

# TWO SORTS OF BARE NOUNS IN BRAZILIAN PORTUGUESE

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It is a consensus in the literature that the so called Bare Singular (BS, from now on) in Brazilian Portuguese (BrP) is not semantically singular (Munn & Schmitt 1999, a.o.), but a number neutral count noun. In this paper, we explore the hypothesis that it is not a count noun. We reach such a conclusion by comparing the bare singular with both the bare mass noun and the bare plural count noun. We show that the behavior of the bare singular in BrP does not parallel that of the bare plural, but strongly parallels that of the bare mass noun. Based on such facts we propose that there are just two sorts of bare nouns in BrP: Bare Mass and Bare Plural. The Bare Mass denotes either the kind or a mass predicate, whereas the Bare Plural always denotes a plural predicate. These different semantics explain their different behavior. As conclusion, we show some unexpected results from our approach.

The outline of the paper is as follows. We begin by showing that the *prima facie* arguments against treating bare singulars as mass nouns are not valid. Our claims are based on the fact that the literature has compared bare singular nouns with non-atomic mass nouns, and has shown that they behave differently with respect to the relevant tests. However, comparing bare singulars with naturally atomic mass nouns such as *mobília* ‘furniture’ gives different results. We then show, in section

2, that the bare singular displays the same distributional restrictions as the bare mass noun both in episodic and generic contexts, a fact that, as far as we know, has gone unnoticed in the literature. This strengthens the case for treating them alike. In section 3 we give a semantics for mass nouns and count nouns in the framework of Rothstein 2010a, b which allows for a unified analysis of bare singulars and mass terms, that differs from that attributed to the bare plural. In section 4, we explain the data from earlier sections in the light of the analysis, and propose a semantics for bare plurals which explains their behavior in BrP. Finally, we also show that our account predicts that so called ‘bare singulars’ can occur with mass determiners, and we give arguments to show that this prediction is correct. Moreover its behavior in comparative contexts also supports our hypothesis that it is a mass.

## **1. Reciprocals, reflexives and distributivity**

In general the literature on the bare singular in BrP (Munn & Schmitt 2005, Schmitt & Munn 1999, Müller 2002 and Paraguassu & Müller 2008, Dobrovie-Sorin & Pires de Oliveira 2008), despite their different theoretical perspectives, takes for granted that the bare singular cannot be treated as mass, because the two forms do not show the same behavior with respect to individuating predicates: reciprocals, reflexives, and distributive predication. The accepted view in the literature is that the bare singular in BrP is a number neutral count term, so it does not behave like a mass noun. This is taken to support the rejection of Chierchia’s 1998 proposal that mass nouns denote atomic Boolean algebras, and the basis for the commitment to Link’s 1983 hypothesis that the mass domain is ontologically distinct from the count domain because it is atom-less.

These authors argue that the bare singular does not behave like bare mass nouns in contexts which ask for some sort of individuation or distributivity, as with reciprocals and reflexives. This result is expected

under the view the predicate must distribute over a set of atoms, and since mass nouns are not generated by sets of atoms, they are not compatible with these operations. On the other hand, it is argued that the bare singular, because it is associated with a count predicate (though number neutral) is generated by a set of atoms. This is illustrated by the examples in (1) and (2), from Munn & Schmitt 2005. Sentence (1) is fine, because *criança* ‘child’ is count. On the other hand, sentence (2) is ungrammatical. This is because the distributive predicate *pesa duas gramas* ‘weighs two grams’ cannot distribute over the bare mass noun *ouro* ‘gold’, since this substance has no atoms in its denotation. (Munn & Schmitt 2005, Schmitt & Munn 1999, also in Paraguassu & Müller 2008):

- (1) Criança (nessa idade) pesa 20 kg.  
 Child (at-this age) weighs 20 kilos.  
 “Children weigh 20 kilos at this age.”

- (2) \* Ouro pesa duas gramas  
 Gold weighs 2 grams.

Further supporting their claim, these authors argue that the same contrast shows up when we combine the bare singular and bare mass nouns with predicates like ‘one after the other’ that also distribute over individual atoms as exemplified below (all the examples are from Schmitt & Munn 1999):

- (3) Elefante cai um atrás do outro.  
 Elephant falls one behind of-the other.  
 “Elephants fall down one after the other”
- (4) \* Ouro cai um atrás do outro.  
 Gold falls one behind of-the other.  
 Intended meaning: “Pieces of gold fall down one after the other”.

The contrast exemplified in (3) and (4) is repeated when the reciprocal is in argument position. In (5) and (6), the reciprocal is fine with the countable bare singular, but not with bare mass nouns. Similarly, the cliticized reciprocal is acceptable with a bare singular subject argument. Schmitt & Munn 1999 argue that this is because the reciprocal must distribute over atomic individuals, and take it as evidence that the bare singular has atomic individuals in its denotation, whereas the mass noun does not.

- (5) Criança briga uma com a outra.  
Child fights one with the other.  
“Children fight with one another.”
- (6) \*Ouro realça um ao outro.  
Gold enhances one to the other.  
Intended meaning: “Pieces of gold enhance each other.”
- (7) Criança se lava sozinha.  
Child self alone  
“Children wash themselves alone.”<sup>1</sup>

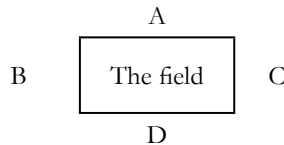
The examples discussed in the literature are all prototypical mass and count nouns, that is mass nouns which denote substances and count nouns which denote inherently individuable entities, that is objects where what counts as one N is part of the meaning of N. Thus gold does not come in natural units, but children do, since if you know the meaning of child, you should in the normal case know what counts as one child.

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<sup>1</sup> We did not find a plausible minimal contrast with (7) with a bare mass subject (and neither, apparently did Schmitt & Munn). We hypothesize that this is because typical mass nouns are non-animate, while *se* verbs typically ascribe some kind of animacy to their subjects. Thus the concatenation of a mass noun with a *se* reflexive is not felicitous independent of issues of atomicity.

However, as Rothstein 2010a argues, this prototypicality provides neither necessary nor sufficient conditions for characterising either mass or count terms semantically. There are mass nouns which denote sets of inherently indivisible entities, such as *furniture* and *silverware* (as argued by Gillon 1992 and Chierchia 1998) and there are count nouns which denote sets of entities where the choice of atoms is contextually determined, such as *fence* or *line*. For example, suppose Figure 1 represents the situation in which 4 farmers have land adjoining a common field, and they each build a fence between their land and the field on the relevant side. We call the four farmers A, B, C, and D:

FIGURE 1:



When we count the number of fences in Figure 1, we come to different numbers, depending on what we choose to count as “one fence”. Suppose we choose as “one fence”, the outcome of a minimal building-a-fence event. Since each farmer built a fence, there will be four fences, one on each side of the field. If, however, we assume that a continuous stretch of fencing counts as one fence, then there is only one fence which encloses the field. And if A and B jointly financed their fence-building from one source while C and D jointly financed their fence-building from a different source, then there are plausibly two fences. This variety of answers to the question “How many fences are there” is possible because *fence* is not a naturally atomic predicate, and the choice of what counts as one is contextually determined.<sup>2</sup>

<sup>2</sup> Rothstein 2010a shows that there may be different possible answers to the question “how many children are there in the room?”, but that this is because of borderline vagueness, or under-determinedness as to who is a child (whether or not a sixteen year-old counts as a child depends on context-dependent age-restrictions), and not because of under-determinedness as to what counts as ‘one.’

Rothstein 2010a argues that it is essential to distinguish *natural atomicity* from *semantic atomicity* (a claim we return to in section 5). Natural atomicity is a characteristic of predicates such as *furniture* and *child* which denote sets of inherently individuable entities and thus, naturally atomicity can in principle be a property of both mass and count predicates. Semantic atomicity, on the other hand, is a property of count nouns, which denote sets of atoms indexed for the context in which they count as atomic. Thus the contextual parameter is encoded grammatically. The set of atoms denoted by a naturally atomic count noun such as *child* (in English) may not vary from context to context in the same way that the denotation of *fence* varies, but since both are grammatically count nouns, the contextual parameter must be grammatically encoded in both cases. (We explain this in detail in section 3.) This theory allows for both non-prototypical mass and count nouns, i.e. naturally atomic mass nouns like *furniture* and *silverware*, and non-naturally atomic count nouns like *fence* and *line*. Rothstein 2010a shows that different grammatical operations may be sensitive to either natural atomicity or semantic atomicity or both.

On closer examination, we see that the effect of combining non-prototypical nouns, (naturally atomic mass nouns and non-naturally atomic count nouns) with reciprocals, reflexives and individuating predicates leads us to the conclusion that these predicates are sensitive not to the mass and count distinction, but to the distinction between naturally atomic and non-naturally atomic predicates. *Ouro* ‘gold’ is not naturally atomic, but *mobília* ‘furniture’ is naturally atomic, although a mass noun. *Criança* ‘child’ is naturally atomic, but *cerca* ‘fence’ or *reta* ‘line’ are not naturally atomic, although they are count in the sense that the stem may combine directly with plural morphology and numerals. The following examples show that bare mass nouns which are naturally atomic behave like bare count nouns with respect to distributivity, reflexivity and reciprocity, and while non-naturally atomic bare singulars pattern with non-naturally atomic mass nouns:<sup>3</sup>

<sup>3</sup> See de Braga *et al* 2010 for empirical evidences concerning the evaluation of native speakers of

- (8)
- a. Móvel (nesta loja) pesa 20 kilos.  
Furniture (in+this store) weighs 20 kilos.  
“Furniture (in this store) weighs 20 kilos.”
  - b. Bijuteria (nesta loja) custa 3 reais.  
Jewellery (in+this store) costs 3 reais.  
“Jewelry (in this store) costs 3 reais.”

Contrary to Schmitt & Munn 1999 and Paraguassu & Müller’s 2008 expectations, which we shall call the canonical view, sentence (8) is not ungrammatical, although *móvel* ‘furniture’ is mass. It is not ungrammatical because furniture has natural atoms; over which the predicate *pesa 20 kilos* distributes. The same reasoning explains its acceptability with reciprocals as indicated in (9):

- (9) Móvel (dessa marca) encaixa uma na outra.  
Furniture (of+this brand) fits one in+the other  
“Pieces of furniture (of this brand) fit into each other.”

On the other hand, *linha* ‘thread’ and *reta* ‘line’ are countable, but not naturally atomic, since what counts as one fence or one (piece of) line varies from context to context. As (10)-(11) show, they do not easily combine with distributive predicates and reciprocals, contrary to the predictions of the canonical view, although they are count nouns as (12) and (13) show:

- (10) ?? Cerca (nesse terreno) tem 2 metros.  
Fence (in+this property) has 2 meters.  
“Fences in this property has 2 meters”

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BrP with respect to these sentences. The authors shows that speakers do not behave as predicted by Schmitt & Munn 1999, since they accept bare mass nouns with distributive predicates given that the noun has natural atoms, and do not accept bare singular nouns with distributive predicates if the noun has no natural atoms.

- (11) ?? Reta cruza uma com a outra.  
 Line cross one with the other.  
 Intended meaning: “Stretches of line cross with each other.”
- (12) Tinha muitas cercas quebradas.  
 Has-imperfective many fences broken.  
 “There were many broken fences.”
- (13) Ele desenhou quatro retas numa página.  
 “He drew four lines on a page.”

These data show that there is good reason to reject the arguments of the canonical view that bare singulars are *prima facie* not mass nouns and allows us to reopen the question of whether bare singular are really mass nouns. In the following section we investigate this further and show that there are many parallels between them.

## 2. Distributional Parallelisms between bare mass nouns and bare singulars

In this section we examine various contexts in which the bare singular, the bare mass noun and the bare plural can be used, and we see that bare singulars behave more like bare mass nouns than like bare plurals both in terms of distribution and interpretation. First, we show that the bare plural is always ambiguous between a generic and an existential reading, whereas the bare singular and the bare mass noun are never ambiguous; both can only be interpreted generically. Then we show that both the bare singular and the bare mass noun show restrictions in where they can be used, in particular in combination with perfective aspect, whereas the bare plural show no such constraints.

Although it is controversial whether the bare singular can be in subject position of kind predicates (Schmitt & Munn 1999, a.o. argue



that it can, whereas Müller 2002 claims that it cannot), Pires de Oliveira *et. al* 2010 found empirical evidence in *corpora* analysis that at least for some dialects of BrP the bare singular combines with kind predicate. Thus, the first observation is that both the bare singular and the bare plural noun phrases can be the subject of generic sentences, in particular they may be in subject position of kind predicates like *estar em extinção* ‘to be in the verge of extinction’. However, they do not mean the same. (14) is ambiguous between the kind reading, where it asserts that all sub-kinds of whales, thus the *genus*, are on the verge of extinction, and the taxonomic reading, discussed in Krifka *et al.* 1995, in which the bare plural denotes a set of sub-kinds of whales and the sentence asserts that some sub-kinds of whales are in the verge of extinction (not the *genus*); a reading that is not available for the bare singular. The sentence in (15) does not have the interpretation of sub-kinds, it has only the kind/*genus* reading.

- (14) Baleias estão em extinção. (taxonomic / kind readings) Whales are in extinction.  
 “Whales (in general) are on the verge of extinction” OR  
 “Some kinds of whales are on the verge of extinction”
- (15) Baleia está em extinção. (only kind reading)  
 Whale is in extinction.  
 “Whales/the whale is on the verge of extinction.”

It is difficult to find unambiguously *genus*-level predicates which apply to mass nouns. Exteberria 2010 treats *to be abundant* as a *genus* predicate for mass. Suppose this is so. Sentence (16) shows exactly the same behavior as a kind predicate applied to a bare singular: in (16) we see that it can be applied only to the substance as a whole, and cannot be used to make an assertion about sub-kinds of the substance – like low quality oil, for instance:

- (16) *Petróleo é abundante nessa região.* (only kind reading)  
 Oil is abundant in+this area.  
 “Oil is abundant in this area.”

In subject position of a kind predicate, the bare mass noun, like the bare singular, only shows a kind reading.

The same contrast in interpretation appears when the bare noun phrases are in subject position of *invent*-passive sentences, as exemplified in (17):

- (17)
- a. *Computadores foram inventados por Babbage.*  
 (taxonomic / kind readings)  
 “Computers (in general) were invented by Babbage.”  
 “Some kinds of computers were invented by Babbage.”
  - b. *Computador foi inventado por Babbage.* (only kind reading)  
 “Computers (in general) were invented by Babbage”.
  - c. *Bronze foi inventado pelos sumérios.* (only kind reading)  
 “Bronze (the kind of substance) was invented by the Sumerians”.

However, a different type of contrast appears when we observe the object position of *invent* predicates. (18a), with a bare plural direct object, is acceptable and the bare plural is interpreted as denoting sub-kinds, types of computers.<sup>4</sup> However, sentences (18b), with the bare singular, and (18c), with a bare mass noun, are just ungrammatical:

- (18)
- a. *Babbage inventou computadores.*  
 (only taxonomic reading)  
 Babbage invented computers

<sup>4</sup> Krifka *et al.* 1995 argues that this is the only reading available for the comparable sentence in English.

- b. \* Babbage inventou computador.  
Babbage invented computer  
\* Os sumérios inventaram bronze.  
The Sumerian invented bronze

Thus the bare singular and the bare mass nouns pattern alike in that they cannot be the object of *invent* predicates.

In object position of dispositional predicates a parallel distinction occurs: the bare plural can have either a kind or an existential reading, while the bare singular and the mass noun have only a kind reading.

(19)

- a. João gosta de cachorros.  
(kind / existential readings)  
João likes of dogs.  
“João likes dogs in general” OR  
“João likes some individual dogs”.
- b. João gosta de cachorro (only kind)  
João like of dog.  
“João likes dogs”.
- c. João gosta de leite (only kind)  
João likes of milk  
“João likes milk.”

Following the same pattern, the famous English sentences about the firemen, brought about by Diesing 1992, also show the same contrast: the bare plural is ambiguous between an existential and a kind reading, whereas both the bare singular and the bare mass noun phrases only display a *genus* interpretation:

(20)

- a. Bombeiros são prestativos.  
(kind / existential readings)  
Firemen are helpful.  
“Firemen in general are helpful”  
OR “Some plumbers are helpful”
- b. Bombeiro é prestativo. (only kind reading)  
Firemen is helpful.  
“Firemen in general are helpful.”
- c. Petróleo é útil. (only kind reading)  
“Oil is useful.”

Schmitt & Munn 1999 observe that the bare plural when in object position of a sentence in which the subject is plural may give rise to “specific readings”, as exemplified below:

(21)

Os alunos estão procurando artigos de linguística para apresentar (ambiguous)  
The students are looking-for articles of linguistics to present  
“The students are looking for linguistics articles to present.”  
(Schmitt & Munn: 8, example (15a))

Sentence (21) is three ways ambiguous: (a) there are articles which all the students are looking for; (b) each student may have specific articles that she or he is looking for; and, (c) the students are all looking for unspecified linguistics articles. As the authors also observe, the bare singular only has the non-specific reading:

(22)

Os alunos estão procurando artigo de linguística para apresentar.

The students are looking-for article of linguistics to present  
“The students are looking for linguistics articles to present.”  
(Schmitt & Munn: 8, example (15b))

Although not noticed in the literature, the bare mass noun shows no ambiguity: *leite* ‘milk’ below only has non-specific reading:

- (23) Os alunos estão procurando leite para beber.  
The students are looking+for milk to drink.  
“The students are looking for milk to drink.”

In fact, it seems that both the bare singular and the bare mass cannot but have the non-specific reading, whereas the bare plural is ambiguous.

The last piece of evidence that the bare plural is ambiguous between kind and existential readings come from the contexts exemplified below. We should note beforehand that both the bare singular and the bare mass nouns only occur as subject of perfective predicates if the noun phrase is focalized. However, the contrast seems to be independent of the focus issue, because the bare plural subject *alunos* ‘students’ in (24), even if focused, is ambiguous between a quasi-universal and an existential reading; i.e. it may be understood as asserting either that students in general were on strike last year or that some students were on strike. Sentences (26) and (27), with the bare singular and the mass noun subjects respectively, only have a kind reading, i.e. the class of students was on strike, and the *genus* milk:

- (24) No ano passado, alunos<sub>F</sub> entraram em greve.  
(existential / “universal” readings)  
In+the year last, students entered in strike.  
“Last year, students (as a group) were on strike.”  
“Last year, some students were on strike.”

- (25) No ano passado, aluno<sub>F</sub> entrou em greve.  
 (only kind reading)  
 In+the year last, student entered in strike.  
 Only: “Last year, students were on strike.”
- (26) No ano passado, leite<sub>F</sub> desapareceu do mercado.  
 (only kind reading)  
 In+the year last, milk disappeared of+the market.  
 Only: “Last year, milk (in general) disappeared from the market.”

We now move to the constraints. As we have already said, another parallel between bare singular and mass nouns shows up in subject of positions of episodic sentences that are not about the kind. As Schmitt & Munn 1999 pointed out, (see also Doron 2003 for Modern Hebrew), the bare singular can freely occur in the subject position of generic sentences, but it cannot be the subject of episodic sentences, unless it gets a list interpretation or is focalized, as shown by (27a). This constraint does not apply to the bare plural; sentence (27b) is naturally grammatical:

- (27)
- a. ?? Mulher usou saia ontem.  
 Woman usedPerfective skirt yesterday.  
 “Women wore skirts yesterday.”
  - b. Mulheres usaram saia ontem.  
 Women usedPerfective skirt yesterday.  
 “Women wore skirts yesterday.”

There are two issues left unnoticed in the literature: (i) the constraint disappears as soon as a kind reading is available, as showed below in (28), where the modification of the adverb denotes a time span that allows for a kind reading. The same modification with the BP gives rise to a ambiguous reading: the bare plural may be interpreted either generically or existentially, i.e. as an assertion about some women who used to wear skirts:

(28)

- a. Mulher usou saia na década de 30. (only kind)  
 Woman used<sub>Perfective</sub> skirt in+the decade of 30.  
 “Women wore skirts in the 30’s.”
- b. Mulheres usaram saia na década de 30.  
 (kind / existential interpretations)  
 Women used<sub>Perfective</sub> skirt in+the decade of 30.  
 “Women wore skirts in the 30’s.”  
 “Women in general wore skirts in the 30’s” or “Some women wore skirts in the 30’s.”

(ii) the bare mass noun shows the same restriction as the bare singular: it cannot be in the subject position of episodic sentences, unless it is focalized or receives a list interpretation, (29a), though it is plainly fine in the subject position of generic sentences, as shown by (29b) and (29c) respectively:

(29)

- a. ?? Cerveja custou caro.  
 Bier cost<sub>Perfective</sub> expensive  
 “Bier was expensive”.
- b. Cerveja custa caro. (kind reading)  
 Bier costs expensive.  
 “Bier is expensive.”

- c. Cerveja custava caro na década de 30.  
 (only kind reading)  
 Bier cost<sub>Imperfective</sub> expensive in+the decade of 30.  
 “Bier used to be expensive in the 30’s.”

Thus, it seems that neither the bare singular nor the bare plural may combine with episodic events, unless they are about the *genus*, as shown below; once again the bare plural is ambiguous between sub-kinds and kind readings, as shown in (30c):

- (30)
- a. Cavalo entrou no Brasil com os portugueses.  
 (only kind)  
 Horse entered<sub>Perfective</sub> in+the Brazil with the+plural  
 portugueses  
 “Horses arrived in Brazil with the Portuguese.”
- b. Arroz entrou no Brasil com a imigração japonesa.  
 (only kind)  
 Rice entered<sub>Perfective</sub> in+the Brazil with the immigration  
 Japanese.  
 “Rice arrived in Brazil with the Japanese immigration.”
- c. Cavalos entraram no Brasil com os portugueses.  
 (taxonomic / kind)  
 Horses entered<sub>Perfective</sub> in+the Brazil with the+plural  
 portugueses  
 “Horses arrived in Brazil with the Portuguese.”

Let us summarize what the above data shows us: (i) the BP is always ambiguous between kind and existential readings; (ii) the bare singular and the bare mass always denote the kind; (iii) only the BP may be the subject of episodic sentences that are not about the kind; (iv) only the BP is ambiguous between specific and non-specific readings, the bare singular and the bare mass are always non-specific.



### 3. Rothstein's approach to mass and count nouns

The claim that bare singulars in many languages are best treated as mass nouns denoting kind terms was made in Rothstein 2010b. In this section we present a summary of the theory of the mass/count distinction elaborated there, which is itself based on Rothstein 2010a. In section 4 we will use this theory to explain the data presented in the previous two sections.

Rothstein 2010a, b assumes, following Chierchia 1998, that nominals are interpreted with respect to a complete atomic Boolean algebra  $M$ . Intuitively,  $M$  is the mass domain.  $U_M$ , the sum operation on  $M$ , is the complete Boolean join operation i.e. for every  $X \subseteq M$ :  $U_M X \in M$ . ( $\subseteq_M$  is the part of relation on  $M$ ). The set of atoms  $A$  of  $M$  is not fully specified, but may remain vague<sup>5</sup>. All nominals are associated with an abstract root noun, which denotes  $N_{\text{root}}$  a subset of  $M$ . More precisely,  $N_{\text{root}}$  is the Boolean algebra generated under  $U_M$  from a set of atoms  $A_N \subseteq M$  (so root noun denotation  $N_{\text{root}}$  has the same 0 as  $M$ , its atoms are  $A_N$ , and its 1 is  $U_M(A_N)$ ). Root nouns are thus lexically plural in Chierchia's sense.

However, root nouns, never appear as lexical items.<sup>6</sup> Mass noun and count noun denotations are derived from root noun meanings. Mass nouns denote  $\cap N_{\text{root}}$ , i.e. the kind associated with  $N_{\text{root}}$ . Following Chierchia 1998, kinds are defined via the maximal entity in the denotation of  $N_{\text{root}}$ . They are functions from worlds/situations onto the maximal entity instantiating  $N_{\text{root}}$  in that world/situation. Thus for any  $N_{\text{root}}$  and world/situation  $w$  the following holds:

$$(31) \quad \cap N_{\text{root}} = \lambda w. U_{\neg_M}(N_{\text{root},w})$$

<sup>5</sup> Rothstein (2010a) points out nothing hangs on this choice and that the theory can be adapted to fit different accounts of mass semantics.

<sup>6</sup> Note that in this respect Rothstein (2010b) differs from Rothstein (2010a). In the latter paper, mass noun denotations are identical to root noun denotations i.e. they are predicates. Rothstein (2010b) argues that mass nouns denote kinds. In this paper, we follow Rothstein (2010b).

Since we can restrict ourselves to extensional contexts in this paper, we can assume that the denotation of a kind term is  $(^{\cap}N_{\text{root}})(w_0)$  (with  $w_0$  the world of evaluation). Kind terms are thus expressions denoting individual entities of type **k**.

(32) Mass nouns:

a. the denotation of a mass noun is

$$N_{\text{mass}} = \text{MASS}(N_{\text{root}}) = (^{\cap}N_{\text{root}})(w_0)$$

b.  $\cup$  is the function from kind(-extensions) to sets of individuals such that for every kind(-extension)

$$d(w_0): \cup(d(w_0)) = \lambda x. x \subseteq_M d(w_0)$$

Fact: for every root noun  $N_{\text{root}}: \cup(^{\cap}N_{\text{root}}(w_0)) = N_{\text{root}}$

So mass nouns denote the kind associated with the root noun, while the predicative use of a mass noun can be recovered by the  $\cup$  function. The  $\cup$  function, when applied to the kind term, will give back the original meaning of the root noun, i.e. the set of instantiations of the kind term in  $w$ .

Count nouns differ from mass nouns because they allow direct grammatical counting. Rothstein (2010a) argues that counting entities is dependent on a contextually determined choice as to what counts as one entity. As we saw in section 2, this is shown by nouns such as *fence*, *wall* and *bouquet*, which are count nouns and therefore must denote sets of countable atoms, but which nonetheless denote different sets of atoms depending on context.

The choice of what counts as one entity is encoded the notion of (counting) context  $k$ :

(33) A **context**  $k$  is a set of objects from  $M$ ,  $k \subseteq M$ ,  $K$  is the set of all contexts.

The set of count atoms determined by context  $k$  is the set  $A_k = \{ \langle d, k \rangle : d \in k \}$

Singular count nouns are derived from root nouns by a count operation  $COUNT_{k \rightarrow \neg \neg \neg}$  which applies to the root noun meaning  $N_{root}$  and picks out the set of ordered pairs

$\{ \langle d, k \rangle : d \in N \cap k \}$ , i.e. the set of entities in  $N_{root}$  which count as one in context  $k$ .

- (34) For any  $X \subseteq M$ :  $COUNT_k(X) = \{ \langle d, k \rangle : d \in X \cap k \}$   
 The interpretation of a count noun  $N_{count}$  in context  $k$  is:  
 $COUNT_k(N_{root})$ .

$N_k$  is the count noun denotation derived by  $COUNT_k(N_{root})$ . Plural count nouns are derived by applying the standard plural operation to the first projection of  $N_k$ . “The  $n$ -th projection of  $N_k$ ” is defined using the  $\pi$  function as in (41). PL applied to  $N_k$  is defined in (42):

- (35)  $\pi_1(N_{k \rightarrow}) = \{ d : \langle d, k \rangle \in N_k \}$   
 $\pi_2(N_{k \rightarrow}) = k$

- (36) In default context  $k$ :  $PL(N_{count}) = *N_k = \{ \langle d, k \rangle : d \in * \pi_1(N_{k \rightarrow}) \}$

Examples:  $STONE_{mass} = MASS(STONE_{root}) = \cap STONE_{root}$   
 $= \mathbf{stone}$   
 $STONE_{count} = COUNT_k(STONE_{root})$   
 $= \{ \langle d, k \rangle : d \in STONE_{root} \cap k \}$

So  $STONE_{mass}$  and  $STONE_{count}$  are different kinds of entities in  $w_o$  and are of different types.  $STONE_{mass}$  denotes the kind in  $w_o$ , type **d** i.e. the maximal quantity of stone in  $w_o$ .  $STONE_{count}$  denotes a set  $\{ \langle d, k \rangle : d \in STONE_{root} \cap k \}$  of type  $\langle dxk, t \rangle$  i.e. the set of indexed entities

which count as one in context  $k$ . We see that crucially root, mass and count terms are of different types. Root terms denote subsets of  $M$  and are of type  $\langle d, t \rangle$ . Mass terms denote kinds and are of type  $d$ . Predicates derived from mass terms via  $\cup$  are of type  $\langle d, t \rangle$ , and have denotations equivalent to root nouns. Count terms, which denote sets of pairs in  $M \times K$ , are of type  $\langle dxk, t \rangle$ .

One of the advantages of this theory, as argued by Rothstein (2010a, b), is that it allows us to distinguish between *natural atomicity* and *semantic atomicity*. *Semantically atomic predicates* are the denotations of singular count predicates. i.e. sets of pairs  $\langle d, k \rangle$ . These are sets of indexed entities bearing the identical index indicating the context in which they count as one. *Naturally atomic predicates* are predicates which denote sets of inherently individuable entities. These sets may be either singular or plural (where the plurality maybe either lexical or grammatical). A set denoted by a naturally atomic predicate is a naturally atomic set. A singular naturally atomic predicate denotes a set of inherently individuable singularities, while a plural naturally atomic predicate denotes a set generated under sum from a naturally atomic set of singularities. Naturally atomic mass nouns and naturally atomic count nouns are defined as follows: A mass noun denoting the kind  $\cap N_{\text{root}}$  is naturally atomic if the  $N_{\text{root}}$  it is derived from is naturally atomic. A count noun denoting  $N_k$  (or  $*N_k$ ) is naturally atomic if  $\pi_1(N_k)$  or  $\pi_1(*N_k)$  is naturally atomic.

In a mass/count language such as English canonical mass nouns such as *water* and *mud* are not naturally atomic, but some mass nouns such as *furniture*, *cutlery*, *jewellery*, *company* are naturally atomic. Conversely, many count nouns are naturally atomic, but some count nouns are not naturally atomic. Examples of these were noted in Mittwoch 1988, Krifka 1992, Rothstein 1999, 2004, 2010a, and include *fence*, *wall*, *lawn*, *sequence*, *line*, *plane*, *twig*. As Rothstein 2010a argues, both natural and semantic atomicity are grammatically relevant for quantity judgment, for certain distributive predicate and for some instances of anaphora. To give just one example here, Rothstein 2010a shows that *big* distributes over natural atoms of furniture when predicated of mass nouns.

(37)

- a. The furniture in our house is big.
- b. In a department store: “The big furniture is on the third floor.”
- c. To movers who are emptying the house: “Take the big furniture down first, please”
- d. “Don’t buy big furniture; the stairs are too narrow to carry it up”.
- e. “Baggage in excess of 70 pounds (32 kilograms) or 115 linear inches (292cm) (total length + width + height) will not be accepted as checked baggage.” (www.continental.com: excess baggage).

Rothstein (2010b) argues that in the default case in English either the rule deriving mass nouns applies to  $N_{\text{root}}$  or the rule deriving count nouns applies to  $N_{\text{root}}$ , but not both. This is formulated in (39):

(38)

*Default principle of exclusive choice for lexical noun derivation (for English):*

Either  $\text{COUNT}_k$  or MASS applies to a root noun, but not both.

In a limited set of cases, namely with foodstuffs such as apple and substances such as stone both rules may apply, and in these cases the language has both mass and count forms of the same root lexeme. Rothstein (2010b) suggests that languages vary as to whether the default principle set out in (38) applies. She suggests that if a language generally allows bare singulars alongside count predicates, this is because the principle in (38) does not apply. Bare singulars are thus mass nouns, which are derived alongside the count form of the lexeme. Brazilian

Portuguese is a good example of such language. On this account, bare singulars in Brazilian Portuguese denote kind terms (just as other mass nouns do). Thus the mass form of *menino* is hypothesized to have the denotation  $\cap \text{BOY}$ , while the count nominal denotes the set of ordered pairs  $\{ \langle x, k \rangle : x \in \text{BOY} \cap k \}$ .

In the following section, we show how this semantic analysis explains the properties of bare singulars in Brazilian Portuguese that we discussed in sections 1 and 2.

#### 4. First steps into understanding the Brazilian data

It is not our aim to present an exhaustive explanation for the behavior of Brazilian Bare Noun Phrases; in particular, we shall not deal extensively with the object position. But rather to explore a new explanation which relies on the hypothesis there are just two sorts of bare nouns in BrP: Bare Mass nouns and bare plurals. We will see in the next section that this hypothesis leads to surprising correct predictions. In this section, we show how an explanation for the facts raised in sections 1 and 2 may be explained taking Rothstein's as starting point.

Let us begin by explaining the data discussed on section 1, where we showed that the predictions of the 'canonical view', according to which distributive predicates – reciprocals, reflexives and distributive predicates like *pesar 20 kg* 'to weight 20 kg' - were to combine only with bare singulars, because only they have atoms, were not confirmed if we consider non-prototypical count and mass nouns. Distributive predicates do not combine naturally with count nouns that have no natural atoms such as *cerca* 'fence', and bare mass nouns that have atoms - *mobília* 'furniture' for instance - are acceptable when they are combined with individuating predicates, contrary to the predictions of the canonical view. These findings give support to Rothstein's hypothesis that natural atomicity should be kept apart from semantic (grammatical) atomicity, and that it plays a role in grammar. As it was already said, naturally

atomic predicates denote sets of inherently individuable entities, whereas semantic atomicity is the characterizing property of a count expression, i.e. an expression of type  $\langle dxk, t \rangle$ .

Now, since what was called bare singulars were build from count nouns, which are prototically naturally atomic, they naturally fit as arguments of these distributive predicates. But since canonical mass nouns such as *mobília* ‘furniture’ are equally felicitous as arguments of these predicates, this cannot be evidence that the bare singulars are not mass. And, as we saw in (10) and (11), non-naturally atomic bare singular correlates of count nouns do not take distributive predicates. This further supports the claim that co-occurrence with distributive predicates distinguishes between naturally atomic and non-naturally atomic nouns and not between mass and non-mass expressions. Note, by the way, that there is cross linguistic variation as to whether these distributive predicates are sensitive to natural or semantic atomicity. In Brazilian Portuguese reciprocals are sensitive to natural atomicity as well as semantic atomicity, and (9), repeated here, is acceptable. In English, reciprocals allow only semantically atomic expressions as their antecedents. The correlate of (9), given in (39a) is ungrammatical, while (39b) is perfectly acceptable.

(9)

Mobília (dessa marca) encaixa uma na outra.  
 Furniture (of+this brand) fits one in+the other  
 “Pieces of furniture (of this brand) fit into each other.”

(39)

- a. \*Furniture is stacked on top of each other.
- b. Pieces of furniture/chairs were stacked on top of each other.

These data show that there is no foundation for the generalization that bare singulars are atomic while bare mass nouns are not, and this means that while distributivity is sensitive to (natural) atomicity, it does

not distinguish between bare mass and bare singular expressions, and thus there is no *prima facie* reason for treating them as separate classes of expressions.

We turn now to the data presented in section 2 that may be summarized as: (i) the BP is always ambiguous between kind and existential readings – including taxonomic readings are some sort of existential; (ii) the BP is ambiguous between specific and non-specific readings; (iii) the bare mass and the singular always denote the kind; and finally (iv) they are never specific. Before presenting our hypothesis we should make clear that many issues will be raised here that will not be discussed, since our aim is just to sketch a possible solution.

In order to explain our facts we have to assume an asymmetry between the external argument position and the internal argument position. This is a hypothesis widely assumed by several authors: for instance, Kratzer's neodavidsonian approach to the agency or Carlson's (2003) claim that weak determiners cannot be in the external argument position. Our hypothesis is that the bare mass noun phrases, when in external position, i.e. a position that is adjoined, always denote the kind via the application of the down operator. Thus, the only individual a bare mass noun can denote as a kind. As formally stated in (31), the down operator applies to the root noun, and results in the maximal sum in each world. *Baleia*<sub>root</sub> 'whale' denotes the set of whales that is not atomically specified, i.e. it does not have semantic atoms, though it does have natural atoms. The down operator applies  $\cap$  *Baleia*<sub>root</sub> and denotes for every world the maximal entity instantiating the whale property in that world. The same derivation applies to a root noun as *Petróleo*<sub>root</sub> 'oil': it denotes the set of non-atomic individuals; the down operator applies to it resulting in the intensional individual, the kind Oil. Thus, the bare singular and the bare mass noun phrases denote intensional individuals, type  $\langle s, d \rangle$ , a function from worlds to the maximal sum in each world, when they are agents. They are in Carlson's 1977a, b terms proper names; they rigidly designate the kind.



If this is so, we immediately explain that they may combine with kind predicates such as *estar extinto* ‘to be extinct’, as in example (15), and *ser abundante* ‘to be abundant’, in example (16). The same reasoning applies to the examples (17b) and (17c) where the bare mass nouns are names of kinds, because they are in subject position of *invent* passive sentences. The examples in (20) – the firemen cases – show that the bare mass nouns cannot have existential readings. When in the position of agency, bare mass nouns can only denote the kind. Thus, we explain why in contexts as exemplified by the sentences in (20) only the kind reading is available. If the predicate is not about the kind, the bare mass is blocked, because there is a crash between the predicate which is about the specimens, and the subject which denotes the kind. This is the explanation for the behavior of the bare mass nouns when in episodic sentences that are not about the kind, as exemplified in sentences (27a) and (29a). The bare nouns in these examples are in external argument position, so they can only denote kind entities, but the predicates ask for stage level individuals, i.e. specimens, and the acceptability of the sentence is blocked. As soon as the predicate is raised to the kind level, the sentence is fine. Focus seems then to be a way of raising the predicate to the kind level, an issue we will leave aside.

In internal argument position the bare mass noun denotes a mass predicate, i.e. a predicate that denotes a lattice without semantic atoms. We propose that this is the reason why the bare mass noun cannot be in object position of *invent* predicates: when in object position they are mass predicates, and as such they cannot denote a particular entity; though they may denote a set of instantiations of the kind. We are thus proposing that the Bare Mass either denotes the individual kind or it denotes a mass predicate, by which we mean a predicate that has no semantic atoms. The main issue with this approach is the examples in (19) with dispositional predicates, which could be understood as counter-examples to our explanation. However, if Kratzer’s suggestion that dispositional predicates allow the scrambling of their object in

the logical form is correct, then the bare mass nouns are not in object position, but rather in an external position, where they must denote an individual, and the only individual they can denote is the kind. Thus, the only option is that the bare mass denotes the kind. And this is precisely the interpretation that we have for (19b) and (19c).

Thus, our proposal is that when in internal argument positions, the bare mass nouns are property denoting expressions, as such they undergo some type of incorporation; thus, they cannot denote a particular individual. In (22) and (23) the students are in an activity of ‘linguistic-papers-searching, and of ‘milk-searching’. They undergo incorporation because they denote a predicate where no operation of semantically individuation has taken place.

Let us explain the distinct behavior of the bare plural. The generalization is that the bare plural is always ambiguous between kind and existential readings, understanding taxonomic readings as some sort of existential reading. We propose that the bare plural always denotes a plural predicate. The derivational process that gives raise to the bare plural in Brazilian Portuguese relies on a contextual operation of constituting a semantic individual, that is, an individual that counts as a unit. The count operation applies to the root noun if there is a contextually given unit, as stated from (33) to (35). We saw on section 3 that the singular predicate is engendered by pairing a contextual unit and an individual. Thus, its type is  $\langle dxk, t \rangle$ , where  $k$  is the contextually given unit. Semantic atoms are then indexed individuals. A pluralized predicate, like *meninos* ‘boys’, denotes the set of indexed plural individual. Now an operation of type shifting must apply so that the bare plural may be in argument position. Since the plural predicate is constituted of indexed individuals, all the operators may apply. Applying the down operator will give us the kind interpretation. Existential closure explains their existential interpretations. The BP may have stage level interpretations when in subject positions because it denotes a set of semantic individuals that may occupy the external position. Thus, there are two alternative: either

the down operator applies resulting in the maximal sum of individuals, the kind, or the up operator applies to the indexed individuals, and the result is the existential reading. This is indeed a good result, because it explains the data presented in section 2. As we have seen throughout the examples, the bare plural in Brazilian Portuguese may denote the kind or it may have existential interpretations. Moreover it explains why the bare plural shows no restriction with respect to being in the subject position of episodic predicates. In such contexts, it will denote indexed individuals, an alternative that is blocked for the bare singular and the bare mass because they do not have semantic atoms in their denotations.

## 5. Some Surprising Predictions

In this section we will further explore our proposal, showing that it correctly predicts some facts that were not even noticed in the literature. We shall explore two data: (i) the combination of the bare singular with mass quantifier, a surprising fact given that the literature has always claimed that the bare singular is bare; (ii), the bare singular in comparative sentences.

The literature on bare singular has always stressed that it is bare, that it always show up without any quantifier. This is the reason why it is said to be bare. Nonetheless, if our hypothesis is sound, and the bare singular is mass, then we expect that it may be under the scope of mass quantifiers. In Brazilian Portuguese, mass nouns combine with *muito*/*muita* ‘much’, whereas plural count nouns only combine with *muitos*/*muitas* ‘many’:

(40)

- a. *Tinha muito óleo na maionese.*  
*Had<sub>imperfective</sub> much oil in+the mayonnaise*  
 “There was too much oil in the mayonnaise.”

- b. *Tinha muitos/\*muito alunos na sala.*  
 Had<sub>imperfective</sub> many/much students in+the room.  
 “There were too many students in the room.”

*Muito* always agrees with its complement in gender and number. When it takes a bare plural form it agrees in gender and is marked plural. With the bare singular it agrees with the complement in gender and there is no surface mark of plurality. However, the predicate cannot be singular, because *muito* cannot apply to a semantic atom. Thus, the only possibility is that the predicate is a root noun.

In order to ask for quantities, BrP uses the *wh*-expressions *quanto* or *quantos*: *quanto* ‘how much’ is used with mass predicates, whereas *quantos* ‘how many’ appears with plural count nouns:

- (41)
- a. *Quanto óleo vai na massa?*  
 How oil goes in+the dough  
 “How much oil goes in the dough?”
  - b. *Quantos livros ele comprou?*  
 Hows books he bought  
 “How many books did he buy?”

But we also have *quanto* with the bare singular, which again cannot be the singular predicate, thus it must be the root noun.

Consider now the following context: João is travelling and has a huge amount of books on his hands. His mother can make the following remarks:

- (42)
- a. *Quanto livro você acha que pode levar!?*  
 Much book you think that can to carry  
 Intended meaning: “What quantity of book can you carry?”

- b. É muito livro pra você levar.  
 Is much book for you to carry?  
 Intended meaning: “The volume of books is too much for you to carry.”

In (42a) the mother is commenting on the volume of book that he is carrying, not on the cardinality of books. The sentence may be true even if he has few books, provided that the books are thick or heavy. Her comment in (42b) is also about the volume, the weight of the books is too much for him to carry. Here again, (42b) may be true in a situation where he has only few books but they are all very heavy.

In contrast with (42a), the sentence in (41b) cannot but be about the number of books that he bought; it cannot be about the volume. The same restriction appears with *muitos* ‘many’. The sentence below is only about the units of books; it is then false in a situation in which he has bought few books, even if they are thick ones:

- (43) João comprou muitos livros.  
 João bought<sub>perfective</sub> many books.  
 “João has bought many books.”

On the other hand, sentence (44) may be used to ask the volume or the weight of the books, as when we buy books by kilo:

- (44) ?? Quanto livro você comprou?  
 How book you bought<sub>perfective</sub>.  
 Intended meaning: What quantity of books did you buy?”

Thus, contrary to the traditional view, the bare singular does not always have to be bare, but it can occur with mass quantifiers, a prediction of our theory.

Another unnoticed fact in the literature about the bare singular which also supports our approach is that the bare singular may appear with a partitive preposition, which cannot occur with the bare plural, but may with the bare mass:

(45)

- a. Quanto de livro eu posso carregar?<sup>7</sup>  
How of book I can carry  
Intended meaning: “What quantity of book can I carry?”
- b. Quanto de leite eu ponho no bolo?  
How of milk I put in+the cake  
“How much milk should I put in the cake?”
- c. \* Quanto de livros eu posso carregar?  
How of books I can carry

Finally, we shall comment on the behavior of the bare singular in comparison sentences. Bale & Barner 2009 argue that the best test to distinguish mass from count nouns is their behavior in comparison sentences: comparing count nouns amounts to comparing the cardinality, whereas mass nouns may access different scales. Comparing *mobília* ‘furniture’, for instance, may be comparing the volume or the number of pieces, because furniture has natural atoms; whereas comparing *meninos* ‘boys’ can only be a comparison of cardinalities. The comparative judgments shift according to the syntactic status of the noun as mass or count. Given our hypothesis we expect that the bare singular behaves like mass: it may be interpreted as comparing units or as comparing according to some other dimension.

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<sup>7</sup> These uses are attested in corpora: O quanto de livro se escreveu e vendeu, ou, quantas pregações se realizaram nos meios de comunicação ou fora deles.  
<<http://www.guiame.com.br/v4/11832-1526-Coluna-Pr-Heliel-Carvalho-Arrependi-vos.html>>

(46)

- a. Esse jardim tem mais pedra do que aquele.  
This garden has more stone of+the that other.  
“This garden has more stone than the other one.”
- b. João tem mais corda que Pedro.  
João has more rope than Pedro.  
“João has more rope than Pedro.”

(46a) may be interpreted as stating that the volume of stones in one garden is greater than in the other or that there are more units of stones in one garden than in the other. The ambiguity disappears with the bare plural which can only be interpreted as comparing number of units – example (47a). (46b) may be true in two different situations: if João has more units of ropes than Pedro has or if the length of the rope that João has is wider than the length of Pedro’s rope. Here again there is no ambiguity with the bare plural: (46b) compares the number of units that they have:

(47)

- a. Esse jardim tem mais pedras do que aquele.  
This garden has more stones of+the that other.  
“This garden has more stones than the other one.”
- b. João tem mais cordas que Pedro.  
João has more rope than Pedro.  
“João has more rope than Pedro.”

As our theory predicts, the bare singular behaves like mass: it may access different scales. Another argument to show the same conclusion is that people may disagree about the interpretation of a comparative sentence when it has a bare singular. Suppose two fishermen go to a store to buy living earthworms for fishing, and they are comparing cans with living worms:

(48)

- a. Essa lata tem mais minhoca do que aquela.  
This can has more earthworm of+the that that.  
“This can has more quantity of earthworm than tha one.”
- b. Não. Essa tem 10 e aquela tem 12 minhocas.  
No, this has 10 and that has 12 earthworms.  
“No, this can has 10, and the other one has 12 earthworms.”
- c. Mas essa pesa mais.  
But this weights more  
“But this one is heavier.”

If Bale & Barnes are correct, the bare singular behaves like mass, as expected by our approach.

## Conclusion

The aim of this paper was to explain the distributional parallelisms between the bare singular and the bare mass noun in contrast with the bare plural, which were so far unnoticed in the literature. We rejected the canonical view according to which the bare singular is not mass because they do not behave alike in distributive contexts. We have shown that the canonical generalization according to which the bare singular is acceptable in such contexts whereas the bare mass is not does not hold when non prototypical mass and count nouns are taken into consideration. Mass nouns which denote sets of natural individuals behave like count nouns: they are acceptable with distributive predicates. On the other side, atomless count nouns behave as mass: they are rejected in such contexts. The contrast between prototypical bare singulars and bare mass nouns in distributive contexts is explained by the speakers' sensitivity to natural atomicity.



In section 2, we presented several distributional parallelisms between the bare singular and the bare mass noun and showed that the bare plural does not have the same behavior. The empirical generalization is that the bare singular and the bare mass noun always denote the kind, whereas the bare plural is ambiguous between a kind or an existential interpretation. Based on Rothstein 2010a, b our proposal is that the bare singular and the bare mass always denote the kind: the root noun is lowered to an intensional individual via the down operator. Since the root nouns do not denote indexed individuals, they cannot be in the external argument position. The bare singular and the bare mass only denote kind. This explains why the bare singular and the bare mass noun cannot occur in episodic contexts, unless the predicate is about the kind. The derivation of the bare plural explains the fact that it may have existential interpretations: it is derived from the singular predicate, which denotes indexed atomic individuals. Since it denotes indexed individuals, it may be in the external argument position. We have briefly argued that the bare singular and the bare mass in object position are predicates, which are interpreted as denoting instantiations of the kind.

Finally, in the last section we showed that our theory predicts correctly two facts: (i) contrary to what is taken for granted in the literature, the bare singular is not always bare, it may be bound by mass quantifiers, and (ii) in comparative sentences, the bare singular behaves as mass, since it does not necessarily access the cardinal scale.

Our analysis has raised at least as many questions as we have answered, and central among them is the question of the relation between perfective aspect, episodic event predicates and the interpretation of bare nouns. We leave these questions for further research.

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