

# Copula sentences and entailment relations

JOHANNES DÖLLING

## 1. Introduction

In her proposal Claudia Maienborn attempts to provide evidence above all for the following basic claims:

First, stative verbal expressions, regardless of whether they represent stage-level or individual-level predicates, pattern with eventive expressions in introducing a hidden referential argument which can be located in time and may serve as an antecedent for anaphoric reference. What separates statives from eventives is that their arguments are not dynamic but static entities, that is, states.

Secondly, statives do not form a homogeneous class of expressions. While verbs like *stand*, *sit*, and *sleep* pass all of the relevant eventuality diagnostics, patterning also in this respect with eventives, copula constructions as well as verbs like *know*, *hate*, and *resemble* fail most of these tests. As a result, the expressions refer to states of two radically different ontological kinds – Davidsonian states (or D-states) and Kimian states (or K-states), respectively.

Thirdly, the K-state argument of copula constructions has its source not in the predicate combined with the copula but in the copula itself. Accordingly, the copula differs from other K-state verbs in having no specific content but only providing an argument position that can be filled by nominal, adjectival or prepositional predicates.

I am in agreement with Maienborn about the first claim. Actually, in Dölling (1999, 2003), it is explicitly argued against an approach, which strictly separates copula sentences from other ones in supposing that the former do not refer to states as reified entities but at best to abstract time

intervals.<sup>1</sup> In particular, I sympathize with her idea that the German expression *dabei* provides additional support for such a reification. Further, I think that the observations underlying Maienborn's second claim are basically correct. The strategy proposed to get the data under control, however, is faced with a number of difficulties. Finally, in regard of the third claim I agree that there are no reasons for assuming that the state argument is introduced by the predicate into the copula construction. But it is an open point whether we should take the alternative suggested.

The main goal of the present paper is to explore some of the consequences of Maienborn's approach for studying the inferential behavior of copula sentences. Specifically, I will discuss what devices are required if we want to explicate entailment relations against this background. In addition, it will be shown that several data left out of account by Maienborn force to examine her assumptions.

## 2. Some weak points of the K-state based approach

To begin with, I disagree with Maienborn that compatibility with locative modifiers and admissibility as infinitival complements of perception verbs are indispensable for considering a verbal expression accessible to an eventuality-based analysis. In fact, my claim is that there are eventives that miss at least one of these properties and, at the same time, call for an account within the Davidsonian paradigm.

To illustrate, look first at the sentences in (1), which are eventive but deviating, just as the stative sentences in (2).

- (1) a. \*Hans wurde (gerade) in Italien 30 Jahre alt.  
Hans became (at.the.moment) in Italy 30 years old.
- b. \*Marias Vertrag lief (gerade) in Deutschland aus.  
Maria's contract ran (at.the.moment) in Germany out.
- (2) a. \*Hans war (gerade) in Italien 30 Jahre alt.  
Hans was (at.the.moment) in Italy 30 years old.

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<sup>1</sup> Dölling (1999) was written partially as reaction to a previous paper by Maienborn, in which she pursued just this approach. For a more detailed version cf. Maienborn (2000).

- b. \*Marias Vertrag war (gerade) in Deutschland zu  
 Maria's contract was (at.the.moment) in Germany at.an  
 Ende.  
 end.

The data in (1a) and (1b) demonstrate that eventive expressions like *30 Jahre alt werden* ('become 30 years old') and, in a context as given, *auslaufen* ('run out') cannot be modified by eventuality-related locatives. It follows that the events referred to do not have a location in space and, therefore, are abstract in a way.

Consider next the sentences in (3), where the eventives display a similarly deviating behavior with respect to perception reports as the statives occurring in (4).

- (3) a. \*Eva sah Hans 30 Jahre alt werden.  
 Eva saw Hans 30 years old become.  
 b. \*Eva sah Marias Vertrag auslaufen.  
 Eva saw Maria's contract run.out.  
 c. \*Eva sah Hans ein Egoist werden.  
 Eva saw Hans a selfish.person become.  
 d. \*Eva sah Maria die Mutter vergessen.  
 Eva saw Maria the mother forget.
- (4) a. \*Eva sah Hans 30 Jahre alt sein.  
 Eva saw Hans 30 years old be.  
 b. \*Eva sah Marias Vertrag zu Ende sein.  
 Eva saw Maria's contract at.an end be.  
 c. \*Eva sah Hans ein Egoist sein.  
 Eva saw Hans a selfish.person be.  
 d. \*Eva sah Maria die Mutter kennen.  
 Eva saw Maria the mother know.

The case of (3a) and (3b) indicates that expressions like *30 Jahre alt werden* and *auslaufen* are also unsuitable for the use as infinitival complements of perception verbs. In addition, as sentences (3c) and (3d) show, this is equally true for expressions like *ein Egoist werden* ('become a selfish person') and *vergessen* ('forget'). We can take these observations to be founded on the fact that not all events are perceptible.

Given this picture, it appears that Maienborn's notion of the category of eventualities is too restrictive and, therefore, has to be weakened. In

particular, the assumption that each of its members is not only a temporal but also a spatial entity can not longer be maintained. As a result, the difference between eventualities and so-called K-states turns out to be smaller than supposed. Taking this into consideration, I wonder whether we should not subsume the latter, along with states related to by verbs like *stand*, *sleep*, and *wait*, under the former. States would divide, then, in analogy to events into two kinds as subtypes of the category of eventualities – spatial states and non-spatial states. Thus, I suggest that at least from this point of view there is no reason for excluding a subclass of statives from a Davidsonian account and, after that, for establishing a dichotomy between D-states and K-states.

Let me add an observation that undermines Maienborn's assumption that K-states are closed under negation. There is no doubt that on the account proposed sentence (5) is allowed to be regarded as referring to a state of this kind.

- (5) Die Landschaft blieb unverändert.  
The landscape remained unchanged.

But look now at sentence (6) which is the result of negating (5).

- (6) Die Landschaft blieb nicht unverändert.  
The landscape remain did.not unchanged.

On condition that the negation applies to its propositional content the sentence indicates that the landscape was changed. Thus, it appears that, in contrast to the assumption, (6) does not denote a state. Further evidence for the conflict under discussion is provided by sentences (7) and (8).

- (7) Der Deich widerstand dem Wasserdruck.  
The dike withstood the pressure.of.water.  
(8) Der Deich widerstand nicht dem Wasserdruck.  
The dike withstand did.not the pressure.of.water.

Again, while the first sentence can be considered a K-state sentence, the second is its negation, indicating that the dike broke, and cannot be understood in such a way. The question arises what entities sentences like (6) and (8) refer to. Are they related to the respective events? If not, perhaps, to entities of a kind differing from eventualities and K-states? It

is also not impossible that we have to analyze the sentences dealt with in an entirely other way, however.

At the end of my general remarks, I want to have a look at the mode of semantic representation proposed for K-state expressions. While in representing the meaning of eventuality expressions Maienborn makes use of the neo-Davidsonian<sup>2</sup> framework, she argues that copula constructions and verbs like *know*, *hate*, and *resemble* call for an analysis which treats K-states as being intimately related to predicate-argument structures. Adopting Asher's (1993) idea that abstract objects such as facts and propositions are introduced by means of different relations of characterization  $\approx$ , her assumption is that K-state expressions have representations that are subject to the schema in (9).

(9)  $z \approx [P(x_1, \dots, x_n)]$ , with  $n \geq 1$

According to (9), a K-state  $z$  is characterized by  $P(x_1, \dots, x_n)$  or, more explicitly, by the predicate  $P$  applying to the arguments  $x_1, \dots, x_n$ .<sup>3</sup>

Obviously, structures of this kind have to be further specified for making clear the difference of K-states as fact-like entities from facts proper. Just saying that they differ from facts by having, similarly to eventualities, a temporal dimension is not enough.

In addition, the representations of stative verbs seem to suffer from a special shortcoming. To illustrate, consider the meaning structure that, according to Maienborn, has to be assumed for *ähnlich sein* ('be similar'):

(10) *ähnlich sein*:  $\lambda y \lambda x \lambda z [z \approx [\text{SIMILAR}(x, y)]]$

The copula construction in (10) expresses a three-place relation between two individuals and a state whereas the predicate **SIMILAR** denotes

<sup>2</sup> It should be mentioned that the term *neo-Davidsonian* is understood by Maienborn to some extent in an unusual way. As a rule, the term being presumably due to Dowty (1989) is used for characterizing an approach which supposes that, first, verbal predicates denote sets of eventualities and, secondly, thematic predicates introduced by conjunction denote relations of eventualities to their participants. Cf. also Parsons (1995) and Bayer (1997).

<sup>3</sup> There is a plain affinity of Maienborn's style of notation with that one suggested by Bierwisch (1988). In fact, the former differs from the latter only in using the predicate 'is characterized by' instead of the predicate of instantiation. Unlike Maienborn, however, Bierwisch assumes that all eventive and stative sentences have to be analyzed in such a non-Davidsonian manner.

only a two-place relation between the respective individuals, missing a place for states. For purpose of comparison, I quote the representation of *ähnelt* ('resemble') which, correctly, is of the same logical type as *ähnlich sein*:

(11) *ähnelt*:  $\lambda y \lambda x \lambda z [z \approx [\text{RESEMBLE}(x, y)]]$

As (11) shows, RESEMBLE is also in parallel with SIMILAR although it could be expected that the first predicate differs from the second in some way.

To take a more intricate case, look at the entry for *wissen* ('know') in (12).

(12) *wissen*:  $\lambda y \lambda x \lambda z [z \approx [\text{KNOW}(x, y)]]$

The verb can be used for referring to states that are characterized by it that an individual knows something. Since Maienborn assumes that unlike spatial eventualities or physical things K-states are mentally constructed entities, however, they do not exist in the real world.<sup>4</sup> Actually, the predicate KNOW does not allow of any reference to states but denotes a relation between holders and objects of knowledge. Thus, in accordance with traditional use we may talk of states of knowledge which individuals are in. According to Maienborn's approach, however, this should happen only for the sake of efficient communication. Do we want to accept such a consequence really?

### 3. On the inferential behavior of copula sentences

The ability to represent patterns of entailment is a crucial for viewing a semantic theory as being adequate. In particular, one of the merits of the Davidsonian analysis is that it straightforwardly accounts for the inferential properties of eventuality sentences. Let me see now whether adopting the K-state based approach to copula sentences in the examination of entailment relations provides evidence in favor of it.

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<sup>4</sup> Of course, in a sense this is true for all entities that are elements of the ontology underlying natural language insofar as they result from projecting our cognitive framework onto environmental input. Hence, we have generally to distinguish the way we conceptualize the world and the way the world really is. Cf. for example Bach (1986) and Dölling (1993, 1995).

It is a striking fact that sentence (13a) entails sentence (13b), where the first describes a scenario that is described in a poorer manner also by the second.

- (13) a. Maria schlief im Bett.  
           Maria slept in.the bed.  
       b. Maria war im Bett.  
           Maria was in.the bed.

While in (13a) the local PP *im Bett* is used as a modifier of the verb in (13b) it is a predicate that combines with the copula. According to Maienborn's paradigm, we can make the assumption that the sentences have the representations in (14a) and (14b), respectively.

- (14) a.  $\exists t, s [t < t_0 \wedge \text{TIME}(s) \supseteq t \wedge \text{SLEEP}(s) \wedge \text{THEME}(s, \text{maria})$   
            $\wedge \text{IN}(s, \text{the\_BED})]$   
       b.  $\exists t, z [t < t_0 \wedge \text{TIME}(z) \supseteq t \wedge z \approx \text{IN}(\text{maria}, \text{the\_BED})]$

As (14a) and (14b) indicate, sentence (13a) refers to a D-state of sleeping by Maria, which is localized in the bed, whereas sentence (13b) denotes a K-state being characterized by the localization of Maria in the bed. If we represent the sentences in this manner the entailment relation between them is not manifest, however. Thus, we are left with the task of deriving the concerning inference. For overcoming it, we might suppose an axiom such as in (15), where V and L are variables for verbal state predicates and predicates of localization, respectively.

- (15)  $\forall V, L, s, x, t [V(s) \wedge \text{THEME}(s, x) \wedge \text{TIME}(s) \supseteq t \wedge L(s)$   
        $\rightarrow \exists z [\text{TIME}(z) \supseteq t \wedge z \approx L(x)]]$

The axiom determines that for each D-state *s* there is simultaneously a K-state *z* such that the theme of *s* has a location coinciding with the location of *s*. It is obvious that on this basis (14b) can be logically inferred from (14a) without effort.<sup>5</sup>

<sup>5</sup> Notice that the axiom in (15) cannot be generalized for any eventuality verbs or any non-local modifiers. For instance, it is not applicable to a sentence like *Maria trank den Kaffee im Bett* ('Maria drank the coffee in the bed') because the theme of the drinking, i.e. the coffee needs not to be localized in the bed. Similarly, the axiom does not hold for a sentence like *Maria schlief zehn Minuten lang* ('Maria slept for ten minutes'), taking into consideration that objects cannot last for a time.

In an analogous way, we may account for the entailment relation holding between the sentences in (16a) and (16b), which are represented by (17a) and (17b), respectively.

- (16) a. Hans lag auf dem Sofa.  
Hans lay on the sofa.  
b. Hans war auf dem Sofa.  
Hans was on the sofa.
- (17) a.  $\exists t, s [t < t_0 \wedge \text{TIME}(s) \supseteq t \wedge \text{LIE}(s) \wedge \text{THEME}(s, \text{hans}) \wedge \text{ON}(\text{hans}, \text{the\_SOFA})]$   
b.  $\exists t, z [t < t_0 \wedge \text{TIME}(z) \supseteq t \wedge z \approx \text{ON}(\text{hans}, \text{the\_SOFA})]$

The structure in (17a) shows that unlike *schlafen* ('sleep') the verb *liegen* ('lie') makes use of the local PP *auf dem Sofa* as an argument that directly specifies the location of the object being the theme of the D-state. That is the reason why we need a second axiom, namely that in (18), for drawing the inference from (17a) to (17b).

- (18)  $\forall V, L, s, x, t [V(s) \wedge \text{THEME}(s, x) \wedge \text{TIME}(s) \supseteq t \wedge L(x) \rightarrow \exists z [\text{TIME}(z) \supseteq t \wedge z \approx L(x)]]$

Thus, on the condition that the correlation suggested by the axiom is a real one, we can again be sure that sentence (16a) entails sentence (16b).

Look next at the sentences in (19a) and (19b), which exemplify equally an entailment from the first to the second.

- (19) a. Eva schlief im Nachthemd.  
Eva slept in.the night-dress.  
b. Eva war im Nachthemd.  
Eva was in.the night-dress.

Essentially, unlike the local PPs in (13a) and (16a), in (19a) the PP *im Nachthemd* is neither a modifier nor an argument of *schlafen* ('sleep'). Instead, it plays the part of a depictive predicate denoting an additional property which pertains to the theme during the eventuality referred to by means of the verb.<sup>6</sup> More specifically, sentence (19a) means something

<sup>6</sup> The occurrence of depictive predicates is not confined to sentences containing stative verbs. Just so, depictives have not to be predicates of localization. Thus, for example, *Eva aß im Nachthemd* ('Eva ate in the night-dress') or *Eva schlief nackt* ('Eva slept naked') are likewise cases of this kind of secondary predication.



like ‘While Eva was sleeping, she was in the night-dress’. For representing it as well as sentence (19b), we might assume the structures in (20a) and (20b), respectively.

- (20) a.  $\exists t, s [t < t_0 \wedge \text{TIME}(s) \supseteq t \wedge \text{SLEEP}(s) \wedge \text{THEME}(s, \text{eva})$   
 $\wedge \exists z [\text{TIME}(z) \supseteq \text{TIME}(s) \wedge z \approx \text{IN}(\text{eva}, \text{the\_NIGHT-DRESS})]$   
 b.  $\exists t, z [t < t_0 \wedge \text{TIME}(z) \supseteq t \wedge z \approx \text{IN}(\text{eva}, \text{the\_NIGHT-DRESS})]$

Since, in contrast to the cases considered before, the logical inference from (20a) to (20b) can be immediately drawn, no specific axiom is necessary here. Instead, the point is how the representation in (20a) is derived from the representations of the lexical items occurring in (19a).

At closer inspection, this is not possible without assuming that some supplementary material of meaning is inserted into the concerning meaning structure. In what follows, the derivation of the representation for the VP *im Nachthemd schlafen* (‘in the night-dress sleep’) is demonstrated:

- (21) a. *schlafen*:  $\lambda x \lambda s. \text{SLEEP}(s) \wedge \text{THEME}(s, x)$   
 b. *im Nachthemd*:  $\lambda x. \text{IN}(x, \text{the\_NIGHT-DRESS})$   
 c. *shift*:  $\lambda P \lambda x \lambda s. \exists z [\text{TIME}(z) \supseteq \text{TIME}(s) \wedge z \approx P(x)]$   
 d. *im Nachthemd*:  $\lambda x \lambda s. \exists z [\text{TIME}(z) \supseteq \text{TIME}(s)$   
 $\wedge z \approx \text{IN}(x, \text{the\_NIGHT-DRESS})]$   
 e. *im Nachthemd schlafen*:  $\lambda x \lambda s. \text{SLEEP}(s) \wedge \text{THEME}(s, x)$   
 $\wedge \exists z [\text{TIME}(z) \supseteq \text{TIME}(s) \wedge z \approx \text{IN}(x, \text{the\_NIGHT-DRESS})]$

As shown in (21), an operator indicated by *shift* is applied to the representation of the PP *im Nachthemd*, making it accessible to a combination with the verb *schlafen*. Essentially, insertions of this kind rely heavily on world knowledge and, hence, contradict the principle of semantic compositionality.<sup>7</sup>

To consider another inference pattern, it is evident that sentence (22a) entails sentence (22b).<sup>8</sup>

<sup>7</sup> In view of the fact that other constructions – cf. for instance *ein seit drei Tagen kranker Mann* (‘a for three days sick man’) – require the application of further shift operators, such transfers of meaning call for a general account. An approach in which the compositionality principle is entirely maintained is proposed in Dölling (2003).

<sup>8</sup> It is not completely clear whether beyond that the sentences are also semantically equivalent. If so, the following consideration is to be extended to the case of equivalence.

- (22) a. Peter las den Brief langsam.  
           Peter read the letter slowly.  
       b. Ein Lesen des Briefes durch Peter war langsam.  
           A reading of the letter by Peter was slow.

In (22a) the manner of an eventuality of reading of the letter by Peter is specified by the adverbial modifier *langsam* whereas in (22b) the same thing is done by means of the adjective *langsam* being now a predicate of the subject-NP. On Maienborn's approach to copula constructions the sentences can be represented by the following structures:

- (23) a.  $\exists t, e [t < t_0 \wedge \text{TIME}(e) \supseteq t \wedge \text{READ}(e) \wedge \text{AGENT}(e, \text{peter})$   
            $\wedge \text{THEME}(e, \text{the\_LETTER}) \wedge \text{SLOW}(e)]$   
       b.  $\exists t, z [t < t_0 \wedge \text{TIME}(z) \supseteq t \wedge \exists e [\text{READ}(e) \wedge \text{AGENT}(e, \text{peter})$   
            $\wedge \text{THEME}(e, \text{the\_LETTER}) \wedge z \approx \text{SLOW}(e)]]$

Like the previous cases, we have to look for an explanation of why (23b) is derivable from (23a). Once more, a possible way out is to assume that there is an axiom that ensures the entailment relation between (22a) and (22b). In particular, we might suppose something like (24), where V and P are variables for verbal eventuality predicates and predicates specifying eventualities, respectively.

- (24)  $\forall V, P, e, t [V(e) \wedge \text{TIME}(e) \supseteq t \wedge P(e) \rightarrow \exists z [\text{TIME}(z) \supseteq t \wedge z \approx P(e)]]$

(24) tells us that for each V-eventuality *e* which owns a property *P* there is simultaneously a K-state *z* being characterized just by it that *e* has *P*. This allows us to infer (23b) from (23a).

So far, I have reviewed a number of entailment patterns with copula sentences. As demonstrated, they turn out to be valid under the K-state based approach if we have several axioms and particular shift operators. Doubtless, having recourse to such extra devices calls for special justification. It is quite certain, however, that alternative analyses are faced with a similar challenge.<sup>9</sup> Therefore, although no additional support for

<sup>9</sup> In particular, this is true both for the classical framework in which copula sentences are only related to time and for Parsons' (1990, 1995, 2000) version of a neo-Davidsonian analysis. For reasons of space I must leave discussion of how on these approaches the respective entailments could be accounted for aside here.

Maienborn's treatment of copula sentences comes from these observations they provide also no reasons telling seriously against it. But, as I will show now, the situation changes if some entailment relations being quite elementary are taken into account.

One of the firmest intuitions underlying predicate logic is that of these sentences,

- (25) a. Anna ist eine blonde Frau.  
           Anna is a blond woman.  
       b. Anna ist blond.  
           Anna is blond.  
       c. Anna ist eine Frau.  
           Anna is a woman.

(25a) entails both (25b) and (25c). Equally basic is the intuition that the conjunction of (25b) and (25c) entails (25a). Naturally, all of these entailments follow if the copula sentences are analyzed in the classical manner, that is if they are represented by (26a)–(26c), respectively.

- (26) a. [BLOND(anna)  $\wedge$  WOMAN(anna)] AT  $t_0$   
       b. [BLOND(anna)] AT  $t_0$   
       c. [WOMAN(anna)] AT  $t_0$

If we introduce a K-state argument into the representations of (25a)–(25c), as suggested by Maienborn, we run into trouble, however.

- (27) a.  $\exists z$  [TIME( $z$ )  $\supseteq t_0 \wedge z \approx$  [BLOND(anna)  $\wedge$  WOMAN(anna)]]  
       b.  $\exists z$  [TIME( $z$ )  $\supseteq t_0 \wedge z \approx$  BLOND(anna)]  
       c.  $\exists z$  [TIME( $z$ )  $\supseteq t_0 \wedge z \approx$  WOMAN(anna)]

Sentences that we traditionally think of as predications on Anna at one and the same time are analyzed as referring to K-states being possibly distinct from each other.

Let me first turn to the problem arising with respect to the validation of the entailments from (25a) to (25b) and (25c). It appears that (27b) as well as (27c) can be inferred from (27a) only if the structure in (28) is supposed as an axiom.

- (28)  $\forall P_1 \dots P_n, z, x$  [ $z \approx [P_1(x) \wedge \dots \wedge P_n(x)] \rightarrow z \approx P_1(x) \wedge \dots \wedge z \approx P_n(x)$ ],  
       with  $n \geq 2$

As at present the relation predicate  $\approx$  is not determined in detail, it is an open point whether such a condition should be true for K-states.

Look now at the more serious problem that we are confronted with in examination of the entailment from (25b) and (25c) to (25a). At first glance assuming an axiom as in (29), i.e. the inverse of (28) is sufficient for justifying the inference between the representations attributed to the sentences.

$$(29) \quad \forall P_1 \dots P_n, z, x \ [z \approx P_1(x) \wedge \dots \wedge z \approx P_n(x) \rightarrow z \approx [P_1(x) \wedge \dots \wedge P_n(x)]], \\ \text{with } n \geq 2$$

But a closer inspection shows that without relying on an implicit assumption the axiom as such cannot be used. For realizing this, note that (27b) indicates that there is a K-state being characterized by the exemplification of the property ‘blond’ at Anna, and (27c) indicates that there is a K-state being characterized by the exemplification of the property ‘woman’ at Anna. Applying successively the rule of Existential Instantiation, of Conjunction and of Existential Generalization we may derive the representation in (30), which discloses the existence of two states, from these premises.

$$(30) \quad \exists z_1, z_2 \ [ \text{TIME}(z_1) \supseteq t_0 \wedge \text{TIME}(z_2) \supseteq t_0 \wedge z_1 \approx \text{BLOND}(\text{anna}) \\ \wedge z_2 \approx \text{WOMAN}(\text{anna}) ]$$

By way of contrast, however, (27a) indicates that there is only one K-state being characterized by the exemplification of both ‘blond’ and ‘woman’ at Anna. So it says something beyond what is said in the premises. As a consequence, for drawing the inference to (27a) the additional assumption has to be made that the K-states referred to by (27b) and (27c) are the same.<sup>10</sup>

Is there such background information that we normally presuppose in case of entailments of this kind and that renders them valid when conjoined with the premises? If so, the precise content of the presupposition as well as the mechanism of its insertion into the respective inferences

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<sup>10</sup> While Parsons’ approach to copula sentences handles entailment relations like those from (25a) to (25b) and (25c) without effort it is similarly left with the problem of validating entailments under discussion. Suggesting that such inferences are valid enthymemes Parsons (2000) is forced to make use of a “trick”.

have to be explicated. If not, the question naturally arises of whether the entailment pattern provides a piece of counter-evidence to Maienborn's proposal. The data here are inconclusive.

*University of Leipzig*  
*doelling@rz.uni-leipzig.de*

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