

Pure Event Semantics

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Abstract

In a pure event semantics for natural language, the domain of quantification and predication is limited to events and states. I offer pure event semantic analyses of several phenomena, some of which have not been treated before in formal semantics. In the pure event semantics sketched in section 2, nouns are state predicates and this provides the starting point for the analyses. The phenomena involve grammatical number, the mass-count distinction, adjectival modification, count adjectives, diminutives, lexical plurals, duals and mass gender. In the conclusion there is a brief discussion of potential metaphysical or psychological ramifications of doing semantics this way.

1 Introduction

It is reasonable, as a first pass, to treat nouns, verbs, and adjectives as predicates of individuals. If Adar is a clever child who owns an owl, then Adar is in the extension of *clever* and of *child*, and the extension of *owns* includes the pair of Adar and some owl. But one cannot conceive of the meaning of a verb without reference to a particular kind of event or state and so an attractive alternative is to treat verbs as predicates of events and states. Adjectives are similarly associated with states and have also been treated as state predicates. The translation in (1) illustrates how these ideas can be implemented using thematic role predicates to connect individual and event or state predication:

- (1) A clever child owns an owl.
 $(\exists x) (\text{child}(x) \ \& \ (\exists s') (\text{clever}(s') \ \& \ \text{hold}(s', x)) \ \& \ (\exists s) (\text{owns}(s) \ \& \ \text{hold}(s, x) \ \& \ (\exists y) (\text{owl}(y) \ \& \ \text{theme}(s, y))))$

According to this implementation, nouns are predicates of individuals. But nouns describe eventualities as well. *ice*, *snow*, *steam* and *water* describe different states of matter. *child* describes a state that Adar is currently in but one that will end at some point. So perhaps our logical forms should include eventualities variables in the noun-predicates as well, ‘*ice*(*s*,*x*)’ in place of ‘*ice*(*x*)’ (cf. Schein 2017, Higginbotham 2000:§1.2). This move invites the next step. Eliminate the individual variable, treating nouns like verbs and adjectives as one-place eventuality predicates. In so doing, we eliminate all non-eventuality variables from logical form and arrive at what I call a pure event semantics. Effecting this change, will force us to rethink a host of issues connected with nouns, including grammatical number, the mass count distinction and nominalization as well as phenomena that are not noun-specific but in which nouns participate, including quantification, modification and anaphora. In this paper, after providing details on the mechanics of a pure event semantics, I will focus chiefly on number, the mass-count distinction and modification.

The system of interpretation will be developed in §2. It will not have individual or object variables – only quantification and predication over eventualities. This will require the introduction of a relation among states to do some of the work of connecting predication across a sentence. Other than that, I adopt and adapt existing accounts of the semantics of plurals, of modification and of the syntax-semantics interface. I’ve chosen to refer to the eventualities described by nouns as states. This seems right for *child*, *steam* and the other nouns that will figure in our discussion. Grimshaw (1990) makes a distinction between ‘simple event nominals’ (*party*) and ‘complex event nominals’ (*examination of the students*). Complex event nominals are beyond the scope of this paper, but if simple event nominals are in fact predicates of events¹, then take ‘predicate of states’ to be short for ‘predicate of states or events’.

¹ A simple event nominal might be a predicate true of a state that an event is in. Consider: *it began as a party but ended up as a brawl*. This might be a better way to interpret the facts that led Roy and Soare (2013) to conclude that simple event nominals “take an individual as argument (rather than an event); it just happens that for simple event nominals that individual variable is an abstract entity, conceptually an event”.

My hope is that §2 will establish the viability of a pure event semantics. In §§3-9, attention will turn to empirical phenomena whose analysis benefits from viewing nouns as state predicates. With the exception of adjectival modification (§9), they all have to do with mass nouns². For this reason, ample space in §2 is devoted to the mass count distinction. Mass nouns pattern in many ways like plural count nouns (Lasnik 2011), leading many to conclude that mass nouns have the same kind of denotation as plural count nouns (Bacon 1973, Bale & Barner 2009, Burge 1977, Chierchia 1998, Gillon 1992, Landman 2020, Laycock 1972, Mufwene 1980). However, there are also ways in which mass nouns behave like singular count nouns, the most obvious being their use in grammatically singular noun phrases (*this soap*). As we will see, treating nouns as simple state predicates opens up a way to treat mass nouns as semantically similar to count plurals without identifying the two types of denotations.

Following the development of the framework in §2, there will be two sections (§§3-4), one on reciprocals and one on “count adjectives” (Bunt 1979: §5). These two sections offer evidential support for the treatment of mass denotations as distinct from count plural denotations and yet still ‘plural’ in a sense to be made precise. In addition, §4 shows that if we extend the eventuality-based characterization of ‘count noun’ to count adjectives, we correctly predict facts about their use with plural count subjects not discussed in the earlier literature. An understanding of the source of the countness along with a brief crosslinguistic survey of such adjectives will lead surprisingly to an explanation of why in many languages a diminutive combined with a mass noun produces a count noun.

Sections 5-7 are concerned with inflectional affixes whose presence indicates a noun has a mass denotation. This includes discussion of lexical plurals (*dregs*, *arms*) in §5, mass gender in §6, and dual marking of bipartites (*scissors*, *pants*) in §7. Picking up on the mass-plural connection, I will show that the plural features in *dregs* and *fumes* have the same syntax, pronunciation and meaning as the ones in *kegs* and *rooms*. The fact that *dregs* and *fumes* are mass nouns will be shown to follow from the fact that their bases (*dreg-*, *fume-*) are only interpreted in nouns that are plural.

Section 8 is about nominal quantification (*every goat*). I raise a problem of overcounting that comes from having a domain of quantification populated with eventualities. There is an easy fix to this problem but adopting it will only lead to the problems of undercounting associated with quantification over individuals. Ultimately, as others have shown, we need a theory of counting and measuring that makes reference to events associated with the entities counted (see Schein 2017). I end by suggesting that a pure event semantics is at no disadvantage as a starting point for such a theory.

In §9, we show how adjectival modification works in a pure event semantics. A key goal will be to supply some rationale for why it is that ‘intersective interpretations’ require the building of a predicative structure around the adjective. Cinque (2014) and others have amassed evidence for this generalization but they have not explained why it is so.

2 A pure event semantics

2.1 Semantics of plurals

Following Scha (1981), I adopt a semantics in which plural definite DPs denote non-singleton sets³ and singular definite DPs denote singleton sets. Given our working assumption about noun meanings, those will be sets of states. Our universe therefore contains states and sets of states.

(2) Variables

s, s' are variables over states.

S, S' are variables over sets of states.

A non-singleton set of states will be called a **plurality**. A set containing just one state will be called a **singularity**. I will identify a singleton set with its members (Winter & Scha 2015:§3.1.1), so that:

² I follow widely accepted usage of the term “mass” to be synonymous with “non-count”.

³ This approach would be classified as singularist and specifically mereological, with subset serving as the part-whole relation. Florio & Nicolas (2021) discuss criticisms of mereological approaches. “After comparing the mereological approach with plural logic,” they “conclude that the former remains a viable and well-motivated framework for the analysis of plurals.”

$$(3) \quad (\forall s) \{s\} = s$$

$$(4) \quad (\forall S)(\forall s) (S = \{s\} \rightarrow S = s)$$

It follows that any state is a singularity.

Identifying singletons with their members makes the implementation go a bit smoother, but it does take getting used to, so I will occasionally include a REMINDER of this identification.

2.2 Stative predications

The sentence

$$(5) \quad \text{A window is open.}$$

reports on a connection between a *window* state and an *open* state. Following Ramchand (2005), I'll refer to the entities of whom a state holds as **participants**. The interstate relation invoked in (5) is that of shared participation, as indicated in the gloss in (6):

$$(6) \quad \begin{array}{l} \text{A window is open.} \\ \text{'The participant in a window state is the participant in an open state'} \end{array}$$

Shared participation among states is a notion familiar from discussions of secondary predication. Note the double reference to the dress in Maienborn (2019:67)'s paraphrase of (7) connecting *wet* and *on the clothesline*:

$$(7) \quad \begin{array}{l} \text{The dress was wet on the clothesline.} \\ \text{'there was a state of the dress being on the clothesline, and this state is temporally} \\ \text{included in an accompanying state of the dress being wet"} \end{array}$$

Temporal inclusion is a necessary part of secondary predication (Rothstein 2004:§3.3), but it is not a necessary part of predication in general (Tonhauser 2021), and so it wasn't included in the gloss of (6) and it won't be included in subsequent glosses.⁴

Returning to (6), *A window is open* involves the sharing of a participant between two states. The examples to follow describe participant sharing among several states.

$$(8) \quad \begin{array}{l} \text{The molecules are in equilibrium.} \\ \text{'The participants in the molecule states are all and only the participants in a state of equilibrium'} \end{array}$$

The state of equilibrium is a **multiparticipant state**. And, by contrast, the state of openness referred to in (6) above is a **single-participant state**. In (8) above, *The molecules* picks out a plurality of states and the participants across that plurality are said to be shared with the participants in a multiparticipant equilibrium state. Next, consider (9) in which two non-singleton sets of states are said to share participants:

$$(9) \quad \begin{array}{l} \text{The molecules are small.} \\ \text{'The participants in the molecule states are all and only the participants in a set of small states.'} \end{array}$$

To cover all these possibilities, we introduce a symbol for participant sharing:

$$(10) \quad \text{The 'same participants' symbol: } \oplus$$

⁴ More generally, tense and the temporal interpretation of noun phrases (Musan 1999, Thomas 2014, Schein 2017) is beyond the scope of this inquiry.

‘ \ominus ’ stands for a relation among sets of states that holds between S and S' when the participants in the states in S are all and only the participants in the states in S' .

With this symbol we can abbreviate our glosses:

- (11) a. A window is open.
b. $\exists s \exists s' s$ is a window state, s' is an open state, $(s \ominus s')$
- (12) a. Some molecules are in equilibrium.
b. $\exists S \exists s' S$ is a set of molecule states, s' is an equilibrium state, $(S \ominus s')$
- (13) a. Some molecules are small.
b. $\exists S \exists s' S$ is a set of molecule states, s' is a set of small states, $(S \ominus s')$

REMINDER s, s' pick out states, which are singleton sets. The definition in (10) connects sets of states. Since s, s' are singleton sets, the definition covers $(s \ominus s')$ and $(S \ominus s')$ in (11)-(12).

2.3 Thematic roles

The same-participant relation can be associated with a silent lexical item θ_{HOLD} (Williams 2015:§9.10), interpreted as in (14)

$$(14) \llbracket \theta_{\text{HOLD}} \rrbracket = \lambda P \lambda S (\exists S') [P(S') \ \& \ (S \ominus S')]$$

Composition can then proceed as follows⁵:

$$\llbracket \theta_{\text{HOLD}} \text{ open} \rrbracket = \lambda S (\exists S') [\text{open}(S') \ \& \ (S \ominus S')]$$

$$\llbracket a \text{ window} \rrbracket = \lambda P (\exists S)(\text{window}(S) \ \& \ P(S))$$

$$(\exists S)(\text{window}(S) \ \& \ (\exists S') [\text{open}(S') \ \& \ (S \ominus S')])$$

Although discussion will be limited to simple stative clauses for the most part, I should indicate how participation might enter into eventive clauses. Thematic relations describe states that event participants are in during the course of the event (Schein 2017:11). While Adar washes the car, he is in an agent state and the car is in a patient state. As the window breaks, it is in a patient or theme state. With a syntax for (15)a as in (15)b, and the interpretations in (16)-(17), we generate the meaning in (18).

- (15) a. A window broke.
b. $[a \text{ window}]_i \lambda_i [\exists e [\theta_{\text{PATIENT}} t_i] \text{ break }]$

$$(16) \llbracket \theta_{\text{PATIENT}} \rrbracket = \lambda S \lambda e (\exists! S') [S' \text{ is a patient state of } e \ \& \ (S \ominus S')]$$

$$(17) \llbracket \lambda_i [\exists e [\theta_{\text{PATIENT}} t_i] \text{ break }] \rrbracket = \lambda S (\exists e) (\exists! S') [S' \text{ is a patient state of } e \ \& \ (S \ominus S') \ \& \ \text{break}(e)]$$

$$(18) (\exists S)[\text{window}(S) \ \& \ (\exists e)(\exists! S') [S' \text{ is a patient state of } e \ \& \ (S \ominus S') \ \& \ \text{break}(e)]]$$

‘There is an event of breaking, its patient state shares all and only participants with a window state’

⁵ The format for quantification and conjunction in the metalanguage gives:

$$(\exists S) (\text{window}(S) \ \& \ P(S))$$

Parentheses will be dropped, or replaced by brackets, to improve readability.

2.4 Multiparticipant states

Above it was pointed out that the state of equilibrium is a multiparticipant state. Multiparticipant states will play an important role in our discussion of noun meanings, so I'd like to mention some relevant properties. A multiparticipant state has at least two participants and some multiparticipant states could have an infinite number of participants⁶. One can perceive a state without knowing much about the participants except that they're in that state. Often, a scene may be composed of participants in various states, some multiparticipant and some single participant. Consider a starry sky on a dark night. There's a multiparticipant state manifested in points of light across the sky. The participants may be associated with those points, and we may perceive that without knowing much more about the participants. In the same scene, there are also countless single participant states, one for each point of light. Finally, there is a single participant state whose sole participant is the sum of all the stars, the constellation.

2.4.1 Defining *multiparticipant*

Using the technical resources introduced above we can define a metalanguage predicate for multiparticipation:

$$(19) \text{multiparticipant}(S) \stackrel{\text{def}}{=} (\exists S_1)(\exists S_2) (\neg(S_1 \ominus S_2) \& ((S_1 \cup S_2) \ominus S))$$

Assuming that any state has at least one participant, ' $\neg(S_1 \ominus S_2)$ ' insures that between them, S_1 and S_2 have at least two participants. In that case, $((S_1 \cup S_2) \ominus S)$ insures that S has at least two participants.

2.4.2 Ways of satisfying *multiparticipant(S)*

There at least two ways S , a set of one or more states, could be multiparticipant.

- (a) S could be a singleton set. In that case, to be multiparticipant, S would have to contain a state that has many participants, such as a state of equilibrium.
- (b) S could consist of several states, each of which has a single participant, but together they involve many participants.

The set S described in (b) consists of several states, hence it is plurality and as described in (b) it is a multiparticipant plurality. Not every plurality is multiparticipant. A set consisting of several states all with the same participant is a plurality but it's not multiparticipant. On the other hand, as we will see below, for a set S that consists of one or more single participant states, if S is multiparticipant, then S is a plurality.

2.5 Definite singular and plural noun phrases⁷

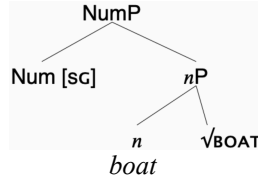
To frame our discussion of the syntax and semantics of noun phrases, we begin with the structure in (20) below, a Number Phrase (NumP) whose head includes the number feature SG found on singular nouns. The head of NumP is combined with the noun *boat* composed of the root $\sqrt{\text{BOAT}}$ and a nominalizing head n :⁸

⁶ Like when you have an infinite number of photons in a cloud of them.

⁷ This section presupposes ideas prevalent in contemporary syntactic and morphological theory. Wiltschko (2021) surveys syntactic analyses of number marking. Number Phrase and little n are covered there in sections 8.3 and 8.4.1 respectively. The approach to morphosyntactic concepts (features, roots, exponence, Vocabulary Insertion) is chiefly that of Distributed Morphology (DM). Introductions to DM include Bobaljik (2017), Kramer (2015:§§1.2.2,1.2.3) and McGinnis-Archibald (2016). Roots in DM are the subject of Harley (2014). Roots are syntactic objects. I follow the custom of naming them with a ' $\sqrt{}$ ' symbol followed by an English word that glosses their meaning. On syntactic features generally see Corbett (2012) and Svenonius (2019).

⁸ n is silent in this case. In other nouns it is pronounced: *marri-age*, *perform-ance*, *refus-al*, *confus-ion*. n is a categorizing head (Embick 2015:180). Other categorizing heads include v found in the verb *dark-en*

(20)

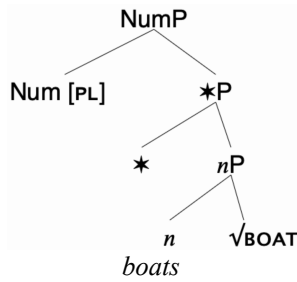


The interpretation of the structure in (20) results from the combination of the root meaning and the meaning for the number feature, to be discussed shortly. The *n* makes no contribution. The root meaning is given in (21):

$$(21) \quad \llbracket \sqrt{\text{BOAT}} \rrbracket = \lambda s. s \text{ is a } \textit{boat} \text{ state}$$

According to (21), any element in the extension of $\sqrt{\text{BOAT}}$ is a singularity (single state or, equivalently, singleton set of states). To produce a noun phrase with pluralities in its extension, we require in addition to the ingredients in (20), a ‘★’, which is an operator that optionally attaches to *nP*⁹.

(22)



The workings of a ★-operator are illustrated in (23). The meaning of our ★ operator is given in (24), where I’ve defined the sum generating operator of Link (1983:(57)) for an algebra of sets:

(23) Illustrating the Effect of the Star Operator

$$P(\{s_1\}) \ \& \ P(\{s_2\}) \rightarrow \star P(\{s_1, s_2\}), \ \star P(\{s_1\}), \ \star P(\{s_2\})$$

$$Q(\{s_1, s_2\}) \ \& \ Q(\{s_3\}) \rightarrow \star Q(\{s_1, s_2, s_3\}), \ \star Q(\{s_1, s_2\}), \ \star Q(\{s_3\})$$

(24) Star Operator Defined: Closure under Set Union

$$\llbracket \star \rrbracket = \lambda P \lambda S \ \exists \mathcal{A} \ \mathcal{A} \neq \emptyset \ \& \ \mathcal{A} \subseteq \{S' \mid P(S')\} \ \& \ S = \bigcup \mathcal{A}$$

Using the meanings in (21) and (24) we arrive at the equation in (25):

$$(25) \quad \llbracket \star \llbracket \text{nP } n \sqrt{\text{BOAT}} \rrbracket \rrbracket = \lambda S. S \text{ is a set of one or more } \textit{boat} \text{ states}$$

Number features, like the other elements in the structures above, have phonological exponents and meanings. The phonological exponents are given by the rules of Vocabulary Insertion in (26) below. *sg* and ★ have zero exponents (Trommer 2012). *-z* is the *elsewhere* exponent for plurals (it devoices in *boats*) and there are other exponents of PL that are found with specific roots (e.g. *oxen*, *loci*, *memoranda*).¹⁰

and *a* found in the adjective *glob-al* (Embick 2015:46). I assume that *n* has no meaning in this case, but in §4.6 and §6.4 we’ll see *n* heads that are meaningful.

⁹ The restriction to *nP* parallels recent evidence presented in Wehbe (2023) showing that ★-operators may attach to *vP* but not below *v*.

¹⁰ Syntactic structures like (22) are used to indicate hierarchical relations. I have adhered here to the custom in much of the syntactic and the semantic literature whereby hierarchically higher nodes are to the

(26) Vocabulary Insertion Rules

$\sqrt{\text{BOAT}}$	\Leftrightarrow	boat
n	\Leftrightarrow	\emptyset
\star	\Leftrightarrow	\emptyset
SG	\Leftrightarrow	\emptyset
PL	\Leftrightarrow	-Z

The feature SG has a meaning given below in two equivalent statements:

- (27) $\llbracket[\text{SG}]\rrbracket = \lambda P \lambda s. P(s)$
 $\llbracket[\text{SG}]\rrbracket = \lambda P \lambda S. P(S) \ \& \ S \text{ is a singularity}$

Given this meaning, we have the equivalences below¹¹:

- (28) a. $\llbracket[\text{SG}] \ n \ \sqrt{\text{BOAT}}\rrbracket = \llbracket[\sqrt{\text{BOAT}}]\rrbracket$
 b. $\llbracket[\text{SG}] \ \star \ n \ \sqrt{\text{BOAT}}\rrbracket = \llbracket[\sqrt{\text{BOAT}}]\rrbracket$

The plural feature has the effect of restricting interpretation to pluralities. This is accomplished with the meaning in (29). As things develop and we cover more data, the motivation for interpreting the plural feature in this particular way will become clear:

- (29) $\llbracket[\text{PL}]\rrbracket = \lambda P \lambda S (P(S) \ \& \ \text{multiparticipant}(S))$

The metalanguage predicate **multiparticipant** was defined in (19) above. As explained there, in order for a set of one or more *boat* states to involve multiple participants, it would have to be a plurality of *boat* states, giving us:

- (30) $\llbracket[\text{PL}] \ \star \ n \ \sqrt{\text{BOAT}}\rrbracket = \lambda S. S \text{ is a plurality of } \textit{boat} \text{ states}$

With singular and plural noun phrases in hand, we now turn to definite descriptions. We will introduce a pure event implementation of Sharvy (1980)'s idea that "the primary use of 'the' is ... to indicate totality; implication of uniqueness is a side effect". The meaning is spelled out in (32) below with some explanation below that. Given the grammatical framework, I associate a meaning with *the* by giving a meaning for the feature [DEF] whose phonological exponent is *the*.

- (31) $[\text{DEF}] \Leftrightarrow \textit{the}$

- (32) $\llbracket[\text{DEF}]\rrbracket$ is a function defined for P iff $(\exists S) [P(S) \ \& \ (S \ominus \cup \{S' \mid P(S')\})]$

If $\llbracket[\text{DEF}]\rrbracket$ is defined for P , then:

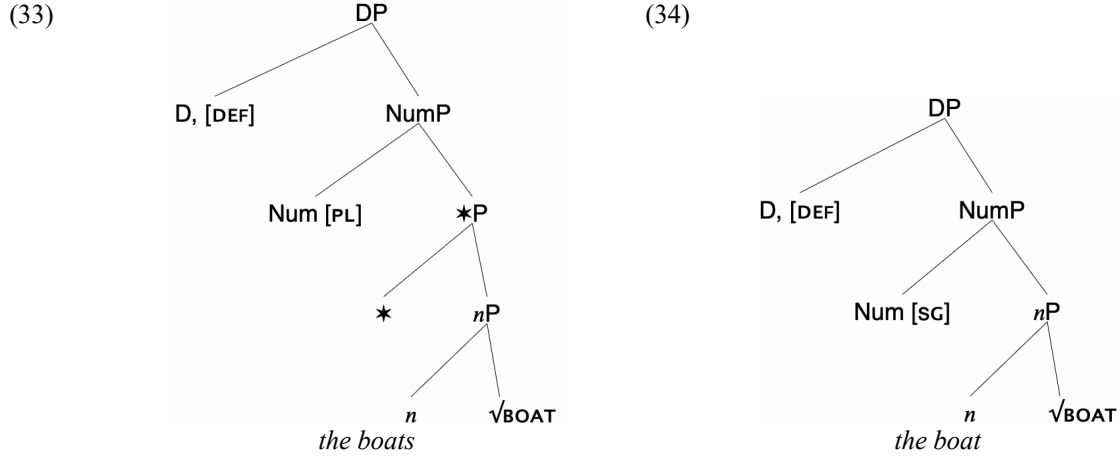
left of lower ones (at least for head initial languages). In (22), for example, PL is higher and therefore to the left of $\sqrt{\text{BOAT}}$. In the morphology literature one often finds the opposite order in the syntactic structures and I will draw some structures that way when the focus is on realization. One way or another, the pieces eventually need to be linearized, so that, for example, the exponent of PL ends up to the right of the exponent for $\sqrt{\text{BOAT}}$. One possibility is that the morphemes undergo head movement giving us the string $\sqrt{\text{BOAT}} \ n \ \star \ \text{PL}$. The Vocabulary Insertion Rules are written with that option in mind. This will be important in §5 where we find Vocabulary Insertion Rules that specify a context for the rule to apply.

¹¹ The equation in b. is relevant for understanding how a singular noun phrase antecedent can licence ellipsis of a count plural noun phrase which would necessarily include a \star -operator. That equation allows them to have identical structures, up to number features (Bassi 2021).

$$\llbracket \llbracket \text{DEF} \rrbracket \rrbracket (P) = \lambda Q (\exists S) [P(S) \ \& \ (S \subseteq \bigcup \{S' \mid P(S')\}) \ \& \ Q(S)]$$

$\bigcup \{S' \mid P(S')\}$ is a set of states. If P holds of a given plurality of states, then each state in that plurality is in $\bigcup \{S' \mid P(S')\}$. Likewise, if P holds of a given singularity, a singleton set of states, then the state in that singularity is in $\bigcup \{S' \mid P(S')\}$. In short, $\bigcup \{S' \mid P(S')\}$ is the set of all states that go into making up the sets in the extension of P . $(S \subseteq \bigcup \{S' \mid P(S')\})$ says that the participants of S are all and only the participants of the various states that go into making up the sets in the extension of P .

One can get a sense of how this works, by considering situations in which the definedness condition is not met, rendering one of the structures below meaningless.



Suppose there is just one boat. In that case, there will be no multiparticpant state and no multiparticpant set of states in the extension of $[\star n \sqrt{\text{BOAT}}]$. That, in turn, means $[[\text{PL}] \star n \sqrt{\text{BOAT}}]$ is not true of anything, and so the first conjunct of the definedness condition will not be met in *the boats*. If there is just one boat, no meaning is defined for *the boats*.

Suppose there are many boats. Given our meanings for [SG] and for $\sqrt{\text{BOAT}}$, if $[[\text{SG}] n \sqrt{\text{BOAT}}]$ is true of something, it is a single participant state. That means no state in its extension could hold of all the participants in all the boat states. The second conjunct of the definedness condition will not be met in *the boat*. If there are many boats, no meaning is defined for *the boat*.

I made two assumptions in giving the meaning repeated below for $\sqrt{\text{BOAT}}$:

(35) $\llbracket \sqrt{\text{BOAT}} \rrbracket = \lambda s. s \text{ is a boat state}$

The first assumption is spelled out in (36):¹²

(36) Roots are Singularity-Only

Any element in the extension of a noun root is a state.

The second assumption had to do with the nature of the states of which $\sqrt{\text{BOAT}}$ is true. Given intuitions about what it means to be a boat, I assumed that any state in the extension of $\sqrt{\text{BOAT}}$ has a single participant. This is true of the actual extension of $\sqrt{\text{BOAT}}$ as well as of possible extensions $\sqrt{\text{BOAT}}$ could have at different indices of evaluation. That makes $\sqrt{\text{BOAT}}$ a ‘single participant predicate’ as defined in (37) below.

(37) Definition: Single participant predicate

¹² By ‘noun root’, I mean a root that can be combined with an n .

A *single participant predicate* has a non-empty extension at some index of evaluation and where its extension is nonempty, every element in its extension is a set of one or more single participant states.

While any noun root is singularity-only, per (36), not every noun root is single participant. Consider the noun *snow*. It supports a kind of cumulative reference. If I know there is snow on the left half of the roof and I know there is snow on the right half of the roof, I can talk about what's on the roof using the phrase *the snow on the roof*. *The snow on the roof* denotes a state whose participants are all and only the participants of the states denoted by *the snow on the left half* and *the snow on the right half*. *snow* is **participant cumulative** in the sense defined below¹³:

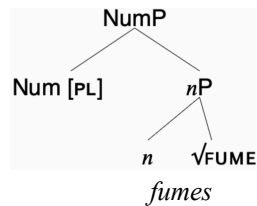
(38) Definition: Participant cumulative

A predicate of states is *participant cumulative* if for any two states s and s' in its extension, there is a state in its extension that has all and only the participants of s and s' .

P is *participant cumulative* iff $(\forall s)(\forall s') [(P(s) \ \& \ P(s')) \rightarrow (\exists s'') [(\{s, s'\} \subseteq s'') \ \& \ P(s'')]]$

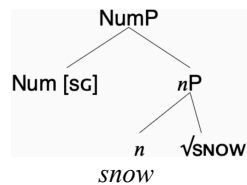
A single participant noun like *boat* could not be participant cumulative. As soon as $\sqrt{\text{BOAT}}$ is true of two states that do not share participants, participant cumulativity would require it to hold of a state with multiple participants, but $\sqrt{\text{BOAT}}$ is true only of single participant states. Conversely, a noun like *snow* that is participant cumulative will in general have multiparticipant states in its extension. Roots that are participant cumulative are therefore compatible with the feature [PL]. In §5, we'll discuss the noun *fumes* with syntax as depicted below:

(39)



Participant cumulative roots can be combined with [PL] but they don't have to be. Given that $\sqrt{\text{SNOW}}$, like any root, has only singularities in its extension, it can safely be combined with a singular number feature to produce an expression with a non-empty extension:

(40)



Elements of the extension of *snow* and *fumes* fit the definition of **multiparticipant** in §2.4. Elements of the extension of the plural *boats* also fit the definition of **multiparticipant** in §2.4. No element in the extension of *boat* fits the definition of **multiparticipant**. *A lot of* combines with *boats* and *snow* but not with singular *boat*:

(41) A lot of snow fell on the roof.

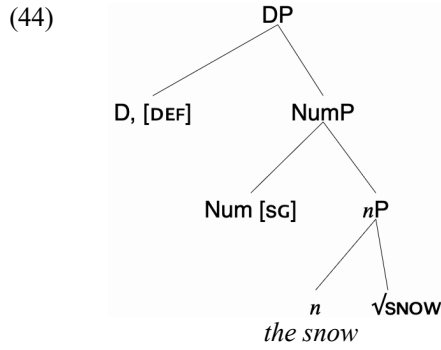
(42) A lot of boats were in the harbor.

(43) ?A lot of boat was in the harbor.

¹³ In §4.3, I will say how and why participant cumulativity differs from cumulative reference as conceived by Quine.

So we might say that *a lot of* combines only with a predicate that has multiparticipant elements in its extension.

Participant cumulativity has consequences for the interpretation of definite descriptions as well. Consider the structure in (44) below. The extension of the NumP consists of singleton sets of states, or equivalently states, in the extension of $\sqrt{\text{SNOW}}$. The definedness condition for [DEF], repeated in (45) below, requires the existence of a state whose participants are all and only the participants of all the states in the extension of $\sqrt{\text{SNOW}}$. Assuming there is some snow, that condition will be met because $\sqrt{\text{SNOW}}$ is participant cumulative.



(45) $\llbracket[\text{DEF}]\rrbracket$ is a function defined for P iff $(\exists S) [P(S) \ \& \ (S \subseteq \cup \{S' \mid P(S')\})]$

If $\llbracket[\text{DEF}]\rrbracket$ is defined for P , then:

$$\llbracket[\text{DEF}]\rrbracket(P) = \lambda Q (\exists S) [P(S) \ \& \ (S \subseteq \cup \{S' \mid P(S')\}) \ \& \ Q(S)]$$

By way of summary, we list the kinds of entities a speaker may refer to with a definite description:

(46) Referents of definite descriptions

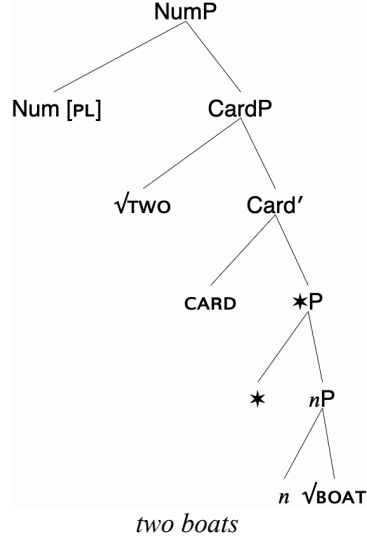
<i>the boat</i>	single participant state
<i>the boats</i>	plurality of single participant states
<i>the snow</i>	multiparticipant state
<i>the fumes</i>	multiparticipant state

2.6 Numeral noun constructions

The number features we've introduced are pure event adaptations of the features defined in Harbour (2014). Recent support for Harbour's proposal has come from Martí (2020a)'s account of cross linguistic differences in number marking in numeral-noun combinations.

Martí's proposal draws on the syntax of Scontras (2014) in which number features (SG, PL) combine with a phrase, here labeled CardP, headed by a cardinality operator CARD and with a numeral as its specifier:

(47)



Except for the \star -operator and some node relabeling, the structure in (47) above reproduces Martí (2020a:16, (31)). To interpret this structure, we'll need a meaning for CARD and for $\sqrt{\text{TWO}}$. In (48) below, I've adapted Martí (2020a:(28))'s meaning to a pure event semantics in which, as we'll discuss in §8, all counting and measuring is counting and measuring of states:

$$(48) \quad \llbracket \text{CARD} \rrbracket = \lambda P \lambda n \lambda S (P(S) \ \& \ |S| = n)$$

Using (48) along with the meanings in (49) and (50), we compute the meaning of *two boats*:

$$(49) \quad \llbracket \text{PL} \rrbracket = \lambda P \lambda S (P(S) \ \& \ \text{multiparticipant}(S))$$

$$(50) \quad \llbracket \sqrt{\text{TWO}} \rrbracket = 2$$

$$(51) \quad \llbracket \star n \sqrt{\text{BOAT}} \rrbracket = \lambda S. \ S \text{ is a set of one or more } \textit{boat} \text{ states}$$

$$(52) \quad \llbracket \text{CARD} \star n \sqrt{\text{BOAT}} \rrbracket = \lambda n. \lambda S. \ S \text{ is a set of one or more } \textit{boat} \text{ states} \ \& \ |S| = n$$

$$(53) \quad \llbracket \sqrt{\text{TWO}} \text{CARD} \star n \sqrt{\text{BOAT}} \rrbracket = \lambda S. \ S \text{ is a set of one or more } \textit{boat} \text{ states} \ \& \ |S| = 2$$

$$(54) \quad \llbracket \sqrt{\text{TWO}} \text{CARD} \star n \sqrt{\text{BOAT}} \rrbracket = \lambda S. \ S \text{ is a set of two } \textit{boat} \text{ states}$$

$$(55) \quad \llbracket \text{PL} \sqrt{\text{TWO}} \text{CARD} \star n \sqrt{\text{BOAT}} \rrbracket = \lambda S. \ S \text{ is a set of two } \textit{boat} \text{ states with distinct participants.}$$

As (55) illustrates, the meaning for PL is compatible with the meaning in (54) for the CardP *two boat*. Compare the meaning for SG¹⁴:

$$(56) \quad \llbracket \text{SG} \rrbracket = \lambda P \lambda S (P(S) \ \& \ S \text{ is a singularity})$$

If SG replaced PL in the structure in (47), the result would be a predicate true of nothing, regardless of what boats there may be. Correspondingly, SG is compatible with *one boat* as in the structure in (59) below, but PL would not be¹⁵.

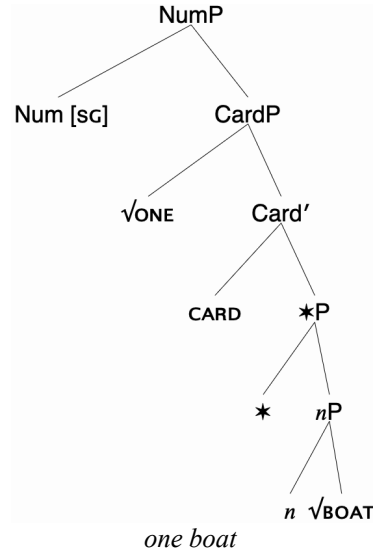
¹⁴ REMINDER A singularity is a singleton set of states, which is a state.

¹⁵ I've included the \star -operator to show the work that the numeral *one* does and to maintain contact with Martí's discussion. The \star could be omitted without affecting the outcome.

(57) $\llbracket \sqrt{\text{ONE}} \text{ CARD } \star n \sqrt{\text{BOAT}} \rrbracket = \lambda S. S \text{ is a set of one or more } \textit{boat} \text{ states \& } |S| = 1$

(58) $\llbracket \sqrt{\text{ONE}} \text{ CARD } \star n \sqrt{\text{BOAT}} \rrbracket = \lambda s. s \text{ is a } \textit{boat} \text{ state.}$

(59)



The net result is that *one* N requires singular marking and *two* N requires plural marking if they are to have non-empty extensions.

Unlike the parameterized determiner of Hackl (2000:82), existential quantification is not encoded in the meaning of CARD. With Martí, I assume there's a quantifier higher up in the structure that takes care of this. Further discussion of cardinal quantifiers can be found in §8.

2.7 The Mass-count distinction

Numerals readily combine with the noun *boat* but not with the noun *snow*. I'll attribute the difference between *boat* and *snow* to a requirement imposed by CARD:

(60) CARD combines only with single participant predicates.

(37) Definition: single participant predicate

A *single participant predicate* has a non-empty extension at some index of evaluation and where its extension is non-empty, every element in its extension is a set of one or more single participant states.

A noun that felicitously combines with a numeral is a **count noun**. It follows from the requirement imposed by CARD that a count noun is a single participant predicate. A noun that does not combine felicitously with numerals is called a non-count noun, or, for historical reasons, a **mass noun**. *snow* is a mass noun. *snow* has extensions that include multiparticipant states so the condition in (60) blocks it from combining with a numeral. *snow* is participant cumulative and this appears to generally be the case with mass nouns. Participant cumulativeness is detected through cumulative inferences and by the fact that felicitous use of the definite requires only existence. To take an example to be discussed in the next section, *luggage* is a mass noun (*#one luggage*, *#two luggage(s)*). It admits cumulative inference – if there's luggage above and luggage below, we can refer to it all with *the luggage*. Given that *luggage* is participant cumulative, it must have multiparticipant states in some of its extensions and that would explain why it is a mass noun.

Bale (2017) alerts us to a danger that comes with the analysis of the mass count distinction in terms of extensions. Noun phrases such as *non-toxic poison*, *snow that is not snow*, *square circle* and *boat that is not a boat* all have empty extensions at every index, yet the first two do not combine with numerals and the latter two do. The definition for single participant predicate in (37) above addresses half of this problem by

requiring non-empty extension at some index. *Snow that is not snow* is not single participant, so it correctly cannot combine with numerals. That leaves us with expressions like *five square circles* or *one boat that is not a boat*. My intuitions waver here. As soon as I judge these grammatical, I find that I am reinterpreting the modifiers in some way that allows them to describe elements in the extensions of *circles* and *boat* respectively.

We will have a lot more to say about mass nouns in the coming sections. For that reason, I'd like to acknowledge two processes that will not play much of a role in our subsequent discussion, but which are important topics in the study of mass nouns. They are **countability classes** and **coercion**.

There are various semantic and syntactic diagnostics that have been associated with the mass count distinction. The most well-known of these turn on the ability to combine with various quantifiers (*much* versus *many*, *every*, *each* and *either*). Allan (1980) and more recently Grimm and Wahlang (2021) have shown that, taken together, the various diagnostics do not yield a binary distinction but rather lead to 10 or more categories they refer to as countability classes. Some of these diagnostics will come up in our discussion, however, the basic mass/count distinction will remain the ability or inability to combine with numerals.

When mass nouns are used to refer to kinds, as in (61) below, or when mass nouns are used to refer to standardized portions as in (62) below, they function as count nouns. In these cases, the noun is said to have undergone coercion.

(61) This chart lists every *wine* we sell. It also lists two *cheeses* that go with each wine.

(62) There are three *spaces* left. Grab a *beer* and come join us!

One can find several ideas about the nature of the coercion process in Kiss et al. (2021). Gillon (2012:715) catalogues a few other types of coercion including a source reading (*a fear I have*). Not all mass nouns are amenable to coercion (*#John expressed a nonsense* Moravcsik 1970, *#every significance*, *#many precisions*).

A final note about the mass-count distinction concerns our meaning for CARD repeated below. It operates on extensions.

(60) $\llbracket \text{CARD} \rrbracket = \lambda P \lambda n \lambda S (P(S) \ \& \ |S| = n)$

I will refrain from incorporating the single participant requirement in (60) in the meaning of CARD. That would involve intensionalizing the semantics, which is otherwise unnecessary for the phenomena we'll be discussing.

2.8 Summary of what has been introduced

Below is a list of key properties of the system laid out in this section.

- A noun root is a predicate of states¹⁶.
- The \star -operator may attach to nP . It closes an extension under set union thereby adding pluralities.
- English has two number features: [SG] and [PL]
 - When [SG] is present in a noun, any element in its extension is a state.
 - When [PL] is present in a noun, any element in its extension is a multiparticipant state or a multiparticipant plurality.
 - [PL] has $-z$ among its phonological exponents.

¹⁶ REMINDER Since a singularity is a set whose only member is a state and since singleton sets are identified with their members, it follows that

- A noun root is a predicate of singularities.

- A [DEF] feature realized as *the* may attach to a NumP. The result has a meaning only if the NumP's extension contains an element whose participants are all and only the participants of all the elements in the extension of the NumP.
- Numerals enter a noun phrase by combining with an operator dubbed CARD. CARD requires its sister to be a single participant predicate.
 - A noun with only single participant states in its extension at every index is a count noun.
 - A mass noun can have multiparticipant states in its extension.
- Count plural definites denote multiparticipant pluralities, singular mass definites and singular count definites denote singularities.

2.9 Aspects of the number features

In this subsection, I draw attention to properties of the number features introduced above and relate them to previous work. The theory is not advanced here in any way.

The features [SG] and [PL] were defined in (27) and (29). They were modeled on features in Harbour (2011, 2014)'s general theory of number¹⁷.

A feature is **restricting** if its meaning combines with a predicate extension to yield a new extension that is a subset of the input. This contrasts with a system in which features are gatekeepers (Cooper 1983). If the meaning of the expression attached to a gatekeeping feature is of the right kind, it gets passed up, otherwise the result is undefined. Our features are restricting. As a result of that and of the way the features are defined, the plural feature gives rise to predicates true exclusively of pluralities. This has consequences for several issues currently at the center of research on plurals, including homogeneity, maximality and markedness. Martí(2020b) discusses homogeneity in connection with restrictive features.¹⁸

Two restrictive features are **complementary**, if the extensions they produce could never have a common element. Harbour's features for plural and singular in English are complementary. The features I've defined are complementary *when attached to count nouns*. The extension of plural *boats* is composed of pluralities, while the extension of singular *boat* is composed of singularities. Our features are not complementary in the realm of mass nouns¹⁹.

Our use of number features in mass noun phrases has terminological consequences. Harbour and others use the semantic label [+atomic] for the feature found on singular nouns. 'atomic' would be appropriate here as well, if understood in its algebraic sense: Let S be the set of all states and let $\wp(S)$ be the set of all subsets of S . The sextuple $\langle \wp(S), \cap, \cup, ', \emptyset, S \rangle$ is a Boolean algebra. The atoms of that algebra are the singleton sets, the singularities. So 'atom' and 'singularity' converge. I've avoided the term 'atomic' because it is prone to interpretation in the material sense. When authors refer to 'atomic entities' or 'atomic individuals' it is often not clear to me if they intend entities that have no proper parts. This danger becomes acute when mass nouns are part of the discussion, especially since in much of the

¹⁷ "Empirically, the theory yields a characterization of all numbers attested crosslinguistically, a combinatorial explanation of Greenberg-style implications affecting their cooccurrence, a natural account of morphological compositionality, and insight into their diachronic sources and trajectories." Harbour 2014.

¹⁸ Here are some hints/reminders for current plural semantics jargon.

- (i) *The pot has no lids* is odd compared with (ii) *The supply house currently has no lids*. This difference is unsurprising assuming that *lids* is true of two or more lids and that a pot generally has one lid, while a supply house would normally stock many. What is unexpected is that (ii) is false if the supply house has just one lid. This effect is known as homogeneity (Križ & Spector 2021, Bar-Lev 2021, Grimm 2013, a.o.).
- *The windows on the bus were open* – does that mean all of them were open or would it be true if just some of them were? That's a question of maximality.
- *Can Every student brought his books* be asserted truthfully when some students brought just one book and others more than one? If yes, then plurals pass the quantification test (Sauerland 2008) for being unmarked, meaning the plural is inclusive, it may be true of pluralities but also of singularities.

¹⁹ Number features do not appear on mass nouns at all in Harbour (2014). He is of the opinion that the locus of number features, Num, "is not present for mass nouns, which lack a foundational atomic stratum".

literature mass nouns are defined and categorized in terms of material parthood or in terms of relations defined on material parthood such as material sum.

3 Reciprocals and other plurality seekers. Multiparticipation ≠ plurality-denoting

The system detailed above follows the spirit of previous authors who say that mass nouns are plural. However, unlike previous authors, our semantics is rich enough for mass noun phrases to involve multiplicity within states and yet still be singular. In this section, we find evidence that definite mass noun phrases denote singularities. We do that using reciprocals. This conclusion proves problematic for previous mass-as-plural accounts. The discussion will include singular mass definites (*the information*) as well as plural mass definites (*the directions to the stadium*). Here I show that plural mass definites denote singularities. An explanation for why that is will come in §5.

The key fact about reciprocals of interest here is that they require an antecedent that denotes a plurality:

- (63) a. The messages contradicted each other.
b. #The message contradicted each other.

Definite mass noun phrases denote singularities so they pattern with singular count nouns. They too are unable to license reciprocals²⁰:

- (64) #The information contradicted each other.
(65) #The directions to the stadium contradicted each other.

A conjunction of two singular count noun phrases can licence a reciprocal:

- (66) The first message and the second message contradicted each other.

and the same goes for mass noun phrases:

- (67) The information in the wiki and the additional information contradicted each other.
(68) The directions you gave me and the directions Ella gave me contradicted each other.

Likewise, two mass noun phrases or two count singular noun phrases can split-antecede a pronoun that licenses a reciprocal²¹:

- (69) The cow told the chicken that they should entertain each other.
(70) The livestock told the poultry that they should entertain each other.

Plurality denoting phrases can also be conjoined and when they are, they give rise to readings that are unavailable with conjoined singularity denoting phrases. Gillon (1992:629) points out that (71) has a reading in which the predicate distributes over the conjuncts. It can be read as “the drapes resemble each other and the carpets resemble each other.” By contrast, the predicate cannot distribute over the conjuncts in (72) or in (73).

²⁰ The incompatibility of plural mass definites with reciprocals and other plurality seekers is observed in Acquaviva (2008:87), who in turn points to Wierzbicka (1988:499-562) for more examples from several languages.

²¹ Example (70) is modeled on Gillon (1992:(34)), who was making a point about split antecedence and mass nouns. I added the reciprocal. Note, plural marking on the pronoun is not sufficient by itself to licence a reciprocal. A plurality denotation is needed:

- (i) [The younger girl]_i said they_i hurt themselves/themself/#each other.
(ii) The directions to the stadium were printed on the ticket, but they contradicted #each other.

- (71) The drapes and the carpets resemble each other.
 (72) The drapery and the carpeting resemble each other.
 (73) The curtain and the carpet resemble each other.

The facts in (71)-(72) are discussed in Chierchia (1998:89), Rothstein (2010:379-384) and in Landman (2020:§6.5) where they are labeled “Gillon’s Problem”. In those accounts, mass noun phrase referents are pluralities, leading one to expect mass nouns to pattern with plural count nouns in combination with reciprocals. As we’ve shown, the facts are otherwise. In §4.4, we’ll briefly return to this data and we’ll take a look at the kind of solution proposed for this problem in those works.

I end this section with two notes on the data reviewed here. Given the meaning for the definite article proposed in (32), the noun phrase conjunctions in the examples above could be interpreted using a higher type *and*²² as in (74):

$$(74) \llbracket \text{and} \rrbracket = \lambda Q_1 \lambda Q_2 \lambda P. Q_1(\lambda S Q_2(\lambda S'. P(S \cup S')))$$

In that case, the meaning of the reciprocal verb phrase applies to a plurality in (67)-(68), just as it does in (63)a.

As demonstrated here, reciprocals are a tool for detecting pluralities. Other plurality-seeking expressions include *one-by-one* (Brasoveanu and Henderson 2009), *one another*, *one after the other*, *both*, *neither*, floated and adnominal *each* (Champollion 2016). For the most part, their antecedent cannot be an unconjoined definite mass noun phrase.

4 Single participant adjectives

Single participancy is a significant semantic property of predicates. It distinguishes count nouns from mass nouns. In this section, we’ll demonstrate that some adjectives have that property as well. Once identified, single participant adjectives will prove useful in a number of ways. These include providing evidence corroborating the idea that mass nouns are multiparticipant (§4.2) and shedding light on a well-known but unexplained use of diminutives in the formation of count nouns from mass nouns (§4.6).

4.1 Single participancy in the grammar of adjectives

The \star -operator was introduced earlier with the definition below:

$$(75) \llbracket \star \rrbracket = \lambda P \lambda S \exists \mathcal{A} \mathcal{A} \neq \emptyset \ \& \ \mathcal{A} \subseteq \{S' \mid P(S')\} \ \& \ S = \bigcup \mathcal{A}$$

‘ $\star P$ is true of the union of any set of sets in P ’.

$$\text{EXAMPLES:} \quad P(\{s_1\}) \ \& \ P(\{s_2\}) \rightarrow \star P(\{s_1, s_2\}), \star P(\{s_1\}), \star P(\{s_2\})$$

$$Q(\{s_1, s_2\}) \ \& \ Q(\{s_3\}) \rightarrow \star Q(\{s_1, s_2, s_3\}), \star Q(\{s_1, s_2\}), \star Q(\{s_3\})$$

The \star is an operator that optionally attaches to an nP to produce a noun phrase with pluralities in its extension. Without it, we wouldn’t get pluralities, given our assumption that roots are singularity-only. We’ll now extend the use of the \star to adjectives (aP) with similar reasoning.

Compare the sentence in (76) to the formula in (77):

- (76) The actors are blond.

$$(77) (\exists S) S \in \llbracket \star \sqrt{\text{ACTOR}} \rrbracket \ \& \ (\exists S') S' \in \llbracket \sqrt{\text{BLOND}} \rrbracket \ \& \ (S \ominus S')$$

(76) is read distributively. If (76) is true and Jack is one of the actors, it follows that Jack is blond. This is not captured by (77). Keeping to our assumption that roots are singularity-only, (77) describes a single

²² Noun phrase conjunctions could be interpreted that way, but see Hirsch (2017) and Schein (2017) for arguments that they aren’t interpreted that way.

blond state, S' , in which all the actors participate. This would require an unavailable collective reading of (76). Intuitively, a blond state holds of a single individual:

(78) $\llbracket \sqrt{\text{BLOND}} \rrbracket = \lambda s. s$ is a state that holds of an individual when they have blond hair.

The distributivity intuited in (76) is correctly captured by the formula in (79) along with (78):

(79) $(\exists S) S \in \llbracket \star \sqrt{\text{ACTOR}} \rrbracket \ \& \ (\exists S') S' \in \llbracket \star \sqrt{\text{BLOND}} \rrbracket \ \& \ (S \ominus S')$

(79) requires each *actor* state to have the same participant as one of the *blond* states in the plurality of *blond* states in S' . Spelling out the silent \star -operators and the thematic role head, the sentence in (76) becomes:

(80) [The \star actors] were [θ_{Hold} \star blond].

While *blond* admits only a distributive reading, there are many predicates that can be understood distributively or collectively. *light* as used in (81) below is one such predicate.

(81) The ducks are light enough to carry.

The sentence in (81) could be used to report on the total weight of a box of rubber ducks. In that case, it entails the formula in (82) below, where a single light state is populated with all the ducks. It is a multiparticipant state whose existence is entailed on the collective reading. Another possibility is that the collective weight of the ducks makes them impossible to carry, but the sentence in (81) is truthfully asserted with the intention of reporting on the weight of each individual duck. In that case, (82) is false, but (83) is true because there is a set of single participant light states whose participants are all and only the participants in the duck states.

(82) $\exists S S \in \llbracket \star \sqrt{\text{DUCK}} \rrbracket \ \& \ \exists S' S' \in \llbracket \sqrt{\text{LIGHT}} \rrbracket \ \& \ (S \ominus S')$

(83) $\exists S S \in \llbracket \star \sqrt{\text{DUCK}} \rrbracket \ \& \ \exists S' S' \in \llbracket \star \sqrt{\text{LIGHT}} \rrbracket \ \& \ (S \ominus S')$

Many predicates admit collective readings, often like *light* in addition to distributive readings. Collective readings are easy to identify with predicates of measure and shape. *The boxes take up a lot of space* is most naturally read collectively. There is a multiparticipant state and each of the boxes is a participant in it. *The ducks form a line/sphere/cube/circle* describe a shape formed out of all the ducks. *Those phone calls cost me \$400 / took a long time* can report on the time or the cost of a phone session. Given the ease with which these predicates are read collectively, it comes as a surprise that the adjectives in the sentences below do not readily admit collective readings:

(84) The boxes are large.

(85) The ducks are long.

(86) The phone calls were long.

(87) The butterflies were spherical.

Upon entering the butterfly conservatory, we behold a perfectly spherical cloud of butterflies. We cannot relate this experience with (87). A long session of brief phone calls will not make (86) true. A long line of ducks crossing the lake will not make (85) true. And a large pile of tiny boxes will not verify (84).

The extension of *take up a lot of space* includes single participant states. These it shares with *large*, hence the synonymy of *The boat is large* and *The boat takes up a lot of space*. The extension of *take up a lot of space* also includes multiparticipant states and these it does **not** share with *large*. In (88), I include the restriction to single participant states in the meaning of the adjective:

(88) $\llbracket \sqrt{\text{LARGE}} \rrbracket = \lambda s. s$ is a single participant state and the participant in that state takes up a lot of space.

Given this restriction, there must be silent ★-operators in (84)-(87) spelled out here for (84):

(89) The ★ boxes are [θ_{Hold} ★ large].

Because they defy expectations and refuse to allow collective readings, I call these adjectives **stubbornly distributive**.

4.2 Stubbornly distributive predicates as mass noun probes

In (89) above, the plural subject introduces a plurality and the participants across that plurality are distributed, each to its own *large* state. It is also possible to introduce multiple participants using mass nouns, and in that case again we find distributivity (Joosten 2010:§3.4, Rothstein 2010:360). (90) below may report on several *large* states, one for each participant in the furniture state.

(90) The furniture is [θ_{Hold} ★ large].

It's worth emphasizing here that the distribution is over participants in a single state introduced by the subject, unlike in (89) whose subject is *the boxes*. Evidence that the subject of (90) indeed denotes a singularity comes from plurality seekers:

(91) #The furniture is touching *each other*.

(92) #The furniture rusted *one by one* over the course of the summer.

Here are some more descriptions of distribution over the participants in a multiparticipant state:

(93) The mail in this box is square and small.

(94) The luggage she brought was big.

(95) The equipment will be too large to fit inside this room. Allan (1980:566)

(96) That genetically engineered popcorn was square!

(97) This spaghetti is too long.

(98) The fruit was perfectly round.

Mass noun phrases predictably give rise to distributive readings when they combine felicitously with stubbornly distributive predicates. But not all mass noun phrases do combine felicitously with such predicates:

(99) ?The snow in my yard is big.

(100) ?The oil on the floor is square.

(101) ?The time we spent in the museum was too long.

(102) ?The information he gave us was small.

The states introduced by these mass noun phrases somehow make them incompatible arguments for a stubbornly distributive predicate. The question marks in (99)-(102) reflect some uncertainty about the data. This might be because speakers coerce those nouns into count nouns (§2.7). To get around that confound, we use examples with pronouns whose antecedent is a mass noun phrase with *much* which blocks coercion:

(103) #You would not believe [how much gasoline]_i spilled on the floor. We had to use an industrial vacuum cleaner to remove it_i, because it_i was so big.

While the connection to distributivity was not made until recently, previous authors were aware of the distinction between nouns that do and do not combine with what I'm calling stubbornly distributive

predicates. McCawley (1979:170) refers to nouns that resist the combination **hard-core**, others call them ‘prototypical’ or ‘canonical’ and many of them are described as ‘substance nouns’ or ‘dense nouns’ (Lauwers 2021:342 following Culioli 1973). Nouns like *furniture* and *equipment* that happily combine with stubbornly distributive predicates are called ‘anomalous mass terms’ (Grandy 1975), ‘fake mass nouns’ (Chierchia 1998), ‘count mass nouns’ (Doetjes 1997, Smith 2016), ‘object mass nouns’ (Barner and Snedeker 2005), ‘aggregate nouns’ (Joosten 2010), ‘naturally atomic mass nouns’ (Rothstein 2010), ‘neat mass nouns’ (Landman 2020), ‘cognitively count mass nouns’ (Chierchia 2021), and sometimes they’re called ‘*furniture* nouns’. Many of these names reflect preconceived notions about what the semantics of a mass noun should be. Nouns that have those meanings are legitimate. Those that don’t have those meanings are specially labeled. In a similar fashion, stubbornly distributive predicates were labeled as such because of their unexpected, single participant nature. The categorization of nouns by whether or not they are hard-core comes under the heading of ‘dimensionality’ in Zhang (2012) who tracks its role in the use of classifiers in Mandarin. Bale & Gillon (2020) explore this further in Mandarin as well as West Armenian under the heading of ‘atomicity’.

It is hard to say what exactly goes wrong when hardcore mass nouns are combined with stubbornly distributive predicates. I speculate that it is related to the intuitions about division often cited in discussions of mass nouns, as when it is pointed out that whenever we observe a portion of water, we are in the presence of many portions of water that make it up. Let us suppose then that if a *water* state has a portion of water as one of its participants, then any watery parts of that portion are also participants in the state. More specifically:

- (104) If x is a participant in a *water* state s , and y is part of x and y is in a *water* state, then y is a participant in s .

If (104) is correct, then *That water is round* could never be true, for while it may be that the puddle I’m pointing to is round, various portions of water making up the puddle are not. But since *round* is a stubbornly distributive predicate, it only has single participant states in its extension and so it would have to have a state for each water participant. For *That water is small* to be true would require a comparison class that could serve both for the puddle I’m pointing to and for all its watery parts, no matter how small. That may not be possible. It may also be that some of those portions are not “spatially delimited” (Truswell 2009:530) or not “well-delineated” (Bunt 1985:208) making them ineligible for participation in the kinds of states that *small* describes. All this may be compounded by a vagueness affecting the relation between states and their participants. As (104) says, whether or not a given y is in the state s that x is in, depends on whether or not y is itself in a *water* state. But the question of whether y is in a *water* state may be murky, especially as we get to smaller and smaller parts of x . It could be that there is a *water* state s' but it’s not settled whether s' holds of y or not. Chierchia (2010, 2017, 2021) associates mass nouns with vague properties, and this too could be a factor. Whatever the reason is, the inability of stubbornly distributive predicates to combine with hardcore mass nouns has made them useful tools for probing for mass meaning. Gil (1996), for example, uses them to show that the collective nouns of Maltese can have hard-core mass interpretations as well as count plural interpretations, making them truly multiparticipant nouns.

4.3 Stubbornly distributive predicates and participant cumulativity

Stubbornly distributive predicates are useful probes into the number and nature of participants in the states denoted by noun phrases. In this section, I’ll use stubbornly distributive predicates as part of an explanation for an important difference between ‘participant cumulativity’ whose definition is repeated in (105) below and Quine’s famous definition of cumulative reference given in (106):

- (105) Definition: Participant cumulative

A predicate of states is *participant cumulative* if for any two states s and s' in its extension, there is a state in its extension that has all and only the participants of s and s' .

P is *participant cumulative* iff $(\forall s)(\forall s') [(P(s) \& P(s')) \rightarrow (\exists s'') ((\{s, s'\} \subseteq s'') \& P(s''))]$

- (106) Cumulative reference (Quine 1960)

“So-called *mass* terms like ‘water’, ‘footwear’, and ‘red’ have the semantical property of referring cumulatively: any sum of parts which are water is water.”

Cumulative reference makes use of material summation. Participant cumulativeness does not. To understand why, we first look at where material sum does enter in to noun semantics and then we can show why material sum is the wrong way to characterize mass nouns.

Recall our earlier discussion (§2.4) of a scene in which we perceive countless single participant states, one for each point of light but also a single participant state whose sole participant is the sum of all the stars, the constellation. In general, I make a distinction between one state that has many participants and a second state that has a single participant composed of the many participants in the first state. *glue* applies to states with multiple participants. It is a mass noun, in fact, a hardcore mass noun: #*The glue on the table is big*. Contrast that with *blob of glue* which is a count noun phrase and which therefore happily combines with a stubbornly distributive predicate: *That blob of glue is big*. *glue* describes multiparticipant states. The single participant in a *blob of glue* state is presumably the material sum of participants in a *glue* state.

Imagine that we visit a children’s museum together. The museum has a big collection of miniature furniture. The furniture is small, but the collection of furniture is not small. *The furniture collection* denotes a state with a single participant, itself the material sum of the participants in the state denoted by *the furniture*. If we assumed that the set of participants in the state denoted by *the furniture* included any sum of participants in that state, then *furniture* and *collection of furniture* would share a participant and it would be a participant that was not in any state in the extension of *small*. In that case, *The furniture is ★ small* would come out false. In the museum situation that sentence is true, showing that mass noun denotations are closed under participation, not material sum of participants.

4.4 Gillon’s problem and stubbornly distributive predicates

In §3, the data in (107)–(109) was taken to show that with respect to readings of reciprocals, mass noun phrases pattern with singular count noun phrases and not with plural count noun phrases.

- (107) The drapes and the carpets resemble each other.
- (108) The drapery and the carpeting resemble each other.
- (109) The curtain and the carpet resemble each other.

This is a challenge for accounts in which the mass-as-plural intuition leads one to conclude that mass noun phrases have the same kind of denotation as plural count noun phrases. In response, proponents of this view have invoked a silent operator that combines with a mass noun or noun phrase and produces a count noun phrase (Chierchia 1998:75,89, Rothstein 2010:383, Landman 2020:§6.5). It functions like *blob* in *blob of glue*. Now if there is a silent *blob* operator in a language, then in that language there should be no problem combining any mass noun phrase with a stubbornly distributive predicate. This, in fact, is how Deal describes Nez Perce and it forms part of her motivation for proposing a silent piece α (for “atomization”) in the syntax of Nez Perce (Deal 2017:146–7). The presence of α on an *nP* allows it to combine with numerals and stubbornly distributive predicates and these combinations do not “depend on any familiar type of coercion of the substance noun”. (Deal 2017:136). The stark contrast with English shows that nothing like α exists in English.

4.5 On the source of stubborn distributivity

In our proposed meaning for $\sqrt{\text{LARGE}}$ repeated in (110) below, we stipulate that it holds only of single participant states.

- (110) $\llbracket \sqrt{\text{LARGE}} \rrbracket = \lambda s. s$ is a single participant state and the participant in that state takes up a lot of space.

That stipulation is motivated by the stubborn distributivity of *large*. The rationale for the remainder of the meaning is most clearly seen by letting *large* takes as its subject a concrete, singular count noun phrase. In that case, distributivity doesn’t enter in and we may paraphrase *large* as ‘takes up a lot of space’:

- (111) The boat is large.
 ‘The boat takes up a lot of space’

Other stubbornly distributive predicates would be similarly handled:

- (112) $\llbracket \sqrt{\text{ROUND}} \rrbracket = \lambda s. s$ is a single participant state and the participant in that state has the form of a circle or sphere.
- (113) $\llbracket \sqrt{\text{SMALL}} \rrbracket = \lambda s. s$ is a single participant state and the participant in that state takes up very little space.
- (114) The boat is small.
 ‘The boat takes up takes up very little space’

Constructing meanings in this way, with a single participant stipulation, invites the conjecture that some languages may have words we would want to translate as *large*, *small* or *round* but which happen not to be stubbornly distributive. The expectation is heightened when one considers that cross linguistic variation with respect to single participancy is well established in nouns. A mass noun in one language may find its best translation in another language in a count noun. To test the aforementioned conjecture, we ought to establish some identifying properties of a near synonym of *large* that lacks the single participant stipulation. To start, it would function just like *large* when predicated of singular count nouns. That would lead to a gloss as ‘large’. With plural count nouns, it would engender ambiguity, just like the English *take up a lot of space*. Perhaps the most telling identifier would come from combination with mass nouns, especially hardcore mass nouns. These are infelicitous with *large* but they are felicitous with *take up a lot of space*.

With these hallmarks in mind, one can find hints in the literature of the expected variation. Kouneli (2020) describes several ways to distinguish mass nouns and count nouns in Kipsigis. These include the inability of stubbornly distributive predicates to combine with hardcore mass nouns. *Múgúl* ‘round’ can take as subject a noun phrase glossed as ‘the ball’ but not subjects glossed as ‘the rain’ or ‘the water’. This contrasts with the adjective *oo* which “is interpreted as ‘big’ when it modifies a singular count noun, but as ‘a lot’ when it modifies a singular mass noun”. Kouneli also reports (pc) that the quantifier *tyaan* means ‘how big’ in combination with singular count nouns and ‘how much’ in combination with mass nouns (compare: *how much space does the boat / the water take up?*). When the quantifier *tyaan* combines with plural count nouns, it is ambiguous between ‘how big’ and ‘how many’ (*tyaan* is found in examples (33-34) of Kouneli 2020). Nevins and Coelho da Silva (2020) examined the behavior of mass nouns and count nouns in Maxakalí. Nouns in Maxakalí are not marked for number, however there are suppletive verbs, where one root is used when the internal argument is count singular and a different root is used when the internal argument is count plural. Interestingly, mass nouns always require the plural root, suggesting that the relevant distinction is to do with multiparticipancy. Coming around to our immediate concerns, the words *xeka* and *kutĩynāg* are glossed as ‘big’ and ‘small’ respectively when they modify *yip* ‘car’ (p281). These words can modify *āxok* ‘sugar’ and when they do, they are glossed as ‘much’ and ‘a little’. One more example concerns diminutives, which will be the subject of §4.6. Wiltschko (2006) discusses diminutive marking in Halkomelem that takes the form of reduplication. From *steqíw* ‘horse’, you get *stitiqíw* ‘small horse’. This diminutive marking may occur on a substance-denoting noun, and when it does, it is glossed as ‘little bit of’. In all three of the cases cited, we find size adjectives combined felicitously with substance nouns to indicate large or small amounts, suggesting that these size adjectives lack the single participant stipulation. There is, in fact, a taste of this in English in the prenominal uses of *little* to mean small amount (*there’s little interest in the proposal, a little sugar*).

There is in addition to the crosslinguistic variation, some tantalizing evidence from acquisition of the stipulative nature of single participation. Syrett (2015) reports on children as young as 3 demonstrating robust awareness of the stubborn distributivity of *big*, *square* and *round* but not of *tall*.

In contrast to what has been assumed here so far, Schein (2017:§12.1.1) claims that, given the right syntactic context²³, a stubbornly distributive predicate can in fact receive a collective interpretation,

²³ Schein’s examples include (p618):

however, the conditions for obtaining this interpretation are not present in simple predications like the ones considered here. According to Schein, the stativity of *be large* has the effect of requiring that the measurement be replicable across various conditions, but size and shape predicates describe properties that are not preserved for a group of objects, for example, when members of the group are scattered. This normally makes a collective reading impossible. Scontras & Goodman (2017) employ similar reasoning. For them, having a stable configuration is a prerequisite for a collective reading. They show how this requirement can be understood as the product of the speaker-hearer effort to converge on a standard of measurement (see also Glass 2018a,b on the rule of measurement). Scontras & Goodman also report on a series of experiments demonstrating the availability of collective readings of stubbornly distributive predicates and the dependence on a perceived stability. If this is correct, then much of what was said above about kinds of mass nouns and about participant cumulativity would still hold, but the explanation would be more involved. A more serious rethinking would be necessary for the just discussed cross linguistic variation and for the etymology of diminutives to be discussed next.

4.6 Diminutives and single participancy

Having identified single participancy as a grammatically significant property specified in the meaning of roots for some adjectives and nouns, we are in a position to address an open question to do with the use of diminutive affixes attached to the roots of mass nouns. Diminutives are affixes that can be used productively with a meaning glossed as ‘little’:

(115) *Dutch* (De Belder 2011:183)

Ik heb de hond-**je**-s geaaid.
I have the dog-DIM-PL petted
‘I have petted the *little* dogs.’

(116) *Italian* (Dressler and Barbaresi 1994:17)

Potrei aver - ne una fett-**ina**?
Could I have of it a slice-DIM?
‘Could I have a *little* piece of it, please?’

(117) *German* (Dressler and Barbaresi 1994: 389)

Es trägt ein weißseidenes Jäck-**chen**
he wears a white-silken jacket-DIM
‘He wears a white-silken *little* jacket’

Across languages, diminutives are used to express an array of additional meanings including affection, approximation, intensification, imitation, and female gender (Jurafsky 1996:533). Among the possible interpretations, there is one that is of interest here, illustrated in the examples below. In each case, a mass noun root combines with a diminutive and a count noun results.

(118) Mass-to-count diminutives

DUTCH	<i>tarwe</i>	‘wheat’	<i>tarwetje</i>	‘wheat loaf’	Jurafsky 1996
DUTCH	<i>zout</i>	‘salt’	<i>zoutje</i>	‘salt cracker’	Borer 2005
GERMAN	<i>Brot</i>	‘bread’	<i>Brötchen</i>	‘bread roll’	Wiltchko 2006
GERMAN	<i>Schlaf</i>	‘sleep’	<i>Schläfchen</i>	‘nap’	Wiltchko 2006

-
- a. A **long** 10,000 popsicle sticks were lined up end to end and called art.
b. I sat through a **long** five skits.
c. Many a **long** five skits are performed without intermission.

GERMAN	<i>Staub</i>	‘dust’	<i>Stäubchen</i>	‘dust particle’	Dressler & Barbaresi 1994
ITALIAN	<i>crema</i>	‘cream’	<i>cremino</i>	‘creme praline’	Acquaviva 2015
ITALIAN	<i>pan</i>	‘bread’	<i>panino</i>	‘sandwich’	De Belder et al. 2014
ITALIAN	<i>latte</i>	‘milk’	<i>lattino</i>	‘milk bottle for a baby’	Dressler & Barbaresi 1994
ITALIAN	<i>vento</i>	‘wind’	<i>venticello</i>	‘breeze’	Dressler & Barbaresi 1994

Dressler and Barbaresi (1994:126) seem to suggest that examples like the ones above involve coercion of the mass noun stem, so that the diminutive attaches to a count noun (see also Borer 2005:92 and Fortin 2011:129). This seems problematic as a general account. To begin with, coercion is not triggered by modification by adjectives meaning ‘small’. As Wiltschko (2006) points out, *Schläpfchen* ‘nap’ is ok, but **kleiner Schlaf* ‘small.M.SG sleep’ is not. And then there are mass nouns that are resistant to coercion no matter the trigger, but still, a count diminutive can be formed with them. *Stäubchen* ‘speck of dust’ is possible but *Staub* ‘dust’, like its English translation, does not easily coerce. Finally, mass-to-count diminutives do not as a rule have the kinds of meanings one expects from coercion (standard portion or kind, see §2.7).

Jurafsky (1996) discusses mass-to-count diminutives and he attests to their cross linguistic robustness with the examples in (119) below.

(119) Mass-to-count Diminutives (Jurafsky 1996:555)

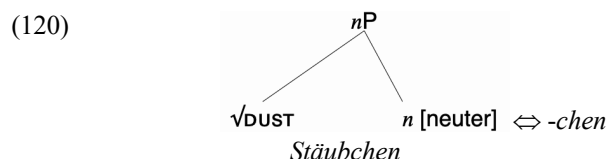
BAULE	<i>ajwe</i>	‘rice’	<i>ajweba</i>	‘rice kernel’
OJIBWA	<i>goon</i>	‘snow’	<i>goonens</i>	‘snowflake’
EWE	<i>sukli</i>	‘sugar’	<i>sukli-vi</i>	‘piece of sugar’
CANTONESE	<i>tong</i> ²¹	‘sugar’	<i>tong</i> ³⁵	‘piece of candy’

Jurafsky proposes a central sense for diminutives together with a small set of meaning relations linking to extensions beyond the central one. These relations include metaphor, generalization and conventionalization of inference, well-known paths of semantic change. In addition, Jurafsky proposes a new mechanism of semantic change which he calls lambda-abstraction-specification and it is this mechanism that he appeals to for the mass-to-count diminutives. A diminutive having the meaning ‘small’ can by this mechanism develop the meaning ‘ λy (smaller than the prototypical exemplar x on scale y)’ and, when combined with a mass noun y is “required to be a scale of amount in a mass noun”. This analysis may work for his examples from Zulu and Shona in which the diminutive signals ‘a few’ and ‘a little’ respectively (compare Kipsigis and Halkomelem discussed earlier) but it is hard to see how this explains the mass-to-count examples. Instead, I would like to propose that mass-to-count diminutives result from the extension of ‘small’ via generalization (to be defined below) in conjunction with the position the diminutive occupies in the syntax. To get started, we require a brief discussion of the syntactic structures that are associated with different diminutive meanings (Wiltschko 2006, Wiltschko and Steriopo 2007, Ott 2011, De Belder, Faust, and Lampitelli 2014, De Belder 2011, Kramer 2015:§10.3).

Building on Wiltschko and Steriopo and De Belder et al, Kramer proposes that diminutive noun structures vary along two dimensions: the position within the noun phrase where the diminutive merges and whether or not gender is projected from the diminutive affix. Mass-to-count diminutive affixes are attached to the root (De Belder et al) and they project their gender (Acquaviva 2015:1180-81)²⁴. In Kramer (2015), a root-attached, projecting diminutive affix is a little *n* (see §6.4 for more on gender and little *n*). In

²⁴ Acquaviva compares two diminutives formed from the Italian mass noun *crema*. There is the diminutive *cremina* which is feminine like *crema* and is a mass noun. That contrasts with the diminutive *cremino* which is masculine and is a count noun. *Cremina* is cream made by whisking together sugar and a little bit of coffee. A *cremino* consists of one or more layers of cream enclosed between two layers of chocolate.

(120) below we apply this idea. *Stäubchen* ‘dust particle’ is a neuter noun formed from the same root as the masculine noun *Staub* ‘dust’. The diminutive heads the *nP* as illustrated below:



Wiltchko (2006) likens the diminutive *-chen* in structures like (120) to a light noun that is the head of a compound, noting that nouns show final devoicing before a diminutive suffix. Dressler & Barbaresi (1994:110) likewise point to devoicing concluding that it is “as if the diminutive suffix were a transparent second part of a compound”²⁵. Let us follow these authors in viewing a mass-to-count diminutive as the head of a compound and return now to the interpretation.

Jurafsky defines generalization as follows (see also Traugott 2006):

(121) Generalization or Bleaching (Jurafsky 1996:544)

A new sense is created from an old one by abstracting away specific features of meaning. The new meaning is more general and less informative than the old one.

Jurafsky (1996:§4.3) discusses instances of generalization in which the resulting sense has completely left the original source domain of size. Suppose we follow this scheme, beginning with (122), modeled on the meaning assigned to $\sqrt{\text{SMALL}}$ in (113) above:

(122) Basic meaning for diminutive.

$\lambda s. s$ is a single participant state and the participant in that state takes up little space.

And now suppose that all reference to size is abstracted away:

(123) Hypothetical meaning for diminutive after generalization/bleaching

$\lambda s. s$ is a single participant state

The result is a pure single participant predicate. It has roughly the meaning of *entity*. If this diminutive functions like the head of a compound noun, that noun will be a count noun. If we now return to the examples of mass-to-count diminutives, we find the same kinds of relations between the head and non-head as have been catalogued for noun-noun compounds. I illustrate this with the examples listed in (118) and (119) above drawing on compound examples and discussion in Jackendoff (2010:§13.5.3). In (124), the non-head describes the star ingredient in the food described by the diminutive or compound noun:

(124) Non-head describes the star ingredient of the whole

Diminutives: *tarwetje* ‘wheat loaf’, *zoutje* ‘salt cracker’, *cremino* ‘crème praline’, *panino* ‘sandwich’

Noun noun compounds: *cherry pie*, *gingerbread*, *cinnamon bun*, *cheesecake*, *noodle soup*, *dill pickle*, *jelly roll*

In the examples in (125), the non-head describes the material making up what is described by the diminutive or compound noun:

²⁵ Ott (2011:§3.2.3) argues that there is no evidence for the phonological independence of the diminutive morpheme, or for a similarity between diminutive-formation and compounding. He concludes that German *-chen* is a cohering affix, however Raffelsiefen (2024:§2.1.3) presents evidence that diminutive *-chen* is in fact non-cohering.

(125) Non-head describes material making up the whole

Diminutive: *Brötchen* ‘bread roll’ *Stäubchen* ‘dust particle’ *Schläfchen* ‘nap’,
venticello ‘breeze’, *ajweba* ‘rice kernel’, *goonens* ‘snowflake’, *sukli-vi*
‘piece of sugar’, *tong*³⁵ ‘piece of candy’

Noun-noun compound: *snowball*, *fireball*, *rubber band*, *tinfoil*, *inkblot*, *corkboard*, *wood chip*,
sugar cube, *dunghheap*, *bearskin rug*, *ice sculpture*, *bloodstain*

Finally, *lattino* ‘baby bottle’ describes a container for what is described by the non-head (milk), just like in *coffee cup*, *photo album*, *soapdish*, and *fishtank*. The meaning of a compound is constrained, but not fully determined, by the meaning of its components along with a small set of relations that may hold between the components (Jackendoff 2010:§§13.4-13.7) and the head principle which says the compound usually denotes a particular subtype of the type denoted by the head. The same applies to mass-to-count diminutives. In that case, the effect of the head principle is that the diminutive noun is a predicate of single participant states.

4.7 Conclusion

In this section, I followed Bunt (1979) and Quine (1960) in identifying a class of adjectives that have the semantic property that characterizes count nouns. In my case, that property is made available in a pure event semantics: count adjectives are those whose extensions are limited to single participant states. This characterization explains why count adjectives are read distributively when predicated of plural count nouns and of so-called object mass nouns (§4.1). Single-participancy appears to be an isolable property of count adjectives. Near synonyms across languages can differ by its presence and it can be acquired gradually across size adjectives. Recognizing the independence of single participancy from the rest of the meaning of size predicates allowed us to envision the process by which a diminutive meaning ‘small’ can develop into a formative that combines with mass nouns to produce count nouns.

This section serves to establish the reality of single participancy in the grammar. And now, if we characterize count nouns as single-participant, we thereby characterize noncount nouns as potentially multiparticipant and that provides the key for their kinship with plural count nouns.

Mass nouns are said to behave like count plurals in some ways but not in others. Within a pure event semantics, we have a way to make sense of that. On the level of numbers of states denoted, count plurals go one way and mass nouns go the other. On the level of numbers of participants in the states described, mass nouns and plural count nouns are on a par. In §3, we saw evidence for the parting of ways on the level of number of states. In the following section we’ll see evidence of similarity on the level of participants.

5 Lexical plurals

5.1 Introduction

Across a variety of languages, plural-only forms are often linked with mass noun interpretations. Lauwers (2021) writes:

“Lexical plural is an umbrella term for items that are always plural (cf. pluralia tantum), at least for a particular sense.

...despite their plural forms, these items are [–count], or more precisely, they exhibit count deficiency, as shown for instance by their incompatibility with cardinal numbers (**three oats*).”

In this section, we explore the link between the restriction to plural form and mass noun interpretation.

5.1.1 A note on terminology, ‘lexical plural’ and ‘pluralia tantum’

Acquaviva (2008:Ch. 2) includes a rich variety of phenomena under the heading of lexical plural. Our discussion concerns only:

(126) plural nouns whose base has a meaning not found in the singular.

This includes *arms* ‘weaponry’ since there is no weaponry interpretation for singular *arm*. It also includes *dregs* which has no singular counterpart at all. The term ‘pluralia tantum’ is usually taken to apply to plural nouns that have no singular counterpart. This would include *dregs* but would exclude *arms* ‘weaponry’. Henceforth, by ‘lexical plural’, I mean nouns that fit the description in (126).

5.1.2 A note on syntactic structures

In this section, because there will be a focus on the realization of number morphemes, right headed structures will be drawn. This way PL occurs to the right of the stem in the structure as it does in the pronunciation. Categorizing *n* heads will initially be omitted to simplify the presentation. They will be reintroduced at the end. I also leave off the feature ‘Num’, writing ‘PL’ instead of ‘Num [PL]’.

5.2 Contextual allosemy

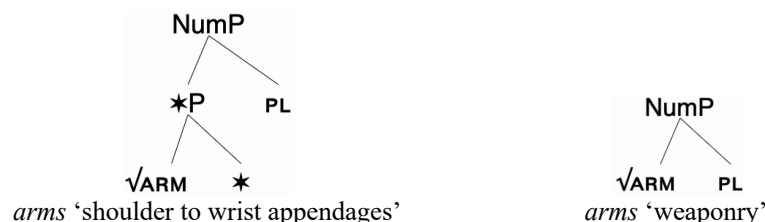
5.2.1 Why lexical plurals are mass nouns

The nouns *arms*, *brains*, *directions*, *effects*, *funds* and *guts* all have at least two senses, on one they pattern as mass nouns and on the other as count. These nouns occur in pairs of sentences below, the first of which is conducive to the interpretation associated with mass grammar and the second to the interpretation associated with count grammar.

- | | |
|--|-------|
| (127) To win the war, they need more arms and ammunition. | MASS |
| A sea star can lose one or more arms and grow new ones. | COUNT |
| (128) The next phase needs more brains and less muscle. | MASS |
| Axial resections were obtained in two brains . | COUNT |
| (129) Download this map for more directions to St. Luke’s, including where to park. | MASS |
| It radiates power in one or more directions . | COUNT |
| (130) They have no personal effects , no furniture, no money, no relations. | MASS |
| Policy measures have had several effects . | COUNT |
| (131) More funds will be available for renewables in the future. | MASS |
| Several funds have been set up to promote adaptation measures. | COUNT |
| (132) The new administration has more guts than its predecessor. | MASS |
| Guts of larvae were investigated by culturing seven individual guts . | COUNT |

The syntax associated with the two meanings of *arms* is given below:

(133)



The structure on the left in (133) contains a ★-operator, as expected for a count plural. In the structure on the right there is no ★-operator. The plural is felicitous without the ★ because on the mass noun ‘weaponry’ interpretation the extension of $\sqrt{\text{ARM}}$ contains multiparticipant states. This is an example of a mass plural (McCawley 1979, Ojeda 2005). The structure on the right does not by itself capture the fact that the mass

interpretation of $\sqrt{\text{ARM}}$ is only available in the presence of the plural. We have here a case of *syntactically conditioned polysemy*²⁶ better known as **contextual allosemy** (Marantz 2013:97, §6.3, McGinnis-Archibald 2016:§3.2, Wood 2021:§§1.3.1, 6.1). After explaining what contextual allosemy is, I will propose rules that encode the dependency of the mass interpretation on the presence of PL.

The plural morpheme in English has several allomorphs. The choice of the allomorph is conditioned by the stem to which the plural is attached: *oxen*, *bats*, *addenda*. This conditioning is referred to as **contextual allomorphy**. An example of contextual allomorphy somewhat closer to our concerns comes from Moskal (2015)’s discussion of nominal suppletion, in which the form of a nominal root is different in the singular and plural, as in these examples from Ket (Yeniseian, Siberia):

(134) Nominal suppletion in Ket (Moskal 2015 based on Werner 1997)

SINGULAR	PLURAL	
di:l’	kʌʔt	‘child’
o:ks’	aʔq	‘tree’
kεʔt	dεʔ-ŋ	‘man’

The rules in (135) below associate exponents with the root in Ket glossed as ‘child’. The rules are applied with an elsewhere logic, whereby a more specific rule preempts a less specific one. So, if PL is present in the structure, the first rule is applied and otherwise the second is applied.

(135) Vocabulary Insertion rules (Moskal 2015)

$$\sqrt{\text{CHILD}} \Leftrightarrow k\lambda^{\text{?}}t \text{ / } ______ \text{ PL}$$

$$\sqrt{\text{CHILD}} \Leftrightarrow di:l’$$

Summarizing, nominal suppletion is modeled in (135) as contextual allomorphy in which the plural feature conditions the choice of allomorph.

Contextual allosemy is the semantic analogue of contextual allomorphy. It is captured by rules that state context sensitive pairings of semantic values with elements of syntax. I’ll call these ‘sense insertion rules’ and formulate them in a manner similar to that of the vocabulary insertion rules, following Harley (2014) and others²⁷. The rules for the root in the noun *arms* are given below:

(136) Sense Insertion rules for $\sqrt{\text{ARM}}$

$$\sqrt{\text{ARM}} \Leftrightarrow \lambda s. s \text{ is a state whose participants are weapons. / } ______ \text{ PL}$$

$$\sqrt{\text{ARM}} \Leftrightarrow \lambda s. \text{ the sole participant of } s \text{ is an appendage from shoulder to wrist.}$$

Terminals and possibly other nodes are paired with meanings in keeping with sense insertion rules. After that, compositional rules of interpretation apply beginning with the rule in (137):

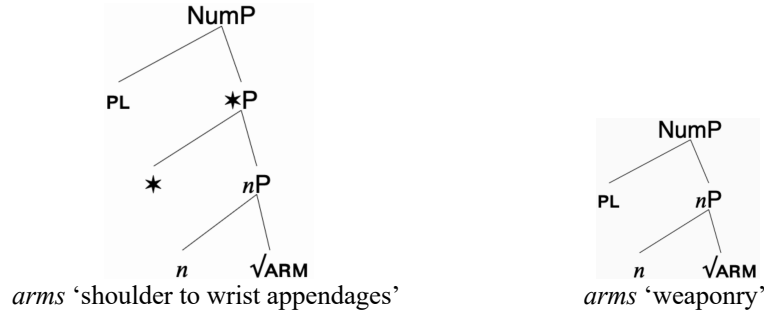
(137) If α is a pair whose second element is a meaning m , then $\llbracket \alpha \rrbracket = m$.

In addition to (137), we have familiar rules such as the one below for function argument application:

²⁶ I take the polysemy in (127)-(132) to be *irregular*, that is, not given by some general rule like ‘container for content’ or ‘author for works’. On the regular-irregular distinction and for a guide to past and present thinking on polysemy, see Vicente & Falkum (2017). For discussion of regular polysemy and the mass-count distinction, see Kiss, Pelletier, and Husić (2021).

²⁷ I used the term ‘sense’ because that’s common in the literature on polysemy.

(152)



PL is ‘semantically adjacent’ to $\sqrt{\text{ARM}}$ in the structure on the right, but not in the structure on the left, where the \star -operator intervenes. With n restored, we see the \star -operator is attached to nP as required (§2.5).

Gender features are arguably located on little n (§4.6, §6.4) and gender features are meaningful when the noun is animate (Kramer 2016). This means they would block a sense insertion rule for a root conditioned by PL.²⁹ We should therefore not find gender marked nouns that are animate, that have a singular and a plural but that have a meaning that only surfaces in the plural. In this paper, I mention two examples of nouns that range over humans and are lexical plurals in Acquaviva’s broader sense of the term (cf §5.1.1). Neither is a mass noun, despite the fact that there are human mass nouns. German *Eltern* ‘parents’ is discussed in §5.3 and Hebrew *be’al-im* ‘owner(s)’ in §6.3. In the former case, there is no singular noun option. In the latter case, the meaning found in the plural is found as well with the singular form *ba’al*. So neither display a meaning conditioned by the plural.

5.3 Pluralia tantum

At the heart of our analysis of lexical plurals is a sense insertion rule that associates a root with a mass meaning. The rule is conditioned by a plural feature and we linked this conditioning with the non-count nature of the meaning. We began our discussion with nouns that have mass senses only in the plural but that can occur in the singular and the plural with a count sense (*arms*, *brains*, *directions*, *funds*, *guts*). Sense insertion rules may also explain the behavior of nouns like *fumes* that only occur in the plural, so-called *pluralia tantum*. English has *gobs* of pluralia tantum. The examples below are among those discussed in Acquaviva (2008) and Ojeda (2005):

(153) *arrears*, *dregs*, *dues*, *fumes*, *furnishings*, *oats*, *proceeds*, *remains*, *suds*, *valuables*, *winnings*

Following a suggestion in Arregi & Nevins (2014:fn5), I propose that there is a sense insertion rule for $\sqrt{\text{FUME}}$ that is conditioned by the plural, like the first line of (154) below, but that there is no rule akin to the second line of (154). In that case, [NumP PL $n \sqrt{\text{FUME}}$], pronounced *fumes*, receives an interpretation but [NumP SG $n \sqrt{\text{FUME}}$], pronounced *fume*, does not receive an interpretation, moreover the interpretation *fumes* receives makes it a mass noun.

(154) Sense Insertion rules for $\sqrt{\text{ARM}}$

$\sqrt{\text{ARM}}$ $\Leftrightarrow \lambda s. s$ is a state whose participants are weapons. / _____ PL

$\sqrt{\text{ARM}}$ $\Leftrightarrow \lambda s. s$ the sole participant of s is an appendage from shoulder to wrist.

On this proposal, *fumes* is a pluralia tantum noun because it only gets a meaning in a plural context. Given our discussion of allomorphy and allosemy, we may expect to find nouns that are pluralia tantum because they only get a pronunciation in a plural context. In that case, the noun could be a count noun since a \star -operator would not intervene with a PL condition in a phonological insertion rule. Trommer (2012:346) writes: “a conceivable analysis for the fact that German *Eltern*-*n*, ‘parents’ doesn’t have a singular form (but contains the regular plural suffix *-n*) is to assume that the lexicon of German provides the allomorph for

²⁹ Thanks to a reviewer for *Linguistics and Philosophy* for pointing this out.

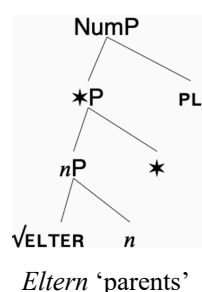
this lexeme in the context of the plural morpheme, but no default Vocabulary item which would be adequate for a non-plural context.” This idea is implemented in the following Vocabulary Insertion rules:

- (155) $\sqrt{\text{ELTER}} \Leftrightarrow \text{Elter} / ___ \text{PL}$
 $\text{PL} \Leftrightarrow -n$

and we add to that a Sense Insertion rule:

- (156) $\sqrt{\text{ELTER}} \Leftrightarrow \lambda s. s$ is a single participant state of someone who has a child.

On this account, $\sqrt{\text{ELTER}}$ has exactly the same meaning as $\sqrt{\text{PARENT}}$ but unlike $\sqrt{\text{PARENT}}$, $\sqrt{\text{ELTER}}$ is never realized without the plural. In that case, $\sqrt{\text{ELTER}}$ has a count noun³⁰ meaning and we get the structure below. The \star does not interfere with the rule in (155) because \star has no phonological exponent.



5.4 Mass count diagnostics

As noted earlier, nouns with plural-conditioned sense insertion are called mass plurals. Their status as mass nouns is established by their inability to combine with numerals:

- (157) Why did they give us #two directions to the stadium?

More evidence comes from their inability to combine with reciprocals, unless conjoined, as seen in these examples from §3.

- (158) #The directions to the stadium contradicted each other.

- (159) The directions you gave me and the directions she gave me contradicted each other.

Some of the mass plurals are hardcore mass nouns and so they resist combination with stubbornly distributive predicates (§4.2):

- (160) #The fumes were big.

Combination with *much* versus *many* tends to correlate with being mass versus count (*much work*, *many jobs*). As noted in §2.7, this and other such correlations hold to a greater or lesser degree. Mass plurals present a point at which the correlation breaks down. Jespersen (1961/65:§5.28) observed that “with regard

³⁰ Here’s an example of its use with numerals:

- (i) In Mexiko wurde das erste Kind weltweit geboren, das Erbmaterial von zwei Müttern hat, also *drei genetische Eltern*.
 ‘In Mexico, the first child in the world was born, with genetic material from two mothers, i.e. *three genetic parents*.’
br.de/nachrichten/wissen/drei-eltern-und-ein-baby

to plural mass-names there is some difficulty in expressing quantity, as *many* cannot well be used because it implies countability, and *much* presupposes the sg number; thus *a great quantity* or similar expressions must be resorted to.” Gillon (1992:613) reports that his informants found both *many* and *much* awkward with plural mass nouns, while his own intuitions vary, with *much brains* versus *many effects*. An explanation for this behavior might come with a better understanding of *much* and *many*. Bacon (1973), Smith (2016), Wellwood (2014), and Bale & Gillon (2020) develop the idea that the choice of *much* vs. *many* is determined by the number feature on the quantified noun, though the data above from Gillon (1992) challenges that idea. In addition, we may discover grammatically relevant distinctions among kinds of multiparticipant states, as we did in our discussion of differences in felicity in combinations with stubbornly distributive predicates (§4.2).

5.5 Mass plurals vs. mass singulars

Nouns whose extensions are restricted to single participant states are count nouns. Mass noun extensions are not so restricted (§2.7). Mass noun extensions include multiparticipant states. But this does not preclude their also having single participant states in their extension. This may not be possible for hardcore/canonical mass nouns, if they are divisive, as suggested earlier (§4.2). But it is possible for fake/aggregate/object mass nouns as many have observed (e.g. Joosten 2010:38, fn22, Leisi 1971:32 cited in Mihatsch 2015:1185 and Martí 2020a:§4.2.2). Križ (2017:§2.3) writes “Certainly my *luggage* can be a single suitcase, today’s *mail* can be a single letter, and a cardinal’s *jewelry* may consist in a single ring.... It is quite possible, for example, to point at a single table and utter *This is furniture*.” With plural mass nouns, the plural morpheme removes the possibility of having single participant states making for the contrast between singular and plural mass nouns pointed out in Gardelle (2016:364) and described in Križ (2017)’s remarks regarding “*clothes, belongings, possessions, goods, movables, valuables, and eatables*, which refer to collections of well-individuated objects.” He writes “it is simply not possible to use pluralia tantum of this kind to refer to a single object...one cannot hold up a single shirt and say #*These are clothes*. or #*This is clothes*.”

5.6 Compounds and other contexts

Harðarson (2021) is a study of conditions for allomorphy and allosemy in compounds. One part of a compound structure may condition allomorphy or allosemy in another. He cites the example of “compound intensifiers in Icelandic (e.g., Indriðason 2016). The stem *eitur* typically receives the meaning ‘poison/venom’, (161)a., whereas in certain adjectival compounds it serves as an intensifier, (161)b,c.”

(161) Icelandic			Harðarson (2021)
a. <i>eitur#slanga</i>	b. <i>eitur#hress</i>	c. <i>eitur#fljótur</i>	
poison#snake	poison#chipper	poison#quick	
‘venomous snake’	‘very chipper’	‘very fast’	

If this is right, then there must be sense insertion rules whose contexts are met only in compounds. This has consequences for the proposal above about pluralia tantum. It was claimed that root $\sqrt{\text{FUME}}$ cannot appear without the plural, because it would not get associated with a meaning. But that conclusion should be qualified. We might expect to find speakers forming compounds with $\sqrt{\text{FUME}}$ without a plural. The following were gleaned from the web:

(162) fume cabinet, fume hood, fume extractor, fume buildup, fume condensation

We also find $\sqrt{\text{FUME}}$ without a plural in verbs, presumably conditioned there by the presence of a little *v*.

(163) They *fumed* about the World Bank’s funding of destructive infrastructure.

5.7 Optionally plural mass nouns

We have explained why *arms* has a mass interpretation only in the plural but curiously we have no explanation for why *wool* or *evidence* have a mass interpretation only in the singular. Plural features are compatible with mass roots, so why don't they optionally combine with $\sqrt{\text{WOOL}}$? One thought might be that the mass meaning of $\sqrt{\text{WOOL}}$ is conditioned on the presence of a singular feature, just as the mass meaning of $\sqrt{\text{FUME}}$ is conditioned on the presence of plural feature. But this analysis seems to miss a generalization made apparent by considering various meanings that get attached crosslinguistically to morphology usually associated with pluralization. There is a group of languages in which singular mass nouns have acceptable plural mass counterparts. This is a diverse group including Biblical Hebrew, Greek, Innu-aiman, Lezgian (exemplified in (147) above), Persian and Turkish³¹ (Alexiadou 2011, 2021, Corbett 2000:§7.3, Ember 1905, Gesenius et al. 1909:§124, Gillon 2015, Haspelmath 1993:§7.2.1, Sharifan & Lotfi 2003, Tsoulas 2006, 2009, Wiese 2012:§4.2.2.3). These languages confirm our expectation that mass nouns can be pluralized as mass nouns, but the plural is not a free variant of the singular. Speakers allow the plural with some roots but not with others (Alexiadou, Kouneli) and the interpretation of pluralized mass nouns is more than what one would expect from the combination of a plural feature and a mass root. According to some, pluralized mass nouns convey abundance (Tsoulas, Alexiadou), according to others disorder and dispersion (Kouneli 2019, Erbach 2019:415, Sharifan & Lotfi), disdain (Tsiakmakis et al. 2021) and intensity (Ember, Gesenius).³² The generalization seems to be that plural features are permitted on mass nouns only when they result in a meaning not achievable with the singular, either because the root doesn't get a mass meaning without the plural (lexical plurals) or because the plural contributes 'added' content. This points to some sort of economy mechanism that blocks the plural when a semantically equivalent singular is available.³³ With count nouns, if a speaker wishes to speak about multiple participants, they must use the plural. And since they must, they may. With mass nouns, there is no such imperative, so if a singular mass noun is available for a given meaning, it must be used.

5.8 Conclusion

Within our pure event framework, without identifying mass denotations and count plural denotations, we can say what they have in common and take this to be the meaning of the plural feature. This explains why a mass noun *can* appear in the plural. In this section, we've shown somewhat the converse, namely: why a noun meaning that only occurs in the presence of the plural must be a mass noun meaning. The explanation appealed to the idea that for there to be contextual allomorphy or contextual allosemy, the feature that conditions the choice of form or meaning must be local to the root or other syntactic object that is assigned that form or meaning. In particular, if PL conditions sense insertion, PL must be semantically adjacent to the root, no other meaningful element may intervene. But if PL is semantically adjacent to the root, then the root must be multiparticipant, in other words, a mass noun.

³¹ Here's an example supplied by İsa Bayırlı:

(i) *Turkish*
viski-**ler**-den biraz-ın-ı iç-di-m.
whiskey-PL-ABL some-3SG-ACC drink-PAST-1SG
'I drank some of the generous amount of whiskey.'

biraz combines with singular mass nouns as well (*biraz kan* 'some blood' Görgülü 2010:13). On the other hand, the count indefinite quantifier *bazı* combines with plural count nouns (*bazı elmalar* 'some apples') but not with plural mass nouns.

³² There is a small analytical literature (Chierchia 2021, Erbach 2019, Kouneli 2019, Renans et al. 2018) which assigns different meanings to number features in English and Greek and deduces abundance as a scalar implicature. But this may not be a strictly plural-mass phenomenon. Wiese (2012:62-3) discusses a parallel effect with an optional singular indicating small amount. Ember (1905) identifies intensive plurals on count nouns (The Biblical "rivers of Babylon" may refer to the (once) mighty Euphrates River.). Several of the special uses of the plural in Corbett (2000:§7.3) also involve count nouns.

³³ This mechanism relies on the plural being disfavored, 'marked', relative to the singular. This could depend on the semantics and morphology of number in a given language. See McCawley 1975:fn9 for comparison of English and Lingala. The markedness of the plural is the subject of research on implicature - see footnotes 18 and 32.

There is a widespread belief that the plural is the hallmark of countability. It has been said that number encodes countability, that number marking encodes the presence of countable units and that plural is a syntactic marker of countability. Borer (2005:94) goes even further arguing that “plurals *create*, so to speak, count nouns from unstructured stuff”. If these views were correct, the plural feature in a mass plural would have to be meaningless. We have assumed otherwise and in the following section, we’ll look at agreement facts indicating that the plural feature in a mass plural has a meaning, the same meaning it has in a count plural.

Borer’s idea about the plural is part of a larger claim according to which count nouns are syntactically complex as compared with mass nouns. Gil (1996) similarly finds in singular mass nouns an iconic association between the simplest form, zero marking, and the simplest meaning, mass interpretations. Borer and Ouwayda (2021:124) list a number of ways in which mass nouns are simpler including the claim that there are no inflectional mass endings. In the next section, we’ll see an example from the study of gender of an inflectional affix marking mass nouns

6 More on the marking of mass nouns

6.1 Introduction

I have assumed that lexical plurals are formed through the combination of a noun root and an inflectional affix, the same affix as one finds in count plurals. The final *s* in *dregs* and the final *s* in *dogs* represent inflectional morphemes that are the same syntactically, morphologically and semantically. In this section, I look at several empirical phenomena that provide support for these assumptions.

6.2 Pronunciation

In a reading study of native speakers of British English, Schlechtweg and Corbett (2021) found no durational difference between word-final fricatives in pluralia tantum and in count plurals. This contrasts with acoustical differences found in the pronunciation of affixal and non-affixal *s*. “The lack of a durational difference,” they conclude “strongly suggests that English pluralia-tantum nouns have a regular plural affix, and control agreement regularly.”

6.3 Semantic agreement

The plural affix in a lexical plural has the same meaning, I claim, as the plural affix in a count plural. This contrasts with the widely held view that lexical plurals, or at least some of them, are ‘semantically singular but syntactically plural’. This is an especially popular view of bipartite nouns, like *scissors*, *trousers* or *pliers*. To say that an expression is ‘semantically singular but syntactically plural’ is to claim a divergence between morphosyntax and semantics. Such divergence is indeed present in a variety of natural language expressions and what one usually finds in those cases is a pattern of agreement that is mixed. A divergent expression will agree with some elements according to its syntax and with others according to its semantics and the choice is not arbitrary (Corbett 2006: 206–37)³⁴. For an example of mixed agreement, we turn to the French second person plural pronoun *vous*. *vous* has an honorific or polite use with a single addressee or with multiple addressees. In (164) below, the agreement on the verb is uniformly plural while the

³⁴ The division into those elements that participate in semantic agreement and those that do not conforms to the Agreement Hierarchy of Corbett (2006:207), repeated below:

attributive > predicate > relative pronoun > personal pronoun

For any controller that permits alternative agreements, as we move rightwards along the hierarchy, the likelihood of agreement with greater semantic justification will increase monotonically (that is, with no intervening decrease).

For analysis of the process of semantic agreement see Wechsler (2011), Landau (2016) and Smith (2017). Wechsler (2015) is a good introduction to the syntactic role of agreement.

number marking on the adjective is singular or plural depending on the reference of the pronoun. The pattern of number marking on the predicative adjectives in (164) is referred to as ‘semantic agreement’.

- (164) *French* (Wechsler 2011:1000)
- | | | | |
|----|---|---------|------------|
| a. | Vous | êtes | loyal. |
| | you.PL | be.2.PL | loyal.M.SG |
| | ‘You (singular, formal, male) are loyal.’ | | |
| | | | |
| b. | Vous | êtes | loyaux. |
| | you.PL | be.2.PL | loyal.PL |
| | ‘You (plural) are loyal.’ | | |

vous in (164)a shows mixed agreement, with a plural verb and a singular adjective. If the lexical plural *ciseaux* ‘scissors’ were indeed syntactically plural but semantically singular, we would expect it to also give rise to mixed agreement, with a plural verb and a singular adjective. But that is not what one finds:

- (165) *French* (Wechsler 2011:1016)
- | | | | | | |
|----------------------------|---------------|--------|----------------|---|-----------------|
| Ces | ciseaux | sont | géniaux! | / | *génial! |
| these.PL | scissors.M.PL | are.PL | brilliant.M.PL | / | *brilliant.M.SG |
| ‘These scissors are cool!’ | | | | | |

ciseaux ‘scissors’ is in fact syntactically and semantically plural and so it agrees with all targets in the plural. Wechsler (2011:1016) reports that mixed agreement has been documented for a variety of languages³⁵ and “in all of these mixed agreement languages, polite plural pronouns trigger plural on a verb but semantic agreement on an adjective, while plurale tantum common nouns trigger plural on both.” In §2.9, it was pointed out that mass nouns are compatible with both [SG] and [PL]. This means that *ciseaux* ‘scissors’ is syntactically and semantically plural and so it agrees with all targets in the plural. The same is true for other plural mass nouns. At the same time, a singular mass noun is syntactically and semantically singular and so it agrees with all targets in the singular. Mixed agreement arises only when syntactic agreement is incompatible with the meaning of the controller.

Above we compared mass plural behavior with that of the pronoun *vous*. Perhaps a tighter comparison can be made with the Hebrew noun *be’al-im* ‘owner(s)’, recently discussed in Landau (2016). This is a noun that has the form of a plural but can be used to refer to a single individual and when it does, it may be modified by a singular adjective. By contrast, adjectives modifying the pluralia tantum noun *mixnasayim* ‘trousers’ must be plural (Avioz 2013:144).

The intuition of ‘semantic singularity’ is understandable. Where a pointing is accompanied by a felicitous utterance of *those pants*, an utterance of *that pair of pants* or *that garment* would be equally felicitous. This kind of observation is suggestive but not conclusive. If it were, then applying similar reasoning to pairs like *⟨those cards, that deck⟩* or *⟨those potatoes, that food⟩* would ultimately lead to the conclusion that all plural nouns are semantically singular. Distinct states or sets of states can manifest in the same space-time, but we shouldn’t identify them.

Summarizing then, the absence of mixed agreement provides evidence that lexical plurals are semantically plural – or more properly ‘semantically multiparticipant’ – just like count plurals.

6.4 Mass gender

My account of lexical plurals posits an inflectional morpheme that signals the presence of a mass interpretation. There is a precedent in the literature on grammatical gender for a mass inflectional

³⁵ “The mixed agreement pattern was documented for Czech, French, Italian, Romanian, Icelandic, and Modern Greek by Comrie (1975: 410). Greville Corbett investigated this issue for all the Slavonic languages, and found this mixed agreement pattern to be favored in Macedonian, Bulgarian, Czech, Slovak, Upper Sorbian, Ukrainian, Belorussian, and Russian (long form adjectives) (Corbett 1983:56ff., 2000:193–194, 2006:230–232).” Wechsler (2011:1001-2)

morpheme. In this section, we look at perhaps the most well-known example, the *neutro de materia* in Asturian.³⁶

Asturian has three genders, masculine, feminine and neuter, illustrated here with postnominal adjective agreement:

- | | | | | | | | | | |
|-------|---------------|----------|--|-----------|----------|--|----------------|----------|-----------------|
| (166) | paisanu | vieyu | | gata | vieya | | ropa | vieyo | <i>Asturian</i> |
| | peasant | old.M.SG | | cat | old.F.SG | | clothing | old.N.SG | |
| | ‘old peasant’ | | | ‘old cat’ | | | ‘old clothing’ | | |

Nouns also agree with prenominal determiners:

- | | | | | | | | | |
|-------|-------------------|---------|----------|--|---------------|------|----------|-----------------|
| (167) | el | paisanu | vieyu | | la | gata | vieya | <i>Asturian</i> |
| | DEF.M.SG | peasant | old.M.SG | | DEF.F.SG | cat | old.F.SG | |
| | ‘the old peasant’ | | | | ‘the old cat’ | | | |

When we combine neuter nouns with determiners, we discover that a neuter noun has two genders, either neuter and masculine (*carbón*) or neuter and feminine (*ropa*). Neuter nouns display mixed agreement, triggering feminine/masculine agreement with the determiner, but neuter agreement with a postnominal adjectival modifier:

- | | | | | | | | | |
|-------|-----------------|--------|-----------|--|-------------------|----------|----------|-----------------|
| (168) | el | carbón | duro | | la | ropa | vieyo | <i>Asturian</i> |
| | DEF.M.SG | coal | hard.N.SG | | DEF.F.SG | clothing | old.N.SG | |
| | ‘the hard coal’ | | | | ‘the old clothes’ | | | |

In addition to postnominal adjectives, neuter agreement shows up on predicative adjectives, participles, pronouns, and some agreeing *wh*-words. The distribution of neuter agreement conforms to what has been documented crosslinguistically for semantic agreement (Corbett 2006)³⁷. Also in keeping with semantic

³⁶ Asturian is a Romance language spoken in Asturias, in northwestern Spain. The term ‘neutro de materia’ refers at once to the semantic import of the relevant markings and to their ancestor, the Latin neuter. The data in this section is from García González (1985), Carretero García (2017) and Loporcaro (2018). Loporcaro (2018:Ch.5) is the most comprehensive discussion of the neutro de materia that I’m aware of.

Loporcaro argues that “each noun of the language is specified in the lexicon for two distinct gender features”. Manzini & Savoia (2017) view the neuter in Italian and Albanian varieties as gender morphology coding a common semantics shared by mass nouns and plurals. These ideas are precedents for the analysis to be proposed here.

³⁷ Adjectives whose subject is an infinitive or tensed declarative also take the neuter form. The examples in (i)-(ii) are from Camblor Portilla and Wood Bowden (2005).

- | | | | | |
|-----|------------------|------------|--|----------|
| (i) | Fumar | ye | | malo |
| | smoke.INF | be.PRS.3SG | | bad.NEUT |
| | ‘smoking is bad’ | | | |
-
- | | | | | | |
|------|---|-------------|------------|------------|----------|
| (ii) | Que fumes | peles | mañanes | ye | malo |
| | that smoke.SBJV.2SG | by=DEF.F.PL | morning.PL | be.PRS.3SG | bad.NEUT |
| | ‘that you smoke in the mornings is bad’ | | | | |

We may capture these facts with the following vocabulary insertion rules for adjectives:

Vocabulary Insertion Rules

$a, [-FEM] \Leftrightarrow -u$

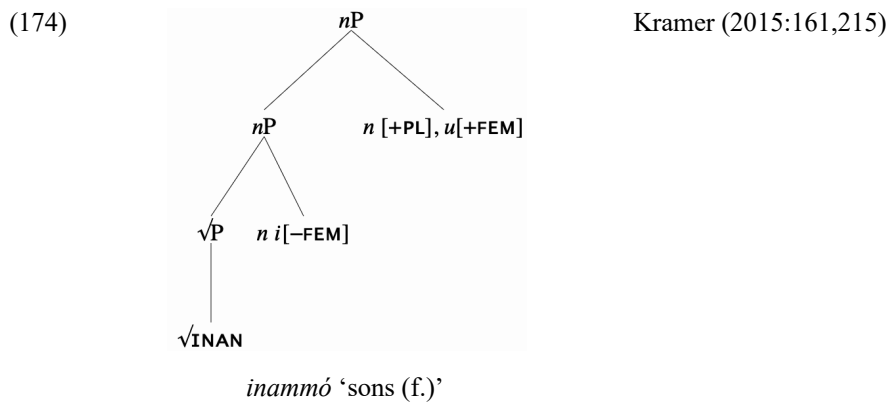
$a, [+FEM] \Leftrightarrow -a$

$a \Leftrightarrow -o$

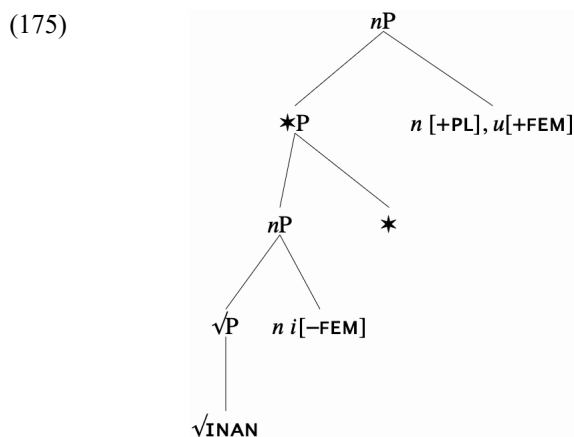
“gender polarity” refers to gender reversals that come with a change in number, as in these examples from Lecarme (2002) reproduced in Kramer (2015:147,151):

(173) SINGULAR	PLURAL	<i>Somali</i>
díbi ‘bull (m.)’	díbí ‘bulls (f.)’	
náag ‘woman (f.)’	naag-ó ‘women (m.)’	
ínan ‘son (m.)’	inammó ‘sons (f.)’	

This interplay of number and gender is taken by Lecarme (2002) as a sign that plural features are bundled together with gender features, so that one cannot form a plural of *ínan* ‘son (m.)’ without thereby producing a feminine noun. For Kramer, this means that *inammó* ‘sons (f.)’ has an uninterpreted [+FEM] feature bundled with a plural feature, [+PL]³⁸. This is in addition to an interpreted [-FEM] feature, “which causes the noun to be interpreted as referring to males”. Agreement with the noun is governed by [+FEM], so it must be higher in the structure than [-FEM]:



Recall now that ★ operators attach to nP, so that there could be a ★ operator below the [PL] feature on the lower nP. Since ‘sons’ is a count noun, there must be a ★ operator below the plural feature³⁹:



³⁸ This analysis is reminiscent of Acquaviva (2008:§9.4)’s analysis of lexical plurals in which number is encoded on [n] (see also Alexiadou 2021). “The observed tight connection between lexicalized plurality and gender or class value, encoded on [n] follows straightforwardly” he writes, and he continues “it becomes understandable why so many lexical plurals lack a discrete number affix.” These considerations hold for Acquaviva’s case studies (Italian plurals in -a, Irish counting plurals, Arabic broken plurals, Breton plurals). They don’t extend to lexical plurals in English.

³⁹ The plural is not restricted to count nouns. Lecarme (2002:126) cites the plural mass nouns *biyó* (m) ‘water’ and *caanó* (m) ‘milk’.

inammó ‘sons (f.)’

The contrast with Somali emphasizes the point that mass interpretation associated with neuter in Asturian is the product of a multiparticipant feature *immediately adjacent* to the root. Summarizing now, the inventory of inflectional features in Asturian includes a neuter gender feature whose sense is multiparticipant. It occurs adjacent to the root in neuter nouns which entails that they are mass nouns. It is in effect another marker of mass. It is a gender counterpart of the plural morpheme in lexical plurals.

6.5 Conclusion

In this section we discussed three cases of semantic agreement with predicative adjectives. In semantic agreement the form of the target is influenced by the meaning of the controller. Controllers in these three cases included the polite French second person plural pronoun *vous*, the lexical plural *ciseaux* ‘scissors’ and the Asturian neuter noun *carbón* ‘coal’. These studies confirm aspects of our analysis of lexical plurals in terms of multiparticipant. The Asturian examples confirm that there is such a thing as a meaning that an inflectional feature can have that makes it compatible with mass noun roots but not count noun roots. The French examples confirm that a plurality denoting expression and a mass plural are in the same meaning category with respect to number agreement. The duration experiments confirm that mass plurals have a feature with the same exponent as the number feature found on count plurals.

In some languages, in addition to singular and plural, nouns can show dual inflection. If plural features can indicate multiple participants in a state, one might think the dual could mark the presence of two participants, a special kind of non-count noun meaning. This intriguing hypothesis is examined in the next section.

7 Lexical duals?

7.1 Introduction

We’ve seen that a single feature, [PL], can indicate different kinds of denotation depending on where in the DP it appears. It can indicate plurality, when it appears adjacent to a count noun and a ★-operator. It can indicate mass nounhood when it appears adjacent to a root. In this section, we turn our attention to those languages that mark the dual, in addition to singular and plural. We’ll show that if dual marking occurs adjacent to a count noun and a ★-operator, it will indicate duality. If it occurs adjacent to a root, it indicates mass nounhood, just like the plural. This last fact becomes relevant when one considers nouns like *glasses* and *scissors*. These are lexical plurals that intuitively seem to denote states with two participants. This intuition is confirmed by the ability to combine with *pair of*, exhibited by these nouns and other so-called bipartites (*pants*, *pliers*, *binoculars*, *tweezers* etc.). As we’ve come to learn, the plural feature, PL, requires multiparticipant and is satisfied whether it comes in the form of one state or many. Likewise, *pair of* requires two participants and is satisfied if they come in one state, *pair of scissors*, or in a plurality of states, *pair of shoes*. On first thought, one might expect that in languages with dual marking, bipartites would be ‘lexical duals’. But in fact, Corbett (2000) observed that while pluralia tantum are found in many languages, one rarely comes across a **duale tantum**, that is, a noun that occurs only with dual number. The absence of lexical duals is less puzzling once it is demonstrated that dual features attached to a root do not in fact indicate anything more than the plural and, as we will explain, the plural is less marked than the dual. We now turn to that demonstration.

7.2 Composite duals: Count nouns

The dual, as it is currently conceived, is not a semantic primitive, rather it is the result of composing a feature, [+minimal], with an expression already marked as plural⁴⁰. In (176), I’ve given the syntax for a noun phrase in a dual marking language that would be glossed as ‘two boats’.

⁴⁰ Harbour (2020) reviews the research that led to this conception of the dual. A key datapoint in this research is the expression of the dual in Hopi where a singular verb combines with a plural pronoun to

(176) $[+minimal] [PL] \sqrt{BOAT}$ ‘two boats’

The feature $[+minimal]$ is so-called because it requires a denotation that is minimal relative to an ordering given by the proper-subset relation (Noyer 1992:180, Harbour 2014, 2020:§3.1):

(177) $[+minimal] \Leftrightarrow \lambda P \lambda S. P(S) \ \& \ \neg \exists S' P(S') \ \& \ S' \subset S$

The meaning for (176) is computed as follows:

(178) $\llbracket \star n \sqrt{BOAT} \rrbracket = \lambda S. S$ is a set of one or more *boat* states

(179) $\llbracket [PL] \star n \sqrt{BOAT} \rrbracket = \lambda S. S$ is a set of one or more *boat* states and S is **multiparticipant**.

(180) $\llbracket [PL] \star n \sqrt{BOAT} \rrbracket = \lambda S. S$ is a set of two or more *boat* states with distinct participants

(181) $\llbracket [+minimal] [PL] \star n \sqrt{BOAT} \rrbracket = \lambda S. S$ is a set of two *boat* states with distinct participants.

The step in (180) relies on the fact that it takes at least two *boat*-states to get multiparticipation, since \sqrt{BOAT} is a single participant root. The last step in (181) relies on the fact that a set containing exactly two states has no proper subset that is a set of two or more states (whereas a set with three or more states does have a proper subset that is a set of two or more states). Decomposing the dual in this way correctly predicts that if a language has a dual, it will also have a singular and a plural (Harbour 2011).

7.3 Composite duals: Root attached duals

Let us now see what happens when the features for the dual are attached to a root.

(182) $\llbracket n \sqrt{SCISSOR} \rrbracket = \lambda s. s$ is a *scissors* state

(183) $\llbracket [PL] \sqrt{SCISSOR} \rrbracket = \lambda s. s$ is a *scissors* state and s is **multiparticipant**.

(184) $\llbracket [+minimal] [PL] n \sqrt{SCISSOR} \rrbracket = \lambda s. s$ is a multiparticipant *scissors* state and s has no proper subset s' itself a multiparticipant *scissors* state

Recall, that we’ve identified states with their singleton sets. Neither a state nor its singleton-set has a proper subset that is singleton set. This means that the added requirement introduced in (184) is vacuous. It follows that dual marking is compatible with multiparticipant roots, but the use of the additional feature $[+minimal]$ is not informative. A language might have a rule like (185).⁴¹

(185) Hypothetical Sense Insertion for $\sqrt{TROUSER}$

$\sqrt{TROUSER} \Leftrightarrow \lambda s. s$ is / _____ $[PL][+minimal]$

but if there is pressure to economize on features, it is not expected. This may explain Corbett (2019)’s observation:

produce dual reference. This data can be found in the Appendix. The feature $[+minimal]$ was independently discovered through the study of pronoun inventories. The Appendix includes representative data of that sort as well. The feature $[+minimal]$ is named for its semantics. To maintain consistency with previous discussion, I’ve kept the morphological label ‘ $[PL]$ ’.

⁴¹ Hebrew has *ofanáyim* ‘bicycle’, *misparáyim* ‘scissors’ and other bipartites with the *-áyim* suffix. However, the status of the suffix *-áyim* is unclear (Acquaviva 2008:31-2, Ritter 1995:415). For non-measure nouns that take that suffix, it serves as a plural marker. Blanc (1970) describes similar facts in dialects of Arabic.

“Linguists who stress the motivation of apparent irregularities sometimes point to bipartites, like *trousers*, as being motivated pluralia tantum. We might ask, then, what might happen to such nouns in a language with a dual. If ‘two-ness’ is the motivating factor, we might expect such nouns to occur as dualia tantum. Yet what we often find (in the relatively few instances where there are data) is that the usual suspects turn up, as pluralia tantum.”

7.4 Conclusion

Within the framework of §2, plural count nouns include the \star -operator and have nonsingleton sets of states in their extension while mass nouns have only singleton sets in their extension. In §3, we showed that plurality seekers such as the reciprocal are sensitive to that distinction. In this section we found further suggestive evidence for this architecture. When combined with a plural count noun the feature [+minimal] will produce a dual, as it was designed to do. However, while [+minimal] is combinable with a plural mass noun, it has no effect on interpretation because the denotation is already minimal. This could be the reason why lexical duals are hard to come by.

This completes our discussion of the internal semantics of nouns with a fixation on the mass-count distinction. A summary of the main points can be found below in §10.1. In the next two sections, we’ll take a brief look at nominal quantification followed by a proposal concerning the distinction between intersective and nonintersective adjectival modification.

8 Nominal quantification

If nouns are predicates of states, then nominal quantification should be quantification over states. Adapting standard generalized quantifier meanings to a pure event semantics, we have:

$$(186) \sqrt{\text{EVERY}} \Leftrightarrow \lambda P \lambda Q \forall S (P(S) \rightarrow Q(S))$$

$$(187) \sqrt{\text{SOME}} \Leftrightarrow \lambda P \lambda Q \exists S (P(S) \& Q(S))$$

$$(188) \sqrt{\text{NO}} \Leftrightarrow \lambda P \lambda Q \neg \exists S (P(S) \& Q(S))$$

With the sense insertion rule in (186), we can compute the meaning of (189) below. Adjacent to the stative predicate *rusty* in (189), there is a null thematic role head, θ_{HOLD} . The meaning for (189) is in (191).

(189) Every nail was rusty.

$$(190) \llbracket \theta_{\text{HOLD}} \text{ rusty} \rrbracket = \lambda S (\exists S') [\text{rusty}(S') \& (S \ominus S')]$$

$$(191) (\forall S) (\text{nail}(S) \rightarrow (\exists S') [\text{rusty}(S') \& (S \ominus S')])$$

Given the discussion of numeral noun constructions in §2.6 and of adjectives in §4.1, the interpretation of (192) below comes down to the formula in (193).

(192) Three \star windows are [$\theta_{\text{HOLD}} \star$ open].

$$(193) \exists S (\star \text{window}(S) \& |S| = 3 \& (\exists S') \star \text{open}(S') \& (S \ominus S'))$$

This analysis leads to overcounting. Suppose there are exactly two windows and they are open. A single window can be in different window states of varying duration. It is possible then to have a set S of three window-states, two of which have the same participant. Such a set would verify (193), incorrectly predicting that (192) is true. One might think this shows that admissible domains of quantifiers are restricted in a way that guarantees that if two states are in the domain of a quantifier, they do not share participants. This would have the effect that when we employ numeral noun constructions, our counting of states amounts to the counting of participants in those states, thus making nominal quantification effectively quantification over individuals. It would mean that when we count, each individual or object

counts as one. In fact, as is well known, that is not how counting works in general (Krifka 1990, Moore 1994, Doetjes & Honcoop 1997, Viebahn 2013, Schein 2017). Consider the words of praise recorded in (194) below:

(194) During Smith's career, she has taught over 100 courses serving *over 2,058 students*.

If Jack was simultaneously enrolled in two of Smith's courses, there were two states of being a student in a Smith course and both figure in the reckoning reported in (194). Those two states have the same participant and yet they are both included in the domain. They both count towards the final tally of 2,058. Here's an example showing a similar feature of measure quantification:

(195) Pablo and Arsenio work for a company that tests drinking water. Pablo measures lead content in the water. Arsenio measures arsenic content. The company pays \$30 per gallon measured. Sometimes, when he is lonely, Pablo goes over to Arsenio's work station and performs his measurements on the same gallon of water that Arsenio is measuring. When asked by the foreman how many gallons were tested this week, Pablo gives his number and Arsenio gives his. These numbers are added together in the final report sent to billing:

Pablo and Arsenio tested 1000 gallons of water this week.

In this scenario, there were several Pablo-Arsenio pairs of water states with shared watery participants and yet both elements of the pair figure in the reckoning reported in (195). As these examples illustrate, when we produce a count, we are not limited by the number of individuals or amount of matter involved. We're also not limited by the number of temporal stages of individuals involved, as some have argued (Musan 1995, Barker 1999, 2010, Gotham 2021). In (194) a temporal stage of Jack is effectively counted twice. In (195), a temporal stage of a portion of water is measured twice. What is needed then is not a domain restriction that compares participation among the states but rather an algorithm for choosing states based on a selection of events with which those states share participants.

9 Adjectival modification

9.1 Indirect modification

In systems where nouns and adjectives are one place predicates of individuals, an adjective noun collocation such as *round boat* or *edible flower* can be interpreted directly by intersecting the extensions of the adjective and the noun. In a pure event semantics as envisioned here the interpretation must be indirect. Let me explain why.

Up to now, I have used a metalanguage predicate such as **flower** to apply to states that were informally called '*flower states*'. Any flower is in a state described by **flower** and only flowers participate in these states. To be in one of those states is what it means to be a flower. Suppose now that some adjectives work that way as well. What it means to be edible is to be a participant in one of the states in the extension of **edible**. Clearly, what it means to be edible could not be the same as what it means to be a flower, so that the statement below could not be true of any state *s*:

(196) **edible**(*s*) & **flower**(*s*)

On the other hand, the statement in (197) below could be satisfied by some state and it would be a state that an edible flower is in:

(197) **flower**(*s*) & ($\exists s'$)[**edible**(*s'*) & ($s \ominus s'$)]

To achieve this interpretation for the adjective noun collocation, the adjective must first combine with a thematic role head (§2.3) or some piece of syntax that includes that head. The result can then combine with the noun (compare Wellwood 2019:77-79). The interpretation flows as follows:

(198) $[_{nP} [_{\theta P} \theta_{\text{Hold}} [_{aP} a \sqrt{\text{EDIBLE}}]] [_{nP} n \sqrt{\text{FLOWER}}]$ Indirect Modification

(199) $\llbracket \theta_{\text{Hold}} \rrbracket = \lambda P \lambda S (\exists S') [P(S') \ \& \ (S \ominus S')]$

(200) $\llbracket [\theta_{\text{Hold}} \sqrt{\text{EDIBLE}}] \rrbracket = \lambda S. (\exists S') [\llbracket \sqrt{\text{EDIBLE}} \rrbracket(S') \ \& \ (S \ominus S')]$

(201) $\llbracket [\theta_{\text{Hold}} \sqrt{\text{EDIBLE}}] \sqrt{\text{FLOWER}} \rrbracket = \lambda S. (\llbracket \sqrt{\text{FLOWER}} \rrbracket(S) \ \& \ (\exists S') [\llbracket \sqrt{\text{EDIBLE}} \rrbracket(S') \ \& \ (S \ominus S')])$

9.2 Validating noun substitution

If what I am holding is an edible flower and what I am holding is also a gift, then what I am holding is an edible gift. When an adjective is combined with a count noun and the result is interpreted indirectly, it validates substitution inferences of the form in (202)⁴².

(202) Noun Substitution Inference

x is an A N₁
 x is an N₂

 x is an A N₂

Let us see why this holds. Given the interpretation in (201), any x that is a participant in a state in the extension of *edible flower* is the sole participant in an *edible* state. Any x that is the participant in an *edible* state and the participant in a *gift* state, is a participant in a *gift* state that shares all its participants with an *edible* state and so it is in a state in the extension of *edible gift*. It now follows that a state that shares all its participants with a state in the extension of *edible flower* and with a state in the extension of *gift*, will share all its participants with a state in the extension of *edible gift*.

9.3 Direct modification

I've drawn a link between adjectival modification that is indirect, mediated by a thematic role head, and the noun substitution inference. When an adjective modifies indirectly, it validates the noun substitution inference. Cinque (2014, 2010) identifies two syntactic sources for adnominal adjectives. Some adnominal adjectives modify the noun phrase directly. Others are found to modify indirectly as predicates of an underlying reduced relative clause. These two sources are associated with different interpretive properties. In particular, adjectives that validate noun substitution inferences⁴³ modify indirectly, as expected on a pure event semantics. Adjectives that do not validate noun substitution inferences modify directly.

skillful is a standard example of an adjective that does not validate noun substitution. An optician who is a skillful fly-fisherman need not be a skillful optician. *skillful* is by no means the only such adjective. Anna is a *close* collaborator and she's a relative but she is not a close relative. Berrit is a *retired* professor and a minister, but she's not a retired minister. Mr. Caliendo is a high school chemistry teacher and he's a *strict* father but he's not a strict teacher. Devin is a *trained* nurse and an untrained dog-catcher.

⁴² The present tense copula is important here. If x was an edible flower at some point and x was a gift at some point, it doesn't follow that x was an edible gift. Rex may have brushed an edible nasturtium with cyanide before presenting it as a gift. To explain these non-inferences, we'd need a temporal semantics to interpret tense and to capture the fact that adjectives must have the same time of evaluation as the nouns they modify (Musn 1999, Keshet 2010).

⁴³ The adjectives that modify indirectly are traditionally called 'predicative adjectives'. I use the noun substitution inference as a test for membership in this category. Byrne (2016:fn13) refers to this as the Geach & Thomson test. 'intersective adjective' is another label for this category. But even those who adopt this label often use noun substitution inferences and not 'intersective inferences' (McNally 2016:447) as a diagnostic (see for example Kamp and Partee 1995:138). Given the possibility to be discussed below of using direct modifiers predicatively, 'intersective inferences' are not good testing tools.

The police chief is in fact a molecular biologist, but he's not a molecular policeman. Eno is a *good* surgeon and a violinist, but unfortunately, Eno is not a good violinist. In all these cases, the adjective in question arguably does not by itself fully characterize a state, unlike *edible* or *carnivorous*. If there is nothing like plain goodness, there is nothing like a *good* state. Rather, there are *surgeon* states that compared with other surgeon states are good. As Maienborn (2020) observes, many of the adjectives just mentioned tell us something about events in which the state they apply to is initiated, manifested, terminated or compensated. A trained nurse has engaged in a training event that initiated the nurse state. A good soccer forward plays well, meaning the events in which the forward state manifests are deemed good. A strict teacher observes the rules exactly when carrying out pedagogical duties. A retired policeman has entered retirement, an event that terminated the policeman state. The reliance on the meaning of the modified noun to characterize the contribution of the adjective suggests that these adjectives are operators on nouns (Parsons 1970), denoting functions of type $\langle vt, vt \rangle$. In that case, unlike the adjectives discussed in the previous section, they could attach directly to nouns with their meanings combined by function-argument application. Alternatively, it is perhaps sufficient for the adjective to 'see' the state described by the noun to make its contribution. In that case, it may apply directly to the state described by the noun. If these adjectives do not by themselves specify a kind of state, then for example:

(203) **strict(s) & teacher(s)**

could be satisfied by some state. **teacher** specifies what kind of state it is and **strict** says something about the events in which that state manifests. On this analysis too, the adjective could attach directly to a noun, with their extensions combined by intersection.

On either of these analyses, direct modification is not expected to licence noun substitution inferences. For the $\langle vt, vt \rangle$ analysis this comes down to the basic fact that a function may assign completely different values to different arguments. To see why the inference doesn't hold on the intersective analysis, consider the invalid inference below:

(204) Invalid Noun Substitution Inference

The Senator is a good surgeon.
 The Senator is a violinist.

 The Senator is a good violinist.

From the first two premises, we learn of a *surgeon* state whose sole participant is the Senator and of a *violinist* state whose sole participant is the Senator. The first premise tells us that the *surgeon* state is in the extension of *good*. To get to the conclusion we need that the *violinist* state is in the extension of *good* but nothing guarantees that.

Under the type $\langle vt, vt \rangle$ analysis, we don't expect the adjectives in question to appear post-copula without a modified noun. That expectation is borne out for some of adjectives that fail to validate noun substitution inferences. Relational adjectives as a rule fulfill this expectation (McNally 2016:448). A molecular biologist is not molecular. There's also a group of adjectives that are ambiguous between readings that do validate and readings that do not validate noun substitution inferences. The non-validating readings of these adjectives are not possible post copula. Above we observed that *close* in *close collaborator* does not validate noun substitution inferences. And now, we can observe that the relevant reading of *close* is not possible post copula. *The collaborator is close* can only mean the collaborator is nearby (pace Siegel 1977:241). This pattern is seen as well in the ambiguous adjectives used in the phrases *old friend* (Larson 1998), *heavy drinker* (Cinque 2010) and *religious official* (Morzycki 2015:§2.2.2). At the same time there are many direct modifiers that can in fact appear post copula. So the type $\langle vt, vt \rangle$ analysis may be right for some but not for all non-validating adjectives.

Under the alternative analysis envisioned in (203), it should be possible for a non-validating adjective to appear without a modified noun. If *good* appears post copula combined with a thematic role head (§4.1), it will have the interpretation in (205) below

(205) $\lambda s. (\exists s')[[\sqrt{\text{GOOD}}]](s') \& (s \ominus s')$

And *one chef is good* will come out as:

(206) $\exists S. ([\sqrt{\text{CHEF}}](S) \ \& \ (\exists S')([\sqrt{\text{GOOD}}](S') \ \& \ (S \ominus S'))]$

When I say *one chef is good*, I may intend the existential S' in (206) to be instantiated by the chef state, in which case I'm saying that chef is good as a chef, but in a different context, I may have in mind a different state the chef is in. During a chess tournament pitting individuals in different professions against each other, you might say *only one chef is good* to mean only one chef is good at chess.

Since *good* can appear post copula in combination with the thematic role head, it could in principle also appear adnominally along with a thematic role head. That means that while *good* can combine with a noun directly, it could in principle also combine indirectly. If *good* combines directly with *chef* it would have to mean 'good as a chef', but if it combined indirectly it could be interpreted otherwise, meaning good in other ways.

Adnominal adjectives can be postnominal or prenominal. According to Cinque's findings, prenominal adjectives in Romance languages must be combined directly with the noun, while post-nominally direct and indirect modification is possible. The following fact reported in Bouchard (1998:142) now follows. French *bon chef* 'good chef' describes a chef good at cooking, while *chef bon* can mean a chef who is a good person. Cinque (2014:5) relates similar facts in Italian.

9.4 Summary and conclusion

In this section, I've described three modes of interpreting adjectival modification in a pure event semantics. These modes are correlated on the one hand with two distinct syntactic configurations and on the other with distinct inference profiles. The correlations pair syntax with interpretive differences in a way that matches that of Cinque (2010, 2014) (Cinque himself does not attempt to explain the correlation, 2010:33)

Adjectives that combine with the noun directly are interpreted via function argument application or intersection. Direct modification does not licence noun substitution inferences ((202) above). An indirect combination of an adjective with a noun is mediated by a piece of syntax that introduces a thematic role head. Indirect modification does licence noun substitution inferences.

We also described types of adjectives. Some adjectives like *carnivorous* pick out states based on their intrinsic properties. To be in a state in the extension of *carnivorous* is just what it means to be carnivorous. Adjectives of this type must modify indirectly. Intersecting their extensions with that of a noun will lead to an empty set. Since they must modify indirectly, they always licence noun substitution inferences. When Betty Rubble acquires a *carnivorous dinosaur* as a pet, she acquires a *carnivorous pet*.

good is not intrinsic. It holds of states in virtue of how they compare relative to other states of the same kind. Other non-intrinsic adjectives hold of states in virtue of properties of the events in which the state is manifested. These adjectives may be combined directly with a modified noun in which case they do not licence a noun substitution inference. These adjectives are tricky to pin down because their meaning allows them to be interpreted directly or indirectly. Nevertheless, out of the blue, they tend to be direct modifiers and in Romance languages, prenominal position is reserved for direct modification.

In (204) above we had an example of an invalid noun substitution inference and below it an explanation for why it's invalid. The fact that it's invalid and the explanation of the logic of its invalidity amounts to an application of the *modifier nonconjunction condition* of Parsons (2000). That condition grows out of discussion of adverbial modification. It's the observation that, for example, the following reasoning is invalid:

(207) Invalid Verb Substitution Inference

Jack is eating slowly.
 Jack is walking.

 Jack is walking slowly.

The condition is called ‘nonconjunction’ because in the logical forms Parsons envisions, the verb has an event argument and the modifier, applied to that argument, is conjoined to the verb. The condition blocks the conjunction of *Walk(e)* with *Slow(e)*. Parsons tested this condition on nouns using an indirect modifier (*under 1.5 meters tall*) and he reached the conclusion that nouns are not state predicates. The test should be performed with direct modifiers in which case it provides evidence that, just like verbs, nouns contain an argument position ranging over states or events.

10 Summary and Conclusion

10.1 Summary

In the introduction, I conjectured that in a semantics of natural language, nouns could and maybe should be treated as one-place predicates of eventualities, just like verbs and adjectives. In §2, §8 and §9, I outlined a system of interpretation in which there are no individual predicates or variables. Nouns, verbs and adjectives are all one-place eventuality predicates. The system treated grammatical number, definite descriptions, simple predication, quantification and modification. Is this way of proceeding correct? Does it offer any new insight into how natural language works? To address these questions, I investigated various phenomena to do with noun semantics, most especially the distinction between count and mass nouns. What follows is a summary of the results of that investigation.

This system described in §2 includes the following principles:

- (a) Any element in the extension of a noun root is a state. (= set containing one state).
- (b) Any element in the extension of a singular noun is a state.
- (c) For any P , the extension of $\star P$ is the closure under union of the extension of P . The \star -operator ‘adds’ pluralities.
- (d) Plural count nouns are formed with the \star -operator.
- (e) The meaning of the feature that characterizes plural nouns, PL, is interpreted so to require multiparticipant elements in the extension of the noun.
- (f) A count noun is such that any element in its extension is a single participant state or a set of single participant states.

Because a plural noun is formed with the \star -operator, its extension may include an element, a set of states, that is multiparticipant. Given (f), a mass noun may also include an element, a state, that is multiparticipant. So plural count nouns and mass nouns both have extensions that may include multiparticipant elements. They differ in this respect from singular count nouns. This bifurcation could serve as the basis for explaining similarities in the distribution and interpretation of mass and count plural expressions including cumulative reference, the ability to appear bare, and a parallel alternation between existential and generic readings (Lasersohn 2011) and for why there are quantifiers that select for mass and plural count but resist singular count nouns (§2.5).

Since mass noun extensions contain multiparticipant elements, they are compatible with the feature that characterizes plural nouns, PL. In §6.3, we saw that plural mass nouns trigger the same semantic agreement as plural count nouns. We also saw independent evidence from mass gender that an inflectional feature could semantically select mass nouns (§6.4).

It follows from (a) and (e), that if PL combines with a noun and no \star -operator intervenes, it must be a mass noun. In a lexical plural, PL conditions the assignment of meaning to the root. Given that conditioning of sense insertion requires adjacency, in a lexical plural, PL is adjacent to the root, thereby requiring the root to be mass. This explains why lexical plurals are mass plurals (§5).

Adjectives that resist combination with substance nouns were labeled in the past ‘count adjectives’. Taking this nomenclature seriously and extending the principle in (f) to adjectives, we conclude that count adjectives have only single participant states in their extension. This explains why, when we predicate them of plural count nouns, the combination is read distributively (§4.1). This analysis of count adjectives also helps us understand how in some languages diminutives form count nouns out of

mass nouns. *small* is a count adjective and diminutives with the meaning of *small* are similarly count predicates of sorts. The diminutive may have a bleached meaning as pure single participant predicate. If the diminutive serves as the head of a compound (§4.6) its count semantics characterizes the combination.

When predicative adjectives appear adnominally, they have merged with the noun as predicates of a reduced relative clause. This is a generalization that grows out of work on the syntax of adjectives. It would be puzzling from the perspective of a grammar in which nouns and adjectives are individual predicates and where intersective modification is interpreted in terms of logical conjunction or set intersection. In that case, there should be no need for a relative clause. On the other hand, if both predicative adjectives and nouns are 1-place eventuality predicates, their combination cannot be interpreted as simple conjunction or set-intersection. A *round* state is different than a *boat* state, so the intersection of the extensions of *round* and *boat* is empty. Some type of predicative syntax must be present to allow *round boat* to be interpreted in terms of two states that share participants (§9).

Given (b), a felicitous definite singular mass noun phrase denotes a single state. A felicitous definite plural noun phrase denotes a plurality. So even though both denotations are multiparticipant, they are distinct. This difference can be detected with plurality seekers (§3, §4.4). This distinction also came up in our discussion of the rarity of dualia tantum (§7). Previous research has posited a feature [+minimal] whose interpretation selects \subset -minimal elements in a grammar, like ours, where pluralization is defined in terms of set-union. This feature in combination with a plural feature creates a dual when attached to a \star -attached count noun. When attached to a mass noun, [+minimal] is superfluous.

10.2 Future research

In the sections below, I pose some basic theoretical questions that the approach taken here must confront. In addition, there are no doubt many linguistic phenomena that would require reappraisal when viewed through the lens of a pure event semantics. Noun-centric phenomena are obvious candidates. These include nominalization, names, the problem of the many, anaphora and genericity. But we should also expect reevaluation of phenomena that are not noun-specific but in which nouns participate. I'd like to single out one in particular, for which a pure event semantics looks promising

Discourse coherence relations hold between eventuality descriptions. Stativity is a key feature in delineating these relations (Altshuler 2021). These relations are traditionally studied intersententially, but they often apply intrasententially as well (Hobbs 2010, Sasaki and Altshuler 2023, Cohen and Kehler 2021: §3.2). The contrast in (i-ii) is a simple example suggesting that nouns as state predicates enter into coherence relations:

- (i) #He married his widow in 1960.
- (ii) He met his wife in 1960.

As Anscombe (1979) observes, the train of cause and effect is a feature not present in (i), but it is present in (ii). More specifically, in (ii) the meeting event led to the wife state, but in (i) the marrying event didn't lead to the widow state, even though it was a prerequisite for it.

10.2.1 On the status of individuals

There are no individual or object variables in our object language but individuals and their participation in eventualities loom large in our metalanguage. What conclusions can we draw from this? One might maintain that individuals and objects are psychologically real or metaphysically real and because they participate in states and events, we are able to talk about them by talking about the eventualities in which they participate. At the other extreme, one might hold the view that objects or individuals do not exist. The relation I've symbolized with ' \ominus ' is a primitive relation. Objects are just those cells in a partition of states induced by the \ominus relation that do not contain multiparticipant states, where 'multiparticipant' itself is defined in terms of the \ominus relation (§2.4.1). It is these reconstructed objects, familiar to speakers, that I've relied on to get across the \ominus -relation in terms of participation. To gain plausibility, this view calls for an account of the kinds of observations that form the basis for determining that two eventualities are in the \ominus -relation in other words for the ability to detect the \ominus relation.

10.2.2 Cognitive or perceptual basis for the mass count distinction

The label “mass noun” was originally chosen to reflect something about the denotations of non-count nouns. There are well-known correlations between properties of the elements of a noun’s denotation and its status as a mass or count noun (Gardelle 2016, Goddard 2010, Grimm 2018, Lauwers 2021, Wisniewski 2010, among many others, see Lasersohn 2011 for review)). Divisivity, cumulativity and continuity are examples of properties associated with mass noun denotations, discreteness and reference to objects are properties associated with count noun denotations. If the account of the mass-count distinction presented in §2.7 is correct, then to the extent that any of these correlations hold (Kulkarni et. al. 2020, Koslicki 2006), the relevant properties must be linked to the choice between a state with single participant versus one with multiple participants. These links would have to explain, for example, why a given property makes single participant states salient, encouraging the creation of names for those states. These links should also play a role in explaining why language learners are prompted to identify objects in the presence of descriptions of single participant states.

10.2.3 Noun states

Much of this paper can be read as an extended argument that nouns contain an argument position ranging over states or events, what James Higginbotham called an ‘E-position’. To fulfill the tasks required of them in the theory proposed here, the states satisfying E-positions in nouns must be such that they have one or more participants. I have assumed that these states have temporal duration, though I don’t think that was crucial. In the discussion of modification, I invoked a notion of ‘manifestation’ which relates states to effects they have on their environment. Also in the discussion of modification, there was an implication that states have intrinsic and extrinsic properties. An intrinsic adjective such as *edible* picks out states based on their intrinsic properties, while extrinsic *good* picks out states based on their extrinsic properties. A key feature of intrinsic predicates is that no two of them could hold of the same state. The aforementioned properties of states are clearly in need of further justification and clarification.

The theory presented here does not require states to be perceptible or to be located in space, yet in some of the literature perceptibility and spatiotemporal location are criteria for being an event or state (Maienborn 2005, 2011, 2019, 2020 and references therein). That literature develops a taxonomy of entities that satisfy E-positions in stative predicates based on a variety of linguistic diagnostics. I have not investigated whether there is an entity within that taxonomy that has the properties enumerated above. It might be that by embracing that taxonomy we make progress on the notions of manifestation and intrinsic predicates.

11 Appendix: [+minimal] and dual marking

This appendix provides a glimpse of the phenomena that lead to the idea of a composite dual (§7).

11.1 [+minimal] in a pronominal paradigm

The chart below is modeled on Nevins (2011:422)’s presentation of a similar paradigm in Ilokano.

(208) <i>Pronominal affixes for active verbs in Winnebago</i>			Lipkind(1945:§29), Noyer(1992:178), Harbour(2011a:226)		
	[+minimal]			[−minimal]	
[+auth, +addr]	hin-	‘I and you alone’	hin-	-wi	‘I and you and others’
[+auth, −addr]	ha-	‘I alone’	ha-	-wi	‘I and others’ (but not you)
[−auth, +addr]	ra-	‘you alone’	ra-	-wi	‘you and others’ (but not I)
[−auth, −addr]	∅	‘he, she, it’	∅-	-ire	‘they’

The person features [+auth, +addr] in the pronouns *hin-* and *hinwi-* apply to any set that includes the author, the addressee and possibly others. Then [±minimal] restrict the meaning further as in the glosses. [+auth, –addr] applies to any set that includes the author and excludes addressees.

11.2 Number in Hopi

(209) *Hopi*

Hale (1997:74)

- | | | | |
|----|---------------------|---------|----------|
| a. | Pam | wari | |
| | that | run.PFV | SINGULAR |
| | 'He/she ran' | | |
| b. | Puma | wari | |
| | those | run.PFV | DUAL |
| | 'They (two) ran' | | |
| c. | Puma | yùutu | |
| | those | run.PFV | PLURAL |
| | 'They (plural) ran' | | |

Compare the singular in (209)a and the plural in (209)c. The contrast between singular and plural is marked on the verb and on the pronoun. Now observe that for the dual in (209)b, the pronoun is like in (209)c and the verb is like in (209)a. Hale (1997) concluded that there are two ways to contrast singular and plural and that the dual is like the plural in one way and like the singular in the other way. Noyer (1992) then made use of the feature meanings discovered in research on pronominal systems to spell out what those two contrasts would be and to show that a language that had these features could with different combinations mark singular, plural and dual.

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