

**Atomicity Revisited:  
Discrepancies in  
Logical Analyses of Plural Number**

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# Outline

**Introduction**

**2. Morphosyntactic Criteria for Count and Mass**

**3. The Semantics of Count and Mass**

**4. The Problem**

**A Brief Excursus: BECL**

**5. Annotation Insights**

**6. Corpus Investigations**

**Conclusion and Further Work**

# Introduction

**Count and Mass as properties are normally analyzed at a two-dimensional scale:**

- 1. Based on the morphosyntactic behavior of a specific noun**
- 2. By assumed semantic key properties**

**→ the latter is often used as the hypothetical basis for classifying count and mass nouns**

## 2. Morphosyntactic Criteria for Count and Mass

	Count Nouns	Mass Nouns
<b>Numeral Modifiers</b>	four cars, five books	* three water, *ten sand
<b>Plural Morphology</b>	cars, books	*waters, *sands
<b>Classifier Phrases</b>	*two pieces of car	three pieces of furniture, three bottles of wine
<b><i>each/ every/ a few/ several/ many</i></b>	each/ every/ a book, several/ few books	*each/ few water
<b><i>a little/ much/ more</i></b>	*little/much car, pencil, book	little/ much water, sand, furniture
<b><i>a lot of/ plenty</i></b>	a lot/ plenty of cars, books *a plenty of car, book	a lot/ plenty of water, furniture
<b><i>some/ the</i></b>	the/ some car(s), book(s)	the/ some water, furniture
<b>Indefinite Article</b>	a car, a book	*a water, *a furniture

## 2. Morphosyntactic Criteria for Count and Mass

Although these criteria are mostly agreed upon in the literature, the observed data shows a certain degree of variation

→ morphosyntactic criteria may not indicate a purely binary distinction of mass and count

→ The impression might root from the investigation of only small sets of data (celebrity nouns) that does not reflect the full range of the continuum

## 2. Morphosyntactic Criteria for Count and Mass

Prominent examples for this claim:

**Dual-Life Nouns** and so-called “**fence-like**” nouns

### (1) Dual-Life

- a. drink a beer / eat a cake (count)
- b. drink beer /eat cake (mass)

### (2) “fence-like” nouns

- a. five fences/ a hedge
- b. 3km of fence / 100 yards of hedge

## 2. Morphosyntactic Criteria for Count and Mass

### Another factor:

The countability preference of a noun might be influenced by polysemy or homonymy and therefore be based on its sense, not on its lemma

(3)

- a. fruitcake#1 a whimsically eccentric person.  
(count)
- b. fruitcake#2 a rich cake containing dried fruit and nuts and citrus peel and so on (mass)
- c. genius#3 a quality that makes someone be excellent at many Things (mass)
- d. genius#2 a person that excelles in many fields (count)

### 3. The Semantics of Mass and Count Nouns

#### Semantic Proposals:

Finding the basis for Count and Mass based on properties of their denotation

**Key feature: *Atomicity* – as opposed to *Homogeneity***

→ Count and Mass are analyzed in terms of denoting or not denoting atomic parts or as having lexically *accessible* atomic parts (cf. Link, 1983; Chierchia, 1998; Rothstein, 2010)

### 3. The Semantics of Mass and Count Nouns

Formal representation distinguishes three types of nouns:

**(a) Count Nouns**

that are in singular form which refer to one entity and have a plural counterpart (*a clock, a pencil*)

**(b) Count Nouns**

that are in plural form which refer to more than one entity and have a singular counterpart (*clocks, pencils*)

**(c) Mass Nouns**

that are in singular form, have no plural counterpart and refer to stuff or aggregates of things (*sand, water, mud*)



### 3. The Semantics of Mass and Count Nouns

#### Mass Nouns:

do not have a singular/plural alternation.

→ in this framework, they are like plural count nouns, but: their atoms are assumed vague because they are lexically not accessible

### 3. The Semantics of Mass and Count Nouns

#### The denotation of plural count nouns presupposes atomicity:

whenever a noun has an atomic structure it will likely be a count noun that provides a singular/plural alternation.

Use of the indefinite article and the ability to pluralize as two main characteristics (or countability markers) for countability.

#### It has been claimed:

every singular count noun can occur with the indefinite article and has a plural counterpart

a cat vs. cats, a car vs. cars, a hat vs hats

On the contrary, mass nouns lack both features:

\*a sand or \*sands, \*a mud or \*muds.

## 4. The Problem

**Morphosyntactic criteria** = means for identification of Mass/Count

\*does not work well for a set of counter examples (or exceptions)  
Dual-Life, „fence-like“ nouns, polysemouy nouns

We will focus on two criteria: **singular indefinite** and **plural number**

**In our proposal we argue against:**

- a uniform treatment of two criteria for countability, i.e. plural number and indefinite article, and
- the dependent relationship between plural and atomicity.

## A Brief Excursus: BECL

### The Bochum English Countability Lexicon (Kiss et al, 2014, 2016)

Test	Question	Possible Answers
<b>Syn1</b> (TestI.1)	Can the noun-sense pair in its singular form appear with more?	yes, no, not applicable
<b>Sem1</b> (TestI.2)	If Syn1 = yes, is the comparison made on number of entities, or a different mode of measurement?	number, not number, not applicable
<b>Syn2</b> (TestII.1)	Can the noun-sense pair in its plural form appear with more?	yes, no, not applicable
<b>Sem2</b> (TestII.2)	If Syn2 = yes, is the sentence equivalent to one with an explicit classier?	equivalent, not equivalent, not applicable
<b>Syn3</b> (TestIII.1)	Can the noun-sense pair in its singular form and combined with the indenite determiner be the subject of a denition or characterization?	yes, no, not applicable
<b>Syn4</b> (TestIII.2)	Can the noun-sense pair in its singular form but without the indenite determiner be the subject of a denition or characterization?	yes, no, not applicable

## A Brief Excursus: BECL

**Syn1 and Syn2 are tests that reflect the use of the singular and plural form:**

### (4) Syn1

- a. \*A owns more car than B.
- b. A owns more furniture than B.

### (5) Syn2

- a. A owns more cars than B.
- b. \*A owns more furnitures than B.

## A Brief Excursus: BECL

**Syn3 and Syn4 describe the occurrence vs. non-occurrence of the indefinite article together with the noun.**

### (6) Syn3

- a. A car is a vehicle.
- b. \*A steel is an alloy.
- c. A sheep is an animal.
- d. \*A purgatory is...

### (7) Syn4

- a. \*Car is a vehicle.
- b. Steel is an alloy.
- c. Fish is edible and delicious.
- d. \*Purgatory is....

## 5. Annotation Insights

The criteria mentioned earlier can be attested through the annotation in BECL, especially plural morphology in Syn2 and the indefinite article in Syn3.

### a. Plural Morphology

Count nouns take plural morphology, mass nouns do not:  
*boxes, books, cars \*waters, \*sands, \*furnitures*

### b. Singular Indefinite

Only count nouns can be combined with an indefinite article:  
*a car, a book, a pencil*

## 5. Annotation Insights

Noun	Description	Syn1	Sem1	Syn2	Sem2	Syn3	Syn4
<b>action#4</b>	a process existing in or produced by nature (rather than by the intent of human beings); \the action of natural forces"; \volcanic activity"	yes	not number	NA	NA	no	yes
<b>action#1</b>	something done (usually as opposed to something said); \there were stories of murders and other unnatural actions"	no	NA	yes	not equiv.	yes	no
<b>brunch#1</b>	combination breakfast and lunch; usually served in late morning	yes	not number	yes	not equiv.	yes	yes

## 5. Annotation Insights

**Following those constraints, English count nouns should have:**

a "yes" in Syn2

a "yes" in Syn3

**Mass nouns are supposed to have:**

a "no" in Syn2

a "no" in Syn3

Class	Syn1	Sem1	Syn2	Sem2	Syn3	Syn4	SUM
235	N	NA	Y	¬EQ	Y	N	8371
721	N	NA	Y	¬EQ	Y	Y	16
73	N	NA	Y	¬EQ	N	N	3
528	Y	¬NUM	NA	NA	N	Y	2405
519	Y	¬NUM	N	NA	N	Y	62
531	Y	NUM	NA	NA	N	Y	21
510	Y	¬NUM	Y	EQ	N	Y	412
726	Y	¬NUM	Y	¬EQ	Y	Y	278
729	Y	NUM	Y	¬EQ	Y	Y	6
513	Y	NUM	Y	EQ	N	Y	2
523	N	NA	NA	NA	N	Y	50
37	N	NA	NA	NA	N	N	37
190	N	NA	N	NA	Y	N	21
514	N	NA	N	NA	N	Y	9
199	N	NA	NA	NA	Y	N	18
28	N	NA	N	NA	N	N	6
371	NA	NA	Y	NA	NA	NA	37
353	NA	NA	N	NA	NA	NA	8

## 5. Annotation Insights

**887 noun senses in BECL do not belong to a class in BECL which pattern verifies the expected behaviour for either count or mass**

**We will now focus only on those noun senses that:**

- a. can either be pluralized but do not take the indefinite article
- b. can occur with the indefinite article but do not have a plural form

**since those two features are consistently regarded as key properties of mass and count nouns in the literature**

**This corresponds to the BECL Classes 73, 510, 513, 190 and 199**

## Classes 73, 510 and 513

**73, 510 and 513:**

**417 noun-sense pairs from 252 distinct lemmata in BECL**

**Common Feature:**

they have a plural, but they cannot occur with the indefinite article in singular

Tested for our hypothesis were only lemmata that were consistently and completely annotated as belonging to the mentioned classes regarding all their accessible senses provided by WordNet.

## Examples for Classes 73, 510, 513

Sense	WordNet Description	Class
<b>linoleum#1</b>	a floor covering	510
<b>boldface#1</b>	a typeface with thick heavy lines	510
<b>china#4</b>	Dishware made out of porcelaine	513
<b>dissimilarity#1</b>	the quality of being dissimilar	510
<b>silicone#1</b>	any of a large class of siloxanes that are unusually stable over a wide range of temperatures; used in lubricants and adhesives and coatings and synthetic rubber and electrical insulation	510
<b>self#4</b>	your consciousness of your own identity	73

## Classes 190 and 199

### Classes 190 and 199:

**39 noun-sense pairs from 26 distinct lemmata:**

### Common Feature:

They both allow an indefinite determiner to be used with that noun-sense, but do not allow it to be pluralized

→ neither class allows the noun to be bare and still have the sense given in these classes.

→ all these senses have to occur with an indefinite determiner, or with a type of modification we call “semi-classifiers”

## Examples for Classes 190 and 199

Sense	WordNet Description	Class
heyday#1	the period of greatest prosperity or productivity	199
nip#4	the property of being moderately cold; \the chilliness of early morning"	199
stupor#1	the feeling of distress and disbelief that you have when something bad happens accidentally; \his mother's death left him in a daze"; \he was numb with shock"	199
blush#1	a rosy color (especially in the cheeks) taken as a sign of good health	190
plethora#1	extreme excess; an embarrassment of riches	190
front#1	the side that is forward or prominent	190

## Classes 190 and 199

(10)

- a. Your sudden departure left him in a stupor
- b. He's having a real heyday
- c. There's a nip in the air
  
- d. There was an embarrassed blush on his cheeks, as he ....
- e. She gave a plethora of excuses. (semi-classifier)
- f. That building has a front that maintains its heritage status.
  
- g. \*Messi had six heydays.
- h. \*There were two nips in the air this morning.
- i. \*I had two stupors this last week.

## Classes 190 and 199

Plurals for 190 nouns can occur, but usually do not cover the sense under consideration:

- (11) front#6: a sphere of activity involving effort.  
*“they advertise on many different fronts”*

## Classes 190 and 199

### Puzzle of Class 199 and 190:

How can it be that there are no plurals for these noun-senses (according to Test Syn2) and yet one can (indeed must) use the indefinite article with them?

### "Unique Entities"?

→ there can only be one of them in any specific circumstance or situation, as evidenced by the fact that you can't pluralize the sense:

### "Unique Indefinite Entities"

## 6. Corpus Investigations

Those findings imply that plural morphology does not entail that a noun can be combined with the indefinite article while the realization of the indefinite article does not entail that the noun can also be pluralized!

**However:**

**it might be possible that this case depends on the very specific sense of the noun...**

**Corpus study: the distribution of a set of nouns in Open ANC (OANC)**

## 6. Corpus Investigations

Set of selected nouns in the mentioned classes that show deviant behaviour: 73, 510, 513, 190 and 199.

### Additional constraints:

Non-multiples: we selected only senses of nouns that consistently all fall in the same countability class

Assigned properties for sentences:

(12)

a. [+ plural form] and [- singular indefinite]

*three dogs, the bottles*

b. [- plural form] and [+ singular indefinite]

*a big dog, a bottle*

c. [-plural form] and [- singular indefinite]

*this big dog, that bottle and that mud, this water*

## 6. Corpus Investigations

*The combination of [+ plural form] [+ singular indefinite] (\*a big dogs, \*a bottles) is never present since it is ungrammatical.*

**It should be assumed:**

that all count – NPs have one of the three above mentioned labellings

while all mass – NPs should be labeled as [- plural form] [-singular indefinite].

## 6. Corpus Investigations

### However:

several nouns that either can occur in singular indefinite construction but lack plural occurrences or the other way around:

#### **(13) Nouns that have plural but no singular indefinite occurrences**

artistry, bran, boldface, dissimilarity, our, gravel, lemonade, manure, scarcity, wallpaper...

#### **(14) Nouns that have singular indefinite but no plural occurrences**

heyday, midline, modicum, null, plethora, tad, while...

## 6. Corpus Investigations

**Corpus Data:** some nouns presented in (13) have occurrences with an indefinite determiner, but accompanied by a clear shift in meaning – in most cases, sorting:

(15)

- a. Like any other endeavor where helpless animals are placed at a **disadvantage** (in this case, they spin the pheasants first to make them dizzy) in order to provide adorable little children with the joy of inflicting pain and causing death.
- b. In cases where one PCR primer was located within a repeat, the primer from within the unique sequence was tagged with a **fluorescent dye**.

## 6. Corpus Investigations

**Corpus Data:** some nouns presented in (13) have occurrences with an indefinite determiner, but accompanied by a clear shift in meaning  
– in most cases, sorting:

(15)

c. Among the endangered animals poached for aphrodisiacs are tigers (for their penises made into a soup) and rhinoceroses (for their horns made into a powder)

**Those examples do exist, but are problematic and can mostly not be considered semantically unaltered**

## 7. Conclusions and Further Work

The findings from both token-based (annotation) and type-based (corpus investigation) imply that a certain amount of data shows deviant behavior in terms of morphosyntactic features for mass and count

- However, it is difficult to disentangle
- annotation errors
  - semantically altered occurrences of indefinite articles and plural
  - polysemous nouns
  - domain-specific unorthodox use of certain senses
  - missing data

The current work in progress only allows a first insight of the phenomenon, further work will hopefully deepen our understanding of the relation between semantics and morphosyntax in terms of countability and broaden it to other languages

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**Thank you!**