Events and the Mass-Count Distinction

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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 two main 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 (1986) 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).

The notion of an atom is central for the first view, on which atoms make up the extension of singular count nouns, but not mass nouns. The notion of integrity is central for the second view: entities that have a boundary, form or other sort of integrity make up the extension of singular count nouns, but not mass nouns. Theories of the semantic mass-count distinction of either sort generally face three sorts of major challenges:

[1] from classifier languages such as Chinese, which lack a syntactic mass-count distinction among nouns and in which all nouns are, it seems, treated as 'mass' or 'number-neutral', regardless of their extensions or the entities they describe,

[2] from 'object mass nouns', a rather large class of nouns in English (and other languages) such as *furniture, luggage, personnel, hardware*, and *police force*, to which standard semantic characterizations of mass nouns do not apply, and

[3] from the relative arbitrariness of the choice of mass or count categories of nouns across languages as well as within the same language, with mass and count nouns often competing for the same items (*chothes - clothing, shoes, footwear, hair* – ital. *capelli* (plural) dishes – German *Geschirr* (mass)).

Yet the syntactic mass-count distinction clearly appears to go along with a semantic mass-count distinction. A novel view that has emerged more recently emerged in face of those challenges is what I call the *grammar-based approach*, the approach according to which the

content of the mass-count distinction is to be understood at a level of 'grammaticized individuation' (Rothstein 2010, 2017) or language-driven ontology (Moltmann, to appear). This, roughly, means that 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. Object mass nouns fail to convey unity in that sense, even though their lexical content appears to describe well-individuated entities at the level of cognitive ontology or reality. Nouns in languages such as Chinese likewise fail to convey unity in that sense and generally require the use of a numeral classifier for the purpose of counting. The language-driven notion of unity is often based on natural unity at the level of cognition, but it need not be.

There are different ways of conceiving of such language-imposed unity:

[1] as a feature conveyed by a silent or explicit classifier (Borer 2005)

[2] as the property of being an atom relative to a context (Rothstein 2010, 2017)

[3] as the property of being a unified whole in a situation or under a perspective

[4] as a primitive property that some entities have and others lack, without that amounting to a substantial ontological difference. In this paper, I will make use of option [4], but not too much hinges of that choice for the particular aims of this paper.

The mass-count distinction raises the general question how syntactic categories that lack a morpho-syntactic mass-count distinction fare with respect to a semantic mass-count distinction. The grammar-based approach makes a clear prediction: syntactic categories not exhibiting a morpho-syntactic mass-count distinction should not display a semantic mass-count distinction, since countability is tied to the use of a count category. This paper presents particular evidence that that prediction is borne out, namely from the mass-count classification of verbs with respect to their Davidsonian (1967) event argument position.

In natural language semantics, at least since Bach (1986), it has been taken for granted that verbs, VPs, or sentences as predicates of events or what I will call *the verbal domain of events* display the same sort of semantic mass-count distinction as nouns, with achievement and accomplishments (or telic VPs or sentences) classifying semantically as count and activities and states (or atelic VPs or sentences) as mass. The parallelisms are generally observed from the point of view of approaches [1] or [2] to the mass-count distinction and thus are cast in terms of properties of extensions or of entities. The parallelisms between the nominal domain and the verbal domain of events have 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. In addition, they appear to receive support by recent research in cognitive science (Wellwood / Hespos / Rips 2018).

However, the existence and explanatory role of such parallelisms does not mean that the verbal domain of events displays the actual content of the mass-count distinction. The paper will argue that it in fact fails to display the mass-count distinction given criteria for mass and count that are applicable to verbs: verbs with respect to their event argument position display the diagnostics of mass rather than count, regardless of their Aktionsart and the event-process/state distinction. The mass-count criteria applicable to verbs 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*. The classification of verbs as mass (with respect to their event argument position) is predicted by the grammar-based approach to the mass-count distinction, and the mass diagnostics displayed by verbs can be accounted in terms of semantic selection within that approach, in just the way such diagnostics have been accounted for within the grammar-based approach for nouns (Rothstein 2017).

This 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. The generalization then is that syntactic categories lacking a (syntactic) mass-count distinction classify semantically as mass rather than count. This generalization can be further extended to non-referential uses of NPs on which semantic properties of extensions won't matter, such as NPs used intensionally, predicatively, or as measure phrases. 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. Again, the absence of grammaticized individuation or language-driven unity can explain the mass diagnostics of such uses of nominal categories.

The paper will first present the standard criteria for the mass-count distinction in English as well as the two standard approaches to the content of the mass-count distinction with their application to the verbal domain of events. It then discusses the diagnostics for the mass status of verbs and gives an account of them in terms of the grammar-based approach. Finally, it extends the view to 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 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.[1] 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 a few new diagnostics specifically from German, which are applicable to verbs.[2]

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. Furthermore, count nouns go with quantifiers like *many* , *few*, and *several*, mass nouns with *much* and *little*. Count nouns go with modified number (*a large / small number*), mass nouns with modified *amount* (*a large / small amount*) (Kayne 2010). Count NPs also support count-related anaphora such as *one* and *another*, but not so mass NPs. Another important mass-count criterion is that count nouns allow for the application of cardinal numerals (*two shoes*), but mass nouns do not (* *two footwear*). Moreover, count nouns allow for ordinal numerals such as *first, second*, and *third* (*the first house*), but not mass nouns (?? *the second wood / furniture*).

Related to the last two criteria are corresponding semantic selectional constraints on verbs, which are not generally noted in the literature.[3] C*ount* generally applies only to count NPs (*John counted the piles of wood*), not mass NPs (??? *John counted the wood*). Predicates of ranking or listing apply to count NPs (*John ranked / listed enumerated the dresses*), but not mass NPs (?? *John ranked / listed / enumerated the clothing*).

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[1] See Treves and Rothstein (to appear) and Bale / Gillon (to appear).

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

[3] But see Moltmann (1997) for part-structure-sensitive semantic selection that verbs such as *count*, *rank* and *enumerate* impose.

1.2. Standard approaches to the mass-count distinction

Two types of standard approaches to the semantic content of the mass-count distinction among nouns can be distinguished: [1] the extension-based approach and [2] the object-based approach. The extension-based approach can be traced to back to Quine (1960), the object-based approach 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 1998, 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) Extensional mereological account of the semantic mass-count distinction
    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_{plur}, $[N_{plur}] = \{ x \mid \exists P (P \neq \emptyset \ \& \ P \subseteq [N] \ \& \ x = \oplus P\}$
    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).

The extension-based approach to the mass-count distinction faces two sorts of well-known problems. First, atomicity does not generally hold for singular count nouns, for example not for count nouns like *entity*, *twig*, *fence*, *sequence* or *part* (Moltmann 1997, 1998, Zucchi/White 2001, Rothstein 2010). Moreover, object mass nouns such as *police force, furniture, personnel, clothing, jewelry*, a rather large subcategory of mass nouns in English, fail to satisfy standard extensional mereological conditions on mass nouns such as not being atomic (Chierchia 1998, Rothstein 2017, Cohen, to appear). 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 (Chrierchia 1998, Rothstein 2017).

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 (Simons 1987) or integrity in a situation of reference carrying contextual information (Moltmann 1997, 1998). Entities in the extension of mass nouns lack a

boundary or integrity, or integrity in a situation of contextual information. The following is an integrity- and situation-based account of the mass-count distinction along the lines of Moltmann (1997, 1998):

(2) <u>Integrity-based account of the semantic mass-count distinction</u>

    a. If N is a singular count noun, then for a situation of reference s, if $<x, s> \in [N]$, then x is an integrated whole in s.

    b. For a plural noun N_{plur} , $[N_{plur}] = \{<x, s> | \exists P(P \neq \emptyset \ \& \ P \ x \ \{s\} \ \subseteq [N] \ \& \ x = \bigoplus P)\}$

    c. If N is a mass noun, then for a minimal situation of reference s such that $<x, s> \in [N]$, then x is not a (strong) integrated whole in s.

The integrity-based account avoids the problems for atomicity for sequence-type nouns. Since atomicity is not imposed on count nouns, there is no problem for part of an entity in the extension of *sequence* to be in the extension of *sequence* again.[4]

However, the integrity-based account faces difficulties of its own. First, there are nouns to which the notion of integrity is hardly applicable, for example *amount, sum*, or *loose collection*, or *sequence*.[5] Moreover, the integrity-based account faces similar difficulties as the extensional mereological account for object mass nouns, whose extensions consists in inherent integrated wholes.[6]

Let me turn to the grammar-based approach to semantic mass-count distinction. The basic idea of that approach is that the use of a count noun or classifier (and only that) conveys a notion of unity (and hence countability), a notion that need not align with the individuation of entities at the level of cognition or reality. On that approach, object mass nouns fail to convey unity, even though their lexical content describes well-individuated entities.[7] Also nouns in languages such as Chinese will fail to convey unity on the grammar-based approach.

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[4] The reason why we generally able to refer to a unique entity with *the sequence* because situations of reference generally contain just entities with the highest degree of integrity, the maximal sequence, a maximal entity consisting of connected parts.

[5] Such cases could at best be handled by positing a notion of merely conceived, ungrounded integrity (Moltmann 1997).

[6] By modifying the role of situations, the integrity-based account might permit an account of object mass nouns by allowing the situations to 'leave out' conditions that define entities as integrated whole, as was suggested by Cohen (to appear).

[7] 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).

Conveying unity with such nouns requires the addition of a numeral classifier.[8] There are different versions of the grammar-based approach. I will focus on two versions that have been proposed in the literature and propose a third version that I will adopt.

Borer's (2005) theory of the mass-count distinction is in a way is a purely 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 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.

Rothstein's (2010, 2017) version of the grammar-based approach conceives of the content of the mass-count distinction in terms of 'grammaticized individuation', as she calls it. A count noun N applies to entities n only relative to a context k in which they count as atoms with respect to N, where context is a restricted set of entities. Mass nouns, by contrast, apply just to entities, which means they do not guarantee that the entities they apply to are atoms. The difference between count nouns and mass nouns, most importantly, consists in a type difference: mass nouns are of type $\langle e, t \rangle$ (properties of entities), whereas count nouns are of type $\langle\langle n, k \rangle, t \rangle$ (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 a predicate of type $\langle e, t \rangle$ onto a predicate of type $\langle\langle e, k \rangle, t \rangle$, 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

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[8] Bale / Gillon (to appear) 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 conveyed lexically as well (Section. 3.3.).

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*).

On the third version of the grammar-based approach to the mass-count distinction, the language-driven notion of unity is by taken to be a feature that some entities at the relevant level of ontology have and others don't.[9] Unity itself can be taken to be a primitive notion. Unity is usually grounded in conditions of integrity of some sort or atomicity (with respect to a relevant concept); but it need not be so grounded. After all, whether some pieces of wood are regarded 'a pile of wood' (entity with unity) or just 'wood' (entity without unity) or 'pieces of wood' (non-unity) seems entirely a matter of choice or perspective.[10]

The distinction between entities that have unity in the language-driven sense and entities that don't may also be understood in perspectival, and thus less ontological, terms, as the distinction between entities that have unity under the relevant perspective or in the relevant situation and entities that lack unity under the relevant perspective or in the relevant situation.

Elaborating the distinction in one of these ways further is a philosophical task that goes beyond the scope of this paper. For present purposes the two views serve the same purpose: what matters is that the domain of entities that provides semantic values for quantifiers and referential NPs divides into two distinct subdomains: a subdomain D_u of entities that come with unity and a subdomain D_n of entities that don't, regardless of whether the entities in D_u and D_n are just individuals or perspectival beings (individuals-in-situations). Entities in the domain D_u allow for a 1-1 mapping onto numbers, for the purpose of counting, listing or enumerating, entities in the domain D_n don't.[11] The distinction between the two subdomains most importantly serves the purpose of allowing mass nouns and count nouns to differ in their denotations, but without that amounting to a type difference or a substantial ontological difference (that is, an ontological between entities as they 'really' are).

The distinction between the two types of entities (D_u and D_n) allows predicates to semantically select one or the other. The restriction of cardinal and ordinal numerals to count NPs, thus, is a matter of semantic selection, just like the restrictions of the corresponding

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[9] If preferred, one might also take unity to be a feature that acts as a gloss for some entities ('x qua unity'), but not others.

[10] See Moltmann (to appear).

[11] There is a question whether the difference between beings that have unity (individuals) and beings that don't (quantities) can be captured in terms of standard formal means of set theory, as a distinction between two domains of entities. After all, in the metalanguage the entities in both domains are treated as single entities. But again this is a philosophical question that needs to be pursued elsewhere. In the present context, a simple representation of the intuitive difference must suffice.

verbs *count*, *rank*, *enumerate*, and *list*. That is, a predicate P from this group is subject to the following condition:

(3) <u>Semantic selectional requirement for number-related predicates</u>

For a number-related predicate P and an entity e, [P](e) = true or false only if

$e \in \{d \mid \exists P(P \neq \emptyset \ \& \ P \subseteq D_u \ \& \ d = \oplus P)\}$

The distinction between D_u and D_n also serves the semantics of classifiers. Similarly to Rothstein's (2017) account, classifiers will denote a function mapping entities in D_n onto entities in D_u, which is an ontological operation, but not of a substantial ontological sort.

2. 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*).[12] 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).

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

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[12] 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.

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 doubts 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. 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 not applied to complex NPs that way.[13, 14] The application of the proper diagnostics of the mass-count distinction should be to verbs, rather than VPs or sentences.

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[13] 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

3. Mass diagnostics and the verbal domain of events

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.[15] 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 quantifiers

Verbs generally take mass quantifiers as adverbial quantifiers, such as *much, little*, *a little bit*, a good deal, a great amount, rather than count quantifiers such as *many*, *few*, *a few*, or *a large number*:

(4) a. John jumped too much / * too many.

　b. John stumbled only a little / * only a few.

　c. John slept / worked a little bit / * few.

　d. John slept / worked too little / * too few.

　e. Last week, Mary worked out a good deal / a great amount / * a large number.

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whole in a sense, it is never treated as 'one' for the purpose of counting. Still, the notion of an integrated whole in a situations can be semantically relevant. See Fn 20.

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

[14] 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.

[15] The criterion of a singular-plural distinction applies, it seems, to verbs in some languages as well. This phenomenon of pluractionality is found, for example, in some Native American languages (Hendersen 2019). In this paper, I will focus on English, though the question of mass-count diagnostics for verbs in those languages is quite relevant and should be explored.

Much, little, and a little bit apply as adverbial modifiers whether the verb describes bounded events or processes / activities.[16]

One might try to explain the impossibility of *many* and *few* as adverbial modifiers syntactically: *many* and *few* are adjectival and moreover generally require a silent noun that relates the preceding discourse. However, first of all, *few* and *many* with a silent noun as restriction could act adverbially, just as *many times* does, and a silent noun can, it seems, be linked to the verb. *A little bit* generally also requires an anaphoric restriction (that is how *a little bit* is understood in *She knows a little bit*), and *a little bit* can be used adverbially, with the Davidsonian event argument position acting as its restriction semantically. There is, moreover, the general question why there isn't an adverbial version of *many* or *few* that could then apply to verbs. Across languages, it seems, simple adverbial quantifiers are formed from nominal mass, not count, quantifiers.

For the count quantifiers *few*, *many* and a large number to count Davidsonian events, they need to modify the noun *times*:

(5) a. John jumped many times.

    b. John stumbled a few times

    c. John slept / worked a few times / too many times.

    d. John worked out a great number of times this year.

Times has the function of a numeral classifier, by picking out events that have unity in one of three ways: [1] by having a boundary (or being atoms with respect to the verbal event concept) as in (5a), [2] by being maximally continuous in time; [3] by occurring at contextually given occasions. The latter two options are in principle available for (5b) (the second interpretation, for example, when continuing with *when I visited*).

3.3. Obligatory numeral classifiers with cardinal and ordinal numerals

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[16] There are some restrictions to what verbs *much* and *little* can apply. In particular, they 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.

Cardinal numerals do not form adverbials ranging over Davidsonian events. For counting events in the verbal domain, they need to combine with the classifier *time*, and that regardless of the Aktionsart of the verb, even with achievements and accomplishments:

(6) a. * John died only one.

    b. John died only one time.

(7) a. * John jumped three.

    b. John jumped three times.

(8) a. * John ran to the house two.

    b. John ran to the house two times.

With activity verbs and stative verbs, *times* individuates events by imposing a condition on temporal separation or connecting them to contextually given occasions: [17]

(9) a. John slept three times today.

    b. Mary worked out three times this week.

    c. John was truly happy three times in his life.

As with *many* and *few*, one might attempt a syntactic explanation why cardinal numerals cannot be used as adverbial modifiers. They are adjectival and generally require an overt noun or silent anaphoric noun as restriction. Again, the fact is that cardinal numerals are not used to form adverbs that could then modify the verb.

    This is different for ordinal numerals. *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 stumbled*). However, ordinal numerals cannot act as adverbials ranking the described event in a list of events of the same type; for that they need to combine with the classifier *time(s)*:

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

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[17] *Time(s)* generally does not apply to stative verbs (H. Filip p.c.):

(i) John knew Bill three times.

But there are exceptions, namely when there are clearly distinct constitutive conditions for separate states:

(ii) John owned the painting three times in his life.

b. Mary stumbled a third time.

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

b. John married a second time.

Time is on a par with numeral classifiers in a language such as Chinese, making a count quantifier or numeral applicable to a non-count category. *Time(s)* in fact exhibits other properties characteristic of individuating classifiers, such as not allowing adjectival modifiers (Cheng/Sybesma 1999):

(12) 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*. More generally, it appears that count quantifiers and numerals across languages can apply to Davidsonian events only with the use of an event classifier. [18] 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. [19]

Frequency adverbials may seem to pose a challenge to this generalization. Frequency adverbials are apparent count quantifiers and can modify verbs without the presence of *time(s)*:

(13) a. John stumbled frequently.

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[18] 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*.

[19] Cinque (2006) argues that temporal measure words such *years* and *days* also act as numeral classifiers in English.

b. John slept frequently.

However, frequency adverbials do not just count events; rather they count events at particular, temporally separated occasions, involving the same individuating condition as the event classifier *time(s)*. Frequency adverbials thus incorporate the semantic effect of *time(s)* as part of their lexical meaning.

In fact, the adjective *frequent*, from which *frequently* is derived, is syntactically not a count expression since it can modify event mass nouns as in (14a, b) and not just plural nouns as in (14c) (Moltmann 1997):

(14) a. the frequent rain

   b. the frequent fog in this region

   c. the frequent rainfalls

Frequent(ly) ensures countability by way of its lexical meaning, which enables it to apply to mass categories as well.

Frequently is not the only apparent count 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). The units may be distinguished contextually or in virtue of the nature of the substance. For example, *vieles* in (15a) 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 (15b) only has a measurement reading:

(15) a. vieles Holz

    many wood

     'many pieces / sorts of wood'

   b. viel Holz

     'much / a lot of wood'

Vieles thus is a nominal mass quantifier whose lexical meaning conveys conditions of discreteness, ensuring countability. 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, an option that the grammar-based approach to the mass-count distinction will need to admit.

3.4. The German duality-introducing quantifier *beides*

There is one other quantifier in German that conveys countability lexically and applies to Davidsonian events. This is the quantifier *beides* 'both'. *Beides* is syntactically singular, requiring singular agreement on the verb.

(16) a. Beides ist / * sind unmoeglich.

'Both is / are impossible.'

However, it is not count, since it cannot anaphorically relate to a count NP, say a collective NP, as in (16b). It can anaphorically relate only to a mass NP, which needs to stand for two distinguished quantities, as in the case of the conjunction in (16c):

(16) b. Hans traf ein Ehepaar. * Beides sind Amerikaner.

'John met a couple. Both are Americans.'

c. Hans trank den Wasser und das Bier. Er hat beides schnell getrunken.

'John drank the wine and the beer. He drank both quickly'.

Beides can also act as a floated quantifier with a mass NP that stands for two contextually well-individuated subquantities, as below:

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

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 beiden Schachteln kostet beides 100$.

'The jewelry in the two boxes is both 100$.'

Beides thus is syntactically mass, yet it conveys countability lexically, similarly to *frequent(ly)* and *vieles*. That it introduces a plurality of two entities is shown by the fact that predicates of counting and listing can apply to it:

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

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

Beides thus involves the meaning of a classifier, mapping an entity of the domain D_n onto a plurality of entities in the domain D_u.

　　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 (19a, b), or just as anaphorically, as in (19c):

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

　　　　It was lightning and thunder. 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 did it both yesterday.'

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

　　　　'Mary danced and painted. Both she had just learned.'

The ability of *das beides* to relate to Davidsonian events gives further support for the classification of verbs as mass rather than count with respect to their event argument place.

3.5. Support of plural anaphora in German

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

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

(20) in itself is not indicative of the mass status of verbs, though, since conjunctions of definite mass NPs in English do support plural anaphora:

(21) a. John drank the water and the wine. He drank them quickly.

   b. John bought rice and meat. He paid little for them.

However, in German, conjunctions of mass NPs do not support plural anaphora; only plural NPs do:

(22) 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 fruit and salad. He needed both / them for lunch.'

In German, lack of plural anaphora support thus is a diagnostics for mass.[20] Note that German permits the mass quantifier *beides* in (22a, b) as well. The German translation of (20a) with sie 'them' is equally bad, but not with das *'that'* or *das beides*:

(20) b. Hans oeffnete die Tuer und schloss das Fenster. Er tat ?? sie / ok das / ok das beides

      vor einer Stunde.

This further supports the classification of verbs as mass with respect to their Davidsonian event argument position.

3.6. Selection of relative pronouns in German

There is another mass count diagnostics in German that applies to verbs, and that is the choice of relative pronouns. German has two kinds of relative pronouns: w-pronouns (*was*) and d-

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[20] 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 (21a, b).

pronouns (*der, die, das*). The generalization, roughly, is that count full NPs select d-pronouns, whereas non-definite mass full NPs select w-pronouns:[21]

(23) 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 masculine or feminine mass NPs, which select *das*:

(24) 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'

With bare quantifiers and *das* 'that', which are mass, always w-pronouns are chosen:

(24) c. alles / nichts / etwas / das, was / das

   'all / nothing / something that / that'

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:

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

   'John laughed / rested, which he does rarely'.

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[21] 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 Fn 14.

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 sand, which she both had not done for a long time.'

Note in (25) the floated mass quantfier *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 as mass, rather than dividing into mass and count.

4. The grammar-based approach to the mass-count distinction and the mass diagnostics of the verbal domain of events

4.1. Explaining the mass diagnostics of the verbal domain of events

The mass behaviour of verbs presents serious difficulties for the standard, extension-based and integrity-based approaches to the semantic mass-count distinction, in addition to the more familiar problems 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 actual or of actual, perceived, or situation-relative mereological properties of Davidsonian events. The grammar-based approach to the mass-count distinction, by contrast, does permit entities in a mass domain to be divided, at the level of cognition, into natural or contextual units. Davidsonian events may come in natural units or contextual units, which may still play semantic roles, for example, as we have seen, for the semantics of *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, to appear).

The classification of verbs as mass is predicted by the grammar-based approach to the mass-count distinction. On that approach, only count categories and classifiers convey the relevant sort of unity, but not non-count categories, such as mass nouns and verbs, and that regardless of their lexical content or the nature of the entities in their extension. Language-

driven unity is associated with count categories, but not with the syntactic mass category or syntactic categories lacking a syntactic mass-count distinction.[22]

The language-driven notion of unity may diverge from 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).

The present version of grammar-based approach to the semantic mass-count distinction explains the mass diagnostics of verbs in terms of semantic selection, namely the semantic selectional requirement in (3). That is, cardinal and ordinal numerals, count quantifiers, d-pronouns, plural anaphora, and verbs like *count, rank*, *enumerate*, and *list* semantically select entities or pluralities of entities in the domain D_u, which includes Davidsonian events. They cannot apply to Davidsonian events without the mediation of the classifier *time(s)* (which maps entities D_n onto entities in D_u). Mass quantifiers and w-pronouns semantically select entities or pluralities of them in D_u and thus can apply to Davidsonian events.[23] Note that this does not exclude that mass quantifiers like *little* and *much* with verbs like *jump* may still 'measure' by counting 'atomic' events.

The classifier *times* maps a set of Davidsonian events (a subset of D_n) onto a set of events or pluralities of events that have unity (a subset of D_u), based on natural event units (or atoms), external occasions, or maximal temporal continuity. The duality-introducing quantifier *beides* maps an entity in D_n onto a plurality of two entities in D_u on the basis of a contextual division.[24]

4.2. Event Nominalizations

[22] Also 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, thus side with mass nouns.

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

[24] On Rothstein's (2017) account, they would be considered a matter of semantic type. With respect to their event argument, verbs would, in the simplest case, be of type $<e, t>$ (say the verb *rain*). A mass quantifier can apply to a predicate of that type, but not a numeral, which can only apply to a predicate of type $<<n, k>, t>$. The event classifier *time(s)* maps a verb V of type $<e, t>$ to a complex predicate of type $<<n, k>, t>$, by ensuring, in one way of another, contextual atomicity of events. This enables cardinal and ordinal numerals to apply to *time(s)*.

Events that are Davidsonian event arguments of verbs need to be distinguished from events that are referents of counts nouns, including deverbal nominalizations that are count. Given the grammar-based approach to the mass-count distinction, deverbal count nominalizations do more than just pick up an event argument of a verb. By taking part in the morpho-syntactic mass-count distinction among nouns, they specify the unity of the events in their extension. This happens generally on the basis of the individuation of events in the cognitive ontology and thus what the object-based approach takes to be the semantic mass-count distinction (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 else on other natural units of events, such as events displaying maximal temporal connectedness (*walk, speech, workout*).

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

5.1. Other non-nominal categories and the semantic 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.

The first case to look at 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.[25] As is expected on the grammar-based approach to the mass-count distinction, clauses display diagnostics for mass rather than count. (Moltmann 1997). First, clauses in German chose w-pronouns, not d-pronouns:

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

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

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[25] 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.

Second, conjoined clauses in German support mass pronouns, but not plural pronouns as anaphora, a criterion that this time also applies to English:

(27) 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 (28a, b), unless they modify the noun *thing,* as in (28c), which serves as a kind of numeral classifier:

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

   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 support og mass pronouns, but not plural pronouns as anaphora (Moltmann 2013a, 2017):[26]

(29) 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: 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).

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[26] Number words in argument position have been considered nonreferential in Hofweber (2005) and Moltmann (2013a, b). But see Moltmann (2017) for a recent critique of that view.

5.2. Nonreferential uses of NPs and the mass-count distinction

Nominal categories 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 observations then 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:

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

   'John needs an assistant, which Bill needs to.'

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

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

Furthermore, they can be replaced only my mass quantifiers:

(31) John needs too much / a great deal / * several / * a great number, an assistant, a

   secretary, a cook, and a trainer

Pure quotations are not referential NPs even if they are generally considered referential terms standing for expression types (with there being different views of how that may be achieved). Pure quotations do not refer in virtue of meaning, which means that, even if they consist in nominal categories, the content of the mass-count distinction would not apply to their denotations. As expected, pure quotations classify as mass by the criteria pertaining to German:

(32) a. 'Rouge' bedeutet 'rot', was / * das 'red' auch bedeutet.

   'Rouge' means 'red', which 'red' means too.'

   b. 'Cher' bedeutet 'lieb' und 'teuer'. 'Dear' bedeutet das / * sie auch.

   'Cher' means 'lieb' and 'teuer'. 'Dear' means that / * them too.'

   c. Hans hat 'cher' und 'beau' uebersetzt. Maria has das beides / diese Worter / * sie /

            * die auch uebersetzt.

           'John has translated 'cher' and 'beau'. Mary translated that both / those words / them /
               them too.'

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

The starting point of this paper has been the grammar-based approach to the mass-count distinction on which count nouns or numeral classifiers convey unity and thus countability and mass nouns the lack of it. The grammar-based approach allows for major discrepancies between the ontology of countability conveyed by language and the cognitive ontology in which entities are individuated according to conditions of integrity, function, and persistence across times and situations. 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 so is independent of the mass-count distinction as such (Chierchia 2015). The grammar-based approach to the mass-count distinction is able to deal with a range of notorious problems for the standard, extension-based or object-based approaches to the content of the mass-count distinction.

    Unlike object-based and extension-based approaches to the content of the mass-count distinction, the grammar-based approach predicts that categories without a morpho-syntactic mass-count distinction always classify as mass, rather dividing semantically into mass and count. The paper has shown that this prediction is borne out for verbs with respect to their Davidsonian event argument position, which always classify as mass according to mass-count diagnostics applicable to verbs. It also holds for non-nominal categories that can appear in argument position as well as for nonreferential uses of NPs. The mass diagnostics of verbs, the choice of mass quantifiers and pronouns, the lack plural anaphora support, and the inapplicability of number-related predicates, were treated in terms of semantic selection, just as in the case of mass nouns on Rothstein's (2017) account, making use of the absence of a language-driven notion of unity. 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. Language imposes its own notion of syntax-based unity, which may or may not

go along with unity at the level of cognition or reality. The content of the syntactic mass-count distinction thus is a matter of 'grammaticized individuation' rather of a substantive difference in cognitive ontology or the real structure of things.

As a subsidiary contribution, the paper has shown that countability may be lexically conveyed by particular quantifiers, that is, quantifiers that are nominally mass, yet convey unity by way of their lexical meaning. Frequency expressions, which apply to mass nouns as well as verbs, are one example. The German quantifiers *vieles* and *beides* are other examples.

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