

Perspective on individuals

Philippe DE GROOTE — *Université de Lorraine, CNRS, Inria, LORIA*

Timothee BERNARD — *Université Paris Cité, CNRS, Laboratoire de linguistique formelle*

Abstract. Davidson’s proposal that action verbs contain a hidden event argument, later refined by Parsons and others, has provided a powerful framework for understanding the logical form of sentences, in particular those involving adverbial modification. In this paper, we parallel this approach in the nominal domain by introducing the notion of *perspectives*, which function analogously to events. Our goal is to develop a logical account of adnominal modification that mirrors the insights of event semantics.

We propose a compositional framework in which adjectives and undetermined noun phrases are interpreted as sets of perspectives rather than sets of individuals or modifiers of sets of individuals. This approach synthesises Fine’s concept of *qua objects* and Larson’s suggestion that Davidsonian event semantics should be applied to adjectival modification. Our analysis captures entailment relations and intensional aspects of modification without recourse to meaning postulates or possible world semantics. Furthermore, we demonstrate that our perspective-based semantics naturally accommodates different adjective classes, including subsective, intersective, modal, and privative adjectives.

Keywords: event, perspective, individual, noun, adjective, modification.

1. Introduction

In a seminal paper, Davidson (1967) posits that action verbs should be interpreted as containing a hidden argument corresponding to the event to which they refer. His main motivation was, in his own words, “to get the logical form of simple sentences about actions straight”. In particular, he wanted to remove a difficulty associated with the logical interpretation of verbs, namely, their apparent variable polyadicity, i.e. the fact that the number of the arguments they can take seems almost arbitrary. For example, while the transitive verb *to butter* intuitively denotes a binary relation, in sentence (1) it also seems to take a location argument and a time argument, for a total of four arguments.

(1) Jones buttered the toast in the bathroom at midnight.

Davidson also wanted the logical form of the sentences to provide a logical account of the entailment relations that exist between sentence (1) and each of sentences (2a), (2b), and (2c).

- (2) a. Jones buttered the toast in the bathroom.
b. Jones buttered the toast at midnight.
c. Jones buttered the toast.

Davidson’s idea of adding a hidden argument to the logical form of verbs has proved to be the most fruitful. It has been generalised by followers, mainly as a result of the work of Parsons (1990), and has allowed various phenomena related to verbal modification to be given a formal account, giving rise to a new field in formal semantics known today as “event semantics”.

Our aim in the present paper is to give an account of adnominal modification comparable to the

way in which event semantics accounts for adverbial modification. In particular, we want to provide a purely logical account of the entailment relation existing between sentences (3a) and (3b), while avoiding the problems usually associated with an intersective treatment of subsecutive adjectives such as *skilful*.

- (3) a. Mary is a skilful surgeon.
 b. Mary is a surgeon.

To this end, we introduce a notion of *perspective* that plays at the nominal level a part comparable to the part played by the notion of event at the verbal level. We then develop a compositional fragment of English in which nouns are interpreted as sets of perspectives rather than sets of individuals. The resulting theory can be seen as a synthesis of two ideas: the use of *qua objects*, introduced by Fine (1982) and which are conceptually very close to perspectives, and the insight of Larson (1998), who writes that one “should import Davidson’s analysis of adverbial modification to adjectival modification”.

The remainder of this paper is organised as follows. Section 2 develops the parallel between adverbial and adnominal modification. We recall the basic principles of event semantics and discuss how it provides an elegant treatment of the intensional aspects of subsecutive modification. In Section 3, we formally introduce our notion of perspective and show how it can be used to accommodate different types of adjectives (subsecutive, intersective, modal, and privative). Then, in Section 4, we show how our perspective semantics is amenable to a compositional treatment. Section 5 reviews related work. We conclude in Section 6.

2. Paralleling adverbial and adnominal modification

2.1. Brief introduction to event semantics

In order to illustrate the principles underlying Davidson’s event semantics, let us consider slight variants¹ of examples (1), (2a), (2b), and (2c).

- (4) a. Jones butters the toast in the bathroom at midnight.
 b. Jones butters the toast in the bathroom.
 c. Jones butters the toast at midnight.
 d. Jones butters the toast.

As stressed in the introduction, a transitive verb such as *to butter* is expected to denote a binary relation, as is reflected in sentence (4d). The relation denoted by *to butter* seems, however, to take four arguments in sentence (4a), and three arguments in (4b) and (4c).

A naive solution to this puzzle would consist in introducing into the logical language multiple predicates for the verb *to butter*, one for each possible combination of arguments. But this solution is not satisfactory, as it would amount to considering such a verb to be highly ambiguous, which would run against the strong intuition that the different occurrences of *butters* in example (4) have the same meaning, and would obliterate the entailment relations that exist between (4a), on the one hand, and (4b), (4c) and (4d), on the other hand. Restoring these

¹We use the present tense in these variants. Tense and aspect are, as far as we know, orthogonal to the problems discussed here.

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entailment relations would then require numerous meaning postulates akin to (5), which is not very appealing.

$$(5) \quad \forall wxyz. (\mathbf{butter4} \ w \ x \ y \ z) \rightarrow (\mathbf{butter2} \ w \ x)$$

Another possible solution would be to consider that the verb *to butter* denotes a relation with as many argument slots as needed to account for all possible combinations of arguments. In such a solution, the semantic arguments that are not syntactically realised would be considered implicit and semantically realised by existential closures. In other words, sentence (4d) would be regarded as an ellipsis of *Jones butters a toast somewhere at some time*. An advantage of this solution is that it would account for entailment relations at the logical level. For instance, the fact that sentence (4a) entails sentence (4d) would be predicted as a consequence of the fact that formula (6a) entails formula (6b).

- (6) a. **butter jones toast bathroom midnight**
 b. $\exists xy. \mathbf{butters \ jones \ toast} \ x \ y$

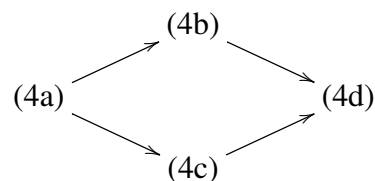
Despite this advantage, this second solution is not realistic because it would be extremely difficult, if possible at all, to determine the maximum number of arguments that an action verb like *to butter* could take. In fact, as illustrated by sentences (7a) and (7b) from Davidson (1967), it seems that additional arguments can be added almost ad libitum.

- (7) a. Jones buttered the toast in the bathroom with a knife at midnight.
 b. Jones buttered the toast in the bathroom with a knife at midnight, by holding it between the toes of his left foot.

In contrast, Davidson's proposal relies on the idea of modelling a transitive verb such as *to butter* with a single predicate that takes three arguments: an implicit *event* argument, and the two usual arguments contributed by the subject and the object, respectively. Seemingly additional arguments (location, time, etc.) are then related to the implicit event argument by means of specific binary predicates. Accordingly, sentence (4a) is semantically interpreted by the following logical form:

$$(8) \quad \exists e. (\mathbf{butter} \ e \ \mathbf{jones \ toast}) \wedge (\mathbf{in} \ e \ \mathbf{bathroom}) \wedge (\mathbf{at} \ e \ \mathbf{midnight})$$

As expected, Davidson's solution avoids the pitfalls of the two naive solutions first sketched, and provides a purely logical account of the entailment relations that exist between the various sentences of example (4). These relations may be pictured as



and are captured by the logical relation between the following formulas:

- (9) a. $\exists e. (\mathbf{butter} \ e \ \mathbf{jones \ toast}) \wedge (\mathbf{in} \ e \ \mathbf{bathroom}) \wedge (\mathbf{at} \ e \ \mathbf{midnight})$
 b. $\exists e. (\mathbf{butter} \ e \ \mathbf{jones \ toast}) \wedge (\mathbf{in} \ e \ \mathbf{bathroom})$
 c. $\exists e. (\mathbf{butter} \ e \ \mathbf{jones \ toast}) \wedge (\mathbf{at} \ e \ \mathbf{midnight})$

d. $\exists e$. **butter** *e* **jones toast**

Crucially, these relations derive essentially from fundamental properties of logical disjunction ($\alpha \wedge \beta \models \alpha$ and $\alpha \wedge \beta \models \beta$).

Similarly, many adverbs can be modelled as event predicates. For instance, sentence (10a) may be analysed as (10b).

- (10) a. Jones butters the toast slowly.
 b. $\exists e$. (**butter** *e* **jones toast**) \wedge (**slowly** *e*)

In fact, Davidson’s idea has proven to be quite productive and has led to numerous developments. A notable one is the *neo-Davidsonian* approach (Higginbotham, 1985; Parsons, 1990), which extends Davidson’s event semantics in three directions:

- Davidson’s approach is applied to most or all verbs, not only to action verbs; as a result, the Davidsonian implicit argument of a verb does not always correspond to an event in the strict sense of the term, but can also correspond to a state or, more generally, to an *eventuality* (Bach, 1986);
- Davidson’s distinction between argument and adjunct is abandoned, and all arguments (mandatory or optional) are treated in the same way; consequently, verbs are taken to lexicalise unary predicates of events;
- the binary predicates used to attach an argument to an event are interpreted as *thematic roles*.

As an illustration, applying these principles to the interpretation of sentence (4b) results in the following logical formula:

- (11) $\exists e$. (**butter** *e*) \wedge (**agent** *e* **jones**) \wedge (**theme** *e* **toast**) \wedge (**location** *e* **bathroom**)

In the remainder of this paper, we follow a neo-Davidsonian approach. Nevertheless, we will continue to use expressions like *Davidsonian semantics* or *Davidsonian approach* even to refer to a neo-Davidsonian treatment.

2.2. Two different ways to avoid spurious inferences

Event semantics is often presented as offering a parallel between the semantic treatment of verbs and that of nouns — with events and individuals playing parallel roles in the verbal and the nominal domains, respectively. This parallel emphasises the similarities that exist between adverbs and adjectives, and more generally between verbal modifiers and nominal ones. To illustrate this parallel, consider sentences (12a) and (12b) together with the logical forms (13a) and (13b), inspired by Montague and Davidson, respectively.

- (12) a. Olga is a Ukrainian vocalist.
 b. Olga sings beautifully.
- (13) a. $\exists x$. (**vocalist** *x*) \wedge (**ukrainian** *x*) \wedge (*x* = **olga**)
 b. $\exists e$. (**sing** *e*) \wedge (**beautiful** *e*) \wedge (**agent** *e* **olga**)

The analogy between these two logical forms is indeed striking. In particular, the noun phrase

Ukrainian vocalist and the verb phrase *sings beautifully* are both analysed as the intersection of two sets: $\lambda x. (\mathbf{vocalist } x) \wedge (\mathbf{ukrainian } x)$ and $\lambda e. (\mathbf{sing } e) \wedge (\mathbf{beautiful } e)$, respectively.

This parallel between the Montagovian treatment of nouns and the Davidsonian treatment of verbs seems however to quickly reach its limits when one considers adjectives that do not behave as simply as *Ukrainian*. For illustration, let us compare the adjective *graceful* with its adverbial sibling, *gracefully*. Suppose that Olga sings gracefully and that she dances. This does not entail that she dances gracefully. Event semantics correctly accounts for this lack of implication, since (14c) is not a logical consequence of $\{(14a), (14b)\}$.

- (14) a. $\exists e. (\mathbf{sing } e) \wedge (\mathbf{graceful } e) \wedge (\mathbf{agent } e \text{ olga})$
 b. $\exists e. (\mathbf{dance } e) \wedge (\mathbf{agent } e \text{ olga})$
 c. $\exists e. (\mathbf{dance } e) \wedge (\mathbf{graceful } e) \wedge (\mathbf{agent } e \text{ olga})$

Similarly, that John is both a graceful singer and a dancer does not imply that he is a graceful dancer. However, the logical forms below, which parallel the ones above, are unsatisfying since (15c) is a logical consequence of $\{(15a), (15b)\}$.

- (15) a. $\exists x. (\mathbf{singer } x) \wedge (\mathbf{graceful } x) \wedge (x = \mathbf{john})$
 b. $\exists x. (\mathbf{dancer } x) \wedge (x = \mathbf{john})$
 c. $\exists x. (\mathbf{dancer } x) \wedge (\mathbf{graceful } x) \wedge (x = \mathbf{john})$

This problem is due to the fact that *graceful* is not an *intersective* adjective (i.e. there is no set G such that, in general, the set of graceful Ns is the intersection of G with the set of Ns).

To avoid such spurious inferences, the usual treatment of non-intersective adjectives, which derives from the work of Montague (1970) and Kamp (1975), consists in interpreting adjectives as operators acting directly on the denotation of nouns, that is, as set transformers insofar as nouns denote sets of entities. For instance:

- (16) $\exists x. (\mathbf{singer } x) \wedge (\mathbf{graceful dancer } x) \wedge (x = \mathbf{john})$

This solution, however, does not provide for a purely logical account of the fact that *graceful* is *subsective* (i.e. the set of graceful Ns is always a subset of the set of Ns). In order to infer that John is a singer from the fact that he is a graceful singer, one needs a meaning postulate such as:

- (17) $\forall S. \forall x. (\mathbf{graceful } S x) \rightarrow (S x)$

Finally, note that *graceful* is not only non-intersective but is also *intensional* (i.e. it does not generally allow for *salva veritate* substitution of the noun that it modifies by a coextensive noun). Suppose that this adjective were taken to denote an extensional set modifier, i.e. an operator of type $(e \rightarrow t) \rightarrow e \rightarrow t$. Then, whenever **dancer** and **singer** are coextensive, **graceful dancer** and **graceful singer** would also be coextensive. In other words, proposition (18a) would have as a logical consequence proposition (18b).

- (18) a. $\forall x. (\mathbf{dancer } x) \leftrightarrow (\mathbf{singer } x).$
 b. $\forall x. (\mathbf{graceful dancer } x) \leftrightarrow (\mathbf{graceful singer } x)$

This would be rather problematic because propositions (18a) and (18b) would have for paraphrase sentences (19a) and (19b), respectively, while (19a) clearly does not entail (19b).

- (19) a. Every dancer is a singer, and vice versa.
 b. Every graceful dancer is a graceful singer, and vice versa.

To avoid this incorrect prediction, Montague (1973) interprets modifiers as operators acting on set intensions, i.e. operators of type $(s \rightarrow e \rightarrow t) \rightarrow s \rightarrow e \rightarrow t$, where s is the type of (possible) worlds.

The above discussion illustrates that while Davidson’s event semantics and the standard Montagovian treatment of adjectives prevent the prediction of similar spurious inferences related to modification, they do so in a very different spirit. According to event semantics, in *Olga dances gracefully*, the verb and the adverb each lexicalises a predicate and they do not describe the subject (Olga) but an implicit entity (a dancing event) related to the subject through a thematic role. Thanks to this implicit entity the semantics of both the verb and the adverb stay simple. In contrast, according to the Montagovian treatment of adjectives, in *John is a graceful dancer*, the noun and the adjective do describe the subject (John), but only the noun lexicalises a(n intensional) predicate while the adjective lexicalises a(n intensional) predicate modifier. Interestingly, while the adverb *gracefully* is intensional (i.e. it does not generally allow for *salva veritate* substitution of the verb that it modifies by a coextensive verb), Davidson’s approach does not require to resort to possible-world semantics.

Our goal in this paper is to explore whether the Davidsonian approach, which was devised to deal with adverbial modification, can be paralleled to the case of adnominal modification. To this end, we need to strengthen the parallel that exists between the interpretation of nouns and the interpretation of verbs.

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3.1. Interpreting nouns as set of perspectives

In *Olga sings gracefully*, the adverb *gracefully* does not express that Olga’s way of acting is graceful in general, but that her singing is graceful — this is literally captured by the Davidsonian analysis which results in logical form (14a). Likewise, in *John is a graceful singer*, the adjective *graceful* does not express that John’s attitude is graceful in general, but that his attitude as a singer is graceful — this is what we intend to literally capture at the level of logical forms.

In order to further the parallel between the treatment of nouns and the Davidsonian treatment of verbs, we introduce a notion of *perspective* together with a relation \succ between perspectives (type p) and individuals (type e), which we call the *on-relation*; “ $p \succ x$ ” is interpreted as “ p is a perspective on the individual x ”. With this new apparatus, we interpret nouns as sets of perspectives (just as verbs are interpreted as sets of events). Accordingly, the noun phrases *singer* and *graceful singer* are assigned the following logical forms, where p is crucially a variable of type p :

- (20) a. $\lambda p. \mathbf{singer} p$
 b. $\lambda p. (\mathbf{singer} p) \wedge (\mathbf{graceful} p)$

As intended, the above logical forms match perfectly the logical forms of the verb phrases *sings*

and *sings gracefully*:

- (21) a. $\lambda e. \mathbf{sing} e$
 b. $\lambda e. (\mathbf{sing} e) \wedge (\mathbf{graceful} e)$

We now analyse sentence *John is a graceful singer* as

- (22) $\exists p. (\mathbf{singer} p) \wedge (\mathbf{graceful} p) \wedge (p \succ \mathbf{john})$

which, again, parallels the logical form of *Olga sings gracefully* above in (14a).

3.2. Subjective adjectives

One of our main motivations in undertaking the present work was to give subjective adjectives an interpretation that avoids the spurious implications discussed in Section 2.2, without having to resort to meaning postulates to account for their subjectivity. To see how our proposal achieves this goal, consider again some of the examples previously discussed:

- (23) a. John is a graceful singer.
 b. John is a dancer.
 c. John is a graceful dancer.

In Section 2.2, we assigned to these three sentences the unsatisfactory interpretations given in (15), repeated here as (24):

- (24) a. $\exists x. (\mathbf{singer} x) \wedge (\mathbf{graceful} x) \wedge (x = \mathbf{john})$
 b. $\exists x. (\mathbf{dancer} x) \wedge (x = \mathbf{john})$
 c. $\exists x. (\mathbf{dancer} x) \wedge (\mathbf{graceful} x) \wedge (x = \mathbf{john})$

The problem with these interpretations lies in the substitution property of equality. Using this property, proposition (25) may be inferred from proposition (24a).

- (25) $(\mathbf{singer} \mathbf{john}) \wedge (\mathbf{graceful} \mathbf{john})$

Similarly, proposition (26) may be inferred from proposition (24b).

- (26) $(\mathbf{dancer} \mathbf{john})$

One can then derive (27) from (25).

- (27) $(\mathbf{graceful} \mathbf{john})$

Finally, from (26) and (27), one can derive (28), which is equivalent to (24c).

- (28) $(\mathbf{dancer} \mathbf{john}) \wedge (\mathbf{graceful} \mathbf{john})$

Now, consider the logical form that our perspective semantics assign to the sentences (23a)-(23c), where **graceful** is a predicate of perspectives (like **singer** and **dancer**):

- (29) a. $\exists p. (\mathbf{singer} p) \wedge (\mathbf{graceful} p) \wedge (p \succ \mathbf{john})$
 b. $\exists p. (\mathbf{dancer} p) \wedge (p \succ \mathbf{john})$
 c. $\exists p. (\mathbf{dancer} p) \wedge (\mathbf{graceful} p) \wedge (p \succ \mathbf{john})$

These three logical forms have exactly the same structures as those given in (24). Consequently, (29b) can be derived from (29c) just as (24b) can be derived from (24c). The subjectivity of

graceful is thus predicted by relying only on the basic properties of logical conjunction. The only difference between the logical forms in (29) and those in (24) is the use of the on-relation (\succ) instead of the equality relation ($=$), and this difference is crucial in accounting for the non-intersectivity of *graceful* because the on-relation does not satisfy any kind of substitution property.

3.3. Intersective adjectives

Let us go back to an arguably simpler adjective. If Olga is both a Ukrainian singer and a dancer, then she is a Ukrainian dancer. This inference is valid because the adjective *Ukrainian*, in contrast with *graceful*, is intersective. In other words, there is a set U of Ukrainian individuals such that, in general, the set of Ukrainian Ns is the intersection of U with the set of Ns. In our setting, we can account for this intersective property by using a predicate of individuals **ukrainian** and giving the sentence *Olga is a Ukrainian dancer* the following logical interpretation:

$$(30) \quad \exists x. (\exists p. (\mathbf{singer} p) \wedge (\mathbf{ukrainian} x) \wedge (p \succ x)) \wedge (x = \mathbf{olga})$$

Formula (30), which is logically equivalent to $\exists p. (\mathbf{singer} p) \wedge (\mathbf{ukrainian} \mathbf{olga}) \wedge (p \succ \mathbf{olga})$, together with formula (31a) entail formula (31b). This gives a logical account of the inference aforementioned, namely, that if Olga is both a Ukrainian singer and a dancer, then she is a Ukrainian dancer.

$$(31) \quad \begin{array}{l} \text{a. } \exists x. (\exists p. (\mathbf{dancer} p) \wedge (p \succ x)) \wedge (x = \mathbf{olga}) \\ \text{b. } \exists x. (\exists p. (\mathbf{dancer} p) \wedge (\mathbf{ukrainian} x) \wedge (p \succ x)) \wedge (x = \mathbf{olga}) \end{array}$$

Now, if we interpret undetermined noun phrases as sets of perspectives as we suggest (e.g. $\llbracket \text{graceful singer} \rrbracket = \lambda p. (\mathbf{singer} p) \wedge (\mathbf{graceful} p)$), we have to explain how the logical predicate **ukrainian** is applied to an individual when $\llbracket \text{Ukrainian singer} \rrbracket$ is applied to a perspective.

In order to answer this question, we first posit that the on-relation is functional:

$$(32) \quad \mathbf{Functionality\ of\ the\ on-relation} \\ \forall p. (\exists x. p \succ x) \wedge (\forall xy. ((p \succ x) \wedge (p \succ y)) \rightarrow (x = y))$$

This allows us to introduce the unique function \downarrow such that $\forall p. \forall x. (\downarrow p = x) \leftrightarrow (p \succ x)$. In other words, $\downarrow p$ is the individual on which perspective p is. Then, we can assign to the noun phrase *Ukrainian singer* the following logical form:

$$(33) \quad \lambda p. (\mathbf{singer} p) \wedge (\mathbf{ukrainian} \downarrow p)$$

Consequently, we analyse sentences (34a)-(38a) with formulas (34b)-(38b).

$$(34) \quad \begin{array}{l} \text{a. } \text{Olga is a Ukrainian singer.} \\ \text{b. } \exists p. (\mathbf{singer} p) \wedge (\mathbf{ukrainian} \downarrow p) \wedge (p \succ \mathbf{olga}) \end{array}$$

$$(35) \quad \begin{array}{l} \text{a. } \text{Olga is a singer.} \\ \text{b. } \exists p. (\mathbf{singer} p) \wedge (p \succ \mathbf{olga}) \end{array}$$

$$(36) \quad \begin{array}{l} \text{a. } \text{Olga is Ukrainian.} \\ \text{b. } \exists p. (\mathbf{ukrainian} \downarrow p) \wedge (p \succ \mathbf{olga}) \end{array}$$

$$(37) \quad \text{a. } \text{Olga is a dancer.}$$

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- b. $\exists p. (\mathbf{dancer} p) \wedge (p \succ \mathbf{olga})$
- (38) a. Olga is a Ukrainian dancer.
b. $\exists p. (\mathbf{dancer} p) \wedge (\mathbf{ukrainian} \downarrow p) \wedge (p \succ \mathbf{olga})$

The intersective behaviour of *Ukrainian* is illustrated by the fact that (34b) entails both (35b) and (36b), and that (34b) and (37b) together entail (38b). Once again, these entailments rely only on the basic logical properties of the propositional connectives.

3.4. Modal adjectives

So far we have discussed the case of adverbs and adjectives that, so to speak, act at the verb phrase level and at the noun phrase level, respectively. There is, however, another type of adverb that arguably takes scope over the whole sentence. For example, in sentence (39a), we do not interpret the adverb *probably* as describing any Olga-singing event, but as a modifier of the proposition that such an event exists. This interpretation is supported by the fact that sentence (39a) can be paraphrased as (39b).

- (39) a. Olga will possibly sing at the party.
b. It is possible that Olga will sing at the party.

By contrast, sentences (40a) and (40b) do not have the same meaning.

- (40) a. Olga sings beautifully.
b. It is beautiful that Olga sings.

In fact, adverbs like *possibly* are known as *modal adverbs* because they seem to behave logically like modal operators, i.e. logical operators that specify the mode in which a given proposition is valid. For instance, sentence (41a) can be analysed as (41b) (here and below, \diamond and \square are the usual possibility and necessity operators, respectively):

- (41) a. Olga possibly lives in Paris.
b. $\diamond(\exists e. (\mathbf{live} e) \wedge (\mathbf{experiencer} e \mathbf{olga}) \wedge (\mathbf{location} e \mathbf{paris}))$

Now, just as there are modal adverbs, there are modal adjectives too. Typically, *necessary*, *possible* and *probable* are such adjectives (corresponding to the adverbs *necessarily*, *possibly* and *probably*, respectively). The parallel between adverbs and adjectives then suggests an interpretation of modal adjectives as lexicalising modal operators. For example, the noun phrases *a necessary choice* and *every possible solution* can be analysed with logical forms (42a) and (42b):

- (42) a. $\lambda q. \exists x. \square(\exists p. (\mathbf{choice} p) \wedge (p \succ x)) \wedge (q x)$
b. $\lambda q. \forall x. \diamond(\exists p. (\mathbf{solution} p) \wedge (p \succ x)) \rightarrow (q x)$

It is to be noted that a lot of modal adjectives falls into Kamp's and Partee's (1995) class of plain non-subjective adjectives. The adjective *alleged*, for instance, can be given a modal interpretation.

A last technical remark is in order concerning the meaning of the modal operators. It is well known that modal connectives cannot be interpreted as Boolean truth functions, and that modal logic is usually given a semantics in terms of possible worlds. Consequently, it seems that the

interpretation of a formula like (41b) requires both notions of events and possible worlds. However, as discussed above, events and perspectives can be used to model the semantics of some intensional modifiers without resorting to possible world semantics, and we believe in fact that events and perspectives can be used more generally in natural language semantics instead of a primitive notion of possible world. To do so, we suggest defining possible worlds as (appropriate) sets of events and perspectives, and then re-expressing the semantics of modal connectives in terms of such sets. This program, however, would require technical developments that are beyond the scope of the present paper.

3.5. Privative adjectives

The by-now more or less standard classification of adjectives, as reviewed by Kamp and Partee (1995), includes a class of *privative* adjectives to which belong for instance *fake*, *spurious*, and *counterfeit*. These adjectives (e.g. *fake*) are such that when applied to a noun (e.g. *gun*), the resulting expression (here *fake gun*) is used to describe entities that *cannot* be described by the noun alone (here *gun*), as illustrated by the following true sentence:

(43) A fake gun is not a gun.

These privative adjectives can be accounted for in a Montagovian way; they are interpreted as (intensional) predicate modifiers such that the extension of their output is always disjoint from the extension of their input (a property that can be straightforwardly encoded in a meaning postulate). Such a treatment of privative adjectives, however, is not entirely satisfying. First, it seems to be committed to the idea that *gun* and *real gun* are synonymous, with the adjective *real* being assigned a trivial interpretation (namely, the identity function). Second, as Partee (2010) points out, it fails to account for the interpretability of sentences like question (44): if no gun is a fake gun, the question is predicted to have a trivial answer (i.e. *The gun is real*).

(44) Is that gun real or fake?

To resolve the tension between the truth of (43) and the need for an adequate interpretation of (44), Partee (2010) proposes to interpret privative adjectives as subsective adjectives applied to a coerced expansion of the denotation of the noun they modify. According to her proposal, the denotation of the noun phrase *fake gun* is thus obtained in two steps. First, the set of entities denoted by the noun *gun* (i.e. the set of actual guns) is expanded in order to also contain other gun-like entities. This expanded set is then restricted to the set of fake guns by applying the subsective modifier denoted by the adjective *fake*. In question (44), *that gun* is taken to refer to an entity that belongs to the expanded denotation of *gun*, and such an entity is neither a priori a real gun nor a priori a fake gun.

A perspective-based variant of Partee's approach can be formalised in a straightforward way. Let **gun** denote the set of (real) gun perspectives and $\overline{\mathbf{gun}}$ be its coerced expansion; while only real guns have a **gun** perspective, real and fake guns alike have a $\overline{\mathbf{gun}}$ perspective. The noun phrase *fake gun* may then be assigned the following logical form:²

(45) $\lambda p. (\overline{\mathbf{gun}} p) \wedge (\mathbf{fake} p)$

²Using **fake gun** as an abbreviation of (45), the noun phrase *fake fake gun* would be assigned the following logical form: $\lambda p. (\mathbf{fake gun} p) \wedge (\mathbf{fake} p)$.

Now it remains to be explained how the adjective *fake* triggers the coercion of the denotation of the noun *gun*. We come back to this question in the next section.

Guerrini (2024), who proposes another treatment of the privative adjectives, criticises Partee’s solution for being incomplete in its predictions. It is indeed the case that Partee’s proposal does not give a logical account of the truth of (43). Without any further specification of how the set denoted by the noun *gun* is coerced to its expansion, deriving the validity of (43) requires a meaning postulate. In the case of our perspective-based presentation of Partee’s proposal, this meaning postulate is as follows:

$$(46) \quad \forall x. (\exists p. (\overline{\mathbf{gun}} p) \wedge (\mathbf{fake} p) \wedge (p \succ x)) \rightarrow \neg(\exists p. (\mathbf{gun} p) \wedge (p \succ x))$$

Intuitively, Guerrini’s proposal amounts to interpreting the phrase *fake gun* as synonymous with *intended to look like a gun but not a gun*. In fact, this solution can be seen as a refinement of Partee’s, with *intended to look like a gun* playing the part of the coerced expansion, and *not a gun* playing the part of the subsective restriction. As such, it is amenable to a perspective-based formalization like the one discussed above. The technical details of this formalization, however, are beyond the scope of this paper and are left for future work.

4. Compositionality

4.1. Basic principles

It has been argued that event semantics does not fit well with compositional semantics because of a problematic interaction between quantification over individuals and existential quantification over events. This problem, which Winter and Zwarts (2011) call *the event quantification problem*, appears if one allows the existential quantifier that binds the event variable to take scope over other quantifiers. Consider, for instance, sentences (47a) and (48a) together with tentative logical forms (47b) and (48b).

$$(47) \quad \begin{array}{l} \text{a. Everybody loves Olga.} \\ \text{b. } \exists e. \forall x. (\mathbf{human} x) \rightarrow ((\mathbf{love} e) \wedge (\mathbf{experiencer} e x) \wedge (\mathbf{stimulus} e \mathbf{Olga})) \end{array}$$

$$(48) \quad \begin{array}{l} \text{a. John loves nobody} \\ \text{b. } \exists e. \neg(\exists x. (\mathbf{human} x) \wedge (\mathbf{love} e) \wedge (\mathbf{experiencer} e \mathbf{john}) \wedge (\mathbf{stimulus} e x)) \end{array}$$

Formula (47b) expresses the existence of a unique collective state of love which involves all humans as experiencers and of which Olga is the stimulus. The interpretation of (47a) that is usually favoured, in contrast, is that there is an individual state of love for each human as experiencer (which is not logically equivalent to (47b) without additional assumptions). Even more problematic is formula (48b) as a translation of (48a). This formula expresses the existence of an event that is not a loving event of any human being by John (without any other constraint); it is thus true as soon as such an event exists (e.g. a raining event), independently of whether there are loving events of any human being by John.

A problem similar to the event quantification problem arises with perspectives. As a simple illustration, let us parallel (47) and consider sentence (49a) and its tentative interpretation (49b):

$$(49) \quad \begin{array}{l} \text{a. Everybody is a singer.} \end{array}$$

$$b. \quad \exists p. \forall x. (\mathbf{human} \ x) \rightarrow ((\mathbf{singer} \ p) \wedge (p \succ x))$$

Formula (49b) assert the existence of a unique collective perspective that is a singer perspective simultaneously on everyone. Not only is this interpretation incompatible with the functionality of the on-relation (see (32)), but even without this assumption would we favour the non-equivalent interpretation according to which there is an individual singer perspective on each human being.

An elegant solution to the event quantification problem, which has been worked out by Champollion (2011, 2015), consists in interpreting verb phrases and sentences as generalised quantifiers over events rather than as sets of events. We here adapt this solution and interpret nouns as generalised quantifiers over perspectives, i.e. as terms of type $(p \rightarrow t) \rightarrow t$, where p is the type of perspectives. Accordingly, we use the following lexical entries for the common noun *singer*, the subjective adjective *graceful* and the intersective adjective *Ukrainian*:

$$(50) \quad \llbracket \mathbf{singer} \rrbracket = \lambda f. \exists p. (\mathbf{singer} \ p) \wedge (f \ p)$$

$$(51) \quad \llbracket \mathbf{graceful} \rrbracket = \lambda N f. N (\lambda p. (\mathbf{graceful} \ p) \wedge (f \ p))$$

$$(52) \quad \llbracket \mathbf{Ukrainian} \rrbracket = \lambda N f. N (\lambda p. (\mathbf{ukrainian} \ (\downarrow p)) \wedge (f \ p))$$

As is usual, determined noun phrases are interpreted as generalised quantifiers over entities (terms of type $(e \rightarrow t) \rightarrow t$). Hence determiners are interpreted as operators that transforms terms of type $(p \rightarrow t) \rightarrow t$ into terms of type $(e \rightarrow t) \rightarrow t$. For example, we use the following lexical entry for the determiner *every*:

$$(53) \quad \llbracket \mathbf{every} \rrbracket = \lambda NP. \forall x. (N (\lambda p. p \succ x)) \rightarrow (P \ x)$$

As a result, *graceful singer* is analysed as (54), and *every graceful singer* as (55).

$$(54) \quad \begin{aligned} \llbracket \mathbf{graceful} \ \mathbf{singer} \rrbracket &= \llbracket \mathbf{graceful} \rrbracket \llbracket \mathbf{singer} \rrbracket \\ &= \lambda f. \exists p. (\mathbf{singer} \ p) \wedge (\mathbf{graceful} \ p) \wedge (f \ p) \end{aligned}$$

$$(55) \quad \begin{aligned} \llbracket \mathbf{every} \ \mathbf{graceful} \ \mathbf{singer} \rrbracket &= \llbracket \mathbf{every} \rrbracket \llbracket \mathbf{graceful} \ \mathbf{singer} \rrbracket \\ &= \lambda P. \forall x. (\exists p. (\mathbf{singer} \ p) \wedge (\mathbf{graceful} \ p) \wedge p \succ x) \rightarrow (P \ x) \end{aligned}$$

4.2. Accommodating privative adjectives and predicative uses

We now return to the case of the privative adjectives. Let us consider the possibility of using for *fake* a lexical entry similar to that of *graceful* in (51):

$$(56) \quad \llbracket \mathbf{fake} \rrbracket = \lambda N f. N (\lambda p. (\mathbf{fake} \ p) \wedge (f \ p))$$

Then, in order to obtain the interpretation (45) that we discussed above for *fake gun*, one would have to use for *gun* the lexical entry in (57) rather than the one in (58).

$$(57) \quad \llbracket \mathbf{gun} \rrbracket = \lambda f. \exists p. (\overline{\mathbf{gun}} \ p) \wedge (f \ p)$$

$$(58) \quad \llbracket \mathbf{gun} \rrbracket = \lambda f. \exists p. (\mathbf{gun} \ p) \wedge (f \ p)$$

This would mean considering that the noun *gun* refers by default not to the set of actual guns (or rather, of actual gun perspectives), but to its expansion to all gun-like entities. This position is tenable to some extent. For instance, in the following discourse, the occurrence of the noun

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gun is not interpreted as *actual gun* even though nothing prevents so in the sentence in which it occurs.

(59) I have three guns. All three are harmless. The first is an old pistol from the 18th century. The other two are high-quality replicas made for Western movies.

Nevertheless, this position runs against the common intuition and presents at least two serious defects:

- it assumes that there is a single relevant expansion of a noun denotation (e.g. from real guns to real and fake guns), while it seems that different expansions are relevant in different contexts (e.g. from real guns to real and imaginary guns when using *imaginary*);
- it predicts that *fake fake gun* is synonymous with *fake gun* and thus does not satisfyingly account for iterated modifications.

Example (59) shows that the coercion of a noun is not or at least not always triggered lexically. However, as a first solution, we modify our fragment so as to encode the coercion of a noun by an adjective directly in the lexical entry of the adjective. To do so, we need to change the semantic types associated with both parts of speech. More precisely, we now use lexical entries of type $((p \rightarrow t) \rightarrow p \rightarrow t) \rightarrow (p \rightarrow t) \rightarrow t$ for nouns, as illustrated with (60) for *gun*, where c is a variable of the type of modifiers of sets of perspectives (i.e. $(p \rightarrow t) \rightarrow (p \rightarrow t)$).

(60) $\llbracket \text{gun} \rrbracket = \lambda c f. \exists p. (c \text{ gun } p) \wedge (f p)$

Here is the lexical entry we now use for the adjective *fake*:

(61) $\llbracket \text{fake} \rrbracket = \lambda N c f. N (\lambda s. c (\text{coerce}_{\text{fake}} s)) (\lambda p. (\text{fake } p) \wedge (f p))$

As a result, *fake gun* is analysed as (62).

(62) $\llbracket \text{fake gun} \rrbracket = \llbracket \text{fake} \rrbracket \llbracket \text{gun} \rrbracket$
 $= \lambda c f. \exists p. (c (\text{coerce}_{\text{fake}} \text{gun}) p) \wedge (\text{fake } p) \wedge (f p)$

This term still expects a modifier of sets of perspectives as argument (c), allowing for further coercion as in the case of *fake fake gun*. A determiner eventually closes this argument slot, typically by providing an identity function ($\lambda s. s$).

We adapt the lexical entries of the other adjectives as well and use for instance the following for *Ukrainian* instead of (52):

(63) $\llbracket \text{Ukrainian} \rrbracket = \lambda N c f. N c (\lambda p. (\text{ukrainian } (\downarrow p)) \wedge (f p))$

A final word is in order about adjectives in predicative position. Applying Montague's strategy of generalizing to the worst case, we interpret the copula *to be* as a type-raised version of equality:

(64) $\llbracket \text{is} \rrbracket = \lambda A S. S (\lambda s. A (\lambda a. s = a))$

Therefore, in order to use an adjective in predicative position we need an operator to transform the lexical entry of the adjective into a term of type $(e \rightarrow t) \rightarrow t$. We use the following:

(65) $\text{PRED} = \lambda A P. \exists x. (A (\lambda c f. \exists p. c f p) (\lambda s. s) (\lambda p. p \succ x)) \wedge (P x)$

Applying this operator to entry (63) yields:

$$(66) \quad \lambda P. \exists x. (\exists p. (\mathbf{ukrainian} (\downarrow p)) \wedge (p \succ x)) \wedge (P x)$$

Then, the sentence *Olga is Ukrainian* is analysed as:

$$(67) \quad \begin{aligned} \llbracket \text{Olga is Ukrainian} \rrbracket &= \llbracket \text{is} \rrbracket (\text{PRED} \llbracket \text{Ukrainian} \rrbracket) \llbracket \text{Olga} \rrbracket \\ &= \exists x. (\exists p. (\mathbf{ukrainian} (\downarrow p)) \wedge (p \succ x)) \wedge (\mathbf{olga} = x) \end{aligned}$$

This formula is logically equivalent to the one that we provided earlier in (36a).

We conclude this section by presenting a piece of grammar that allows the various examples we have considered to be treated.

$\llbracket \text{Olga} \rrbracket = \lambda P. P \mathbf{olga}$: NP
$\llbracket \text{John} \rrbracket = \lambda P. P \mathbf{john}$: NP
$\llbracket \text{Paris} \rrbracket = \lambda P. P \mathbf{paris}$: NP
$\llbracket \text{the party} \rrbracket = \lambda P. P \mathbf{the_party}$: NP
$\llbracket \text{everybody} \rrbracket = \lambda P. \forall x. (\mathbf{human} x) \rightarrow (P x)$: NP
$\llbracket \text{somebody} \rrbracket = \lambda P. \exists x. (\mathbf{human} x) \wedge (P x)$: NP
$\llbracket \text{nobody} \rrbracket = \lambda P. \neg (\exists x. (\mathbf{human} x) \wedge (P x))$: NP
$\llbracket \text{dances} \rrbracket = \lambda Sg. S (\lambda s. \exists e. (\mathbf{dance} e) \wedge (\mathbf{agent} e s) \wedge (g e))$: NP \rightarrow S'
$\llbracket \text{sings} \rrbracket = \lambda Sg. S (\lambda s. \exists e. (\mathbf{sing} e) \wedge (\mathbf{agent} e s) \wedge (g e))$: NP \rightarrow S'
$\llbracket \text{lives} \rrbracket = \lambda Sg. S (\lambda s. \exists e. (\mathbf{live} e) \wedge (\mathbf{experiencer} e s) \wedge (g e))$: NP \rightarrow S'
$\llbracket \text{loves} \rrbracket = \lambda OSg. S (\lambda s. O (\lambda o. \exists e. (\mathbf{love} e) \wedge (\mathbf{experiencer} e s) \wedge (\mathbf{stimulus} e o) \wedge (g e)))$: NP \rightarrow NP \rightarrow S'
$\llbracket \text{is} \rrbracket = \lambda AS. S (\lambda s. A (\lambda a. s = a))$: NP \rightarrow NP \rightarrow S
$\llbracket \text{choice} \rrbracket = \lambda cf. \exists p. (c \mathbf{choice} p) \wedge (f p)$: N
$\llbracket \text{dancer} \rrbracket = \lambda cf. \exists p. (c \mathbf{dancer} p) \wedge (f p)$: N
$\llbracket \text{gun} \rrbracket = \lambda cf. \exists p. (c \mathbf{gun} p) \wedge (f p)$: N
$\llbracket \text{singer} \rrbracket = \lambda cf. \exists p. (c \mathbf{singer} p) \wedge (f p)$: N
$\llbracket \text{solution} \rrbracket = \lambda cf. \exists p. (c \mathbf{solution} p) \wedge (f p)$: N
$\llbracket \text{vocalist} \rrbracket = \lambda cf. \exists p. (c \mathbf{vocalist} p) \wedge (f p)$: N
$\llbracket \text{graceful} \rrbracket = \lambda Ncf. N c (\lambda p. (\mathbf{graceful} p) \wedge (f p))$: N \rightarrow N
$\llbracket \text{Ukrainian} \rrbracket = \lambda Ncf. N c (\lambda p. (\mathbf{ukrainian} (\downarrow p)) \wedge (f p))$: N \rightarrow N
$\llbracket \text{possible} \rrbracket = \lambda Ncf. \diamond (N c f)$: N \rightarrow N
$\llbracket \text{necessary} \rrbracket = \lambda Ncf. \square (N c f)$: N \rightarrow N
$\llbracket \text{fake} \rrbracket = \lambda Ncf. N (\lambda s. c (\mathbf{coerce}_{\text{fake}} s)) (\lambda p. (\mathbf{fake} p) \wedge (f p))$: N \rightarrow N
$\llbracket \text{real} \rrbracket = \lambda Ncf. N (\lambda s. c (\mathbf{coerce}_{\text{real}} s)) (\lambda p. (\mathbf{real} p) \wedge (f p))$: N \rightarrow N
$\llbracket \text{a} \rrbracket = \lambda NP. \exists x. (N (\lambda s. s) (\lambda p. p \succ x)) \wedge (P x)$: N \rightarrow NP
$\llbracket \text{every} \rrbracket = \lambda NP. \forall x. (N (\lambda s. s) (\lambda p. p \succ x)) \rightarrow (P x)$: N \rightarrow NP
$\llbracket \text{gracefully} \rrbracket = \lambda Vg. V (\lambda e. (\mathbf{graceful} e) \wedge (g e))$: S' \rightarrow S'
$\llbracket \text{possibly} \rrbracket = \lambda Vg. \diamond (V g)$: S' \rightarrow S'
$\llbracket \text{in} \rrbracket = \lambda NVg. N (\lambda n. V (\lambda e. (\mathbf{location} e n) \wedge (g e)))$: NP \rightarrow S' \rightarrow S'
$\llbracket \text{at} \rrbracket = \lambda NVg. N (\lambda n. V (\lambda e. (\mathbf{location} e n) \wedge (g e)))$: NP \rightarrow S' \rightarrow S'
$\text{PRED} = \lambda AP. \exists x. (A (\lambda cf. \exists p. c f p) (\lambda s. s) (\lambda p. p \succ x)) \wedge (P x)$: (N \rightarrow N) \rightarrow NP
$\text{CLOSURE} = \lambda V. V (\lambda e. \mathbf{true})$: S' \rightarrow S

where $NP = (e \rightarrow t) \rightarrow t$
 $N = ((p \rightarrow t) \rightarrow p \rightarrow t) \rightarrow (p \rightarrow t) \rightarrow t$
 $S' = (v \rightarrow t) \rightarrow t$
 $S = t$

5. Related work

Because of the existence of non-intersective adjectives — be them subsective (*typical*), privative (*would-be*), or plain non-subsective (*alleged*), in the terminology of Kamp and Partee (1995) — Montague (1970) interprets all adjectives as (intensional) predicate modifiers, turning noun meanings (e.g. $\llbracket \text{criminal} \rrbracket$) into other noun meanings (e.g. $\llbracket \text{alleged criminal} \rrbracket = \llbracket \text{alleged} \rrbracket \llbracket \text{criminal} \rrbracket$).

This uniform treatment of adjectives, typical of the “generalising to the worst-case” approach of Montague, has been criticised by different authors. In particular, Siegel (1976) argues for a grammatical distinction between two classes of adjectives, one modelled with predicates of individuals combined intersectively with noun meanings, and one modelled with predicate modifiers combined functionally with noun meanings. A crucial feature of this approach and similar ones (e.g. von Stechow and Heim 1999) is thus that non-intersective adjectives are modelled as in the work of Montague (1970).

Larson (1998), however, judges this view as inadequate. He argues that subsective adjectives are no more predicate modifiers than intersective adjectives, and that the absence of entailment from *Olga is a skilful dancer* to *Olga is a skilful singer* even when assuming that all dancers are singers (and conversely, even necessarily) is to be explained by a parallel with Davidsonian event-semantics. He argues that the predicates lexicalised by nouns, like the ones lexicalised by most verbs, also have a hidden event argument. In contrast with verbs, however, this hidden argument is bound by a *generic quantifier* (Chierchia, 1995). Glossing over some subtleties, his analysis paraphrases (68a) as (68b); the absence of the relevant spurious entailments can be seen as a result of the fact that, according to this account, *skilful* does not describe individuals but their (implicit) actions.

- (68) a. Olga is a skilful {dancer/singer}.
 b. In general, for eventualities that are {dancing/singing} by Olga, those eventualities are beautiful.

Our analysis is in line with this approach in that we also interpret subsective adjectives as (unary) predicates rather than predicate modifiers. The main difference, however, is that we take them to apply to a perspective bound by an existential quantifier — a standard operator of type theory — rather than to an event bound by a generic quantifier.

It is worth noting that we use the term *perspective* in a sense that is closer to the one used in frame semantics (Fillmore and Baker, 2009), for which a buying and a selling might be two distinct perspectives on the same underlying entity, than to the one used more recently in philosophy of language and which corresponds to the point of view of the interpreter of a linguistic expression (Lasnik, 2016; Asudeh and Giorgolo, 2016; Burke, 2022). Intuitively, our perspective are more *on* a subject than *from* a point of view.

These perspectives are thus conceptually similar to the *qua objects* of Fine (1982). This author postulates that for some entities x (e.g. a person, an object, an event) and descriptions ϕ true of x , there exists an entity named “ x qua ϕ ”; this entity is a *qua object*, obtained by *glossing* x with ϕ . Examples of *qua objects* include Socrates qua philosopher, for any statue and the matter that constitutes it, the matter qua statue, and, when one raises their arm, the movement of their arm qua intentional movement. Fine introduces *qua objects* for metaphysical purposes; for instance, to explain the relation of constitution that typically holds between an object and the matter that constitutes it, to explain the relationship of an act to the intention with which it is done, or to explain the relation between an emotion and its object.

6. Conclusions

The usual treatment of non-intersective adjectives takes them to be (intensional) predicate modifiers. However, as already discussed by Larson (1998), parallel entailment (or lack thereof) patterns between the nominal and the verbal domain suggest a Davidsonian-like treatment of nouns and adjectives. Similar to how the adverb in *Olga danced beautifully* does not directly describe Olga but one of her action, we have proposed that the adjective in *John is a beautiful singer* does not directly describe John but one of his *perspective* (or, a perspective on him).

Our notion of perspectives parallels the notion of events in the nominal domain. Events involve individuals as participants and perspectives are on an individual. Crucially, events and perspectives have properties of their own that are not properties of these individuals. Furthermore, the same individual might be involved in multiple events, and in multiple perspectives. We have proposed that adjectives and undetermined noun phrases are interpreted as sets of perspectives, just as adverbs and verb phrases can be interpreted as sets of events. In both cases, this move allows for an account of some kinds of intensional modification based on a simple intersective semantics relying only on the basic logical properties of propositional connectives, without having to resort to meaning postulates nor to possible world semantics.

We have in addition shown how our perspectives were compatible with treatments of modal and privative adjectives, and that our proposal could be implemented in a fully compositional fragment of English.

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