home when it started raining.

In (13)a. on *a stormy day* has wider scope than *everybody*, which in turn has wider scope than the event quantifier of *come*. Thus on a stormy day cannot be a modifier of the event, but rather of the entire situation in which everybody was involved in an event of coming late. Only in (13)b., *on a stormy day can* be taken as a modifier of the event, and also in this case conditions on predication are satisfied. A similar contrast is found in (13)c. and (13)d.

Notice that predication theory may - for the same reasons - rule out lack of passivization with cognate objects, as well. Passivization is impossible also with predicative NPs.

(14) A man was become/remained by John.

Now it appears that like the event predicates mentioned, certain clauses must stand in the syntactic predication relation to the verb. These types of clauses are the topic of the next section.

3. Clauses as Event Predicates

3.1. Sentence Meanings Construed as Event Properties

Before I discuss the types of clauses that I have in mind, I would like to motivate a construal of sentence meanings as event predicates and elaborate this for simple cases.

The leading idea with this construal is that sentences do not denote absolute propositions (such as sets of possible worlds or situations or functions from contexts into such sets), but rather are in an essential way related to an event, namely either a given event of uttering the sentence or - in the case of embedded sentences - the event described by the matrix verb.[1]

The main empirical motivations for construing sentence meanings as event properties are indexicality and intensionality phenomena. With respect to independent sentences, most indexical aspects (in a broad sense) of a sentence can be taken to involve a relation to the utterance of the sentence in a specific situation. With respect to embedded sentences, indexical aspects are to an extent not dependent on the utterance of the entire sentence, but rather on the event described by the matrix verb. I will illustrate the dependence of indexical aspects on an event (an utterance or a described event) first with independent sentences. Consider (15).

(15) The ghost disappeared.

Suppose u is an utterance of (15). Then in order to find out whether (15) is true or false, we must know the following. First, we must know what the speaker of u refers to with *the ghost*. Second, we must know the time of u. Third, we must know which domain of events (for instance at a specific time interval) the speaker of u considers for there being an event of disappearing of the ghost. Only if these indexical aspects of (15) are fixed that way, can we find out whether (15) is true or false.

   If we take these indexical aspects of (15) as properties of utterances, then we can construe the meaning of (15) as a whole as a property of utterances, namely in the following way. If a given utterance u has the utterance property expressed by (15), then (15) is true (with respect to u).

   Informally speaking, (15) is true of an utterance u if roughly the following conditions hold.

(16) The speaker of u refers with the utterance of *the ghost* to exactly one
     thing x that belongs to the set of discourse referents of u and is a ghost,
     and there is an event e in the set of discourse events of u previous to u
     such that e is an event of disappearing of x.

   Let me symbolize the notions that occur in (16) as follows. ag(u) is the speaker of u, u(K) the part of u that is the utterance of K (where K is a constituent).[2] Ref is the relation of speaker reference such that Ref(ag(u), u(K), x) holds if ag(u) refers with u(K) to x. UD(u) (from 'universe of discourse') is the set of discourse referents relevant at u. Finally < is temporal precedence (a relation that may hold between events).

   Now we can symbolize the meaning of (15) as given in (16) in the following way.

(17) λ u[$\exists$!x (Ref(ag(u), u(*the ghost*), x) & x $\in$ UD(u) & ghost(x)) & for all x
       (Ref(ag(u), u(*the ghost*), x) --> $\exists$e (e $\in$ UD(u) & disappear(e, x) & e<u)]

(17) is the property which holds of an utterance u iff there is exactly one thing relevant at u that the speaker of u refers to with uttering the ghost, and for all x the speaker refers to with uttering the ghost there is a relevant event e (which is for instance relevant at a given time) previous to u such that e is a disappearing of x.

   Now consider (15) as an embedded sentence, namely as the clausal complement of *say* in (18).

(18) John said that the ghost disapppeared.

Think of (18) as being uttered in a situation in which John uttered the ghost died and believed - contrary to the speaker's belief - that there are ghosts and that a particular ghost had disappeared previous to John's coming to believe this. In this situation (18) is true.

   In this reading, apparently the relevant indexical aspects of (15) do not depend on the utterance of the entire sentence (18), but rather on the utterance of John that is described by (18). John refers with uttering something like *the ghost* (possibly in a language other than English) to exactly one ghost in the set of discourse referents dependent on u and there is an event of dying of the ghost among the discourse referents dependent on John's utterance and this event is previous to John's utterance. The set of discourse referents dependent on John's utterance may contain entities only John, but not the speaker uttering (18) has committed himself to (see below).

   The dependencies of indexical aspects of the clauses in (18) on the decribed utterance rather than the utterance of the entire sentence can be accounted for in a rather simple fashion given the analysis in (17). We can take the clause in (18) to have exactly the same meaning as in (17) but now the content of the clause is not related to a potential utterance of (18), but rather to the described utterance of John. Formally this means, the event predicate given in (17) is predicated over an act of saying by John, which is the event argument of *say* .

So abbreviating the event predicate in (17) with P, (18) can schematically be represented as in (19).

(19) λ u[∃ !x (Ref(ag(u), u(John), x) & x ∈ UD(u) & x is called John) & for all x
       (Ref(ag(u), u(John), x) --> ∃e (e ∈ UD(u) & say(e, x, P) & e < u))]

In order to get predication of the clause over the described event, we will assume the following lexical postulate for the verb say.

(20) <u>Lexical Postulate for *say*</u>
       say(e, x, P) iff e is an utterance by x and P(e)

If we apply P to e, the utterance of John as described in (18), we get the following proposition.

(21) ∃ !x (Ref(ag(u), u(*the ghost*), x) & x ∈ UD(u) & ghost(u) & for all x
       (Ref(ag(u), u(*the ghost*), x) --> ∃ e (e ∈ UD(u) & disappear(e, x) & e < u)

That is, the speaker of u, John, refers with the utterance of something similar in meaning to *the ghost* to exactly one ghost in the set of discourse referents dependent on John's utterance (the event argument of say) and there is among the discourse referents of John's utterance an event of dying previous to the utterance involving the ghost John refers to.
   We have construed the set of discourse referents involved in (18) as a function of John's utterance. This is a way to account for phenomena of intensionality. The set of discourse referents depending on John's utterance may contain entities that only John conceives of, but not the speaker. So in order for (18) to be true, the speaker need not believe in ghosts. Thus, we may tentatively characterize sets of discourse referents as functions of events in the following way.

(22) UD(u) = the set of (actual or nonactual) entities which ag(u) conceives of and which
       are relevant for ag(u) at u.

Furthermore, we have to interpret u(K) for a constituent K not strictly as the utterance of K, but as the utterance of something similar in meaning to K. Thus we can give the following characterization of u(K).[3]

(23) u(K) = the part of u that is similar in meaning to K.

   This analysis accounts for other propositional attitude verbs, as well. Consider the examples in (24) and suppose *the ghost* is interpreted de dicto, rather than de re.

(24) a. John believes that the ghost disappeared.
       b. John imagines that the ghost disappeared.
       c. John sees that the ghost disappeared.

In (24)a. the set of discourse referents depends on a state of believing, in (22)b. on an act of imagining and in (24)c. on a state of seeing. Like *say, believe, imagine* and *see* will denote three-place relations between events, agents and event properties, and the same postulate as for say given in (20) will hold of these verbs. We only have to generalize some notions that occur in (17). ag(u) is more generally the agent or intentional subject of the mental state u, u(K) is interpreted as the part of such a state that corresponds in meaning to K. Tense and reference, as well, are related to mental states as described by the verbs in (24).
   Not all verbs denote three-place relations between events, agents, and event properties, which express the content of the event. As might be expected from the event-based theory of clauses,

verbs may take *that* -clauses which do not denote an argument of the verb, but rather act as modifier of the event, specifying that the event has a certain content.

3.2. Clauses as Adjuncts

As has often been noted (e.g. Stowell 1981), certain *that* -clauses exhibit the properties of adjuncts, rather than arguments. These clauses include clausal complements of certain manner of speaking verbs such as *sigh* and *scream.*

    In the event-based semantics of clauses, the semantics of adjunct clauses is straightforwardly accounted for. For instance, (23) can simply be analysed as in (26) (in the relevant respects).

(26) John sighed that the ghost died.
(27)   ∃ e (sigh(e, John) & PAST(e) & P(e))

In the following I will list some of the indications for the adjunct status of these clauses.
    First, clausal complements of *sigh* and *scream* do not allow wh extraction, as observed in Erteshik-Shir(1977) (where these verbs are therefore labeled 'nonbridge verbs').

(28)a. *What did John sigh that Mary did t?
     b. *What did Mary scream that Bill discovered t?
(29) What did John say/believe/imagine/see that Mary saw t?

Impossibility of extraction from adjunct clauses as in (28) follows from recent generative syntactic theory (Chomsky 1986). Adjunct clauses do not receive a theta role from the verb and thus are not L-marked in the sense of Chomsky (1986). Therefore they create barriers for extraction.
    Second, like all adjuncts, adjunct *that* -clauses are generally optional.

(30)a. John sighed.
     b. John screamed.
(31)a. *John said.
     b. *Mary believed/imagined/saw.

   Third, adjunct *that*-clauses disallow passivization.

(32)a. *That the room was too cold was sighed by everybody.
     b. *That Mary was in danger was screamed suddenly by John.
(33)a. That snow is white was believed by everybody.
     b. That snow was edible was imagined by every Eskimo during the hunger period.

   Fourth, adjunct clauses disallow topicalization.

(34)a. * That it is raining, John sighed t.
     b. * That Mary is in danger, John screamed t.
(35)a. That snow is white, everybody believes/says t.
     b. That snow was edible was imagined by every starving Eskimo t.

As with cognate objects this can be explained by predication theory. The verb, which acts semantically as the 'subject', must c-command the clause. C-command is not satisfied in sentences with topicalization or passivization.
    Safir(1986) gave an explanation of the data in (34) in terms of Case theory. The crucial assumptions in this explanation are that variables (the traces t in (34)) must be assigned Case and that *sigh* and *scream* are not Case-assigning verbs. However, this explanation is weakened by the

fact that cognate objects - which bear accusative Case - are possible with *scream* and the fact that other verbs that take clausal arguments do not assign Case, as argued in Pesetsky (1982).

Finally, adjunct clauses are not allowed with certain nominalizations, as in (36) and (37).

(36)a. * Mary's sigh that it was always raining.
    b. * the scream that Mary is in danger
(37)a. John's belief that the ghost disappeared
    b. Mary's assertion that snow is white

Notice that the clauses in (37) are appositives, rather than complements, since the nominals in (37) refer not to the events (John's belief state in (34)a. or Mary's assertion in (37)b.) , but rather to the content of the events, as expressed by the clause. I will therefore call these nominalizations 'content nominalizations'. That the nominals in (37) refer to the content rather than the event is further confirmed by the fact that they disallow indefinite or quantifying determiners (as observed in Higginbotham 1986, following Montague).

(38)a. *a belief that it is raining
    b. *every belief that it is raining
(39)a. *an assertion that it is raining
    b. *most assertions that it is raining
(40)a. the fact that snow is white
    b. *a fact that snow is white
    c. *every fact that snow is white

This arguably follows from the fact that propositions are uniquely determined by a *that*-clause. That is, a *that*-clause, for instance that it is raining, describes one and only one proposition, in this case the proposition that it is raining (at the relevant location). Apparently a description that determines necessarily a unique referent can only go with the definite article. Compare this to the obligatoriness of the definite article with superlatives, which also necessarily determine a unique object, as seen in (40).

(40) a. the tallest man
    b. *a tallest man
    c. *every tallest man

Given the event-semantic assumptions and the theory of clauses developed so far, (37)a. is to be analysed semantically roughly as in (41), where P is the event predicate given in (17).

(41) $\iota Q \, [\exists e \, (\text{believe}(e, \text{John}, Q) \, \& \, Q = P)]$

From this analysis of nominalizations with appositives, the unacceptability of (36)a. and (36)b., however, does not yet follow immediately. We must make an additional assumption about the interpretation of clauses in the complement position of deverbal nominalizations. Notice that the nominals in (36)a. and b. without the clauses are fine.

(42)a. the scream
    b. Mary's sigh

Scream and *sigh* in (43) refer to events of screaming or sighing. In this interpretation, they also allow for modifiers that are predicates over the events such as on that *night* in (43)a. or without any pause in (43)b.

(43)a. The scream on that night worried John for several days.
   b. Mary's long sigh without any pause embarrassed John.

If *that* -clauses are just predicates over events we would expect that the event nominals in (42) should take *that-* clauses in the same way as the event modifiers in (43). But, as we can see from (36), this is not the case. The nominals in (36) cannot refer to events. This suggests that *that* -clauses which are in the complement position of deverbal nominalizations must obligatorily be interpreted as appositives, thus forcing the nominal to refer to the content, rather than to the event. This observation calls for a syntactic explanation that I am unable to provide in this paper.

   Given this generalization about the interpretation of *that* -clauses as appositives with deverbal nominalizations, we can explain the unacceptability of (36) as follows. The event predicates expressed by the clauses in (36)a. and b. do not occupy an argument position of the verb. Therefore an interpretation of (36)a. and b. as in (41), the only admissible interpretation, is impossible.

   It appears that adjunct *that* -clauses are possible with any verb under appropriate semantic conditions. However, the verb must describe events that can be intentional events, i.e. events that can represent a state of affairs. This follows from the way the event properties which constitute the content of *that* -clauses are conceived. Event properties as expressed by *that* -clauses can only hold of intentional or potentially intentional events. For instance, an event of trembling can never have an intentional content. Therefore *tremble* disallows that clauses as adjuncts, as (44)a. illustrates. But notice that *tremble* allows for cognate objects, which do not imply intentionality, as seen in (44)b.

(44)a. *John trembled that Mary suddenly entered the room.
   b. John trembled a small earthquake.

   There are two kinds of adverbials, adverbials that are optional as in (44)a. and adverbials that are syntactically obligatory, as in (44)b.

(45)a. Mary sang badly.
   b. Mary sang.
(46)a. John behaved badly.
   b. *John behaved.

Badly in (46)a. is syntactically selected by behave, yet it certainly does not denote an argument of the relation designated by behave. The semantic function of *badly* in (45)a. is simply that of a predicate of the event argument of behave.

   The clauses that we have considered in this section have (as event-predicates) syntactically the same status as *badly* in (46)a. In the next section, I argue that there are clauses that have syntactically and semantically the status of *badly* in (46)a., namely clauses that are syntactically selected event predicates and that are semantically not arguments of the verb.

3.3. Selected Clauses without Argument Relation

Clausal complements of *seem* and *appear* are syntactically obligatory.

(47)a. It seems/appears that John is tired.
   b. *It seems/appears.

However, there is some evidence that complement clauses of *seem* and *appear* are not arguments. Nominalizations of *seem* and *appear* do not take clausal appositives.

(48)a. *the appearance that John is tired

b. *the seeming that John is tired

Furthermore, topicalization of clausal complements of *seem* or *appear* is disallowed.

(49)a. *That John is here, it seem t.
   b. *That John is here, it appears t.
(50)a. *That John is here seems.
   b. *That John is here appears.

We may take this as an indication (though not conclusive) that clausal complements do not express arguments of *seem* or *appear.* But as lack of topicalization shows, the clausal complements of *seem* or *appear* must nonetheless fulfill the syntactic conditions of predication, namely, they must be c-commanded by the verb. If it is correct that clausal complements of *seem* and *appear* are not arguments, but rather selected modifiers of the verb, then there is a natural explanation at hand why the clausal complements must stand in the syntactic predication relation to the verb. If predication of the clause over the event argument of the verb is not governed by the lexical meaning of the verb such as the condition in (20), then semantic predication over the event argument must be based on the syntactic predication relation, which requires c-command of the clause by the verb. Notice that this explanation holds also for (50) whether the clauses in (50) are taken to be in topic position (Koster 1978) or in subject position.

   There is independent evidence that clausal complements of *seem* and *appear* are event predicates. Notice that *seem* and *appear* allow for *as if* clauses, as shown in (51).

(51)a. It seemed as if John was tired.
   b. It appeared as if it would rain all day.

As if clauses are typical event predicates in other contexts. As adverbials, they clearly modify the event argument of the verb. In (52)a. we see a selected *as if* clause and in (52)b. an adjunct *as if* clause.

(52)a. John behaved as if he was tired.
   b. John walked as if he had drunk too much.

Apparently, *as if*-clauses are restricted to certain types of events. Propositional attitude verbs generally do not allow for *as if* clauses and predicates that take sentential subjects such as *is probable* or *is true* disallow *as if* clauses.

(53)a. *John believed as if it was raining.
   b. *It is probable/true/obvious as if it was raining.

It should follow from a semantic analysis of as if that only events of a certain type (events of evidence or certain behaviours) are sortally correct for as if.
   As if clauses can also occur with *seem* and *appear* in a small clause construction, as in (54).

(54)a. John seemed/appeared [t as if he was sick].
   b. John seemed/appeared [t sick].

In (54)a. the *as if*-clause is predicated over John rather than the event argument of seem. However, this shows only that *as if*-clauses can in certain circumstances be predicates of objects rather than events. Therefore (54) does not weaken the general point that *as if*- clauses can be predicates over events. Notice that (51)a. and b. cannot be reanalysed along the lines of (54), namely with *it* being weather *it* or more generally ambient *it* (see Napoli (1988)), as in (55).

(55) It seems/appears [t as if John was tired].

It in (51) is clearly expletive *it,* rather than ambient *it,* since it is unable to control, as (56)a. shows.

(56)a. *It seemed as if it was raining, without seeming as if it was snowing.
    b. It rained without snowing.

Therefore we can conclude that the *as if*-clauses in (51) are indeed predicates of the event arguments of *seem* and *appear*.
  I have suggested that both adjunct *that*-clause and selected *that*-clause complements of *seem* and appear must enter a syntactic predication relation with the verb. In neither case does the clauses denote an event property that satisfies an argument position of the verb as occurs with the clausal complements of *say, believe, imagine* and *see*. In the case of verbs like *say*, predication of the clause over the event argument is a matter of the lexical meaning of these verbs, a consequence of a 'meaning postulate' such as (20). Therefore predication over the event argument need not be represented in sentence meaning. Unlike adjunct clauses and clausal complements of *seem* and *appear*, clausal complements do not have to enter syntactic predication relation with respect to the verb, as we have seen.
  We have observed certain correlations with respect to semantic argumenthood and syntactic predication. A clause that is a semantic argument of the verb need not enter a syntactic predication relation with the verb. But a clause that is not an argument of the verb must enter such a syntactic predication relation. So the lack of semantic argumenthood correlates with syntactic predication. A clause that is semantically not an argument of the verb must be represented as a predicate of the event argument of the verb in the sentence meaning. Now it is clear why syntactic predication must hold. In order for the semantic operation of predication to apply, the clause must stand in a specific syntactic relation to the verb, which in this case is syntactic predication. In contrast, a specific syntactic relation is not required is a semantic operation is based on a lexical condition.

Appendix

In this appendix I will outline a small fragment of the event-based semantics that was employed in this paper.
  In this fragment, the basis of semantic operations are not syntactic rules combining constituents, but rather either the syntactic category of a constituent or syntactic relations holding among subconstituents of a constituent. Thus semantic composition essentially consists in the correlation of either a syntactic category C or a syntactic relation R and a semantic operation O. So if a constituent in a sentence belongs to category C or consists of subconstituents c1 and c2 such that R holds between c1 and c2, then the semantic operation correlated with C or R applies to the meaning m of c and yields the meaning m' of c with respect to the category C, or the semantic operation applies to the meaning of c1 and the meaning of c2 and yields the meaning (or part of the meaning) of c.
  Thus we have (roughly) the following principles for semantic composition for a correaltion of syntactic categories or syntactic relations and semantic operations <C, O> or <R, O>, where m(c) is the (lexical or structural) meaning of a constituent c.

Principles of Semantic Composition for a Language L
Let C be correlated with O and R be correlated with O' in L and let c be a constituent of an expression in L, then
(1) if c is a C, then m(c) = O(c) or m(c) = m(m'(c))
(2) If c consists of constituents c1 and c2 and R(c1, c2), then m(c) =
    O'(m(c1), m(c2))

The Fragment
Categories of English:
Det = {*the, a, every* }
N = {*man, ghost, scream* }
V = {*seem, scream, disappear* }

Metalinguistic Symbols
l(c): the lexical meaning of c (taken as properties or relations)
Ln: variable ranging over lexical meanings that are n-place relations
E: variable ranging over event properties
E1: variable ranging over 2-place relations between events and objects, ...,
En: variable ranging over (n+1)-place relations between events and n objects.

Correlation of Syntactic Categories or Relations and Semantic Operations:
< L, B>, <L', B'>, <C1, O1>, <C2, O2>, <C3, O3>, ..., <C8, O8>

Semantic Basic Operation for Lexical Cateories
L: lexical category (N or V) and not head of a predicative NP,
B: B(Ln) = $\lambda u x1...xn$ [l(c)(x1, ..., xn) & x1 UD(u)]

Interpretation of Predicates
L': head of predicative NP or predicative NP
B': B'(Ln) = Ln

Referential Conditions for Referential NPs
C1 = NPs of the form the N
C2 = NPs of the form a N (but not predicative) and NPs of the form every N

O1: O1(c, E1) = λu[$\exists$!x (Ref(ag(u), u(c), x) & E1(u, x)]
O2: O2(c, E1) = λu[for all x (Ref(ag(u), u(c), x) <--> E1(u, x)]
(=nonspecific reading of indefinite NPs)
Note: As an exception, O1, O2 apply to pairs of constituents and event-object relations (The
constituents are NPs, the event-object relations are the result of applying B to the head nouns, thus
O1, O2, schematically speaking, apply to a pair <NP, B(N)>).

Tense Interpretation
C3 = verb form in past tense
O3: O3(E1) = $\lambda u x$[$\exists$ e (E1(e, x) & e<u)]

Event Predication
C4 = is event predicate of
O4: O4(En, E) = $\lambda u e x_1...x_n$[En(e, x_1,..,xn) & E(e))]

Construction of Propositions
C5 = is clausal complement of
O5: O5(En, E) = $\lambda u e x_1...x_{n-1}$[E2(e, x_1,..., x_{n-1}, E)]

C6 = is complement of the form the N or every N of
O6: O6(c1, E1) = $\lambda u e$[for all x (Ref(ag(u), u(c1), x) --> E1(e, x))]

C7 = is complement of the form a N of
O7: O7(c1, E1) = $\lambda u e$[$\exists$ x (Ref(ag(u), u(c1), x) & E1(e, x))]

Conjunction of Referential Conditions and Proposition
C8 = the relation that holds between c1 and c2 iff c1 is referential complement of the main verb of the clause c2
O8: O8(E, E') = λu[E(u) & E'(u)]

Examples

(3) The man screamed a scream.

Syntactic Categories and Relations in (3)
man and s*creamed* are lexical expressions, hence Ls;
a scream is predicate, hence an L';
a scream is event predicate to screamed, hence <*a scream, screamed*> is in C4;
screamed a scream is VP in the past tense, hence an C3;
a man is definite complement to screamed a scream, hence <*the man, screamed a scream*> is in C1;
a man is complement of *scream* of (3), hence <*the man, scream*> is in C6.

Application of Semantic Operations on the Basis of Syntactic Categories or Relations in (3)
m(*man*) = B(l(man) =   λux[man(x) & x   UD(u)]
m(*screamed*) = B(l(*scream*) =   λux[scream(e, x) & e   UD(u)]
m(*a scream*) = B'(l(*scream*)) = ∃ e[scream(e)]
m(*scream a scream*) = O4(m(*screamed*), m(*a scream*)) = λuex[scream(e, x) & e   UD(u)
  & scream(e)]
m(*screamed +past tense a scream*) = O3(m(*scream a scream*) = λ ux[∃e(scream(e) & e
  UD(u) & e<u]
m(*the man*) = O1(*the man*, m(*man*)) =   λu[∃ !x Ref(ag(u), u(*the man*), x) & man(x) & x
  UD(u)]
  (= the referential condition of (3))
m(*the man screamed a scream*) = O6(*the man*, m(*screamed +past tense a scream*) =
  λux[for all x (Ref(ag(u), u(the man), x) --> ∃e (scream(e, x) & e   UD(u) & scream(e))]
  (= the proposition of (3))
 m'(*the man screamed a screamed*) =   λu[m(*the man*)(u) & m(*the man screamed a
  scream*)]

(4) Every man screamed

 m(*Every man screamed*)
= O8(O2(*every man*, B(l(*man*)), O6(*every man*, O3(B(l(*scream*)))))
=   λu[(for all x (Ref(ag(u), u(*every man*), x) <--> man(x) & x UD(man)) &   for all x (Ref(ag(u),
  u(*every man*), x) --> ∃e (scream(e, x) & e   UD(*scream*) & e<u))]

(3) A man screamed

 m(*A man screamed*)
= O8(O2(*a man*, B(l(*man*)), O7(*a man,* O3(B(l(*scream*)))))
=   λu[(for all x (Ref(ag(u, u(*a man*), x) <--> man(x) & x   UD(*man*)) & ∃ x (Ref(ag(u), u(*a
man),* x) & ∃ e (scream(e, x) & e   UD(*scream*) & e<u))]

(4) It seemed that the ghost disappeared

m(*It seemed that the ghost disappered*)

= O3(O4(B(l(*seem*)), O8(O1(the ghost, B(l(*ghost*))), O6(*the ghost,*
   O3(B(l(d*isappear*)))))))))

= λu[∃ e (seem(e) & e   UD(seem) &   λu'[∃ !x ((Ref(ag(u), u(*the ghost*), x) & ghost(x) & x
   UD(ghost))) &   for all x(Ref(ag(u), u(the ghost) --> ∃ e (disappear(e, x) & e   UD(disappear)
   & e < u'] (e)]

Notes

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[1] The dependence of sentence meanings on utterances and speakers, rather than on contextual 'indices' has been emphasized by Burge(1974) and has been formalized in a more explicit way in the theory of Lieb (1979, 1983). Both authors employ the notion of speaker reference roughly in the way it is conceived in this paper. What is mainly new in this paper on the background of the proposals by these authors is that the dependencies of sentence meanings on utterance and speaker can be shifted in embedded contexts from the utterance to the event described by the matrix verb.

[2] Concerning the notion u(K) for a constituent K, I will assume for simplification that K is unique in the sentence under consideration. That way we can further below more or less adequately say that the part of u is uniquely determined by similarity in meaning to K. But in order to account for cases in which an expression occurs twice in a sentence or two expressions with the same meaning, we must take into account the position of K in order to get a unique correlate of K in an event u.

[3] The employment of the function u, where u(K) is the part of u similar in meaning to K, is reminiscent of Davidson's(1969) suggestions in his analysis of indirect speech. However, the motivations of this notion for Davidson's analysis and the analysis of embedded clauses in this paper are rather different. In contrast to Davidson's analysis, the similarity relation does not play a crucial role in accounting for intensionality. In the theory of this paper intensionality would rather be traced to the set of discourse referents of an event u, UD(u), than to the similarity relation between constituents and event parts. In order to account for intensionality I conceive UD(u) such that it may contain both nonactual objects and partial objects (as conceived by ag(u)). This then accounts for lack of existential generalization and lack of substitutivity of coextensional terms.

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Linguistics and Philosophy 11

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