

# The Mass-Count Distinction and Davidsonian Events: A Truthmaker-Based Approach

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## Abstract:

The mass-count distinction is a morpho-syntactic distinction that is generally taken to have semantic content or reflect a semantic mass-count distinction. Three general approaches to the semantic mass-count distinction can be distinguished: 1. the object-based approach, 2. the extension-based approach, and 3. the grammar-based approach in the spirit of what Rothstein's (2017) calls 'grammaticized individuation'. The grammar-based approach predicts that category lacking a syntactic mass-count distinction should semantically side with mass rather than count. This paper argues that this prediction is borne out in the behavior of verbs with respect to their Davidsonian argument position as well as other syntactic categories in English that lack a mass-count distinction. The paper outlines a truthmaker-based account as an alternative to Rothstein's version of the grammar-based account of the mass-count distinction, making use of a primitive notion of unity relativized to a situation.

The mass-count distinction is a morpho-syntactic distinction among nouns and is generally taken to have semantic content, that is, to reflect a semantic mass-count distinction. There are three general approaches as to what such a semantic mass-count distinction consists in:

[1] *the extension-based approach*, according to which the semantic mass-count distinction consists in mereological properties of the extension of nouns, an approach that goes back to Quine (1960) and has been developed particularly by Link (1983) and others following him.

[2] *the object-based approach*, according to which the semantic mass-count distinction consists in mereological properties of the entities (or entities-in-contexts/situations) in those extensions, an approach that goes back at least as far as Aristotle and more recently Jespersen (1924).

[3] *the grammar-based approach*, which takes the categories of mass and count themselves to play a role for the individuation of entities or entities under a perspective, an approach has been pursued most explicitly by Rothstein (2017), for whom the semantic mass-count distinction consists in a difference in 'grammaticized individuation'.

The three approaches make use of different notions of unity or the property of being a single entity, the basis of countability and the distinctive feature of the content of singular count

nouns. The notion of an atom is central on the extension-based approach: atoms make up the extension of singular count nouns, but not (or not generally) the extension of mass nouns. A notion of integrity is central on the object-based approach: entities that have a boundary, form or other sort of integrity make up the extension of singular count nouns, but not mass nouns. The notion of unity on the third approach is tied to the use of count nouns: unity, roughly, requires the use of a count category or other unity-introducing expression. The grammar-based approach embraces discrepancies between the ontology reflected in the mass-count distinction and expressions or constructions related to it and the ontology reflected in our cognition and the ontology of what there really is. In particular, the use of a count noun (but not a mass noun) conveys a notion of unity (and hence countability) which need not align with the individuation of entities at the level of cognition or the real structure of things.

This paper will outline a version of the grammar-based approach that is cast in terms of truthmaker semantics (Fine 2017). The idea is that predicates do not just apply to entities, but to entities in types of situations, situations that are the ‘exact truthmakers’ of the linguistic material used to describe the entities. Crucially, the material may include count nouns or other unity-introducing expressions, thus allowing for the satisfaction of semantic selectional requirements of predicates requiring single entities. Entities that don’t come with situations in which they have unity won’t be able to satisfy such semantic selectional requirements, regardless of how they may be individuated at the level of cognition or the real structure of things.

Given the association of the morpho-syntactic mass-count distinction with a semantic mass-count distinction, the general question arises: how do syntactic categories that lack a morpho-syntactic mass-count distinction fare with respect to what is taken to be the semantic mass-count distinction? The extension-based and the object-based approaches both predict that the semantic mass-count distinction applies in just the same way: the extension of an expression that does not take part in the syntactic mass-count distinction classifies semantically as either mass or count, depending on the properties of its extension. The object-based approach predicts that an entity in the extension of an expression that is neither mass nor count classifies as countable or not depending on its properties (of integrity). The grammar-based approach makes a different prediction: syntactic categories not exhibiting a morpho-syntactic mass-count distinction should not display a semantic mass-count distinction, rather they should just behave as mass, since unity and thus countability is tied to the use of a count category. This does not mean that mereological properties of individuals

and of extensions are semantically irrelevant; they are just not directly tied to the mass-count distinction.

This paper argues that the prediction of the grammar-based approach is borne out. Most importantly that concerns the semantic mass-count behavior verbs with respect to their Davidsonian (1967) event argument position. Verbs with respect to their Davidsonian event argument position classify as mass, rather than dividing into mass and count, a classification that bears both on semantic and syntactic selectional requirements of expressions. As the grammar-based approach predicts, this does not apply to event nouns, which, like all nouns in English, display a mass-count distinction, with mereological properties of the event or the event argument position influencing the choice of mass or count.

Denying that verbs take part in a semantic mass-count distinction goes against the dominant view in semantics. At least since Bach (1986) it has been taken for granted that verbs, VPs, or sentences as predicates of events divide into mass and count, with achievement and accomplishments (or telic VPs or sentences) classifying semantically as count and activities and states (or atelic VPs or sentences) as mass. Such parallelisms between the nominal domain and the verbal domain of events have generally been taken to consist in the mereological properties of verbal extensions or of in verbal entities and served to account for a range of semantic phenomena, such as the applicability of *for*- and *in*-adverbials, and the way adverbials such as *frequently* or *more* count or measure. However, the existence and explanatory role of such parallelisms does not mean that verbs display the actual content of the mass-count distinction with respect to their event argument position. Verbs rather classify as mass for the purpose of semantic selection and syntactic agreement. This include the applicability of cardinal and ordinal numerals and count quantifiers without event classifier (*time(s)*) and, in German, the support of plural or mass anaphora, the choice of count or mass relative pronouns, and the applicability of the duality introducing mass quantifier *beides*. This is accounted on the proposed account since events as arguments of verbs fail to have unity in the situation reflecting the description used to describe them.

The prediction of the grammar-based approach to the mass-count distinction generalizes to other categories lacking a morpho-syntactic mass-count distinction, such as *that*-clauses and numerals in argument position, which exhibit the applicable diagnostics for mass-categories. Moreover it applies to non-referential uses of NPs on which semantic properties of extensions won't matter, such as NPs used intensionally or predicatively. On such uses, NPs semantically classify as mass rather than count, regardless of their syntactic category (as mass

or count) and regardless of the semantic or ontological properties one may attribute to their contents or intensions.

The paper will first give a brief discussion of the three approaches to the mas-count distinction and present the truthmaker-based version of the grammar-based approach. It then discusses the diagnostics for the mass status of verbs and develops the semantics of the relevant constructions within the grammar-based approach. Finally, it extends the view to other categories lacking a morpho-syntactic mass-count distinction.

## 1. Views of the mass-count distinction

### 1.1. Criteria for the mass-count distinction

The mass-count distinction is a morpho-syntactic distinction among nouns, and there is a range of diagnostics for it. Not all languages share the same diagnostics, and there is always the question whether particular diagnostics are just a reflection of the morpho-syntactic distinction or whether they can be explained semantically, in terms of the content of the syntactic mass-count distinction.<sup>1</sup> For the present purposes, I will focus on standard diagnostics that are generally taken to hold for the mass-count distinction in English and related languages. But I will augment them with new diagnostics specifically from German, which are applicable to verbs.<sup>2</sup>

One important syntactic criterion for the mass-count distinction is that count nouns generally display a singular-plural distinction, but not mass nouns. Verbs show singular or plural agreement with a count NP as subject, but singular agreement with a mass NP as subject. Count nouns allow for cardinal numerals *one*, *two*, etc, both as noun modifiers (*two shoes*) and in the predicative construction *is one of / are two the N'*, but mass nouns do not (*\*two footwear*). Count NPs moreover support count-related anaphora such as *one* and *another*, but not so mass NPs. Count nouns likewise allow for ordinal numerals *first*, *second*, and *third* (*the first house*), but not mass nouns (*?? the second wood / furniture*). Count nouns go with count with count quantifiers such as *many*, *few*, and *several*, mass nouns with *much* and *little*.

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<sup>1</sup> See Treves/Rothstein (2020) and Bale/Gillon (2020).

<sup>2</sup> See, for example, Doetjes (2015), Pelletier/Schubert (1989/2013), Chierchia (1998), and Rothstein (2017) for standard criteria for the mass-count distinction. There may not be a single set of mass-count diagnostics that applies across languages, but rather various sorts of sets, and they may determine a gradual distinction, rather than a binary one (Treves/ Rothstein 2020). It is therefore important to focus on particular diagnostics and a semantic or syntactic account of them.

Count nouns go with the modified noun *number* (*a large / small number*), mass nouns with the modified nouns *amount* or *deal* (*a large / small amount, a good deal*) (Kayne 2005, 2010).

Related to the last two criteria are corresponding semantic selectional constraints on verbs (Moltman 1997, 2021). Number-related predicates like *rank*, *list*, and *enumerate* generally apply only to count NPs (*John ranked / listed / enumerated the dresses*), but not mass NPs (?? *John ranked / listed / enumerated the clothing*).<sup>3</sup>

## 1.2. Extension-based and integrity-based approaches to the mass-count distinction

There are two main approaches to the semantic content of the mass-count distinction among nouns: [1] the extension-based approach and [2] the object-based approach that makes use of notions of integrity. The extension-based approach can be traced back to Quine (1960) and has become particularly influential in natural language semantics due to Link (1983); the object-based approach goes back to Aristotle and, in modern times, Jespersen (1948).

On the extension-based approach, the semantic distinction between singular count, plural and mass nouns resides in properties of their extensions, generally formulated in terms of extensional mereology (Link 1983, Krifka 1989, Chierchia 1989, Champollion/Krifka 2017). A common version of the approach is given below, making use of the proper-part relation  $<$  and the sum formation operator (on sets)  $\oplus$ :

### (1) The semantic mass-count distinction on the extension-based approach

- a. For a singular noun  $N$ ,  $[N]$  is atomic, i.e.  $\forall x(P(x) \rightarrow \forall y(y < x \rightarrow \neg P(y)))$
- b. For a plural noun  $N_{\text{plur}}$ ,  $[N_{\text{plur}}] = \{x \mid \exists P (P \neq \emptyset \ \& \ P \subseteq [N] \ \& \ x = P)\}$
- c. For a mass noun  $N$ ,  $N$  is cumulative  $P (P \neq \emptyset \ \& \ P \subseteq [N] \rightarrow \oplus P \in [N])$  and not atomic.

Sometimes a stronger condition than lack of atomicity is imposed on mass nouns, namely divisiveness (a predicate  $P$  is divisive iff  $\forall x(P(x) \rightarrow \forall y(y < x \rightarrow P(y)))$ ) (Chang 1973).

There are two problems for the extension-based approach of the semantic mass-count distinction that were motivations for Rothstein's grammar-based account. One of them is so-called 'object mass nouns' such as *police force*, *furniture*, *personnel*, *clothing*, *jewelry*, a rather large subcategory of mass nouns that fail to satisfy standard extensional mereological conditions on mass nouns such as not being atomic (Chierchia 1998, Rothstein 2017, Cohen

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<sup>3</sup> The predicate *count* tends to be better with mass NPs (*John counted the clothing*), see Moltmann (2021) for discussion.

2021). The approach likewise does not offer an account of pairs like *clothes* – *clothing*, *rice* – *grains* – *rice* etc., which will have the very same extensions, yet display semantic differences (Chierchia 1998, Rothstein 2017). Another problem for the extension-based approach to the semantic mass-count distinction is that atomicity does not generally hold for singular count nouns, for example not for count nouns like *entity*, *twig*, *fence*, *sequence* or *part* (Moltmann 1998, Zucchi/White 2001, Rothstein 2010).

On the object-based approach, the semantic distinction between singular count, plural and mass nouns resides in the sorts of properties nouns attribute to entities or entities in contexts/situations. Singular count nouns convey properties that involve a boundary or more generally conditions of integrity, a notion that was central in Aristotle’s metaphysics and Aristotle’s particular view of unity (see also Simons 1987). The object-based approach has been endorsed by Jespersen (1948) as well as Langacker (1987). One particular version of the object-based approach is the theory of situated part structures (Moltmann 1997, 1998), which I will briefly present since it is somewhat similar to the truthmaker-based approach that I will propose, though it is as problematic as extension-based approaches in a crucial respect (which I will come to shortly).

Like other object-based accounts, the theory of situated part structures takes the semantic mass-count distinction to consist in that (singular) count nouns convey properties of integrity of some sort, whereas mass nouns don’t. The central idea of the theory of situated part structures is that predicates do not apply to entities as such, but entities in *situations of reference*, situations carrying relevant information, in particular information about the integrity of entities or their parts. Singular count, plural, and mass nouns are semantically distinguished as below:

(2) The semantic mass-count distinction on the theory of situated part structures

- a. If  $N$  is a singular count noun, then for an entity  $x$  and a situation of reference  $s$ , if  $\langle x, s \rangle \in [N]$ , then  $x$  is an integrated whole in  $s$ .
- b. For a plural noun  $N_{\text{plur}}$ ,  $[N_{\text{plur}}] = \{ \langle x, s \rangle \mid \exists X (X \neq \emptyset \ \& \ X \subseteq \{ y \mid \langle y, s \rangle \in [N] \}) \ \& \ x = \bigoplus X \}$
- c. If  $N$  is a mass noun, then for any entity  $x$  and any minimal situation of reference  $s$  such that  $\langle x, s \rangle \in [N]$ ,  $x$  is not an integrated whole in  $s$ .

The restriction to a minimal situation in (2c) rules out that other information in the reference situation defines the referent of a mass NP as an integrated whole.<sup>4</sup>

### 1.3. Problems for extension-based and integrity-based approaches to the semantic mass-count distinction

One general problem with the theory of situated part structures, as well as other integrity-based accounts of the mass-count distinction, is that it fails to distinguish two properties that must be kept apart:

- [1] the property of having unity (being countable)
- [2] the property of being an integrated whole (in a situation).

Failure to distinguish the two is also a problem for some versions of the extension-based approach, which makes use of the notion of an atom rather than conditions of integrity. One place where the distinction is apparent is conjunctions of definite plural or mass NPs:

- (3) a. John compared the men and the women / the gold and the silver.
- b. ??? Bill counted the men and the women / the gold and the silver.

Maximal quantities and pluralities satisfying a property count as integrated wholes in a situation, thus enable a reading of (3a) distributing over two subpluralities or subquantities. But they can never count as single things, for the purpose of the application of number-related predicates. The same problem arises on extension-based accounts on which subpluralities are taken to be atoms (Link 1983).

Along with the distinction between unity and integrity, two different sorts of predicates need to be distinguished: predicates that may take contextually divisions or pluralities and quantities into account and predicates that presuppose the unity or countability of their arguments:<sup>5</sup>

- (4) a. Predicates applicable to contextually given divisions of quantities and pluralities

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<sup>4</sup> In addition to the mass-count distinction, the relativization to situations was meant to account for predicates applying to a contextually given division of a plurality or quantity into subpluralities or quantities.

<sup>5</sup> The distinction between *gather* and *numerous* has recently been discussed by Kuhn (2020) as a distinction between mass and count. *Numerous* itself, of course, is an adjective, which does not display a syntactic mass-count distinction. However, what *numerous* shares with count category is that count categories convey unity and *numerous* presupposes the unity of the members of the plurality to which it applies.

*Compare, gather, embrace, similar, related, connected, rate*

b. Number-related predicates (predicates applying only to pluralities or single entities)

Cardinal and ordinal numerals, *list, rank, enumerate, numerous, count*

There is another general problem with the theory of situated part structure, shared by integrity-based and extension based approaches, and that is that there are count nouns that can be used without conveying a notion of integrity. In particular, these are [1] portion nouns such as *portion, amount, quantity*, or *body* (as in *body of water*) and [2] *collection nouns* such as *bunch, collection, set* (on a non-technical use), or *sum*. Portion and collection nouns can apply without implying any form of integrity of their referent, yet they contrast with the corresponding mass NPs (McKay 2017, Moltmann 2021):

- (5) a. the portion of wine John drank – the wine John drank
- b. the body of water on earth – the water on earth
- (6) a. the bunch of papers Mary proposed as readings – the paper Mary proposed as readings
- b. the collection of things that remained in the house – the thing that remained in the house

NPs with portion nouns classify as singular count NPs, by the various syntactic and semantic criteria (Khrizman et al 2015). For example, they permit predicates like *was one of the portions offered* and support anaphoric *another*.<sup>6</sup>

Portion and collection nouns are equally a problem for the extension-based account, since portion and collection nominals such as *portion of wine* and *body of water* share the very same extension with the mass nouns *wine* and *water*. Portion and collection nouns are not atomic and the NPs in (5)-(6) do not refer to entities that are atoms in a context.<sup>7</sup>

(5) – (6) are of course limit cases of the use of language. In general, the use of portion or collection nouns goes along with some form of integrity of the referent. But what is important is that the use of the count category in natural language does not require that. This means

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<sup>6</sup> Scontras (2017) discusses degree uses of NPs with head noun *amount*:

(i) John drank the amount of wine Bill drank.

But this is not the reading that portion and collection nouns generally exhibit.

<sup>7</sup> Landman (2020) builds a theory of the mass-count distinction based on disjointness, which would apply to uses of portion nouns in particular contexts. However, disjointness is not a plausible condition on count nouns in general and hardly applicable to NPs with collection nouns, for example, which may easily stand for overlapping collections. See McKay (2017) for further discussion.



integrity or atomicity cannot as such be tied to the content of count nouns, which shows a fundamental inadequacy of object- or extension-based approaches. The content of count nouns is associated with the notion of being a single entity (having unity), without that being reducible to integrity or atomicity.

How is that notion of unity to be understood? The question of how to understand the notion of unity (or being one, a single entity) is one of the oldest problems in metaphysics and has been at the centre of discussion already in antiquity (Parmenides, Plato, Aristotle). It continues to be a difficult and central topic in metaphysics about which there is little unanimity (see Priest 2015 for a recent discussion and proposal). Obviously, it is a topic that is closely linked to language, in particular the mass-count distinction and the use of count of nouns and number-related predicates in particular, and it plays a role in cognition independently of language as well. But to explain the notion of unity should better not be considered the task of formal semantics; rather formal semantics theories should be compatible with whatever metaphysical account of unity may turn out the right one. For the purpose of the semantics of the mass-count distinction and number-related predicates, I therefore take the notion of unity to be a primitive notion, not to be reduced to other notions in the semantic theory itself. I will only make the assumption that unity forms the content of the syntactic count category (and unity-introducing expressions) and is involved in particular ways in the meaning of number-related predicates.

#### **1.4. The grammar-based approach to the semantic mass-count distinction**

The basic idea of the grammar-based approach to semantic mass-count distinction is that (only) the use of a count noun and expressions acting like individuating classifiers convey the semantically relevant notion of unity (and hence countability). That notion of unity need not align with the individuation of entities at the level of cognition or reality.

Rothstein (2017) gives three motivations for the grammar-based approach:

- [1] ‘object mass nouns’, a rather large class of nouns in English (and other languages) such as *furniture*, *luggage*, *personnel*, *hardware*, and *police force*, nouns whose lexical content appears to describe well-individuated entities at the level of cognitive ontology or reality, but which are mass nouns, rather than plural nouns, and behave as such in a number of respects;
- [2] the relative arbitrariness of the choice of mass or count across languages as well as within the same language, with mass nouns and count nouns often competing for the same items

(*clothes* - *clothing*, *shoes*, *footwear*, *hair* – ital. *capelli* (plural), *dishes* – German *Geschirr* (mass)).

[3] classifier languages such as Chinese, which lack a syntactic mass-count distinction among nouns and in which countability is conveyed by classifiers rather than nouns.

The topic of classifier languages is of considerable complexity and controversy, though, and this paper will be focused on generalizations from English and other European languages, just assuming that classifiers *may* convey countability rather than the noun itself.<sup>8</sup>

Here, briefly, is Rothstein's (2010, 2017) version of the grammar-based approach. Rothstein's version actually is a contextualized extension-based account, but by introducing a semantic type distinction for count nouns and mass nouns, it is also a grammar-based account. For Rothstein, a count noun *N* applies to entities *e* only relative to a context *k* in which they count as atoms with respect to *N*, a context being a restricted set of entities. Mass nouns, by contrast, apply just to entities, which means that they do not guarantee that the entities they apply to are atoms. The difference between count nouns and mass nouns, thus, consists in a type difference: mass nouns are of type  $\langle e, t \rangle$  (properties of entities), whereas count nouns are of type  $\langle \langle e, k \rangle, t \rangle$  (properties of entities in contexts). The difference in type is used to explain why numerals and count quantifiers require count nouns: they only select nouns of type  $\langle \langle e, k \rangle, t \rangle$ , but not of type  $\langle e, t \rangle$ . Classifiers semantically map predicates of type  $\langle e, t \rangle$  onto predicates of type  $\langle \langle e, k \rangle, t \rangle$ , thus making numerals applicable.

Rothstein's type-theoretic distinction between mass and count nouns faces several difficulties. First, there are context in which an NP is used neutral between mass and count, for example the pronouns *what* in *What did John eat? John ate soup and beans*. Second, Rothstein's type-theoretical account has difficulties accounting for conjunction of NPs, as in *John took the wood and the stones*. It is unclear how *the wood and the stones* could stand for a sum of entities that belong to different types. Even more difficult to handle would be *the wood and the stones in the garden*, where the restriction *in the garden* should apply to both conjuncts. Finally, the type-theoretic approach would impose an implausible type ambiguity onto all verbs with respect to their subject or object position, since verbs generally take both count and mass NPs, with exceptions such as *count*, *rank* and *list*.<sup>9</sup>

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<sup>8</sup> In particular, there is a controversy whether Chinese nouns lack a mass-count distinction or not. See Doetjes (2012) and Cheng/ Sybesma (1999, 2005) for a view that differs from that of Rothstein (2017).

<sup>9</sup> Borer's (2005) theory of the mass-count distinction is a syntactic version of the grammar-based approach. On Borer's syntactic theory, count NPs are distinguished from mass NPs by the presence of an implicit classifier *ind*, which is spelled out by the singular determiner *a* or plural morphology in English and as a numeral classifier in languages such as Chinese. On that theory, the restriction of numerals is accounted for syntactically, in terms

In this paper, I propose a version of the grammar-based approach on which all entities that are arguments of predicates are relativized to situations, not just entities denoted by count nouns. The situations come about in a particular way: they keep track of information used to describe the entities in question, in particular information about their unity. The distinction between things that have unity and things that don't is thus understood in perspectival, less ontological terms, as the distinction between entities that have unity in the relevant situation and entities that lack unity in the relevant situation.

How are situations able to keep track of the information carried by predicates? The recent development of truthmaker semantics (Fine 2017) provide a suitable notion within a novel situation-based semantics, namely the notion of exact truthmaking. Exact truthmaking is a relation that holds between a situation and a sentence just in case the situation makes the sentence true and is fully relevant for the truth of the sentence. Situations in truthmaker semantics are taken to be fully specific parts of possible worlds. The set of situations that are its exact truthmakers make up the (positive) extension of a sentence.<sup>10</sup> Since situations are fully specific and the information content of an NP generally is not, it will not be particular situations that are parts of the arguments of predicates (and denotations of NPs), but types of situation. For present purposes, I will identify situation types with sets of situations. Types of situations thus keep track of how an entity has been described at the relevant point in the composition of the meaning of a sentence.

For the present purposes, the exact truthmaking relation  $\models$  also applies to formulas ' $P(<d, S>)$ ' consisting of a one-place predicate ' $P$ ', a term ' $d$ ' for an object  $d$  (represented by itself) and a term ' $S$ ' for a situation type  $S$  (again represented by itself) .  $s' \models P(<d, S>)$  requires  $s'$  to have as part some situation  $s$  that belongs to  $S$ :<sup>11, 12</sup>

#### (7) Condition on situational inclusion

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of their requirement of a (silent or overt) classifier. This, however, fails to give an account of the inapplicability of *count* and *rank* to mass NPs, for which a syntactic explanation would be inapplicable. Borer's (2005) theory predicts that verbs do not display a semantic mass-count distinction, which for her is tied to the presence or absence of a classifier. Verbs, which do not involve a classifier or plural morphology, will thus side with mass nouns.

<sup>10</sup> The actual, bilateral proposition a sentence expresses is in fact a pair consisting of the set of truthmakers and the set of falsitymakers of the sentence: I will disregard the negative part in the context of this paper, also for the purpose of the minimal compositional semantics that I outline, for the sake of simplicity.

<sup>11</sup> I will restrict myself to one-place predicates.

<sup>12</sup> This means that  $S$  is a partial content of the set  $\{s' \mid s' \models P(<d, S>)\}$ , in the sense of partial content of Fine (2017).

For a situation  $s'$ , a type of situation  $S$ , a predicate  $P$ , and an entity  $d$ , if  $s' \models P(\langle d, S \rangle)$ , then for some situation  $s \in S$   $s < s'$ .

Sentence meanings are built by first applying semantic operations to pairs consisting of an object  $d$  and the empty or null situation, the situation that is part of every situation, and then to outcomes of such operations. I will distinguish two sorts of semantic operations: what I will call *predication* and *modification*, associated with expressions acting as predicates and as modifiers respectively. When  $P$  acts as a predicate, it is interpreted by an operation mapping a pair  $\langle d, S \rangle$  onto the set of situation  $S'$  such that for all  $s' \in S'$ ,  $s' \models P(\langle d, S \rangle)$ . Nouns as heads of referential or quantificational NPs as well noun modifier are interpreted by modification. If  $N$  act as a modifier, then  $N$  denotes a function that maps a pair  $\langle d, S \rangle$  onto a pair  $\langle d, S' \rangle$ , where  $S' = \{s \mid s' \models N(\langle d, S \rangle)\}'$ . Thus we have the following:

(8) a. The semantics of predication

For a one-place predicate  $P$ , an entity  $d$ , and a situation type  $S$ ,

$[P](\langle d, S \rangle) = \{s' \mid s' \models P(\langle d, S \rangle)\}$ , if  $\langle d, S \rangle$  satisfies the presuppositions of  $P$ ;  
undefined otherwise

b. The semantics of modification

For a one-place predicate  $N$ , an entity  $d$ , and a situation type  $S$ ,

$[N](\langle d, S \rangle) = \langle d, \{s' \mid s' \models N(\langle d, S \rangle)\} \rangle$ , if  $\langle d, S \rangle$  satisfies the presuppositions of  $N$ ;  
undefined otherwise

Expressions interpreted as modifiers can be stacked. Thus, the interpretation of an intersective adjective and a noun  $N$  applied to an entity  $d$  and a situation type  $S$  will be  $[A N](\langle d, S \rangle) = [A]([N](\langle d, S \rangle)) = \langle d, S' \rangle$ , where  $S' = \{s' \mid s' \models N(\langle d, S \rangle)\}$ , if  $[N](\langle d, S \rangle)$  satisfies the presuppositions of  $A$ , undefined otherwise. A definite description *the*  $N$  will be evaluated as  $[the N] = \langle d, S \rangle$  such that  $S = \{s \mid s \models N(d, S)\}$

I take the denotations of plural nouns (somewhat simplifying) to be pluralities in the sense of entities whose proper parts ( $<$ ) are single entities, but that themselves lack unity if they have parts in the sense of  $<$ . The content of the mass-count distinction can then be given as in (9), where 'UNIT' is the predicate standing for the property of having unity ('being a single entity') and  $\oplus$  is sum formation applying to sets:

(9) Semantic conditions on singular count nouns and mass nouns

- a. For a singular count noun  $N$ , an entity  $d$ , a situation  $s$ , and a situation type  $S$ ,  
if  $s \models N(\langle d, S \rangle)$ , then  $s \models \text{UNIT}(d)$ .
- b. For the plural  $N_{\text{plur}}$  of a noun  $N$ , an entity  $d$ , a situation type  $S$ ,  
 $s \models N_{\text{plur}}(\langle d, S \rangle)$  iff  $\exists X (X \neq \emptyset \ \& \ P \subseteq \{x \mid \langle x, S \rangle \in [N]\} \ \& \ d = \oplus X)$
- c. For a mass noun  $N$ , an entity  $d$ , a situation  $s$ , and a situation type  $S$ ,  
if  $s \models N(\langle d, S \rangle)$ , then  $\neg s \models \text{UNIT}(d)$ .

Number-related predicates can be true or false only of pluralities or single entities (pluralities being taken to be entities whose proper parts are entities that have unity and that have at least two such parts).

(10) a. Selectional requirement of number-related predicates

For a number-related (one-place) predicate  $P$ , an entity  $d$ , and a situation type  $2$ ,  
if  $s \models P(\langle d, S \rangle)$  or  $s \models \neg P(\langle d, S \rangle)$ , then either for all  $s' \in S$ , all  $d'$ ,  $d' < d$ ,  
 $s' \models \text{UNIT}(d')$  and  $s' \models \neg \text{UNIT}(d)$  provided  $\exists_{>1} d' (d' < d)$ , or  $s' \models \text{UNIT}(d)$ .

That is, a number-related predicate presupposes that an argument be either a plurality of at least two or be itself a single entity. Unity-introducing modifiers, by contrast, introduce unity based on conditions  $c_N$  of integrity obtaining of the parts of an entity or its parts:

(10) b. The semantics of unity-introducing modifiers

For a unity-introducing expression  $N$ , an entity  $d$ , a situation  $s$ , and a type of situation  $S$ ,  
 $N(\langle d, S \rangle) = \langle d, S' \rangle$ , where  $S' = \{s' \mid s' \models N(\langle d, S \rangle) \ \& \ (\exists_{>1} d' (S' \models d' < d)) \rightarrow \forall d' (d' < d \ \& \ c_N(d') \rightarrow S' \models \text{UNIT}(d') \ \& \ s \models \neg \text{UNIT}(d)) \vee \text{UNIT}(d))\}$

A unity-introducing modifier sets up a situation type for an entity  $d$  in which either  $d$  is a plurality of at least two single entities or else  $d$  is a single entity itself, based on conditions of integrity. These conditions of integrity  $C_N$  depend on the lexical content of the expression (individuating classifiers) as well as possibly the context, in which case they may include temporal continuity or link to particular occasions (frequency adverbials, cf. Section 3.4.) or maximality (*beides*, Section 3.5.).

The theory of situated part structures is able to deal with object mass nouns by taking the situations in question to ‘leave out’ conditions that define entities as integrated wholes.<sup>13</sup> The present use of situations also serves that purpose. Object mass nouns fail to convey unity, even though they stand for well-individuated entities.<sup>14,15</sup> Object mass nouns describe entities by focusing on their function or overall quality, rather than their unity. Situations acting as truthmaker represent just those properties, that is, the denotations of object mass nouns will fail to have unity in truthmaking situations, though they may have unity in reality or the ontology that reflects cognition.

## 2. Standard views of events and the semantic mass-count distinction

There is a long tradition of classifying events or rather event predicates into different types or Aktionsarten, distinguishing in particular achievements and accomplishment from activities and states (Kenny 1963, Vendler 1957, Mourelatos 1978). A related distinction is that between telic and atelic VPs as well as that between non-homogeneous and homogenous VPs (Verkuyl 1972, Bach 1986, Krifka 1989). *Run to the house* is telic, *run* and *run toward the house* are atelic; *eat an apple* and *drink the wine* are telic, *eat apples* and *drink wine* atelic. A common criterion for telicity (non-homogeneity) is the applicability of *in*-adverbials (*John ate an apple/drank the wine / ran to the house in five minutes*, \* *John ate apples / drank wine / ran toward the house in five minutes*). A common criterion for atelicity is the applicability of *for*-adverbials (*John ate apples / drank wine / walked toward the house for one hour*, \* *John at the apple / drank the wine / ran to the house for five minutes*).<sup>16</sup> Telicity (of a VP or sentence) depends on the meaning of the verb, properties of temporal modifiers, grammatical aspect (progressive, perfective and imperfective), as well as mereological, quantificational and referential properties of nominal arguments expressing event participants (Verkuyl 1972, 1992, Bennett/Parte 1972, Dowty 1979, Krifka 1998).

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<sup>13</sup> See also Cohen (2021).

<sup>14</sup> Object mass nouns and plural mass nouns in fact may not just reflect a semantic difference, as on the grammar-based approach, but even in cognitive ontology, as has been argued by Wisniewski / Imai / Casey (1996).

<sup>15</sup> Bale and Gillon (2021) show that there are some quantifiers in Chinese that do not require classifiers. This would be compatible with the grammar-based approach, which permits countability to be introduced lexically as well (Section. 3.3.).

<sup>16</sup> The criterion is not uncontroversial, though. See Moltmann (1989) for the view that *for*-adverbials do not in fact select homogenous event predicates, but just act as quantifiers over contextually relevant parts of an interval.

Bach (1986) was the first to explicitly propose that the verbal domain of events divide into a mass and a count domain parallel to that of the nominal domain, taking the extension-based approach to the mass-count distinction (see also Krifka 1989 and Champollion 2017). Bach associates events not with verbs, though (as Davidsonian arguments), but rather takes sets of events to be the denotations of more complex verbal or sentential expressions whose composition influences the relevant mereological properties. Those denotations are then classified just like that of nouns: as mass in case they are cumulative and divisive (homogenous) (*John ran, John drank wine*), singular count in case they are atomic (*John ate the apple, John ran to the house*) and plural in case they consist of sums of atomic events (*John jumped, John ate apples*).

The aim of this paper is not to put into doubt the parallelisms between extensions of count and mass nouns and telic and atelic event predicates (or achievements/accomplishments) in terms of properties such as atomicity, cumulativity, and homogeneity.<sup>17</sup> It does not question their role for explaining the choices of adverbials as well as other semantic phenomena. The point rather is that they do not match the proper classification of verbs in terms of the mass-count distinction: all verbs show diagnostics of mass rather than count, regardless of the semantic (extensional-mereological) properties of the event predicates in which they occur.

The fact that sentences or VPs rather than just verbs are classified in terms of the (semantic) mass-count distinction is a first indication that the traditional view misapplies the mass-count distinction. The mass-count distinction is a morpho-syntactic distinction among nouns with a content distinguishing among noun contents. The classification of VPs or sentences according to a semantic mass-count distinction makes the (verbal) domain of events not parallel to the nominal domain. As a matter of fact, complex NPs could be classified in the same way as VPs or sentences with respect to the semantic mass-count distinction. Applying the extension-based approach to the semantic mass-count distinction means that *the water in the glass* would classify as singular count, since it satisfies atomicity (no proper part of the entity that is the denotation of *the water in the glass* is also the denotation of *the water in the glass* (which refers to the maximal quantity of water in glass)). Moreover, *the water in the glasses* might satisfy the criterion for semantic plurality since the denotation of *the water in the glasses* is a fusion of entities that are referents of *the water in a glass* and as such classify as atoms (with respect to that description). However, the mass-count distinction is generally

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<sup>17</sup> The parallelism of the distinction between individuals and stuff and between events and states is also supported by recent research in cognitive science (Wellwood/ Hespos/Rips 2018).

not applied to complex NPs that way.<sup>18, 19</sup> The application of the proper diagnostics of the mass-count distinction should be to verbs, rather than VPs or sentences.

### 3. Diagnostics for mass and count and Davidsonian event arguments

#### 3.1. Diagnostics for mass and count

The criteria for mass and count are generally applied to nouns. However, some of them are applicable to verbs as well, in particular the choice between mass and count quantifiers and the applicability of cardinal and ordinal numerals. In addition, German offers three mass-count diagnostics that are applicable to verbs: the choice of relative pronouns, support of plural or mass anaphora, and the quantifier *beides* ‘both’, which is syntactically mass, yet lexically dual.

#### 3.2. Choice of mass and count quantifiers

Verbs generally take mass quantifiers as adverbial quantifiers, such as *a little bit*, *a great deal*, *much*, and *little*, rather than count quantifiers such as *a large number*, *a couple*, *many*, *few*, and *a few*, a generalization that holds not just for English (Moltmann 1997, chap. 7.2.), but crosslinguistically (Doetjes 2008):

- (11) a. John slept / worked a little bit / \* a couple.  
 b. Last week, Mary worked out a great deal / \* a large number.<sup>20</sup>

<sup>18</sup> Within the object-based approach, Moltmann (1997) actually argued for a semantic mass-count distinction for complex NPs that is independent of the syntactic mass-count distinction. *The water in the glass* counts as an integrated whole in a situation of reference *s* (being a maximal quantity satisfy the property ‘water in the glass’ in *s*), *the water in the glasses* counts as a plurality of integrated wholes in a reference situation. Moltmann (2016) criticized that approach to the semantic mass-count distinction: even if ‘the water in the glass’ is an integrated whole in a sense, it is never treated as ‘one’ for the purpose of counting.

By contrast, complex NPs have not been classified with respect to a semantic mass-count distinction within the extension-based approach, only VPs and sentences.

<sup>19</sup> Pelletier/Schubert (1989/2013) do take the syntactic mass-count distinction to apply to NPs, rather than just nouns. But that is because on their view all nouns can be used as mass or as count nouns and the identification as mass or count may depend, for example, on the choice of the determiner. They do not apply extensional mereological criteria to the denotation of the NP for identifying them semantically as mass or count parallel to what is commonly done to VPs.

<sup>20</sup> *A great deal* sounds better with verbs than *a great amount*; the latter is fine with event nouns as well:

(i) a. ?? John worked a great amount



- c. John and Mary argued a good deal / \* a great number.
- d. John jumped too much / \* too many.
- e. John slept / worked too little / \* too few.

*A little bit, a great/good deal* and *much, little*, can act as adverbial modifiers whether the verb describes bounded events (*jump*) or processes / activities (*sleep, work, work out, argue*).<sup>21</sup> *A little bit* and *a great deal* are mass quantifiers that syntactically NPs (Kayne 2005) and thus bare NP Adverbs (Larson 1985) (i.e., [a [Q]little [Nbit]]). *A great/ large number* and *a couple* are count NPs of the very same syntactic structure. The fact that only mass NPs, not count NPs can be chosen as event-quantifying bare NP adverbs means that verbs are classified as mass rather than count. The choice of *little, much* as opposed to *few/many* is indicative of the same generalization.<sup>22</sup>

- 
- b. great deal / amount of work
  - c. a good deal / amount of arguing

The same holds for German *eine Menge* ‘a great amount / number’:

- (ii) a. eine Menge Arbeit  
a amount work  
‘a great amount of work’
- b. Hans hat eine Menge gearbeitet.  
John has an amount worked  
‘John has worked a great amount.’

<sup>21</sup> There are some restrictions to what verbs *much* and *little* can apply, depending on the nature and the structure of the events described. For example, *much* and *little* are rather bad with stative verbs (as opposed to adverbials like *strongly* or *well*):

- (i) a. ??? Mary believes little / too much that it will rain tomorrow.
- b. ??? John knows French too much.

They are also bad when applied to verbs describing single events:

- (ii) ??? The bird died little.

But if the verb is sufficiently neutral, *little* can also apply when a single achievement is described:

- (iii) Little happened, only the bird died.

Mass quantifiers in general require some degree of homogeneity of the domain to which they apply. The fact that there are constraints on the domain to which event mass quantifiers can apply does not go against the generalization that verbs go with mass quantifiers rather than count quantifiers.

<sup>22</sup> There is a question about the syntactic status of *many/few* as opposed to *little/much*. *Little/much* as bare quantifiers can act both as adverbials as NPs in argument position. By contrast to *little/much*, when *many* and *few* occur in argument position without an overt noun, their restriction is understood anaphorically relating to a previously uttered NP or a salient set of objects (deletion under identity):

- (i) a. John ate too many / too few N.

Across languages, simple adverbial quantifiers are formed from nominal mass quantifiers, not count quantifiers. For count quantifiers to range over the event arguments of verbs, they require the noun *times* (Moltmann 1997, chap. 7.2., Doetjes 2008):

- (12) a. John jumped a great number of / a couple of many times.  
 b. John stumbled many / a few times.  
 c. John slept / worked a few times / too many times.  
 d. John worked out a great number of times this year.  
 e. John was inattentive too many times.

*Times* has the syntactic properties and the semantic function of a numeral classifier (Doetjes 1997, Landman 2006). Semantically, it introduces event units that are based on [1] by having a boundary (or being atoms with respect to the verbal event concept) as in (14a, b), [2] by being maximally continuous in time, as in (14c), or [3] by occurring at contextually given occasions, as in (14e).<sup>23</sup> *Time* thus has a unit-introducing function, which is given in truthmaker semantic terms (for singular *time*) below:

(13) The semantics of the event classifier *time*

For an event *e* and a situation type *S* and a context *c*

$[time](e, S) = \langle e, S' \rangle$ , where  $S' = \{s' \mid \exists s \in S, s < s' \ \& \ s' \models UNIT(e)\}$ , if *e* is

- 
- b. John ate too much / too little.  
 (ii) a. She knows many  
 b. She knows little.

This indicates that *many/few* are not bare quantifiers, but require an overt or deleted NP. The reason appears semantic: counting requires a sortal. By contrast, *much/ little* need not involve a restriction that is linked to the preceding discourse that way. This does not mean that *much* and *little* do not apply to a noun, but the noun may be a functional, light noun that can stay silent without being anaphoric (Kayne 2010). In both cases, in adverbial position, the unpronounced restriction of both *many/few* and *much/little* should be able to be linked up to the verb, so that the Davidsonian event argument position provides the restriction (rather than a previously uttered nominal or salient set).

Note that even if there was a syntactic difference between *many/few* and *much/little* that is responsible for *many/few* not being able to act adverbially, the question is why bare count quantifiers are never chosen as adverbials across languages.

<sup>23</sup> *Time(s)* fails to apply when no individuating conditions obtain, for example, under ordinary circumstances, below:

- (i) ??? John knew Bill a few times.

The countability imposed by *-times* does not come for free, but needs to be grounded, in integrity conditions that come with the events or states that are being described.

bounded, maximally continuous or connected to an occasion in *c*; undefined otherwise.

*Time* has the semantic function of at least certain types of numeral classifiers, by introducing countability and thus making count quantifier and numerals applicable to a non-count category. *Time(s)* exhibits other properties characteristic of individuating classifiers, such as not allowing adjectival modifiers (Cheng/Sybesma 1999):<sup>24</sup>

(14) a. ??? John stumbled three unusual times.

b. ??? We met three beautiful times.

Classifiers like *times* in English can be found in many other languages, including Italian (*volta*), Spanish (*vec*), French (*fois*), German (*mal*) and Mandarin Chinese *ci*. Verbs pattern just like nouns in languages such as Chinese, requiring a numeral classifier for a count quantifier or numeral to apply, regardless of their lexical content and the nature of the events they describe.<sup>25</sup> To summarize, for count quantifiers to range over Davidsonian events they require first the application of an expression acting as an event classifier.<sup>26</sup>

### 3.3. Obligatory event classifiers with cardinal and ordinal numerals

Cardinal and ordinal numerals behave just like count quantifiers, not being able to act adverbially without the addition of the event classifier *times*.

<sup>24</sup> Doetjes (1997) notes that in some languages the correlate of *times* need not agree in number with the numeral, for example Dutch and German (*funf Mal* ‘five time’).

<sup>25</sup> Cinque (2006) argues that temporal measure words such *years* and *days* also act as numeral classifiers in English.

<sup>26</sup> There are also event classifiers that involve natural units in a structured event, rather than imposing a condition on temporal separation. Examples in Mandarin Chinese are ‘turn’-type classifiers, as in (ia, b), which contrast with ‘time’-type classifiers, as in (ic) (Huang /Ahrens 2003):

- (i) a. (dale) play-ASP san three tang CL taijiquan Tai-Chi yihou after ta s/he shenti body  
shufu comfortable duo more le LE  
‘S/he feels much better after performing three rounds of Tai Chi.’
- b. dale play-ASP san three bian CL taijiquan Tai-Chi yihou after ta s/he shenti body  
shufu comfortable duo more le LE  
‘S/he feels much better after performing three rounds of Tai Chi.’
- c. dale play-ASP san three ci CL taijiquan Tai-Chi yihou after ta s/he shenti body  
comfortable duo more le LE  
‘S/he feels much better after performing three times Tai Chi.’

(ia) with *tang* and (ib) with *bian* are better than (ic) with the time-based classifier *ci*.

First, cardinal numerals show the very same pattern as *many/few*. They do not form adverbials ranging over Davidsonian events. For counting Davidsonian event arguments, cardinals need to combine with the classifier *time*, and that regardless of the Aktionsart of the verb, that is, even with achievements and accomplishments:<sup>27</sup>

- (15) a. \* John died only one.  
       b. John died only one time / once.
- (16) a. \* John jumped three.  
       b. John jumped three times.
- (17) a. \* John ran to the house four.  
       b. John ran to the house four times.

With cardinals, *times* introduces event units in the very same way, based on boundedness, temporal separation, a connection to contextually given occasions, or other individuating conditions such as possession, as illustrated with activity and stative predicates below:<sup>28</sup>

- (18) a. John slept three times today.  
       b. Mary worked out three times this week.  
       c. John was attentive three times.  
       d. John owned the painting three times in his life.

Ordinals make an even better case for the mass status of the event argument position of verbs. Unlike cardinals, *first, second, third* etc. *can* act as adverbials, in particular in sentence-initial position when ranking the proposition asserted in a list of others (*Third, John*

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<sup>27</sup> *Once* and *twice* obviously are morphological composites, composed of a number root *on-* and *tw-* and morpheme *-ce*. *Once* and *twice* have been analysed by Kayne (2015) as containing silent *time*, as *on-time-ce* and *tw-time-ce*. Kayne argues that the morpheme *-ce* is a preposition ‘at’ and silent *time*, which, Kayne argues, is singular even with *tw*, a numeral classifier (see also Fn 23 for Doetje’s observation about the possible lack of number agreement of overt *time*). Note that other languages use instead of morphologically complex *once* and *twice* syntactically complex adverbials (French *une fois, deux fois*, Italian *una volta, due volte* etc).

<sup>28</sup> In argument position cardinals, like other count quantifiers, generally require an overt or else silent anaphoric noun as restriction:

- (i) John ate three.

But again the reason is semantic: counting requires a sortal. The important observation is that verbs cannot provide such a sortal when cardinals occur adverbially.

*stumbled*). But ordinal numerals cannot act as adverbials ranking the described event in a list of events of the same type; for that, again, they need to combine with the classifier *time(s)*:<sup>29</sup>

(19) a. ??? Mary stumbled third(ly).

b. Mary stumbled a third time.

(20) a. ??? John married second(ly).

b. John married a second time.

The reason for the inability of ordinals to act as adverbials must be a semantic one: the failure for verbs to convey the countability of events.

### 3.4. Frequency adverbials as unity-introducing expressions

Frequency adverbials may seem to pose a challenge to the generalization that count quantifiers do not apply to Davidsonian events directly. Frequency adverbials appear to be count quantifiers and to be able to modify verbs without the presence of *time(s)*:

(21) a. John stumbled frequently.

b. John slept frequently.

However, frequency adverbials do not presuppose countability, but rather they introduce it, just like *times*. That is because the adjective *frequent*, from which *frequently* is derived, can modify event mass nouns as in (22a, b) and not just event plural nouns as in (22c):<sup>30</sup>

(22) a. the frequent rain

b. the frequent fog in this region

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<sup>29</sup> In English, ordinals can occur adverbially ranking an even participant with respect to other individuals playing the same thematic role with respect to the same type of event:

(i) a. John entered first.

b. Mary died third.

However here *first* and *third* act as subject-oriented secondary predicates, not as event predicates, just like *fully dressed* and *poor* below:

(ii) a. John entered fully dressed.

b. Mary died poor.

<sup>30</sup> This was observed in Moltmann (1997, Chap. 5.1., p. 142ff).

## c. the frequent rainfalls

*Frequent(ly)* introduces countability on the basis of the same conditions as the unity-introducing classifier *times*: inherent boundedness of events, maximal continuity, and connectedness to occasions. Semantically, *frequent* thus decomposes into what is conveyed by *times* and a count or metrical quantifier (roughly ‘many times’).

*Frequently* is not the only unity-introducing quantifier able to apply to mass categories. In German, *vieles* ‘many’ is a quantifier that is syntactically mass (being singular and requiring singular verb agreement). But it has the meaning of ‘many’, counting well-distinguished units and contrasting with *viel* ‘much’ (Moltmann 1997, Chapter 5, 156ff). The units may be distinguished contextually or in virtue of the nature of the substance. For example, *vieles* in (23a) counts either units of wood that are well-distinguished from each other in the context or else different types of wood; by contrast, *viel* in (23b) only has a measurement reading:

(23) a. *vieles Holz*

many wood

‘many pieces / sorts of wood’

b. *viel Holz*

much wood

‘much / a lot of wood’

*Vieles* thus is a mass quantifier which presupposes the discreteness of the domain it applies to and introduces countability on the basis of it. Though *vieles* does not apply as an adverbial to events, it illustrates the possibility for a quantifier to impose countability on a domain by way of its lexical meaning.

### 3.5. The German quantifier *beides*

The German quantifier *beides* ‘both’ is another quantifier that introduces countability lexically and applies to Davidsonian events. *Beides* occurs both in argument position and as a floated quantifier. It is syntactically singular, requiring singular agreement of the verb:

(25) *Beides ist / \* sind unmöglich.*

both is / are impossible

‘Both is / are impossible.’

*Beides* can anaphorically relate only to a mass NP, as in (26a), not a count NP, say a collective NP, as in (26b):

(26) a. Hans trank den Wasser und das Bier. Er hat beides schnell getrunken.

John drank the water and the beer. He has both quickly drunk

‘John drank the wine and the beer. He drank both quickly’.

b. Hans traf ein Ehepaar. \* Beides ist Amerikaner.

John met a couple. both is American

‘John met a couple. Both are Americans.’

The antecedent of *beides* needs to stand for two descriptively distinguished subquantities. This also holds when *beides* acts as a floated quantifier with a mass NP:

(27) a. Das Gold und das Silber kostet beides zu viel.

the gold and the silver cost both too much

‘The gold and the silver costs both too much.’

b. Hans kaufte Wasser und Bier. Das war beides sehr billig.

John bought water and beer. it was both very cheap

‘John bought water and beer. They were both very cheap.’

c. Der Schmuck in den zwei Schachteln kostet beides 100\$.

the jewelry in the two boxes costs both 100\$

‘The jewelry in the two boxes is both 100\$.’

*Beides* generally triggers a distributive interpretation of the predicate, as in (27a, b). *Beides*, moreover, makes number-related predicates applicable to mass NPs, that is, predicates that ordinarily cannot apply to mass NPs:

(28) Der Wein und der Champagner, Hans hat das (\*beides) mitgezaehlt / mitaufgelisted.

the wine and the champagne, John has it (both) with counted : with listed

‘The wine and the champagne, John has that both counted / listed too.’

*Beides* thus introduces countability by way of its lexical meaning, similarly to *frequent(ly)* and *vieles*. The important observation in the present context is that *beides* can relate to Davidsonian events introduced by a conjunction of VPs, either as a floated quantifier of the mass pronoun *das*, as in (29a, b), or just as anaphorically, as in (29c):

(29) a. Es blitzte und donnerte. Das hat beides nicht lange gedauert.

It lightened and thundered. it has both not long lasted.

‘There was lightning and thunder. They did not last long.’

b. Hans schrieb einen Brief und unterzeichnete ihn. Er hat das beides gestern gemacht.

John wrote a letter and signed it. he has both yesterday made

‘John wrote a letter and signed it. He did it both yesterday.’

c. Maria tanzte und malte. Beides hatte sie gerade gelernt.

Mary danced and painted. both had she just learned

‘Mary danced and painted. Both she had just learned.’

The ability of *das beides* to relate to Davidsonian events indicates that verbs are syntactically classified as mass. *Beides* does not presuppose unity, but introduces it: it is a unity-introducing expression, introducing a plurality of two distinct entities based on the content of the event description. *Beides* thus has a situation-shifting meaning as below:

### (30) The semantics of German *beides*

For an event  $e$  and a situation type  $S$ ,  $[beides](e, S) = \langle e, S' \rangle$ , where for all  $s' \in S'$ , there is a  $s \in S$ ,  $s < s'$ , and  $s' \models \text{UNIT}(e_1)$  and  $s' \models \text{UNIT}(e_2)$ , for distinct entities  $e_1$  and  $e_2$  such that  $e = e_1 \oplus e_2$

### 3.6. Failure to support of plural anaphora

Another diagnostics for the status of verbs as mass rather than count comes from support of plural anaphora. Geis (1975) observed that conjoined VPs do not support plural anaphora in a subsequent sentence:

(31) John opened the door and closed the window. He did ?? them / ok that an hour ago.



It is not obvious what the reason for the unacceptability of (31) is. Conjunctions of definite mass NPs in English do support plural anaphora:

- (32) a. John drank the water and the wine. He drank them quickly.  
 b. John bought rice and meat. He paid little for them.

The reason for the unacceptability of (31) seems a condition that the antecedents of plural anaphora be nominal and referential. Conjunctions of clauses and predicates likewise do not permit plural anaphora (Section 5).

Plural anaphora in German are subject to different conditions. One of them is that the antecedent may not be a conjunction of mass NPs:

- (33) a. Hans trank das Wasser und das Bier. Er trank es (beides) / ?? sie schnell.  
 'John drank the wine and the beer. He drank it both / them quickly.'  
 b. Hans kaufte Reis und Salad. (Das) beides / ?? Sie brauchte er fuers Mittagessen.  
 John bought rice and salad. that both / them needed he for lunch  
 'John bought fruit and salad. He needed both / them for lunch.'

In German, lack of plural anaphora support thus is a diagnostics for mass.<sup>31</sup> Note that German permits the mass quantifier *beides* in (33a, b) as well. The German translation of (33a) with *sie* 'them' is equally bad, but not with *das* 'that' or *das beides*:

- (34) Hans oeffnete die Tuer und schloss das Fenster. Er tat ?? sie / ok das / ok das beides vor einer Stunde.

The reason why German imposes more conditions on plural anaphora may be linked to gender agreement being syntactically rather the semantically determined in German. The difference then resides in that German plural anaphora require all features to be shared between

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<sup>31</sup> What seems to matter for plural anaphora in English is that the antecedent stand for a plurality of entities presented as having a boundary or more generally being integrated wholes, in the sense of Moltmann (1997). One way of being presented as an integrated whole is by being described by a singular count noun; another way is by being described as a maximal entity satisfying a property, such as being water or being beer in (33a).

antecedent and anaphor, whereas English requires the antecedent to be nominal and provide a semantically suitable entity. Plural anaphora in German then show that verbs are unable to classify as count syntactically.

### 3.7. Selection of relative pronouns in German

The prediction that verbs classify as mass when they have to be classified for the syntactic mass- count distinction is also supported by the choice of relative pronouns. German has two kinds of relative pronouns: w-pronouns (*was*) and d-pronouns (*der, die, das*). The generalization, roughly, is that count full NPs select d-pronouns, whereas non-definite mass full NPs select w-pronouns:<sup>32</sup>

- (35) a. das Kind, das / \* was  
           ‘the child that’  
       b. alles / etwas Wasser, was / \* das im Behaelter war  
           ‘all / some water that was in the container’  
       c. das Wasser, das / \* was im Behaelter war  
           ‘the water that was in the container’

More precisely, neutral non-definite mass NPs select *was*, but not so masculine or feminine mass NPs, which select *das*:

- (36) a. aller Sand / Wein / Unfug, der / \* was  
           ‘all (the) sand (masc) / Wine (masc) / nonsense (masc), that’  
       b. alle Farbe / Fluessigkeit / Schoenheit , die / \* was  
           ‘all (the) color (fem) / liquid (fem) / beauty (fem) that’

Bare quantifiers and *das* ‘that’, which are mass, always choose w-pronouns:

- (37) alles / nichts / etwas / das, was / das  
           ‘all / nothing / something that / that’

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<sup>32</sup> The selection of d-pronouns by definite mass NPs may be attributed to the fact that definite mass NPs stand for quantities that are integrated wholes, a notion that is distinct from language-driven unity, but does play a semantic role. See also Fn 30.

This means that, provided the gender category of the head noun is neutral and setting definite full NPs aside, the selection of w-pronouns is indicative of mass rather than count. The choice of w-pronouns is a sufficient (though not necessary) indication of mass.

The important observation then is that verbs always select w-pronouns rather than d-pronouns, regardless of their Aktionsart:

(38) a. Hans lachte / ruhte, was / \* das er selten tut.

‘John laughed / rested, which he does rarely’.

b. Maria klopfte an der Tuer, was / \* das sie selten tut.

‘John knocked at the door, which he rarely does.’

c. Maria tanzte und sang, was / \* das sie beides lange nicht mehr getan hatte.

‘Mary danced and sang, which she both had not done for a long time.’

Note in (38c) the floated mass quantifier *beides*.

The choice of the mass pronoun *was* over the count pronoun *das* shows further that verbs regardless of their lexical content and semantic environment classify syntactically as mass, when syntactic mass-count classification needs to be made.

### 3.7. The alignment of language-driven unity and unity at the level of cognition

The classification of verbs as mass with respect to the Davidsonian event argument position presents serious difficulties for extension-based and object-based approaches to the semantic mass-count distinction, in addition to the more familiar problems for those approaches that were mentioned. If verbs classify as mass, then this cannot be a reflection of mereological properties of the extension of verbs, VPs, or sentences or of actual, perceived, or situation-relative mereological properties of Davidsonian events. The grammar-based approach to the mass-count distinction predicts that verbs do not convey unity. This does not mean that Davidsonian events may not come with inherent or contextually given integrity conditions. In fact these play a semantically important role for the applicability of unity-introducing expressions such as *time(s)*, *frequent*, *vieles* and *beides*.

This is also the case for nouns in classifier languages such as Chinese, where natural units in the denotation of nouns play a semantic role for the choice of sortal classifiers (Cheng / Sybesma 1999). Moreover, in the case of object mass nouns, the cognitive individuation of

entities in their denotation matters for the application of predicates of size and shape (*large furniture, round hardware*) (Moltmann 2021).

The language-driven notion of unity may diverge from the notion of unity at the level of cognition, where conditions of integrity or concept-relative atomicity are constitutive of unity and thus countability. There is often a strong tendency that those conditions match the unity conveyed by the grammatical count categories, but language-driven unity as such is not derivable from any actual or perceived properties an entity may have (integrity) or from mereological properties of the extension of the expression used to refer to it (atomicity). Note that this does not exclude that mass quantifiers like *little, much* or *more* with verbs like *jump* may still ‘measure’ by counting ‘atomic’ events.<sup>33</sup>

#### 4. Further issues: event nouns and pluractionality

The main thesis of this paper is that events that are Davidsonian arguments of verbs do not exhibit the semantic mass-count distinction. Events that are denotations of nouns, by contrast, do, and that is quite simply because nouns divide into mass and count syntactically. Given the grammar-based approach to the mass-count distinction, deverbal nominalizations that are count do more than just pick up an event argument of a verb: they are unity-introducing like all count nouns. The choice of mass or count for a deverbal nominalization is generally not arbitrary, but rather depends on how events are individuated in the ontology reflected in cognition, such as distinction between bounded events and activities / states (Barner / Wagner / Snedeker 2008). Mass event nominalizations generally are based on activity verbs (*laughter, rain, sleep*), whereas count event nominalizations are based on achievement or accomplishment verbs (*jump, crossing, death*) or event-individuating conditions such as maximal temporal connectedness (*walk, speech, workout*). But as with nouns for material objects, the alignment is not strict. Thus, the very same on-goings can be described by a mass noun (*activity*) or a count noun (*action*).

Pluractionality is an apparent marking of event plurality on verbs, which can be found, for example, in some Native American languages (Hendersen 2019, Cabredo-Hofherr, to appear). This might suggest that verbs in such languages display the mass-count distinction and thus could classify as count. However, Doetjes (2008) argues, pluractionality seems less the

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<sup>33</sup> See Wellwood/Hacquard/Pancheva (2012) for observations about *more* to that effect. This is also the case for object mass nouns, with which comparative *more* generally counts individuals rather than measuring in terms of volume (Barner/Snedeker 2005).

marking of countability, but of a general ‘increase’ of eventuality, not distinguishing between amount and number; so that countability then would be reserved to nouns.

### 5. Other categories or uses of categories lacking a mass-count distinction

Not only verbs, but also other non-nominal categories display diagnostics of mass rather than count. This is expected on the grammar-based approach to the semantic mass-count distinction since those categories (at least in English and related languages) do not display a morpho-syntactic mass count distinction. syntactic categories which do not display a morpho-syntactic mass-count distinction classify as mass, regardless of the nature of their denotations (or semantic functions).

One such category is clauses. It is a common (but not universally shared) view that clausal complements or subjects act as referential terms standing for propositions. However, clauses are not NPs and thus do not display a morpho-syntactic mass-count distinction.<sup>34</sup> As expected, clauses display diagnostics for mass rather than count (Moltmann 1997, p. 237ff). First, clauses in German chose *w*-pronouns, not *d*-pronouns:

(39) Hans glaubt, dass es regnen wird, was / \* das Mary auch glaubt.

‘John believes that it will rain, which Mary believes too.

Second, conjoined clauses in German (and English) support mass pronouns as anaphora, but not plural pronouns:

(40) Hans glaubt, dass Maria schuldig ist und dass Bill unschuldig ist. Er glaubt das (beides) / ?? sie / ?? die seit langem.

‘John believes that Mary is guilty and that Bill innocent. He has believed that (both) / them for a long time.

Finally, quantifiers in place of clauses are mass rather than count, as in seen in (41a, b), unless they modify the noun *thing*, as in (41c), which serves as a kind of numeral classifier:

(41) a. John assumes little / too much / a little bit / a great deal.

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<sup>34</sup> It has been argued that clauses sometimes are headed by a DP node (Kastner 2015), but this does not mean that they engage in a syntactic mass-count distinction.

- b. ?? John assumes few / too many / a few / a great number.
- c. John assumes a few things / several things / many things.

The second case is cardinal numerals. Cardinal numerals are adjectives, but they can also occur in argument position, seemingly acting as terms referring to numbers. Numerals used in argument position do not come with a morpho-syntactic mass-count distinction and thus the prediction is that they classify as mass rather than count (despite apparently standing for single abstract entities). This is born out, given the mass diagnostics from German of taking w-pronouns and supporting mass pronouns and not plural pronouns as anaphora (Moltmann 2013a, 2017):<sup>35</sup>

(42) a. Zwei was / \* das eine Primzahl ist, ...

‘Two, which is a prime number...’

b. Maria addierte zehn und drei. Hans addierte \* sie / ok diese Zahlen auch.

‘Mary added ten and three. John added them / those numbers too.’

The observations about clauses and numerals support the general prediction of the grammar-based approach to the mass-count distinction:

Another case are categories that can be used non-referentially, for example as intensional NPs and pure quotations. Even though nominal categories as such come with the morphosyntactic mass-count distinction, when they are used nonreferentially, the semantic content of that distinction is inapplicable to their denotations (setting aside the question of what exactly the semantics of such nonreferential NPs is). The empirical data point to the generalization that non-referential uses of nominal categories display diagnostics for mass rather than count. First, NP-complements of intensional verbs take w-pronouns and support mass pronouns rather than plural pronouns as anaphora in German:

(43) a. Hans braucht eine Assistentin, was / \* die / \* das Bill auch braucht.

‘John needs an assistant, which Bill needs to.’

b. Hans braucht eine Assistentin und eine Trainerin. Bill braucht das beides / \* sie auch.

‘John needs an assistant and a trainer. Bill needs that (both) / them too.’

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<sup>35</sup> Number words in argument position have been considered nonreferential in Hofweber (2005) and Moltmann (2013a, b). But see Moltmann (2017) for a critique of that view.

Furthermore, they can be replaced only by mass quantifiers:

- (44) John needs too much / a great deal / \* several / \* a great number, an assistant, a secretary, a cook, and a trainer.

That non-referential uses of NPs classify as mass rather than count is of course expected on the grammar-based approach to the mass-count distinction. The denotations of such uses of NPs do not count as units given the inapplicability of a count category.

## 6. Conclusions

This paper has proposed a truthmaker-based version of the grammar-based approach of the mass-count distinction on which the content of the mass-count distinction is a matter of entities in situations that reflect the use of linguistic categories or expressions, rather than a substantive difference in cognitive ontology or the real structure of things. In particular, the semantically relevant notion of unity is tied to the use of count categories as well as of expressions that act as individuating classifiers, such as *time*, frequency expressions and quantifiers such as German *beides* and *vieles*. The paper has argued the prediction of the grammar-based approach is borne out, namely that categories without a morpho-syntactic mass-count distinction classify as mass, rather dividing semantically into mass and count.

The grammar-based approach allows for discrepancies between notions of unity reflected in language and reflected in cognition: unity in cognition generally aligns with conditions of integrity, function, and persistence across times and situations, but not so for unity reflected in language. This matches findings in cognitive science: the cognitive division of entities into objects and stuff has been shown to precede the acquisition of language and is independent of the mass-count distinction as such (Chierchia 2015). Language imposes its own notion of unity, which may or may not go along with unity at the level of cognition or reality. This notion of unity tends to go along with an entity being an atom (with respect to a concept) or with having integrity of some sort, but it need not, and conversely.

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