Lexical Pragmatics and Unification: The semantics of German causal 'durch' ('through')

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Abstract

The German causal preposition *durch* ('by', 'by means of', 'through') specifies the nature of the causing event in a causal relation between events. In combination with a causative predicate, *durch* simply contributes additional information concerning the causing event in the causal relation expressed by the predicate. When combined with a non-causative change of state predicate, however, *durch* may also introduce such a causal relation by itself. It is shown that modelling this varying contribution of *durch* poses a challenge to formal-semantic analyses applying mechanisms of strict compositionality such as functional application. An alternative formalism based on recent developments in Discourse Representation Theory is developed, including unification as a mode of composition as well as a more elaborate analysis of presuppositional phenomena. It is further argued that the analysis can be restated in pragmatic terms, providing an argument for presuppositions applying solely to the sentence-internal level.

1 Introduction

There is a growing insight in the formal-semantic literature that not all linguistic phenomena can or should be expected to adhere to principles of strict compositionality as in the narrower sense of functional application for instance. In this paper, empirical substance is added to the view that alternative modes of composition need to be applied. The data discussed here involve the multiple marking of causal relations. They mainly consist of combinations of causative and non-causative change of state predicates with the German causal preposition *durch* ('by', 'by means of', 'through').[1]

The discussion centres around the status of the abstract predicate CAUSE and its origin in identical complex semantic structures which can be argued to be differently composed.

[1]It should be noted that there exists another causal variant of *durch* which is more properly translated by e.g. *due to* or *because of*, cf. (i):

In the present analysis, as in many formalisms introduced to handle phenomena which are taken to be problematic for strict compositionality, unification (Bouma 2006) is applied. It is argued that the multiple markers of causality may be unified, merging multiple occurrences of variables and predicates into one.

The paper is structured as follows: first, the challenge of trying to build a compositional semantics for the combination of causal *durch* phrases with both causative and inchoative predicates is presented in section 2. Second, after a brief discussion of some possible solutions in section 3, an alternative analysis which is held in a Discourse Representation Theory bottom-up formalism (Kamp 2001), applying unification as a mode of composition (Bende-Farkas and Kamp 2001, Sæbø to appear) is offered in section 4. Section 5 discusses how the unificational analysis can be restated in pragmatic terms as involving (sentence-internal) presupposition verification and accommodation. Section 6 concludes the paper with a brief outlook on the generality of the approach and further applications of the formalism.

2 The variant problem

Adverbials may in general be assumed to contribute information which is not contained in the predicates they modify. However, they may also alter the properties of a predicate to various extents. Adverbials headed by the preposition *durch* may be argued to have both these properties, depending on the predicate in question.

The main function of causal *durch* is to specify the nature of the causing event in a causal relation between events, as exemplified in (1)-(2):[2]

(1) *Ein Polizist wurde durch einen Schuss aus der eigenen Dienstwaffe*
a policeman was through a shot from the own service weapon
getötet.
killed
'A policeman was killed by a shot from his own service weapon.'

(i) *Durch die schlechte Akustik war der Sänger nicht zu hören.*
through the bad acoustics was the singer not to hear
'It was not possible to hear the singer because of the poor acoustics.'

This variant, which will not be discussed in this paper, is more adequately analysed as marking a causal relation between propositions, facts or other non-eventive abstract entities. See Solstad (2006) for further comments on the relation between the two variants.

[2]Most examples are based on authentic data from either the corpora of the Institut für deutsche Sprache (IdS) in Mannheim or the Oslo Multilingual Corpus (OMC) developed by the SPRIK project group at the University of Oslo. I will not indicate the origin of specific examples. Please visit the following web pages for further information:
IdS-corpus (in German): `http://www.ids-mannheim.de/kl/projekte/korpora/`
OMC: `http://www.hf.uio.no/forskningsprosjekter/sprik/english/corpus/`

(2) *Durch bloßes Handauflegen versetzte sie den Sowjetmenschen in*
through mere laying-on-of-hands transferred she the Soviet individual in
Glückseligkeit.
blessedness
'By a mere laying-on-of-hands she could induce a state of bliss in the Soviet individual.'

In (1), the causative predicate *töten* ('kill') is used. I assume that the semantics of *töten* involves a causal relation between two events, one of which is the caused event, a transition to a state of being dead, and one of which is the causing event of this transition. As for the unmodified *töten* predicate, the nature of the causing event is not specified in any way: nothing is said about how the transition was brought about. Verbs like *töten* are thus termed *manner-neutral* causatives (Pusch 1980, Sæbø to appear).

In (1), the *durch* phrase specifies the nature of the causing event of the modified predicate *töten* in the following way: it is stated that the policeman was killed *by a shot from his own service weapon.*

A simplified semantic representation for *töten* could be formulated as in (3), e_2 representing the caused transition and e_1 the causing event:

(3) $\lambda y \lambda e_2 \lambda e_1 [\textsc{become}(\textit{dead}(y))(e_2) \wedge \textsc{cause}(e_2)(e_1)]$

Analysing causatives this way, the function of the *durch* phrase is to specify the nature of e_1 in (3). Thus, a simplified, preliminary semantics of *durch* only needs to involve an identity relation between events, where the event described by the *durch* phrase is identified with the unspecified causing event e_1 of the causative predicate. Common to all occurrences of *durch* phrases with causative predicates is that they only seem to specify the predicates they are adjoined to by adding some conditions or restrictions to them (see e.g. Chung and Ladusaw 2004), such as $\ldots \wedge \textsc{shoot}(e_1)$ in (7) below.

It is essential to note that in addition to occurring with causative predicates, *durch* can also be used with inchoatives (in the narrower sense of non-causative change of state predicates), as illustrated in (4)-(5):

(4) *Ohnesorg starb durch einen gezielten Schuss.*
Ohnesorg died through an accurate shot
'Ohnesorg died through an accurate shot.'

(5) *Der Verlust an Vielfalt und Eigeninitiative ist durch die Verstaatlichung*
the loss of diversity and one's-own-initiative has through the nationalisation
gesellschaftlicher Bedürfnisse entstanden.
social needs emerged
'The loss of variety and initiative has resulted from the state taking over responsibility for social needs.'

For inchoative predicates like *sterben* ('die'), a semantic representation without an underlying CAUSE is assumed, as in (6):[3]

(6) $\lambda y \lambda e_2.\text{BECOME}(dead(y))(e_2)$

However, after composition with *durch* a semantic representation similar to the one assumed for (1) intuitively seems to be the most plausible one: a CAUSE and a specification for the causing event e_1 should be included (an accurate shot causes Ohnesorg's death). The examples in (1) and (4) could thus be given a common simplified neo-Davidsonian semantic representation, as the one offered in (7):

(7) $\exists e_1 \exists e_2 \exists y[\text{BECOME}(dead(y))(e_2) \wedge \text{CAUSE}(e_2)(e_1) \wedge \text{SHOOT}(e_1)]$

Besides, an agent should also be included for (4), as implied by the adjectival modifier *gezielt* ('accurate'). This means that the semantics of an inchoative predicate like *sterben*, which does not include a CAUSE relation, and normally excludes the presence of an agent, can be included in a formula where the resultant state is caused by some event controlled by an agent.[4] As the event described by the internal argument of *durch* (the semantic equivalent of the syntactic complement of *durch*) is obviously deliberately performed, a CAUSE analysis seems at least as justified for *sterben* in (4) as for *töten* in (1). In fact, sentence (4) makes stronger claims about agentivity and intentionality than (1) in the sense that the shot in (1) could have gone off accidentally, whereas the shot in (4) must have been fired deliberately, as indicated by *gezielt*. It is due to this addition of a CAUSE relation and the implication of the presence of an otherwise excluded agent, that the *durch* adverbial is claimed to radically alter the properties of the predicate *sterben*.

However, the CAUSE element of the semantic representation in (7) for the sentences in (1) and (4) must obviously have different sources on the semantic representations assumed for causatives in (3) and inchoatives in (6). In the first case, it originates in the causative predicate, whereas in the latter case its source cannot be the inchoative predicate itself. This suggests that *durch* may itself introduce a CAUSE element when combined with an inchoative, it being the most plausible alternative candidate for such an introduction (see also section 3).

If we want to assume that no two CAUSE elements are present when *durch* is combined with a causative predicate, potentially yielding an interpretation of indirect causation in a cause-to-cause relation, we seem obliged to postulate two different lexical items *durch*. One of these would be used in combination with causatives, and the other with inchoatives and other non-causative predicates, which do not include a CAUSE element on their own. This varying contribution of *durch* and its seemingly conflicting consequences for lexical semantics will be referred to as the *variant problem*.

[3]Härtl (2003) presents an alternative view, cf. section 3.

[4]It may be generally assumed that unaccusatives like *sterben* or *die* exclude agentive modification, cf. (ii):

(ii) *Ohnesorg died by a policeman.

However, dealing with two different lexical items *durch* is clearly counterintuitive from the point of view of lexical semantics. The contribution of *durch* is parallel in the two cases: *durch* specifies the nature of the causing event in a causal relation. Thus, to assume two lexical items *durch* to be able to represent both (1) and (4) as in (7) is not very desirable. The main motivation for the assumption of an ambiguity in *durch* would lie in the restrictions of the formalism. It is therefore preferable to look for alternative ways of giving a uniform analysis of the two combinations.

3 Alternative approaches

Approaches exist in which the variant problem is seemingly avoided, allowing the introduction of a CAUSE predicate if a change of state is present. One alternative is to start from the premise that effects normally follow their causes, as Wunderlich (1997, p. 36) does in his analysis of resultatives:

(8) The bell jangled the neighbours awake.

Resultatives such as in (8) are normally assumed to be interpreted as involving a causal relation between the event expressed by the main verb and the (resultant) state expressed in the adjective. However, neither *jangle* nor *awake* are assumed to include a causal relation.[5] On Wunderlich's approach, it is assumed that in cases where two events or an event and a state are temporally adjacent, but not completely overlapping, the first event will be conceptualised as the causing event of the second one. Put differently, a CAUSE may enter into semantic composition whenever a process temporally precedes a change of state involving BECOME. Thus, in (8) the process of the bell jangling is interpreted as causing the event of the neighbours awakening. With regard to the issue of compositionality, this analysis is characterised by the possibility of the compositional procedure itself introducing a CAUSE predicate.

It should be underlined that from the point of view of semantic composition, it is not very desirable to let the compositional procedure introduce semantic material not present in any of the constituents of a complex expression. Such an approach reduces the transparency of the composition (Dowty 2006). Matters are not very clear-cut here, though. One could argue that Wunderlich's analysis only involves a weakening of compositionality, but no great departure from it (Partee 2004, p. 163 f.).

Another alternative would be, simplifying a view put forward by e.g. Härtl (2003), to claim that every change involves a cause at some level, under the assumption that "even if no specific causing entity or action is expressed, something must be responsible for the change of state in the affected entity" (Härtl 2003, p. 899 ff.). By exploiting this kind of conceptual knowledge, Härtl's analysis avoids any challenge of compositionality. A CAUSE is always available for inchoatives too since they involve a change of state.

[5] Resultative constructions as in (8) may be termed *concealed causatives* (Bittner 1999).

In both these approaches, the presence of the causal relation assumed in combinations of *durch* with inchoative predicates like *sterben* could be attributed to the change of state expressed by the inchoative predicate. With regard to this view, *durch* itself does not need to involve a CAUSE element in any case.

However, there are some further distributional facts concerning *durch* which render these approaches less attractive. In addition to the combinations discussed in section 2, *durch* may also occur with stative predicates:

(9) *Der durch diese Haltung hohe Luftwiderstand kann auf längeren Strecken*
the through this posture high air resistance may on longer distances
ganz schön schlauchen.
pretty much scrounge
'The high air resistance due to this posture may put you through the mill over longer distances.'

The state expressed in the predicate *hoch* ('high') is interpreted as a resultant state caused by the eventuality expressed in the internal argument of *durch*, *Haltung* ('posture').[6] If the *durch* phrase is left out, as illustrated in (10), the stative *hoch* is not interpreted as a resultant state:[7]

(10) *der hohe Luftwiderstand*
the high air resistance
'the high air resistance'

It can be concluded that *durch* has a similar effect in combination with both stative and inchoative predicates and that *durch* can be made responsible for the interpretation of a causal relation. The internal argument of *durch* specifies the nature of the causing event in this causal relation.

In attempting to analyse the combinations with statives in the above approaches, one would be left in a situation where the reinterpretation (in the sense of Egg 2005) needed to achieve the desired semantic representation, including the introduction of a change of state and a CAUSE relation, would be without any obvious triggers, since no change is present in the first place.

If, conversely, *durch* is assumed to introduce the CAUSE element itself, an intuitively more plausible analysis can be developed. With this alternative, the desired reinterpretation follows automatically from the presence of the CAUSE element of *durch*, as in standard counterfactual analyses (see also Kratzer 2005).

Additional evidence comes from the fact that the internal argument of *durch* has to be reinterpreted as being an event. This is illustrated in (11):

[6] *Haltung* has both a stative and an eventive reading. It has an eventive, bounded (Egg 1995) reading in contexts where the position has to be upheld deliberately, as in (9).

[7] This could be achieved by focussing *hoch*, though, introducing a set of alternatives which are related to *hoch* through scales or negation (Rooth 1992).

(11) *Das Spracherkennungssystemen wird durch eine Taste aktiviert.*
the speech recognition system is through a key activated
'The speech recognition system is activated by pushing a key.'

In (11), *durch eine Taste* (lit. 'through a key') is interpreted e.g. as *by* ***pushing*** *a key*, involving a sortal shift of an entity to an event.[8] This is expected if *durch* includes a CAUSE predicate, which involves a relation between two events.

I propose then to assume a CAUSE predicate to be included in the semantics of *durch*. In the next section, I offer a solution to the variant problem described in section 2.

4 A unificational analysis

It is fairly obvious that from the perspective of strict compositionality it is a considerable challenge to provide a general semantic analysis of *durch* in combination with all the above predicate types. Applying functional application, one is left in a situation where one either has to explain how the CAUSE of *durch* and the CAUSE of a causative are combined into one, or how a CAUSE element emerges with an inchoative or a stative predicate.

It should be added that this presupposed consensus on the notion of strict compositionality hardly exists, see e.g. the discussion in Partee (2004). Although the data in this paper are argued to present a challenge to approaches applying strict compositionality, the analysis in this section is certainly intended to be compositional in a rather strict sense.

Assuming that strict compositionality is identified with functional application, I will argue that an alternative mode of composition should be sought to be able to handle adequately those cases where *durch* should not contribute an extra CAUSE predicate, as with causatives. The approach advocated here applies unification in the compositional procedure. The process of unification will involve the merging of variables and predicates which may be identified with each other.

Intuitively, it makes sense to formalise what is going on when combining *durch* with causatives or inchoatives in terms of unification: the causative predicate and the *durch* phrase both contribute information concerning one and the same sub-event in a causal relation.

4.1 General remarks on the construction procedure

There is as yet no coherent formalisation of all the aspects relevant to the analysis promoted here, and many details will also be left out in the present paper. Though the derivation for two example sentences will be shown, the exact construction principles will only be discussed informally, but hopefully precisely enough to provide a rough idea of the framework. As in Kamp (2001), a bottom-up compositional DRT analysis is applied. The

[8] In the semantic literature, *type coercion* or *type shifting* are widely used, but the shift in (11) involves more than just an adjustment of types, hence the term *sortal shift* (see also the notion of *sortal type coercion* Egg 2005).

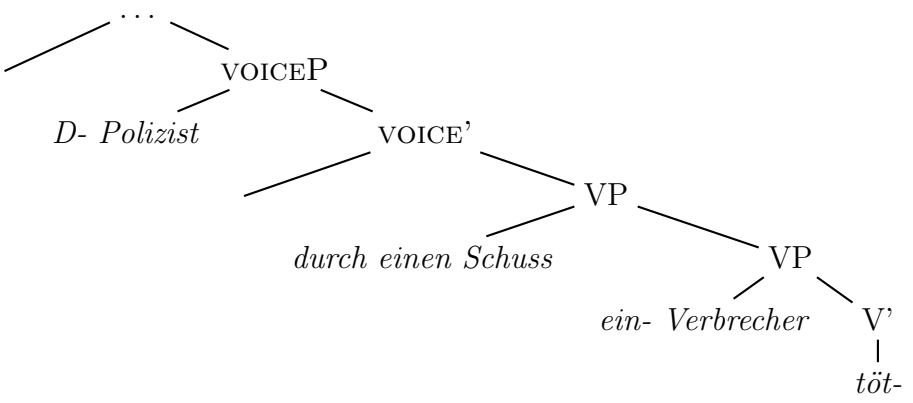

Figure 1: Simplified underlying syntactic structure for sentence (12).

reader is referred to Kamp (2001), especially pp. 221-231, for more details concerning the formalisation.

The semantic details included here will mostly be limited to the VP level, assuming a Kratzer (1996) analysis of Voice. Consequently, the semantics of tense or aspect will be ignored. A sentence like (12) will be assigned the simplified underlying syntactic structure indicated in Figure 1 on page 8.

(12) *Der Polizist tötete einen Verbrecher durch einen Schuss.*
the policeman killed a criminal through a shot
'The policeman killed a criminal with a shot.'

It is assumed that the *durch* phrase is adjoined at VP level, below any possible agents (Solstad 2006).

It should be added that in the formal analysis to be presented in this section, only causative and inchoative predicates will be considered. The combinations with stative predicates such as in (9) will be excluded from the discussion of the formalisation.

The following general format, termed a *semantic node representation*, is used for the semantic information attached to the tree nodes:

(13) $$\left\langle \overbrace{\left\{ \langle \text{Variable}, \boxed{\text{Constraint}}, \text{Binding condition} \rangle \right\}}^{\text{STORE}}, \boxed{\text{CONTENT}} \right\rangle$$

The semantic node representation is a pair consisting of a *content* and a *store* element. The content representation is always a Discourse Representation Structure (DRS), whereas the store is a set of one or more triples of a variable, a constraint (also a DRS) and a binding condition. Binding conditions provide information on the possible bindings of a variable, and constraints add to this, often by stating the semantic content of the variable, like

gender features necessary for the correct binding of pronouns. The motivation for dividing a semantic representation in a store and a content part, as opposed to just having a main DRS, is that many of the variables which are introduced in (bottom-up) composition cannot be bound right away. A storage mechanism is needed.

It is further assumed that content-store-pairs attached to different tree nodes are unified when they are combined. This is a fairly recent development within DRT, Bende-Farkas and Kamp (2001) being to my knowledge the first to advocate such an approach.

The formalisation has a further important predecessor in a paper by Kjell Johan Sæbø, in which Kamp's analysis is applied to manner-neutral causatives (Sæbø to appear). I will briefly discuss the main ideas in Sæbø's paper and how they relate to the present one.

While Kamp (2001) is mainly concerned with presuppositional phenomena, Sæbø discusses the semantics of English instrumental *by* phrases in combination with causative predicates, as in the following example (p. 2):

(14) Yahweh made Adam by scooping up some clay and breathing on it.

Sæbø characterises the manner-neutral causing event of the causative verb *make* as an "abstract predicate" and states: "There is a strong intuition that [...] the merge of the *by* phrase and the phrase it modifies denotes one set of events, and that somehow, the *by* phrase predicate fills a slot in the abstract predicate." (p. 2).

With regard to the compositional procedure, Sæbø assumes in accordance with Kamp (2001) that "[w]hen two nodes meet, unification of store variables of the same type is driven by the binding conditions, and the two content DRSs are then merged" (p. 11).

In brief, Sæbø assumes two types of store variables: indefinite and definite ones. Indefinite variables may be bound by definite variables. Sæbø assumes that the abstract predicate introduces an indefinite variable, whereas the variable introduced by the *by* phrase is definite. When they both occur in one store, the definite *by* variable will bind the indefinite variable of the abstract predicate.[9]

There are some important differences between the present analysis and Sæbø's approach. First of all, Sæbø does not discuss the status of CAUSE. Sæbø analyses *by* as being semantically empty. Second, I consider causation between events, while Sæbø deals with causality based on propositions. This is partly due to one major difference between *durch* and *by*: The internal argument of *durch* is an event noun, whereas the one of *by* in Sæbø's paper is a gerund, cf. (14). And finally, as already mentioned, I follow a bottom-up composition procedure, where Sæbø is only concerned with the general principles of unification.

[9]If the predicate which is modified by a *by* phrase does not introduce an indefinite variable (as opposed to a definite one), composition will fail, because the *by* variable must find a variable to bind. However, the variable in the abstract predicate may be left unbound.

4.2 Construction for causative predicates

After having presented the general construction procedure, I will show how to compose the semantics of sentence (12), repeated as (15) for convenience:

(15) Der Polizist tötete einen Verbrecher durch einen Schuss.
'The policeman killed a criminal with a shot.'

In accordance with the bottom-up composition procedure, the verb will first be combined with its internal argument, before the resulting VP is unified with the adverbial *durch* phrase. The agent is then combined with the result of this unification (see Figure 1).

The representation of the lexical head of the VP, the causative predicate *töten*, is as follows:

(16)
$$\left\langle \left\{ \begin{array}{l} \langle e_1, \boxed{\begin{array}{l}\textsc{cause}(e_2)(e_1)\\ e_1 \subseteq t_{loc}\end{array}}, \text{indef.}\rangle, \\ \langle e_2, \boxed{\textsc{cause}(e_2)(e_1)}, \text{indef.}\rangle, \\ \langle t_{loc}, \quad\quad\quad\quad\quad\quad, \text{loc.t.}\rangle \end{array} \right\}, \boxed{\begin{array}{|l} \\ \hline \textsc{cause}(e_2)(e_1)\\ \textsc{become}(\mathit{dead}(y))(e_2)\\ \textsc{patient}(y)(e_2)\\ \\ \end{array}} \right\rangle$$

The information in the content part to the right belongs to the invariant semantics of the verb. Following Kamp and Rossdeutscher (1994), the matrix verb is referred to as the *lexical anchor* of the sentence. Among lexical items, only lexical anchors have non-empty content parts, i.e. contain information which will invariably be included in the representation of a complex semantic expression. Concerning the arguments of the verb, only the semantic role of PATIENT is included in the representation under the assumption that the AGENT appears outside the VP in a Voice phrase. The predicate *töten* introduces three variables in the store, one for each of the two events, and one for temporal location. The latter variable will be ignored in the following, except for the final DRS of the derivation.

The binding condition *indef* provides information that a variable can, but need not enter binding relations with other variables. Importantly, when binding occurs, it is assumed that variables and constraints are unified.[10] A variable with an *indef* binding condition will eventually enter the universe or, in other words, be bound existentially, at the relevant level. In the case of indefinite noun phrases, the relevant level of binding seems to be the topmost projection of the syntactic structure, often identified with CP. Exactly where the binding of eventuality variables takes place, is not a settled matter (Kamp 2001, p. 228, fn. 20), and this issue cannot be discussed in any real detail here. It is however reasonable to assume that eventuality variables are existentially bound no later than at the level of aspectual projections. But this does not affect the underlying principles of the present analysis, since the functional projection involving aspect is assumed to be situated above the Voice phrase. More binding conditions will be discussed below.

[10]It should be noted that the unification of the variables has parallels with referent identification in earlier DRT formalisations, but that the unification of predicates is a novelty of later developments in DRT.

As mentioned above, the constraints in the store part include information which is necessary for the correct binding of the variables. Thus, the fact that CAUSE$(e_2)(e_1)$ occurs in both store and content does not mean that the semantics of the verb includes two CAUSE relations, but simply reflects the fact that this information is needed to be able to tell the two variables e_1 and e_2 apart, since they relate differently to the CAUSE predicate. Technically, it would be possible to leave out the CAUSE relation in the content, under the assumption that information associated with bound variables in the store will eventually enter the content. It is however included to indicate that CAUSE is an invariable part of the semantics of the verb. In the end, only constraint conditions for store variables which are not already present in the content part will enter it. Thus, no multiplication of conditions should occur.

The representation of the two noun phrases, *der Polizist* ('the policeman') and *ein Verbrecher* ('a criminal') is as illustrated for *ein Verbrecher* in (17):

(17) $\left\langle \left\{ \langle u\,, \boxed{\text{CRIMINAL}(u)}\,, \text{indef.}\rangle \right\}, \begin{array}{|l|}\hline \\ \hline \\ \\ \hline \end{array} \right\rangle$

The two noun phrases only differ in their binding condition, which is *def* in the case of the definite noun phrase, *der Polizist*.[11]

The VP *einen Verbrecher töten* ('kill a criminal') is represented as:

(18) $\left\langle \left\{ \begin{array}{l} \langle e_1, \boxed{\text{CAUSE}(e_2)(e_1)}\,, \text{indef.}\rangle, \\ \langle e_2, \boxed{\text{CAUSE}(e_2)(e_1)}\,, \text{indef.}\rangle, \\ \langle v, \boxed{\text{CRIMINAL}(v)}\,, \text{indef.}\rangle \end{array} \right\}, \begin{array}{|l|}\hline \\ \hline \text{CAUSE}(e_2)(e_1) \\ \text{BECOME}(\textit{dead}(v))(e_2) \\ \text{PATIENT}(v)(e_2) \\ \\ \hline \end{array} \right\rangle$

The internal argument of *töten* gets a 'placeholder' inserted in the content DRS, whereas the content of the variable inserted in the DRS is specified in the store part along with the variable's binding condition.

Durch is represented as in (19). Kamp (2001) does not discuss prepositional adjuncts, but it seems obvious to assume an empty content part for *durch*, since it is not a lexical anchor:

[11] In both cases, Kamp leaves the content empty, which can be seen as a reflection of the fact that the referents introduced by the noun phrases would otherwise be forcibly established in the discourse. It may be argued that this makes more sense for definite than indefinite noun phrases, but this will not be of any concern here. In order to keep representations as simple as possible, the agent argument, *der Polizist*, will only occur in the final representation of sentence (15), cf. (24) on page 14. Temporal variables are left out (see Musan 1997, Tonhauser 2002).

(19) $\left\langle \left\{ \begin{array}{l} \langle e_3 \, , \boxed{\text{CAUSE}(e_4)(e_3)} \, , \lambda_1 \rangle, \\ \langle e_4, \boxed{\text{CAUSE}(e_4)(e_3)} \, , \lambda_2 \rangle \end{array} \right\}, \begin{array}{|c|}\hline \\ \hline \\ \\ \hline \end{array} \right\rangle$

(19) basically states that *durch* itself adds no content to the DRS as such, but that it involves a causal relation between two events. Here, a third binding condition, λ, is introduced. λ indicates that a variable needs to enter a binding relation. Variables with λ binding conditions will be bound by variables with *indef* binding conditions, resulting in a variable with another *indef* condition. Variables with *indef* binding conditions will eventually be existentially bound as discussed briefly above. λ is used to express that these variables need to be bound, as opposed to the *indef* variables. However, abstraction as such is not involved.

The subscripted numbers on λ_1 and λ_2 relate to the binding order of the two variables involved in *durch*. The ordering is motivated by the fact that what modifies a predicate such as *töten* is not the preposition *durch* alone, but a *durch* **phrase**. The internal argument of *durch*, corresponding to the syntactic complement of the preposition, will be bound first, since it is combined with *durch* before the *durch* phrase modifies the predicate.

For the internal argument of *durch*, the event noun *ein- Schuss* ('a shot'), the following representation is assumed:

(20) $\left\langle \left\{ \langle e_5 \, , \boxed{\text{SHOOT}(e_5)} \, , \text{indef.} \rangle \right\}, \begin{array}{|c|}\hline \\ \hline \\ \\ \hline \end{array} \right\rangle$

The nominalisation derived from the predicate *schießen* ('shoot') includes no semantic roles, since shooting events without agent and patient participants are easily imaginable, e.g. in a situation where a gun falling to the floor causes a shot to be fired into the air. The event expressed in *ein- Schuss* needs to include a location time, but this will be ignored here.

The representation in (21) is the result of combining the representations for *durch* in (19) and *ein- Schuss* in (20). Variable e_5 binds e_3, resulting in an *indef* binding condition for the unified variable. Additionally, the restrictions associated with each of the variables entering the binding relation now occur as restrictions of the unified variable:

(21) $\left\langle \left\{ \begin{array}{l} \langle e_3 \, , \boxed{\begin{array}{l}\text{CAUSE}(e_4)(e_3) \\ \text{SHOOT}(e_3)\end{array}} \, , \text{indef.} \rangle, \\ \langle e_4, \boxed{\text{CAUSE}(e_4)(e_3)} \, , \lambda_2 \rangle \end{array} \right\}, \begin{array}{|c|}\hline \\ \hline \\ \\ \hline \end{array} \right\rangle$

The fact that the content is empty is a heritage from Kamp's formalisation, but there is room for doubt whether it has to be like that after composition of *durch* and *ein- Schuss*. Basically, this boils down to a question of where variables enter the content DRS, and whether eventuality arguments can have varying positions for such entrance, i.e. within a PP, a VP etc.

Unifying the *durch* phrase with the VP, *einen Verbrecher durch einen Schuss töten* ('kill a criminal by a shot'), results in the following representation before binding applies:

(22)
$$\left\langle \left\{ \begin{array}{l} \langle e_1, \boxed{\textsc{cause}(e_2)(e_1)}, \text{indef.}\rangle, \\ \langle e_2, \boxed{\textsc{cause}(e_2)(e_1)}, \text{indef.}\rangle, \\ \langle e_3, \boxed{\begin{array}{l}\textsc{cause}(e_4)(e_3)\\ \textsc{shoot}(e_3)\end{array}}, \text{indef.}\rangle, \\ \langle e_4, \boxed{\textsc{cause}(e_4)(e_3)}, \lambda_2\rangle, \\ \langle v, \boxed{\textsc{criminal}(v)}, \text{indef.}\rangle \end{array} \right\}, \boxed{\begin{array}{l}\\ \hline \textsc{cause}(e_2)(e_1)\\ \textsc{become}(\textit{dead}(v))(e_2)\\ \textsc{patient}(v)(e_2)\\ \\ \end{array}} \right\rangle$$

Now, e_2 will bind e_4. Needless to say, the variable types have to correspond for a binding to be able to take place. Taking the constraints into account, e_4 cannot be bound by e_1, which could be a possible match if one were only looking at the binding conditions: they are not in the same argument position of the CAUSE relation. The variable e_4 represents a caused event, whereas e_1 represents a causing event.

Next, e_1 and e_3 will be unified. This is not a binding in the sense of the binding which takes place between e_4 and e_2, which is necessary, where e_4 not being bound would lead to an unresolved DRS. The variables e_1 and e_3 will be unified under the assumption that one should unify all variables which are a possible match. It should be added that this solution might overgenerate, as discussed with regard to example (33) in section 5, where the limitations of an analysis purely in terms of unification will be touched upon.

In addition, the constraints of the variables entering binding relations will be unified. The application of these principles results in the following preliminary representation before indefinites enter the universe of the content part:

(23)
$$\left\langle \left\{ \begin{array}{l} \langle e_1, \boxed{\begin{array}{l}\textsc{cause}(e_2)(e_1)\\ \textsc{shoot}(e_1)\end{array}}, \text{indef.}\rangle, \\ \langle e_2, \boxed{\textsc{cause}(e_2)(e_1)}, \text{indef.}\rangle, \\ \langle v, \boxed{\textsc{criminal}(v)}, \text{indef.}\rangle \end{array} \right\}, \boxed{\begin{array}{l}\\ \hline \textsc{cause}(e_2)(e_1)\\ \textsc{become}(\textit{dead}(v))(e_2)\\ \textsc{patient}(v)(e_2)\\ \\ \end{array}} \right\rangle$$

The indefinites enter the DRS in accordance with their indef. binding conditions, which are different for event and individual variables. After adding the variables with *indef* binding conditions to the universe of the content part and including the constraints associated with

them among the conditions of the DRS, we obtain the representation shown in (24):[12]

(24)

$e_1\ e_2\ n\ t_{(loc)}\ t'_{(ref)}\ u\ v$
$t' \prec n$
$t = t'$
$e_1 \subseteq t$
CAUSE$(e_2)(e_1)$
BECOME$(dead(v))(e_2)$
SHOOT(e_1)
CRIMINAL(v)
PATIENT$(v)(e_2)$
AGENT$(u)(e_1)$
POLICEMAN(u)

In (24), the CAUSE predicates and event variables introduced by the causative predicate *töten* and *durch* have been unified. As desired, the composition allows for *durch* to include a CAUSE which is identified with a CAUSE present in context, as contributed by a causative predicate.

4.3 Construction for inchoative predicates

In this section, I will show the composition of a *durch* phrase with an inchoative predicate such as *sterben* ('die') in example (4), repeated in (25) for convenience:

(25) *Ohnesorg starb durch einen gezielten Schuss.*
'Ohnesorg died through an accurate shot.'

I will comment only on the steps where the derivation differs from the one in the previous example. As in combination with casuative predicates, it is assumed that the *durch* phrase is adjoined at the VP level. The only argument of the unaccusative predicate *sterben* is commonly assumed to occupy the same position as the direct object of the transitive *töten* (see Figure 1 on page 8). *Sterben* is represented as in (26):

(26) $\left\langle \left\{ \langle e_2, \quad , \text{indef.} \rangle \right\}, \right.$

BECOME$(dead(y))(e_2)$
PATIENT$(y)(e_2)$

$\left. \right\rangle$

The representation of *sterben* differs from that of *töten* in (16) in two respects. First of all, *sterben* includes only one event. Second, *sterben* is not specified for any causal relation,

[12] The definite noun phrase *Der Polizist* ('the policeman') introduces a presupposition which would have to be dealt with separately, cf. Kamp (2001) for details.

and thus has no variable constraint for the change of state event e_2. In a fully specified formalisation, however, this event should be specified as being a change of state, involving a resultant state, a feature it shares with the caused event in the CAUSE relation.

Durch einen gezielten Schuss ('through an accurate shot') is represented as in (27), where the semantics of *gezielt* ('accurate') is simply assumed to be a property of events. *Gezielt* also introduces an agent.

(27)
$$\left\langle \left\{ \begin{array}{l} \langle e_3\ , \boxed{\begin{array}{l}\textsc{cause}(e_4)(e_3)\\ \textsc{shoot}(e_3)\\ \textsc{accurate}(e_3)\end{array}}, \text{indef.}\rangle, \\ \langle e_4, \boxed{\textsc{cause}(e_4)(e_3)}, \lambda_2\rangle, \\ \langle w\ , \boxed{\textsc{agent}(w)(e_3)}, \text{indef.}\rangle \end{array} \right\}, \boxed{\begin{array}{l}\\ \\ \\ \end{array}} \right\rangle$$

The result of combining the representations in (26) and (27) before binding applies is given in (28). The binding condition of variable v, *prop.name*, has similar properties to the *def* condition of definite noun phrases:

(28)
$$\left\langle \left\{ \begin{array}{l} \langle e_2, \quad\quad , \text{indef.}\rangle, \\ \langle e_3\ , \boxed{\begin{array}{l}\textsc{cause}(e_4)(e_3)\\ \textsc{shoot}(e_3)\\ \textsc{accurate}(e_3)\end{array}}, \text{indef.}\rangle, \\ \langle e_4, \boxed{\textsc{cause}(e_4)(e_3)}, \lambda_2\rangle, \\ \langle w\ , \boxed{\textsc{agent}(w)(e_3)}, \text{indef.}\rangle, \\ \langle v, \boxed{\textsc{ohnesorg}(v)}, \text{prop.name}\rangle \end{array} \right\}, \boxed{\begin{array}{l}\\ \hline \textsc{become}(\textit{dead}(v))(e_2)\\ \textsc{patient}(v)(e_2)\\ \\ \end{array}} \right\rangle$$

The binding results in the following representation:

(29)
$$\left\langle \left\{ \begin{array}{l} \langle e_3\ , \boxed{\begin{array}{l}\textsc{cause}(e_2)(e_3)\\ \textsc{shoot}(e_3)\\ \textsc{accurate}(e_3)\end{array}}, \text{indef.}\rangle, \\ \langle e_2, \boxed{\textsc{cause}(e_2)(e_3)}, \text{indef.}\rangle, \\ \langle w\ , \boxed{\textsc{agent}(w)(e_3)}, \text{indef.}\rangle, \\ \langle v, \boxed{\textsc{ohnesorg}(v)}, \text{prop.name}\rangle \end{array} \right\}, \boxed{\begin{array}{l}\\ \hline \textsc{become}(\textit{dead}(v))(e_2)\\ \textsc{patient}(v)(e_2)\\ \\ \end{array}} \right\rangle$$

Finally, the indefinites enter the DRS, resulting in the following representation for sentence (25):[13]

(30)

e_2 e_3 $\mathbf{w}$ n $t_{(loc)}$ $t'_{(ref)}$
$t' \prec n$
$t = t'$
$e_3 \subseteq t$
CAUSE$(e_2)(e_3)$
BECOME$(dead(v))(e_2)$
SHOOT(e_3)
ACCURATE(e_3)
PATIENT$(v)(e_2)$
AGENT$(\mathbf{w})(e_3)$
OHNESORG(v)

Note that the representation in (30) is composed differently from the one in (24) including a causative predicate. The two derivations lead to the same result for the semantic composition of *töten* and *sterben* with causal *durch* phrases. But in the case of the inchoative predicate *sterben*, the *durch* adverbial alters the properties of the predicate as discussed in section 2: the internal argument of *durch* introduces an agent of its own, and *durch* itself contributes the causal relation. In combination with causative predicates, the *durch* phrase simply specifies the nature of the causing event already included in the predicate.

To summarise, the analysis presented in this section has shown that a uniform treatment of *durch* in combination with causatives and inchoatives is possible. In other words, the variant problem identified in section 2 can be dealt with within the DRT framework adopted here. The solution crucially applies unification as a mode of composition to allow *durch* to introduce a CAUSE predicate of its own in cases where it is not provided by the context.

While the challenge to strict compositinality posed by the phenomena under discussion was solved using existing formal devices within DRT, it should be noted that there exist other formalisms which seem suitable to handle similar phenomena. Richter and Sailer (2004) treat negative concord in Polish in an HPSG framework, while Egg (this volume) presents a constrained lambda calculus approach to reinterpretation. In both these formalisms, however, new techniques are developed to achieve a more flexible approach to compositionality.

[13]The discourse referent w is printed in bold to indicate that it is implicit (Kamp and Rossdeutscher 1994). This referent has slightly different properties than the other referents in (30) as e.g. reflected in the fact that it cannot be referred to by a pronoun in the following context.

(iii) Ohnesorg was killed by an accurate shot. *He (=the killer) was a policeman.

5 The semantics of *durch* as a sentence-internal presupposition

In the above analysis, the semantics of *durch* was claimed to be characterised by an empty content part. *Durch* was also said to *involve* a causal relation. In this section, I will specify how the notion of *involvement* may be understood. Given the fact that the formalism applied here was first introduced by van der Sandt (1992) and further developed by Kamp (2001) to handle presuppositional phenomena, two obvious question are: Could the causal relation in *durch* be described as a presupposition? And what would the implications for presupposition theory be? Only a partial answer to the latter question will be given here.

Let us first turn to the question whether there are any parallels between the behaviour of *durch* and presuppositional phenomena in general. It is argued here that the treatment of *durch* presented above amounts to analysing the implicit CAUSE element of *durch* as what I propose to call a *sentence-internal* presupposition. While *durch* asserts the event in the internal argument, it *presupposes* that this event is a cause of some other event. This presupposition is intrasentential in as far as the presupposition of *durch* is verified within the sentence itself. The common basis for generally assumed mechanisms of presuppositional behaviour and the compositional unification-based analysis of *durch* is as follows. When combined with causatives, *durch* seems to lack a meaning of its own. This is due to the unification of the CAUSE of *durch* with the CAUSE of the predicate, which is parallel to presupposition verification. In combination with inchoatives, however, *durch* does seem to make a greater contribution, in the sense that a CAUSE predicate is introduced by the causal preposition itself. In this case, a parallel to context accommodation suggests itself.

A pragmatic account of the combinatorial potential of *durch* can also capture some further properties of the preposition which previously have been ignored or not correctly identified. Two of the additional pragmatic mechanisms involved are *bridging* and *acceptability*.

In (9), repeated for convenience in (31), *bridging* (in the wider sense of Bittner (2001), commonly described as *type coercion* in the semantic literature on aspect, cf. e.g. Egg (2002)) can be argued to take place. The CAUSE associated with the preposition forces a reinterpretation of the state described in the predicate *hoch* ('high') as being a caused *resultant state*.

(31) Der durch diese Haltung hohe Luftwiderstand kann auf längeren Strecken ganz schön schlauchen.
'The high air resistance due to this posture may put you through the mill over longer distances.'

The relevance of *acceptability*, or, more specifically, informativeness, in the sense of van der Sandt (1992, p. 367 ff.) reveals itself in comparisons of *durch* phrases in combination with manner-neutral and *manner-specific* predicates, i.e. causatives where the nature of the causing event is specified. It has been claimed in the literature that *durch* cannot be combined with manner-specific causatives (Härtl 2001). The examples in (32) show

that this is not correct. The verb *erschießen* ('shoot dead') is a manner-specific causative predicate, where the causing event is specified as being a shooting event. (32a) is not really ungrammatical (but admittedly sounds very awkward), and (32b) is fine:

(32) a. ??*Er wurde durch einen Schuss erschossen.*
He was through a shot shot dead
'He was shot dead with a shot'

b. *Er wurde durch einen Genickschuss erschossen.*
He was through a shot-to-the-neck shot dead
'He was shot dead with a shot to the neck.'

In my view, one cannot explain the variation in well-formedness of combinations as in (32) by reference to the semantics of *durch*. One can achieve a more general account of this distribution by assuming that composition is restrained by the pragmatic mechanism of acceptability. Modifying a predicate such as *erschießen* ('shoot dead') by an adverbial like *durch einen Schuss* ('with a shot') as in (32a) is uninformative and thus unacceptable: the adverbial contains no information which is not included in the predicate. However, a specification such as *durch einen* ***Genick****schuss* ('with a shot to the neck') as in (32b) renders the adverbial more specific than the shooting event described in the predicate, adding to the content: *Genickschuss* not only describes a shooting event, but also specifies the target of the shot.[14]

Besides, the reference to pragmatic mechanisms in explaining the compositional behaviour of *durch* has additional benefits as compared to an analysis based on unification alone. This is the case in examples involving indirect causation, where it is plausible to assume that two CAUSE elements occur:

(33) *Der Lehrer ließ das Programm durch einen Befehl starten.*
the teacher let the program through a command start
'The teacher had the program started by means of a command.'

In (33), two causative predicates are used: *lassen* ('let'), which can be compared to the causative uses of *have* in English, and *starten* ('start'). Two interpretational variants are available for (33). What they both have in common is that the teacher is the agent of some event which causes someone else to start the program. In one variant, the command is the event which starts the program (e.g. something a student enters on a keyboard). In this case, the CAUSE presupposition of the *durch* phrase would be verified by the CAUSE of *start*. The other interpretational variant of (33) is one where the command is not part of the starting event, but rather modifies the causing event of which the teacher is the agent, expressed in the *lassen* predicate, i.e. the teacher somehow uses the command to make someone else start the program (e.g. by calling out "start the program"). In this

[14]There is obviously some overlap in the information contributed in the combination in e.g. (32b) as well. It may thus be concluded that acceptability restrictions should exclude cases of *complete* informational overlap.

case, the CAUSE presupposition of *durch* will be verified by the CAUSE of *lassen*. Under this interpretation, the event which starts the program is left unspecified.

One of the problems a case like (33) reveals for the application of an unrestrained form of unification is the following. Let us suppose that unification should be allowed to occur even whenever it can, limited only by general constraints on unification, such as a demand that features of unified variables should be non-conflicting (Carpenter 1992, p. 45 ff.). Then, in the formalisation described above, as in most unificational frameworks, the two CAUSE predicates and the CAUSE of *durch* would be unified (unless some ad hoc principles were defined to avoid unification). But this would run against the actual interpretation of (33) with two CAUSE predicates in a relation of indirect causation.[15]

Crucially, when we conceive the analysis of *durch* as presupposition verification, this mechanism can also be made responsible for determining in a non-ad hoc way the processes which determine unification. In what follows, I will indicate how the data at hand can be explained this way.

Van der Sandt (1992) argues that verification does not always have to occur even if it can. It is certainly the preferred operation over accommodation, but accommodation might under certain conditions occur when verification is possible. What these conditions are, is not an easy matter to settle, but in the case of (33), it might be argued for a more general pragmatic principle in the style of bidirectional optimality-theory (Blutner 2000): there is a simpler expression without *lassen* which is available for direct causation, namely one with only *starten* in combination with *durch*, cf. (34).

(34) *Der Lehrer startete das Programm durch einen Befehl.*
the teacher started the program through a command
'The teacher started the program by means of a command.'

Unifying the two CAUSEs of the predicates *starten* and *lassen* and verifying the presupposed CAUSE of *durch* with these would imply a lack of belief in the informativity of sentence (33) on the hearer's side.

It should be emphasised that in the above examples, all pragmatic mechanisms assumed to account for the compositional behaviour of *durch* apply purely sentence-internally. What is more, the presupposition verification argued for here refers to a word-internal level in several lexical items, involving a decomposition of the semantics of lexical items by means of the predicates CAUSE and BECOME.[16] In this sense, my approach can be said to truly belong to the realm of lexical pragmatics (Blutner 2004).

[15] A semantically motivated restriction to unification, referring to thematic roles, can be imagined: In addition to the teacher, there is an additional implicit agent present: someone executes the orders of the teacher. These two agents cannot be agents of one and the same event (Krifka 1992, p. 44). Thus, the events themselves have to be separable to allow the existence of these two agents, which blocks them from being unified.

[16] Obviously, it has been observed earlier that morphological parts of words trigger presuppositions. One such example is the prefix *re-* in *reenter*, which presupposes an earlier state of being in the space in question, cf. e.g. Fabricius-Hansen (2001). But such morphemes refer to semantic entities introduced in an earlier extra-sentential context.

It might be questioned whether the nature of the alternating CAUSE contribution of *durch* is really a kind of presupposition. Due to reasons of space, this question cannot be discussed anywhere close to satisfaction in this paper.

It is by no means straightforward to corroborate this view, since many tests normally applied as diagnostics for presuppositions are not applicable in the case of *durch*. The pragmatic mechanisms which are argued to be relevant here apply at the sentence-internal level, referring to elements of a decomposition of lexical items, whereas most presuppositional phenomena which have been treated in the literature belong to the intersentential level. These can only be evaluated after the top-most CP-level has been reached. But the verification of the CAUSE presupposition of *durch* rather occurs at VP-level. Thus, traditional tests involving e.g. embeddedness do not make much sense in the case of sentence-internal pragmatics.[17]

One presuppositional test which does seem to be applicable though is the negation test. It involves a non-entailing context in which a presupposition should still be true. Recall that the *durch* phrase is assumed to presuppose that the event in its internal argument is the causing event of some other event:

(35) *Er starb nicht durch einen gezielten Schuss.*
He died not through an accurate shot
'He did not die through an accurate shot.'

It does not make sense to consider the truth of CAUSE alone, but it can be observed that the CAUSE of *durch* survives negation. The sentence is not appropriate in a context where the individual in question does not die. What is negated is not the occurence of death but that the cause was an accurate shot, cf. (36):

(36) $\exists e_1 \exists e_2 \exists y[\textsc{become}(\textit{dead}(y))(e_2) \wedge \textsc{cause}(e_2)(e_1) \wedge \neg \textsc{shoot}(e_1)]$

It is possible to get a sentential negation reading of *nicht* ('not') in (35), but this is a more unlikely reading (cf. the discussion of *metalinguistic negation* in Horn (1989)). The reason for this could be that it does not make sense in (35) to add a causal adverbial like *durch einen gezielten Schuss* if one wants to express that a person did not die (Solstad 2006).

Summing up, the above arguments indicate that a presupposition-like analysis of *durch* is plausible and that such an approach involves an extension of presupposition theory to apply also to the sentence-internal level (see also Fabricius-Hansen and Sæbø 2004).

The inclusion of pragmatic mechanisms to restrain the compositional procedure clearly sets my analysis apart from a strictly compositional one. However, as these mechanisms are well-formed and general, the analysis may still be viewed as compositional.

[17] See Beaver (2001, p. 18-20) and Geurts (1999, p. 6-10) for some short general comments on the problem of testing for presuppositions and delimiting them from other semantic or pragmatic phenomena.

6 Conclusion and outlook

In this paper, it was shown that a semantic analysis applying strict compositionality is not always a viable option. The varying compositional impact of German adverbials headed by the causal preposition *durch* was argued to be better rendered in a unificational framework. It was further contended that pragmatic mechanisms are important in describing the combinatorial distribution of some lexical items, and that what was analysed as a case of unification within DRT may be viewed as a (sentence-internal) presuppositional phenomenon.

An approach as sketched in the present analysis has applications beyond the analysis of *durch*. First, unification as a mode of composition is applied in Sæbø's (to appear) analysis of *by* in English (see above). Second, there are causal prepositions in other languages which show a similar behaviour to *durch*. In English, *through* can also be combined with both causative and inchoative predicates. More interestingly (given the close relationship between English *through* and German *durch*), a language more remotely related to German, such as Bulgarian, also has a preposition which combines with causatives and inchoatives, *ot* ('from'):[18]

(37) a. *Toj be ubit ot tri kurshuma.*
he was killed from three bullets
'He was killed with three shots.'
b. *Toj zagina ot tri kurshuma.*
he died from three bullets
'He died from three shots.'

Third, there are other types of adverbial modification where the above analysis can be applied plausibly, as illustrated in (38):[19]

(38) a. *Sie ging in das Haus hinein.*
She went in the house inside
'She went into the house.'
b. *Sie ging in das Haus.*
'She went into the house.'
c. *Sie ging hinein.*
'She went inside.'

In (38a) the adverbials *in das Haus* ('into the house') and *hinein* ('inside' in addition to viewpoint information) specify a single path of movement. They are not interpreted as describing two (sub-)paths which are combined. There is a double specification of an *in* movement (i.e. *into* as opposed to *out of*), both in the preposition *in* and in the *hinein*

[18]Importantly, as with *durch*, objects or entities as internal argument of *ot* are sortally shifted to events. The noun *kurshuma*, meaning 'bullets', is reinterpreted as an event noun, as indicated in the translations of the sentences in (37).

[19]Thanks are due to Christopher Habel for calling my attention to these data.

element. In addition, directionality is specified twice: in the combination of the preposition with accusative case as well as in the *hinein* element. As can be seen from (38b)-(38c), either of the adverbials in (38a) can occur without the other.

In the spirit of the analysis presented here, the *hinein* element would be assumed to carry the presupposition that there is an object into which movement takes place. In (38a) this presupposition would be sentence-internally verified, whereas it would have to be verified in a wider context or accommodated in (38c). Information on directionality and inwards movement of the two adverbials would be unified whenever they both occur.

To summarise, these data suggest that the presuppositional analyses of Kamp (2001) and van der Sandt (1992) in combination with unification-based composition can be suitably applied in analysing lexical items other than particles and factive verbs.

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