Technical Report

On *Plurality of Mass Nouns and the Notion of "Semantic Parameter"* by Gennaro Chierchia

Submitted to **Prof. Fred Landman** by **Tomer Filiba**

Abstract

Chierchia's paper proposes an analysis for the distinction between *count-nouns* (such as *dog/dogs*) and *mass-nouns* (such as *furniture/*furnitures*), which stems from the way nouns are supposedly stored in the lexicon. Mass nouns, Chierchia explains, come out of the lexicon with **inherently plurality** (the *Inherent Plurality Hypothesis*), even though they normally bear the morphology of singular nouns - and this sole difference can account for the mass vs. count contrast.

He then explores the different properties of mass vs. count nouns, discusses the difficulties of then-contemporary theories regarding the subject, and goes on to show how the Inherent Plurality Hypothesis settles these issues with relative ease, without introducing on vague assumptions into the model.

In the last section of the paper, Chierchia suggests the existence of a *Semantic Parameter*, from which he draws several interesting corollaries, and brings evidence from languages that are said not to have count-nouns to support them.

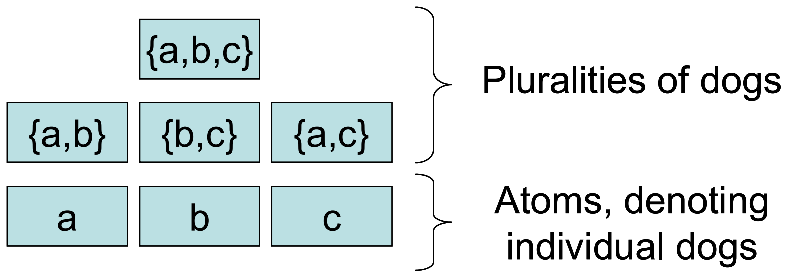
Note: due to the length of the paper, I had to cut off a lot of details, examples, and discussions from this report.

Background

Count-Nouns and Plurality

When dealing with count-nouns (also, *common nouns*), the standard theory suggests a **lattice formation** where the *atoms* of the lattice represent individual entities, on top of which come all combinations of these atoms (sets of atoms). The partial ordering relation that defines the lattice is that of *component-of*, which means that element $x \leq y$ iff (x is an atom and $x \in y$) or (x is a set of atoms and $x \subseteq y$). Hence, $a \leq \{a,b,c\}$ and $\{a,c\} \leq \{a,b,c,d\}$. Note that a is an atom iff $\forall b.\ b \leq a \rightarrow b = a$.

This formation allows us to treat plurality with ease. For instance, assuming the dogs in our model are *a*, *b*, and *c*, we can form the following lattice (with arrows indicating the ordering relation omitted):



Now we can construct the extension of *dog* in our model (assuming a single world) as $\{x \mid dog(x) \text{ for each } x \in D\}$ which equals $\{a, b, c\}$. Similarly, the extension of *dogs* would be all combinations of two or more dogs, explicitly: $\{\{a,b\}, \{b,c\}, \{c,a\}, \{a,b,c\}\}$. But how can we formalize this?

Lattice theory provides us with the tools to define it properly. Given a lattice L, the **sum** ($\sqcup$) of two elements A, B $\in$ L will be the smallest element C$\in$L such that A $\leq$ C and B $\leq$ C; for instance, $a \sqcup \{b,c\} = \{a,b,c\}$. The **supremum** of a set of elements of L is the sum of all of them, e.g., $\sqcup\{a,\{a,b\}\} = \{a,b\}$. Next, we can define the **closure** of A$\in$L (*A) as the set of all sums of elements of A, i.e., $*A = \{\sqcup X \mid X \subseteq A\}$, which is similar to the set-theoretic **powerset**. And last, we can define ιA, which chooses the **maximal element** of A (if A has one), or *undefined* if it does not: $\iota A = \sqcup A$ iff $\sqcup A \in A$, otherwise undefined.

With the necessary theoretic background, we can now treat the plurality of count-nouns as a function that takes the extension of a singular noun and returns its plurality, namely $PL(A) = *A - A$. It is easy to think of the plurality morpheme in terms of this function: $[\![noun+s]\!] = PL([\![noun]\!])$. For instance, $[\![dogs]\!] = PL([\![dog]\!]) = PL(\{a,b,c\}) = \{a, b, c, \{a,b\}, \{b,c\}, \{c,a\}, \{a,b,c\}\} - \{a, b, c\} = \{\{a,b\}, \{b,c\}, \{c,a\}, \{a,b,c\}\}$. Note that by subtracting A (the atoms) from *A, we disallow an atom to be part of its plurality, thus eliminating readings like **Rex is dogs*.

An interesting property of the function PL is that PL applied to a plurality of a noun (or any $\sqcup$-closed set) yields the empty set ($\emptyset$). This is due to the properties of the closure operator, which satisfies $*(*A) = *A$. As such, when PL is applied to a $\sqcup$-closed set A, it reduces to $*A - A = A - A = \emptyset$.

Noun pluralities are distributive by nature: if {a, b, c} $\in$ dogs, then a, b, c $\in$ dog. Likewise, pluralities are also *cumulative*: if a, b $\in$ dogs, it entails {a, b} $\in$ dogs. Verbs, on the other hand, when applied to a plurality, are neither necessarily distributive nor cumulative: "*John and Bill lifted the piano*" $\not\to$ "*John (alone) lifted the piano*", and ("*John lifted the piano*" $\wedge$ "*Bill lifted the piano*") $\not\to$ "*John and Bill (together) lifted the piano*". We will get back to this in the section about *collectives*.

Properties of Mass Nouns

The following is a list of 10 properties that distinguish count nouns from mass nouns, and are said to be universal (according to Chierchia). He also names a couple of other properties, but he explains they are too language-specific to draw conclusions from.

(1) Plural morphology: count-nouns normally exhibit distinct singular and plural morphologies; for instance, dog/dogs, shoe/shoes. Mass-nouns, on the other hand, cannot undergo pluralization: blood/*bloods, furniture/*furnitures. Mass-nouns virtually always posses singular morphology (e.g., *the water **is** hot*) and do not have a plural form.

(2) Numeral determiners: count-nouns can take prenomial numeral determiners (e.g. *three dogs*), while mass-nouns cannot (cf. **three furniture[s]*). While this is probably a syntactic constraints that derives of the lack of plural morphology (property 1), mass-nouns are incompatible with numerals in predicative position as well. For instance, "*the boys from Milan are three*" and *"the blood found on the floor **is** three drops",* as opposed to **"the furniture[s] in the room is/are three"*.

(3) Classifier and measure phrases: In order to count (using numerals) entities of mass-nature, one has to resort to classifiers and measure phrases. For example: "three **grains of** rice", "two **packs of** milk", "two **liters of** water".

Interaction with Determiners: it is evident that the determiner system is sensitive to the count vs. mass contrast:

(4) Some determiners occur **only with count-nouns**: *every, each, a*

(5) Some determiners occur **only with mass-nouns**: *little, much*

(6) Some determiners occur **only with plurals and mass-nouns**: *all, a lot of, plenty of, more, most*

(7) Some determiners are **unrestricted**: *the, some, any, no*

(8) The physical nature of the denotata is not enough: while generally, fluids tend to be denoted by mass-nouns and solid "medium-sized" objects tend to be denoted by count-nouns, there are many exceptions to this. For example, *cloud*s and *puddles* being count while *footwear* and *furniture* being mass.

In fact, some concepts can be treated differently with synonyms: coins/change, shoes/footwear, carpets/carpeting. Moreover, "mass-concepts" in one language may translate to "count-concepts" in another (and vice versa), so it is clear that the distinction is not necessarily inherent in the denotata.

Note: as languages hate perfect synonomy (Markman 89), the words in each pair convey a slightly different meaning, but it is obvious they have the same extension (*[$_{NP}$ the coins in my pocket]* vs. *[$_{NP}$ the change in my pocket]*).

Reinterpretation: some typically-mass nouns can be coerced to count-nouns, and vice versa. This usually calls for a special context.

(9) Count to mass: *There is rabbit in this stew* (as opposed to "*I saw three rabbits"*)

(10) Mass to count: *This refrigerator contains three bloods*, i.e., *types of blood* is assumed.

Collective Nouns and Covers

Chierchia makes a distinction between pluralities and *collectives*, such as *bunch*, *committee*, or *pile*. At first, it might seem natural to think of the extension of a committee as a set of members, e.g., the plurality of its members. However, Chierchia notes, it allows for singular nouns (*committee*) to have a plural extension, thus the simple lattice structure outlined above will no longer hold. Moreover, he says, it seems implausible to regard collectives as the sum of their members, in the way pluralities are. Instead, he suggests (following Schwarzchild 91) to treat collectives as a special kind of atoms that are linked to their members not by the standard ordering relation of the lattice, but by a function (p) that associates each collective atom with its members (a plurality). We can extend the notion of *component-of* to collectives, where "x is a component-of y" translates to $p(x) \leq p(y)$.

Chierchia takes special interest in *groups*, which according to his analysis, are treated as collectives that are defined by a *grouping criterion*. In fact, he analyses the word *group* as a classifier for pluralities, one that maps pluralities into atoms – making it the inverse function of *p*.

Getting back to piano-lifting (a favorite sport of semanticians), let us recall "John and Bill lifted the piano". This sentence has two prominent readings, the first a distributive one, where each man has lifted the piano on his own; the second a collective one, where both of them did the lifting. The distributive reading is analyzed straight-forwardly, by applying the predicate *lift-the-piano* to John and Bill conjunctively. But the second reading poses a slight problem: do we want the predicate, which so far only applied to singularities, to apply directly to the plurality {j, b}? Instead, Chierchia suggests we treat it as "the group consisting of John and Bill lifted the piano", so that the predicate applies to g({j, b}) – the group consisting of John and Bill, which is an atom rather than a plurality. We can then rely on type-shifting rules to solve the type-mismatches, e.g., the incorrect lift-the-piano({j,b}) is shifted to lift-the-piano(g{j,b}) by the rule $[[P]] = \lambda x. P(g(x))$ that applies to fix type mismatches for predicates.

From a philosophical point of view, Chierchia states that plurals are an abstract device (built on sets or lattice-theoretic sums) that are used in the computation of truth conditions, but do not interact with natural language directly; only atoms (individuals or groups) can be regarded as concrete, thematic-role bearers.

Definites

A nice consequence of the lattice-structure of pluralities (pointed out by Sharvy 80) is a simple, unified interpretation of the definite article, which applies equally well to singularities and plurals: $[\![\text{the P}]\!] = \iota[\![P]\!]$, the maximal element of P. This way, if P is plural, *the P* selects the largest group in P; if P is singular (atomic), *the P* selects the one and only P, or will be undefined. This captures the uniqueness presupposition that the definite article has with singulars, as well as the presupposition of more than one element in the case of plurals. Thus, *the cute puppy* would select the one and only cute puppy in the domain, while *the hungry dogs* will select all the hungry dogs, presupposing the existence of more than one hungry dog.

Sadly, though, piano-lifting makes the picture a little more complicated yet again. When we examine a sentence such as "the boys and the girls lifted the piano", it has a distributive reading where each group, of boys and of girls, had separately lifted the piano. If *a* and *b* are *the boys*, and *c* and *d* are *the girls*, the extent of *"the boys and the girls"* would be {a,b,c,d} (or g{a,b,c,d}, to be pedantic), which yields the logical form lift-the-piano(g{a,b,c,d}). Instead, we would like to get to lift-the-piano(g{a,b}) $\wedge$ lift-the-piano(g{c,d}). One way of achieving this is by enriching the theory (Landman 89) so that $[\![\text{the boys and the girls}]\!] = \{[\![\text{the boys}]\!], [\![\text{the girls}]\!]\} = \{\{a,b\}, \{c,d\}\}$, and allowing predicates to distributively apply to **sets of sets** (thus complicating the structure of the domain).

A second approach, favored by Chierchia, is that of contextually-supplied **covers** (Gillon 87). A cover, C, is a function that divides a set into (possibly overlapping) subsets, which is given to us by the context. When a distributive reading is necessary, a distribute cover will be expected. In our case, we say $[\![\text{the boys and the girls}]\!] = \{a,b,c,d\}$, but the cover of which, C({a,b,c,d}) would be {g{a,b}, g{c,d}}. Then, when we evaluate the sentence as $\forall u[u \in C(\{a,b,c,d\}) \rightarrow \text{lift-the-piano}(u)] = \forall u[u \in \{g\{a,b\}, g\{c,d\}\} \rightarrow \text{lift-the-piano}(u)]$, which is the interpretation we were after. Chierchia chooses this approach as it helps maintain the simplicity of the domain's structure (although it obviously puts the burden in the context).

Mass Nouns as Inherent Plurals

Earlier theories that dealt with mass-nouns were usually aware of the striking similarity between mass-nouns and plurals, but relied on complicated devices to bring them together. The Inherit Plurality Hypothesis that Chierchia proposes (in the spirit of Gillon 92) may be seen as the **null hypothesis** – one that doesn't call for any special fixtures, other than what any such theory must already provide. By choosing the extension of mass-nouns to be a sublattice of the domain, many of the properties of mass-nouns can be easily explained.

For instance, we take the extension of the noun *furniture* as the sublattice made of all *pieces of furniture* (the complete $\sqcup$-closure). What constitutes a piece of furniture remains vague, but no more vague than *chair* or *table* which constitute it. For example, if our domain consists of two tables (a and b) and a chair (c), we can say the extension of *piece of furniture* is {a,b,c}, while the extension of *pieces of furniture* is {{a,b}, {b,c}, {c,a}, {a,b,c}}, thus the extension of *furniture* itself is {a, b, c, {a,b}, {b,c}, {c,a}, {a,b,c}} – the entire closure of {a,b,c}.

At times, the atoms that constitute the mass-noun are not well-defined – for instance, *water* or *rice* – but Chierchia explains this discussion is orthogonal to ours, and in fact unnecessary, as mass-nouns **do not foreground their atoms** (they can be seen as "black boxes"). This is the opposite of count-nouns, where the atoms are readily accessible. The deep, philosophical difference between count and mass nouns can be reduced to whether the atoms of the extension are accessible to the semantic system or not.

The theory we've introduced so far can be summarized to the following: a singular count-noun denotes a set of atoms (extensionally or using a characteristic function), a plural count-noun denotes a $\sqcup$-closed set of pluralities of two or more atoms, and a mass-noun denotes a $\sqcup$-closed set of atoms.

Plurality and Numerals

Property #1, of mass-nouns not having plural forms, is trivially satisfied as they are already plural. Formally, if we apply PL to a plural (or a $\sqcup$-closed set) we get $\varnothing$, which immediately leads to contradictions such as **"the chair and the table are furnitures"*, reducing to $\{a, b\} \subseteq \varnothing$.

The second property, of mass-nouns being incompatible with numerals, is also easily addressed as mass-nouns do not foreground their atoms. In order to count, one needs a defined unit (normally an atom) to count over, and mass-nouns do not provide one. We can formalize this notion using the restriction SG, which determines whether a given subset of the domain has an **atomic granularity/texture** or not: if it consists of only atoms of the domain or if it's in the range of PL (i.e., generated by a set of atoms), and undefined otherwise.

The restriction SG allows us to define numerals as generalized quantifiers with ease: $n(X)(Y) = |\sqcup(SG(X) \cap Y)| \geq n$, so that *"three boys walk"* is well defined, while *"three furniture[s] broke"* is not.

Classifiers and Measures

Property 3 states that mass-nouns can only be quantized using classifiers or measure phrases. Beginning with classifiers, it is easy to outline some of their properties. First, they are all relational (requiring an *of*-phrase), as in *"**grains of** rice"*, and are rather odd when the of-phrase is missing (*$^?$I saw three grains*). Second, some classifiers apply only to certain nouns, e.g., *"*three grains of water"*. Third, some classifiers require plural relata (*a pack of cigarettes/*cigarette*) while others require singular ones (*two slices of cake/*cakes*).

All of this can be accommodated by treating classifiers as partial functions from pluralities into sets of atoms. For instance, drop(x)(y) = y is a rounded liquid body of small dimension made of members of x. When applying a classifier to a noun phrase, we can use the supremum to get the relevant plurality, so that $[\![\text{drop of water}]\!] = \text{drop}(\iota\text{water})$, and we'd rely on type-shifting rules to correct mismatches.

Measures (*pounds*, *liters*, etc.), likewise, can be treated as partial functions from plural or singular objects into real numbers. However, unlike classifiers, measures can combine with a limited set of determiners (**most liters of milk in the tank are spoiled*) and hardly allow adjectival modification (*$^?$I bought two beautiful quarts of milk* as opposed to *I bought two beautiful jugs of milk*). To account for their restricted distribution, we will not want to treat measures as entities in the domain; instead, we can analyze them as general quantifiers, along the lines of Lonning 87, such as $\text{n-pounds}(P)(Q) = \exists u \in P\ [\text{pounds}(u) = n \wedge u \in Q]$.

Quantifiers

We've seen in properties 4-7 how the determiner system interacts differently with mass and count nouns, and in this section we'll offer an analysis of how it takes place. We've already seen how *the* can be interpreter as maximality over singulars and plurals (and we can generalize it to $\text{the}(X) = \lambda P.\ P(\iota(X))$). Since we treat mass-nouns as plurals, this definition extends naturally to them: *the water on the floor* denotes the maximum set of aggregates of water which are on the floor, as expected. However, other quantifiers require some fine-tuning.

For instance, if we defined $NO(X)(Y)$ as $X \cap Y = \varnothing$, a sentence like "no men lifted the piano" would rule out all pluralities of men lifting the piano, while allowing singularities to do so. To solve this, we need to introduce a new notion called the *ideal*: $\pi(x) = \{u \mid u \leq x\}$, which is the set of all subcomponents of the supremum of x. Mass-nouns satisfy $\pi(x) = x$, as they already contain of their supremum's components. For singularities, $\pi(x)$ would return their $\sqcup$-closure, and for plurals, it would add their removed atoms. In any case, $\pi(x)$ yields a complete, atomic sublattice of the domain.

Using this, we can now define $NO(X)(Y)$ as $\pi(X) \cap Y = \varnothing$ and $SOME(X)(Y)$ as $\pi(X) \cap Y \neq \varnothing$. Since the ideal operator is a **total function**, GQ defined in terms of it would work on any type of noun: *no **water** leaked, no **men** left, no **dog** will ever fly*. Other quantifiers, like *every* and *each* only operate on singular nouns, which boils down to their distributive nature (they apply to atoms). We therefore need some way to restrict their application. For this, we shall define S(X) = X iff X is a set of atoms, otherwise undefined; on top of S, we can define $P = SG - S$ (thinking of functions as sets of ordered pairs) to restrict to plural entities. Now we can define $EVERY(X)(Y)$ as $S(X) \subseteq Y$.

Next, some quantifiers like *all* only apply to plurals and mass-nouns; the property the two share is being $\sqcup$-closed. For this we shall define the restriction $^{\cup}X$ as X if X=PL(A) or X=*A, for some set of atoms A, otherwise undefined. With this, we can define $ALL(X)(Y)$ as $^{\cup}X \subseteq Y$.

Relative quantifiers, like *many* and *most*, require more sophisticated treatment. For instance, trying to define $MANY(X)(Y)$ as $|X \cap Y| > n$ for some contextual n is insufficient, as n may be infinite (*"many numbers are divisible by 3"*). Instead of directly using cardinality, we can move to a contextually-specified measure function, μ. As *many* only applies to countable pluralities, we shall restrict it using P. This gives us the definition $\mu(\sqcup(P(X) \cap Y)) > n$.

Much is like *many*, but applies to mass-nouns only. Instead of defining it directly, Chierchia goes through Italian *molto*, which applies to countable pluralities as well as to mass-nouns: $MOLTO(X)(Y) = \mu(\sqcup(^{\cup}X \cap Y)) > n$. Therefore, we can derive MUCH as MOLTO - MANY, removing all countable pluralities from it. We can now define $MOST(X)(Y)$ as 1 iff $\mu(\sqcup(^{\cup}X \cap Y)) > \mu(\sqcup(^{\cup}X \cap Y^{c}))$.

To sum it up, we have seen three types of generalized quantifiers: the first type is defined using total functions, which makes it unrestricted (*no*, *some*). The second kind requires an *atomic texture*, which we further restrict using S and P. The third kind, of measure-based (μ) quantifiers, is sensitive to $\sqcup$-closure.

Mass to Count and Back

Properties 8 to 10 demonstrate that the mass vs. count distinction is not absolute. This can be exemplified by the coins/change shift, or by comparing different languages. For instance, English *hair* is mass, but Italian *capello* is count, while English *relative* is count but Italian *parentela* is mass. Speaking of hair, it is interesting to note that Hebrew has both forms: seʕar (שיער) – mass notion of hair; səʕara (שערה) – a single thread of hair; səʕarot (שערות) – multiple threads of hair.

Other than (near) synonomy or cross-lingual evidence, there is also David Lewis' *universal-grinder*, also known as the *part-of operator*, that converts an entity to a set of its parts. This is achieved by computing the ideal (π) of the noun, which neutralizes the plurality-singularity contrast, as in "I ate a lot of shrimp" or "there is a lot of anchovy in this sauce". Such "grinding requirements" lead Chierchia to the conclusion that the domain of quantification in such contexts consists of more than "simple atoms" and their sums – it must also consist of their internal parts. How many such internal parts? "As many as there are ways of slicing up Chierchia" – while Chierchia may be considered atomic on his own, any body part of his may be considered an atom as well. This notion is vague, he admits, and mainly depends on the context, but it is not more vague than alternative theories that suggest "a mysterious domain of atomless substance".

Further Analysis

The justifications given so far for the Inherent Plurality Hypothesis all derive of elegance (or Occam's razor), requiring only a minimal amount of structure to explain the facts. However, Chierchia wishes to fortify his hypothesis with extra-theoretic arguments.

Supremum Test

When comparing *"the furniture is from Italy"* and *"the pieces of furniture are from Italy"*, it is quite obvious the two have the same truth conditions. This boils down to the fact that *"the furniture"* and *"the pieces of furniture"* have the same extent in our theory, which stems from the use of the maximality operator.

This desired property is trivial under the Inherent Plurality Hypothesis, while other theories (namely that of Link 83) have a hard time dealing with it, as they normally assume that mass nouns are drawn from a different domain than that of count nouns, so the two NPs must have different extents. Such theories resolve the conflict by complicated type-shifting rules, but Inherent Plurality clearly excels here.

Translation

We've already seen how the very same object can be viewed as a mass in one language, while having an atomic texture in another. Assuming that the two languages refer to the very same object in the physical world requires that our theory be capable of handling both perspectives.

Link-style theories that assume a different domain for mass-nouns would seem very weak in this sense, as they suggest that the different perspectives taken by different languages denote different real-world objects. For instance, English *[$_{NP}$ Pavarotti's hair]* denotes one entity in the mass-domain, while Italian *[$_{NP}$ I capelli di Pavarotti]* denotes a different, countable entity. Chierchia's take on this is that both nouns denote the same real-world object (as one would expect), but take different perspectives on it. English sees it as a sublattice in the domain while Italian treats it as a countable plurality: the difference is *in the tongue of the beholder*, not the real world.

Reciprocals

Lastly, the Inherent Plurality Hypothesis is capable of explaining (at least to some extent) the complex issue of reciprocals. For instance, if "the furniture" and "the pieces of furniture" have the same extension (although a different denotation), how come *"the pieces of furniture leaned against **each other**"* is grammatical, while *"*the furniture leaned against **each other**"* is not?

Chierchia explains that reciprocal predicates are the only class of predicates that can differentiate a mass notion from its piece-wise notion, unlike Link-style theories, where multiple classes of predicates can make this distinction. Reciprocals distinguish groups from pluralities: this can be made clear by sentences like *"Committee A and committee B fight each other",* as opposed to *"*Committee A fights each other"*.

It seems that reciprocal predicates require access to the **internal structure** of the objects in question. Plurals are formed out of atoms, which makes their internal structure visible to the semantic system. Mass-nouns, on the other hand, come as "built-in" sublattices right out of the lexicon, so their internal structure is not visible to the semantic system. With this in mind, we can explain why *"the drapery and the carpeting resemble each other"* has only one reading, where the drapes resemble the carpets, while "the drapes and the carpets resemble each other" has two readings: one where the drapes resemble the carpets, and another where the drapes resemble each other and the carpets resemble each other. The second reading is made possible due to the fact that the semantic system "sees" both the drapes' and carpets' inner structure, and the inner structure of the group "drapes and carpets". A full description of the mechanics of reciprocals is beyond the scope of this report.

Languages without Count-Nouns

Chierchia justifies the need for mass-nouns in the limitations of our perceptual system: when faced with objects that have no perceptible atoms or basic units, the only way to refer to them is as mass-nouns. This is generally true of liquids and gases (*air*, *fog*), which are "given to us" in sizes ranging from a drop of water to an ocean, without ever revealing an atomic texture. This reasoning leads him to a universal, stating that **no natural language could have only count nouns** – mass-nouns are a must. The opposite universal (*no natural language has only mass-nouns*), however, is false. For once, there is no logical reason to assume that, but most importantly, there are languages known not to have count nouns. In such a language, one would not be able to directly specify numerals on any nouns – because they are all mass – and a classifier or measure will always be necessary.

In fact, he explains, having both count and mass nouns is redundant, as it yields two ways of counting (*three chairs*, *three **pieces of** furniture*). In a mass-only language, every noun would denote a qualitatively homogeneous sublattice of the domain: there would be no *chair*, but a "homogeneous mass" of the chair-kind, out of which we could individuate quantities/entities using classifiers.

Continuing along these lines leads us to several predictions: when all nouns as mass, , there would be **no singular/plural contrast** (as they are already plural). The PL and SG functions would be totally undefined. Second, we would expect **not to find either the indefinite or definite articles**: the indefinite is just a variant of the first numeral, while the definite serves no useful purpose. In count-noun-less languages, noun denotations codify the same information as their maximal elements – the ι operator is unnecessary. Third, as we must rely on classifiers and measures to 'select' elements from any noun, we would require a **generalized classifier system**, where one could express *"I ate one unit of the-homogeneous-entity-of-apples"*.

This is indeed the case of languages like Chinese, where one says *"two pieces-of tablehood"* for *"two tables"*. It can be said that Chinese nouns represent kinds, where [$_N$ table] denotes the table-kind. This leads to the assimilation of common and proper nouns, so one says *"I saw bear"*, without any determiners (cf. *"I saw John"*), translating to "I saw (one or more) instances of the bear-kind".

A Semantic Parameter

Based on the work of Carlson, Chierchia determines that mass-nouns are names of *kinds*, while count-nouns are *predicates*. Using Montegue's notation, we say mass-nouns are of type *e*, while count-nouns are of type *<e,t>*. In English, for instance, nouns can be either *e* or *<e,t>*, allowing mass-nouns to appear bare in argument positions. In Chinese, Chierchia explains, nouns are solely of type *e*; from this he derives all the desired properties we've explored previously: every noun has a mass extension, there is no plural marking, numerals can combine with nouns only through classifiers, there are no definite/indefinite articles and nouns can occur bare in argument positions.

A question then arises, what happens if the type of nouns is restricted to *<e,t>*? At first it might seem contradictory to the universal stating all languages have mass-nouns, but Chierchia explain this universal concerns mainly with the **extension** of the noun – a complete sublattice – less so with the morpho-syntactic features of mass-nouns.

In such languages, he predicts, no noun (mass or count) could occur bare in argument position, as it would result in a type mismatch. French seems to fit this prediction: while it clearly has a mass/count distinction (**trois laits = three milks*), it does not allow **je veux lait = I want milk*; one has to resort to *je veux du lait = I want [some] milk*.

As an anecdote, I just got back from a 12 day trip through France. I know bits of Spanish and Italian, and apart from French's impossible orthography, I was greatly surprised by its determiner system. It seemed to me that everything is marked with a definite article. I thought I was missing something, until we asked for an English menu in one seafood restaurant and got this:

THE MENU TRADITION
24 €
The plate of seafoods
Or
9 hollow oysters of Cancale n° 3
Or
The home-made fish soup with its croutons
Or
6 scallops stuffed in the garlic and parsley butter
or
The traditional mussels in white wine
Or
The Tartar of swordfish in the rust
Or
The kettledrum(timbale mold) of celery in St Jacques, orange tasted butter
Or
Home-made duck foie gras

The roasted cod, the muslin of broccoli and its light broth in Noilly
Or
The sea bream in the traditional cabbage dish, the bitter-sweet sauce

Of course I had to take a picture for further investigation, and by a pure stroke of luck I think I got an answer from Chierchia himself: in France there are no *cod fish*, there are *the cod fish*; likewise, one does not simply drink *water* – one drinks *the water*. I am sure this is only a superficial analysis of French articles, but an interesting one nonetheless.

However, seeing how we can predict/derive a **cluster of properties** directly from the type we assign to nouns – it is makes sense to think of it as a **UG parameter**. Nouns can be ±arg (N can have type *e*) and ±pred (N can have type *<e,t>*). According to our analysis, English is [+arg +pred], Chinese is [+arg -pred], and French is [-arg +pred]. An assignment of [-arg -pred] makes no sense of course, as it would entail that nouns cannot be used at all.

As for acquisition, it can be easily explained if we assume the unmarked setting is of [+arg -pred], which is the most restrictive (following the *subset principle*). Once articles, plural morphology or direct numerals are encountered – the child will switch to the second most restrictive setting of [-arg +pred]. Upon encountering bare nouns, the child would then switch to [+arg +pred], being the most permissive setting.

Closing Words

In this technical report I surveyed the Inherent Plurality Hypothesis proposed by Gennaro Chierchia, along with its necessary background. Naturally, Chierchia's long paper offers more detail and further, more rigorous analysis than what I included here, but I hope I had managed to capture all of the important details of his theory.

In short, Chierchia proposes that we can thoroughly deal with mass-nouns by the means of the standard theory of plurality, without requiring more complicated structure. The only difference between count and mass nouns, he teaches, is that the latter come out of the lexicon with plurality built-in. In other words, while singular nouns are the atoms of the lattice, on top of which pluralities are built, mass-nouns are complete, atomic sublattices to start with.

Throughout the report we've covered how this model explains the morpho-syntactic properties of count and mass nouns and their different distribution. We've also seen the so-called *semantic parameter*, made of two binary switches, that governs the cluster of properties exhibited by different types of nouns. It is clear that Chierchia's paper is only an introduction to the subject and that more work ought to follow it, but it is a promising direction nonetheless that is capable of making strong, falsifiable predictions.

Some Notes on Hebrew

While working on this report, I pondered about the Hebrew counterparts of the mass-nouns that Chierchia used. For instance, furniture is rihut (ריהוט), clothing is bigud (ביגוד), and the two are mass-nouns in Hebrew as well. Interestingly, both belong to the Hebrew mishkal **kitul** (קִטּוּל). I thought I was on to something here, and playing around with this mishkal I found also ciud (ציוד) - equipment, šiʕul (שיעול) – cough, nihul (ניהול) – management, dibur (דיבור) – conversation/talk, ginun (גינון) – gardening, among others, all of mass-nature. It seems Hebrew has a rather productive mishkal for forming mass-nouns. By the way, there is a trend in Modern Hebrew to pluralize such mass nouns, which is most likely due to military lingo. It gave birth to abominations like ?ציודים (equipments) or ?נשקים (weapons), where ציוד and נשק were originally mass.

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