

# At the center of NP is Number

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## 1 Introduction: objects, substances and natural language

5 month old infants are able to distinguish between solid objects and non-solid substances.

- differences in motion;
- differences in the way they accumulate;
- differences in the way they are portioned.

The OBJECT vs. SUBSTANCE distinction emerges prior to language acquisition.

We can safely assume that all languages have ways of talking about both substances such as blood and objects such as tables.

Some languages have overt grammatical (i.e. syntactic) means that loosely correlate with that conceptual (i.e. semantic) distinction.

- (1) a. \* I saw { **every/ a** } blood  
b. I saw { **every/ a** } table

In linguistics, expressions such as *blood* are labeled as **mass**, and expressions such as *table* are labeled as **count**.

For some, like Link (1983, 1984), there is an isomorphism between the conceptual distinction and the grammatical distinction.

- (2) a. If  $x$  is an OBJECT-concept,  $x$  is countable and is expressed with a count noun.  
b. If  $x$  is a SUBSTANCE-concept,  $x$  is non-countable and is expressed with a mass noun.

Q: Does the conceptual OBJECT-SUBSTANCE distinction shape the way that these concepts are expressed in Language?

A: Not really. It is the syntax that modulates count-mass expressions.



Figure 1: *fitch* 1



Figure 2: *fitch* 2

### The argument from language acquisition.

(Soja et al. 1991)

- (3) a. this is a fitch  $\rightsquigarrow$  Figure 1
- b. this is fitch  $\rightsquigarrow$  Figure 2

### Variation in the expression of OBJECT and SUBSTANCE concepts

The structure of the matter in the actual world does not necessarily determine whether a noun (describing some entity/entities in the world) will be grammatically count or mass.

- (4) *rice, beans, lentils*: grains
  - a. \* every **rice** in the stew is still raw.
  - b. every { **bean/ lentil** } in the stew is still raw.
- (5) *jewel/jewelry, light/lighting, carpet/carpeting* = OBJECT-concepts, and countable
  - a. every { **jewel/ light/ carpet** }
  - b. \* every { **jewelry/ lighting/ carpeting** }

### Cross-linguistic variation

The same OBJECT/SUBSTANCE-concept may be expressed as count or mass in a given language.

- (6) a. Pavarotti's **hair** has **all** been burned by a crazy fan.
- b. **I** **capell-i** di Pavarotti sono stat-**i** **tutt-i** bruciat-**i** da un fan  
      the.M.PL hair-M.PL of Pavarotti are been-M.PL all-M.PL burned-M.PL by a fan  
      impazzito  
      crazy  
      ‘Pavarotti’s hairs have all been burned by a crazy fan’ (Chierchia 1998)
- (7) a. The furniture, \*the furniture-**s**.
- b. el mueble, lo-**s** mueble-**s**  
      the.M furniture the.M-PL furniture-PL

Languages differ in the flexibility of their roots to occur in a count or a mass context:

- |   |  |
|---|--|
| <p>(8) <i>Nez Perce</i> (Deal 2017)</p> <p>a. kike't, kuus<br/>blood water<br/>'blood, water' (substance)</p> <p>b. lepit { kike't/ kuus }<br/>two blood water<br/>'two drops of {blood/water}'</p> | <p>(9) <i>A. Mongolian</i> (Toquero-Pérez 2025)</p> <p>a. tsos, os<br/>blood water<br/>'blood, water' (substance)</p> <p>b. * xoirV-n { tsos/ os }<br/>two-ATTR blood water<br/>Int.: 'two drops of { blood/ water}'</p> |
|---|--|

### Interim conclusion

These 'word-world' mismatches indicate that the linguistic and conceptual (pre-linguistic) distinctions are independent of each other.

There are statistical connections between these distinctions and we can probably use them to inform our inferences. But there is little evidence that the linguistic facts transform the conceptual ones.

**The data raise important questions about the grammatical encoding of 'being count' and 'being countable'.**

1. What makes a nominal expression count as opposed to mass?
2. What do countable nominals, both count and mass, share in common?
3. What determines variation within and across languages?

## 2 Languages with an overt count-mass distinction (e.g. English)

There are important morpho-syntactic asymmetries between the class of count and the class of mass nouns.<sup>1</sup> (Krifka 1989; Chierchia 1998; Doetjes 1997, 2021)

1. **Number marking:** does the noun make a singular/plural distinction?
2. **Modification:** can the noun be modified by numerals?
3. **Determiner selection:** can the noun occur with certain determiners (e.g. *every, each, several, which*)?

Nouns that show all these are 'count' while those that do not allow any are 'mass'.

We will observe that the class of mass is not entirely uniform.

- (10) Number-marking
- a. Johnny saw { this jewel/ these jewel-s }
  - b. Johnny saw { this blood/ \*these blood-s }

<sup>1</sup>An additional one that we will not be discussing is concerned with ellipsis. In particular, can the noun undergo *one*-substitution? For details, see Bloomfield (1933); Harley (2005); Bale and Gillon (2020); Toquero-Pérez (2024).

- c. Johnny saw { this jewelry/ \*these jewelri-es }
- d. Johnny saw { \*this fume/ these fume-s }

Within mass, there are three classes:

- unmarked = lack a PL-marked counterpart (e.g. *blood, water*)
- object = same root as count nouns, but resist PL-marking (e.g. *jewelry, furniture*)<sup>2</sup>
- plural = lack an unmarked counterpart (e.g. *fumes, dregs*)

(11) Numeral modification

- a. Johnny saw { one jewel/ two jewel-s }
- b. \* Johnny saw { one blood/ two blood-s }
- c. \* Johnny saw { one jewelry/ two jewelri-e s }
- d. \* Johnny saw { one fume/ two fume-s }

Some determiners can only occur with singular count nouns: *every, each, a*

- (12)
- a. Johnny saw every { jewel/ \*jewel-s }
  - b. \* Johnny saw every blood
  - c. \* Johnny saw every jewelry
  - d. \* Johnny saw every fume(-s)

Some determiners can only occur with plural count nouns: *several, both*

- (13)
- a. Johnny saw several { \*jewel/ jewel-s }
  - b. \* Johnny saw several blood
  - c. \* Johnny saw several jewelry
  - d. \* Johnny saw several fume-s

Some determiners can only occur with count nouns, singular or plural: *which*

- (14)
- a. Which { jewel/ jewel-s } are you talking about?
  - b. \* Which blood are you talking about?
  - c. \* Which jewelry are you talking about?
  - d. \* Which fume-s are you talking about?

<sup>2</sup>If a root appears in an object mass expression, it will (most likely) appear in a count expression giving rise to doublets (Toquero-Pérez 2024). We show this in (i) for English but the pattern is found in other languages (e.g. Spanish, French, Czech, Dutch, Greek)

- (i)
- |              |             |
|--------------|-------------|
| a. jewel-s   | c. carpet-s |
| jewel-ery    | carpet-ing  |
| b. kitchen-s | d. bag-s    |
| kitchen-ware | bag-gage    |

Table 1: Morpho-syntactic properties of mass &amp; count nouns

	Mass			Count	
	unmarked	Object	PL	SG	PL
1. SG/PL-distinction	*	*	*	✓	
2. Numeral modification	*	*	*	✓	✓
3. Determiner compatibility					
a) <i>each, a, every</i>	*	*	*	✓	*
b) <i>several, both</i>	*	*	*	*	✓
c) <i>which</i>	*	*	*	✓	✓

Count nouns form a natural class different from mass nouns.

Potential caveat: some determiners are compatible with both (all types of) mass nouns and only plural count nouns. These include *all* and measure words (e.g. *much, little, many, few, more* etc.).

- (15) a. Johnny saw { all/ more } { \*jewel }  
b. \* Johnny saw { all/ more } blood  
c. \* Johnny saw { all/ more } jewelry  
d. \* Johnny saw { all/ more } fume-s

Q: does this mean that mass nouns and plural count nouns must form a syntactic natural class to the exclusion of singular count?

Plural marking on the noun does not entail count properties!<sup>3</sup>

### 3 The count-mass distinction and the countable/non-countable distinction

**Countable** expressions are those that can be counted, i.e. measured in terms of cardinality.

**Non-countable** expressions are those that cannot be counted, i.e. measured in terms of a different dimension (weight, volume, length etc.).

There are (at least) two diagnostics to determine whether a noun is countable or non-countable.

1. **Size adjectives:** can the noun be modified by size adjectives? (Schwarzschild 2011)
2. **Measurement:** can the noun be measured in terms of ‘cardinality’ when paired with a measure expression (e.g. *much, more, many* and numerals)? (Bale and Barner 2009)

<sup>3</sup>Many analyses of the count/mass distinction presuppose that plural-marking is the defining property of count and countable nouns (e.g. Chierchia 1998; Borer 2005).

(16) Size adjectives

- |   |                                 |
|---|---------------------------------|
| a. Johnny saw the big { jewel/ jewel-s }. | c. Johnny saw the big jewelry.  |
| b. * Johnny saw the big blood.            | d. * Johnny saw the big fume-s. |

(17) Measurement

- |  |                      |
|--|----------------------|
| a. Johnny saw more jewel-s than Bob.               | CARDINALITY, #VOLUME |
| b. * Johnny saw more blood than Bob.               | #CARDINALITY, VOLUME |
| c. Johnny saw more jewelry than Bob.               | CARDINALITY, #VOLUME |
| d. * Johnny saw more fume-s than Bob. <sup>4</sup> | #CARDINALITY, VOLUME |

There is a large degree of overlap between the countable/non-countable distinction and the classes of count and mass nouns respectively. But it is not a perfect correspondence.

**Some important conclusions:**

- Being count entails being countable.
- Being mass does not entail being non-countable.
- Plural-marking does not entail countability.

## 4 The grammatical encoding of count and countable properties

Count and mass NPs differ along two critical dimensions, both of which are syntactically encoded: INDIVIDUATED and Number marking.<sup>5</sup>

- INDIVIDUATED sorts the root into the class of things that can be counted, by introducing reference to atoms and sums of atoms.
- Number can be SG which is unmarked, or PL, which is marked.

Count nouns form a natural class because they are marked for both INDIVIDUATED and SG/PL.

Mass nouns form a natural class because they lack Number.

(18) **The countability hypothesis**

Being countable means being marked for individuation in the syntax.

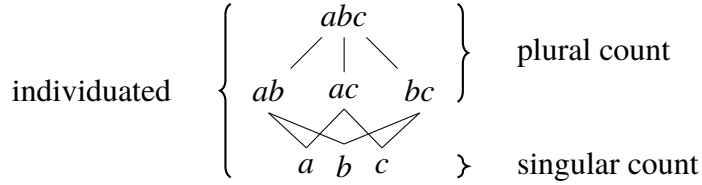
<sup>4</sup>Imagine this context: *Bob saw two small blobs of fumes, whereas Johnny saw a single large blob of fumes.*

<sup>5</sup>Individuation as a syntactic property is not a novel idea, and has in fact been proposed to be encoded in different ways: as a feature on a head (e.g. Harley and Ritter 2002; Cowper and Hall 2009, 2012; Smith 2021) or as a dedicated functional head (e.g. Borer 2005; Bale and Barner 2009; Deal 2017).

### some semantics

- (19) a.  $\llbracket \text{INDIVIDUATED} \sqrt{\text{ROOT}} \rrbracket = \{x: x \text{ is an atomic root-thing or sum of atomic root-things} \} = \{a, b, c, ab, ac, bc, abc\}$   
 b.  $\llbracket \text{SG} \rrbracket (\llbracket \text{INDIVIDUATED} \sqrt{\text{ROOT}} \rrbracket) = \{a, b, c\}$   
 c.  $\llbracket \text{PL} \rrbracket (\llbracket \text{INDIVIDUATED} \sqrt{\text{ROOT}} \rrbracket) = \{ab, ac, bc, abc\}$

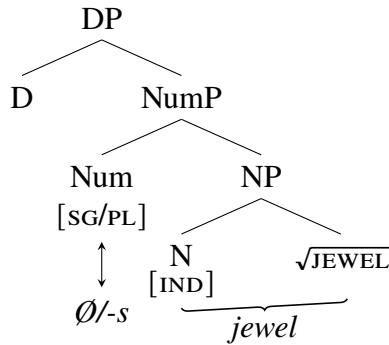
The extension of countable nouns, individuated semi-lattice, where  $a, b, c$  are atoms



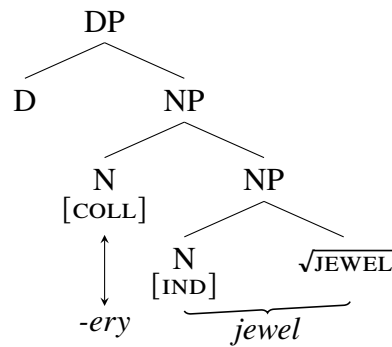
## 4.1 Deriving the syntactic properties

(20) The basic syntax

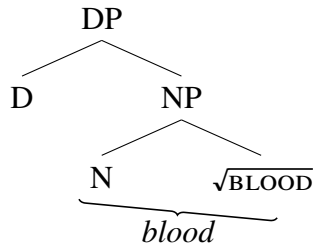
a. SG/PL Count



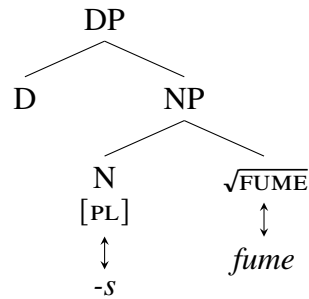
c. Object mass



b. unmarked Mass



d. PL Mass



NumP enables numeral modification.

Size adjectives seem to

(see Deal 2017, for ideas along these lines)

- require adjunction higher than the lowest NP:

1. more peripheral than non-dimensional adjectives (e.g. *big African jewel(ry)*)
2. require SG/PL-marking on the NP in some languages (e.g. Mongolian, W. Armenian)
3. and are higher than classifiers (e.g. Hungarian, Teochew Southern Min)

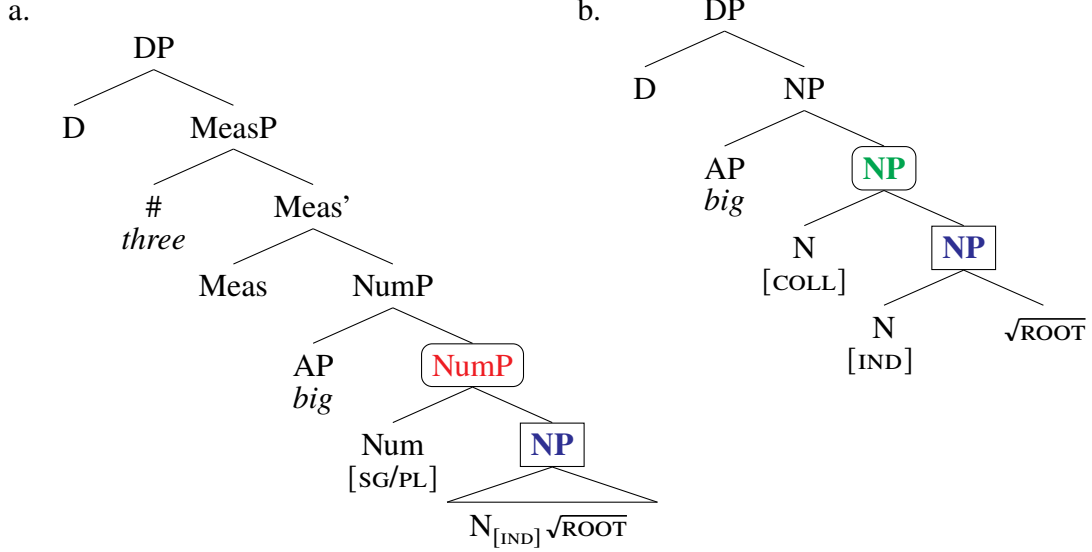
- and impose a lexical requirement on the NP they modify.

(21)  $\llbracket A_{size} \rrbracket = \lambda x: \exists x[P(x) \wedge *atom(x)]. \exists d[\text{dimension}(x) \geq d]$

‘The property of having a size to a degree larger than  $d$  satisfied if  $x$  is in  $P$  and it is an atomic thing or sum of atomic things’

Only [IND]-marked constituents have atoms in their extension.

(22) The articulated structure: numerals and size APs



## 4.2 Determiners

Features in the extended projection of the NP may appear on D as a result of an Agree relation. (e.g. Chomsky 2000; Carstens 2000)

We can group determiners based on the unvalued (probing) features on D.

Table 2: Decomposing Determiners

Type of Determiner	$uF$ on D	F on xNP
SG-count D	$[uSG: \_]$	[SG]
<i>a, every, each</i>	$[uIND: \_]$	[IND]
PL-count D	$[uPL: \_]$	[PL]
<i>several, both</i>	$[uIND: \_]$	[IND]
SG/PL-count D	$[uNum: \_]$	[SG/PL]
<i>which</i>	$[uIND: \_]$	[IND]

### Back to *all*, *much*, *many*, *more*.

Mass nouns and plural count nouns do not form a syntactic natural class under this view: there is no feature or set of features that they have in common.

The existence of determiners like *all* or *more* seems like a big challenge to the account. But this is only purportedly so.



Mass and plural count nouns form a semantic natural class: they are both cumulative.<sup>6</sup>

- (23)  $CUM(P) = \forall x[P(x) \rightarrow \forall y[P(y) \rightarrow P(x \cup y)]]$   
‘a predicate  $P$  is cumulative if for every member in  $P$ , their sum is also in  $P$ ’

The aforementioned determiners require that their NP complement (i.e. their restrictor) be cumulative. This can be encoded as in (24), where  $\mathcal{D}$  stands for all potential domains.

- (24) For any set  $P \subseteq \mathcal{D}$ ,  $\llbracket all/more/much/many \rrbracket(P)$  is defined if  $CUM(P) = 1$

## 5 Languages with no overt count-mass distinction (e.g. Nez Perce)

There are other languages that, at least at first sight, differ from English. For example, that is the case of Nez Perce (Sahaptian, Deal 2017).

Despite having no overt count/mass distinction of the English type, there is still evidence for count and mass syntax as well as for countability.

### 5.1 Some basics

A sample of ‘notional’ count and notional mass nouns is in (25) and (26) respectively.

- |      |                    |                        |      |                       |                    |
|------|--------------------|------------------------|------|-----------------------|--------------------|
| (25) | a. ’aayat<br>woman | c. walc<br>knife       | (26) | a. samq’ayn<br>fabric | c. kike’t<br>blood |
|      | b. miya’c<br>child | d. ’ileeptekey<br>sock |      | b. itx̄<br>clay       | d. qahas<br>milk   |

In Nez Perce, plural-marking on nouns is restricted to human-denoting nouns. But plural-marking is obligatory on the attributive adjective.

### 5.2 count-mass diagnostics

Notional count nouns make singular/plural distinctions.

- |      |  |  |
|------|--|--|
| (27) | a. Yoḥ kuhet ’aayat<br>DEM tall woman<br>‘that tall woman’ | b. Yoḥ <b>ki</b> -kuhet <b>ha</b> -’ayat<br>DEM <b>PL</b> -tall <b>PL</b> -woman<br>‘those tall women’ |
|------|--|--|

Notional substance nouns are grammatical with plural marker on the adjective. But the lack of plural corresponds to a difference in count vs. mass interpretation.

- |      |  |   |
|------|--|---|
| (28) | a. cimuuXCimux samq’ayn<br>black fabric<br>Mass: ‘black fabric’<br>#Count: ‘a (piece of) black fabric’ | b. cicmUXcicmUX samq’ayn<br><b>PL</b> .black fabric<br>#Mass: ‘black fabric’<br>Count: ‘pieces of black fabric’ |
|------|--|---|

<sup>6</sup>See, e.g., Quine (1960); Link (1983); Bach (1986); Krifka (1989); Chierchia (1998)

The same pattern is observed with numerals. They can directly combine with notional count and mass nouns. Again, the notional mass noun has a container reading.

- (29) kii lepit ciickan  
 DEM two blanket  
 ‘those two blankets’
- (30) *Speaker is toying with two nearly identical pieces of white modeling clay*  
 lepit ’itx̂, kii kaa yox̂  
 two clay DEM and DEM  
 ‘Two pieces of clay, this one and that one’

All determiners in Nez Perce require that the NP is cumulative.

- (31) a. \* { mac/ ilex̂ni } ’ilp’ilp aatamoc  
 how.much a.lot red car  
 ‘{ How much/ a lot of } red car’
- b. { mac/ ilex̂ni } **he**’ilpe’ilp aatamoc  
 how.much a.lot **PL**.red car  
 ‘{ how many/ a lot } red cars’
- (32) { mac/ ilex̂ni } ’ilp’ilp samq’ayn  
 how.much a.lot red fabric  
 ‘{ how much/ a lot } red fabric’

These data suggest the following:

- unmarked notional count NPs must be underlyingly singular and count: they are not cumulative.
- unmarked notional mass NPs are not plural (count) underlyingly: PL is not exponed on the adjective.
- unmarked notional mass NPs are not singular (count) either underlyingly: they are cumulative.

#### Interim conclusion I

despite being different from English on the surface, underlyingly the language still makes a distinction between SG/PL-count and mass.

### 5.3 Countability

#### Size adjectives

Notional count nouns, both unmarked and PL-marked, are compatible with size adjectives.

- (33) a. himeeq’is picpic  
 big cat  
 ‘(the) big cat’
- b. **ki**-kuckuc laatis  
 PL-small flower  
 ‘(the) small flowers’

Notional mass nouns can combine “directly” with a size adjective.

- (34) a. himeeq’is kuus  
big water  
‘(the) big portion of water’
- b. **ki**-kuckuc kuus  
PL-small water  
‘(the) small portions of water’

But note the following:

- the interpretation is again a container one.
- when a determiner is added to the unmarked notional mass noun modified by the size adjective, the expression is ungrammatical (35). (adapted from Deal (2017))

- (35) \* { mac/ ilexni } himeeq’is kuus  
how.much a.lot big water  
‘{ how much/ a lot } big portion of water’

The data in (35) suggests that (34a) are underlyingly singular count.

This is similar to English (36)

- (36) We ordered a large { water/beer } for the table.

*Who has more NP?*



*’ileeptekey* ‘sock’



*qahas* ‘milk’

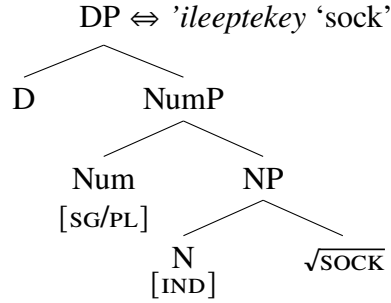
- (37) a. ’Issii-nm ’uu-s qetu ’ilexni **ti**-ta’c ’ileeptekey?  
who-GEN have-PRES COMPR a.lot **PL**-good sock  
‘Who has more good socks?’ CARDINALITY, # VOLUME
- b. ’Issii-nm ’uu-s qetu ’ilexni **ti**-ta’c qahas?  
who-GEN have-PRES COMPR a.lot **PL**-good milk  
‘Who has more portions of good milk?’ CARDINALITY, # VOLUME
- c. ’Issii-nm ’uu-s qetu ’ilexni ta’c qahas?  
who-GEN have-PRES COMPR a.lot good milk  
‘Who has more good milk?’ #CARDINALITY, VOLUME

### Interim conclusion II

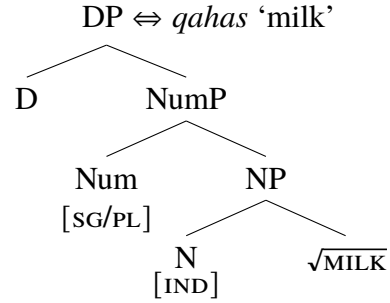
Nez Perce distinguishes between countable and non-countable nouns just like English.

## 5.4 The syntax of Nez Perce

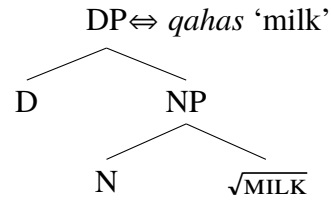
(38) a. Notional Count



b. Notional mass as count



c. Notional Mass



## 6 Broader implications: different but equal

The same surface expression *water/ kuus* may be underlyingly mass or underlyingly count.

The syntax of natural languages determines whether an expression  $\alpha$  is count or mass, regardless of the surface form.

### What makes an NP count as opposed to mass?

Count NPs are decomposed into two sets of features: [IND] on N, [SG/PL] on Number.

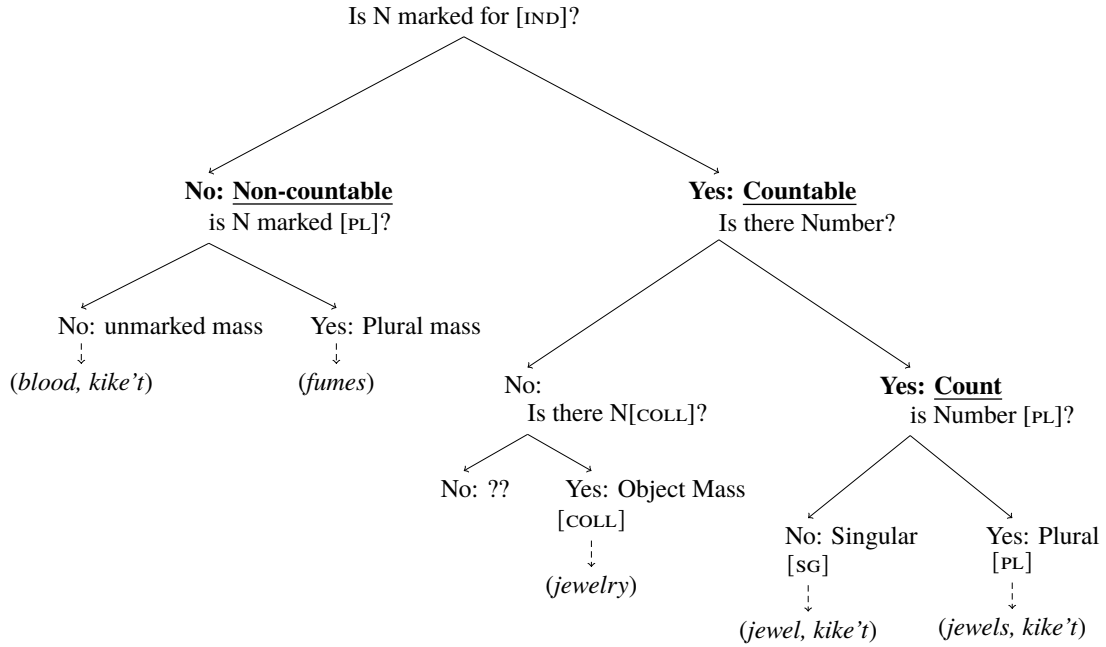
Mass NPs are best understood as lacking Number.

### What makes countable NPs, both count and mass, form a natural class?

The property that enables this is being marked for [IND]. NPs unmarked for [IND] are non-countable.

Our proposal predicts the typology in (3):

Figure 3: Predicting countability asymmetries



### What determines variation?

Shifts between classes of NPs can be accounted for by pairing a root with a different N-head.

At the interface, the object put together by the syntax must be mapped to an exponent and an appropriate meaning: Table 3.

Table 3: Accounting for ‘shifts’

Form	Syntax	Meaning	example
<i>water</i>	$\Leftrightarrow$ $[\sqrt{\text{ROOT}} \text{ N}]$	$\Leftrightarrow$ ‘water substance’	<i>water</i>
<i>water</i>	$\Leftrightarrow$ $[[\sqrt{\text{ROOT}} \text{ N}[\text{IND}]]]$	$\Leftrightarrow$ ‘water unit’	<i>2 waters</i>
<i>waters</i>	$\Leftrightarrow$ $[\sqrt{\text{ROOT}} \text{ N}[\text{PL}]]$	$\Leftrightarrow$ ‘water abundance/type’	<i>international waters</i>

Cross-linguistic variation can be accounted for in similar terms. Certain roots cannot be licensed (i.e. assigned a meaning or form) at the interface in the relevant context.

The syntax is blind as to whether a root can be adjoined to one categorizer or another. But this does not entail that any root-categorizer pair will be appropriately licensed at the interfaces.

(Harley and Noyer 1998, 1999; Acquaviva 2009; Harley 2014)

Cross-linguistic variation thus results from the way that the syntax puts terminal nodes together in concert with the satisfaction of the different requirements at the interfaces.

Table 4: Idiosyncratic variation across-languages

Language	Form		Syntax		Meaning	example
N. Perce	<i>kuus</i>	$\Leftrightarrow$	$[\sqrt{\text{ROOT}} \text{ N}]$	$\leftrightarrow$	‘water substance’	<i>kuus</i>
	<i>kuus</i>	$\Leftrightarrow$	$[\sqrt{\text{ROOT}} \text{ N}[\text{IND}] ]$	$\leftrightarrow$	‘water unit’	<i>3 kuus</i>
	<i>kike’t</i>	$\Leftrightarrow$	$[\sqrt{\text{ROOT}} \text{ N}]$	$\leftrightarrow$	‘blood substance’	<i>kike’t</i>
	<i>kike’t</i>	$\Leftrightarrow$	$[\sqrt{\text{ROOT}} \text{ N}[\text{IND}] ]$	$\leftrightarrow$	‘blood unit’	<i>2 kike’t</i>
English	<i>water</i>	$\Leftrightarrow$	$[\sqrt{\text{ROOT}} \text{ N}]$	$\leftrightarrow$	‘water substance’	<i>water</i>
	<i>water</i>	$\Leftrightarrow$	$[\sqrt{\text{ROOT}} \text{ N}[\text{IND}] ]$	$\leftrightarrow$	‘water unit’	<i>2 waters</i>
	<i>blood</i>	$\Leftrightarrow$	$[\sqrt{\text{ROOT}} \text{ N}]$	$\leftrightarrow$	‘blood substance’	<i>blood</i>
	<i>blood</i>	$\Leftrightarrow$	$[\sqrt{\text{ROOT}} \text{ N}[\text{IND}] ]$	$\leftrightarrow$	#	<i>2 bloods</i>
Mongolian	<i>os</i>	$\Leftrightarrow$	$[\sqrt{\text{ROOT}} \text{ N}]$	$\leftrightarrow$	‘ water substance’	<i>os</i>
	<i>os</i>	$\Leftrightarrow$	$[\sqrt{\text{ROOT}} \text{ N}[\text{IND}] ]$	$\leftrightarrow$	#	<i>2 os</i>
	<i>tsos</i>	$\Leftrightarrow$	$[\sqrt{\text{ROOT}} \text{ N}]$	$\leftrightarrow$	‘ blood substance’	<i>os</i>
	<i>tsos</i>	$\Leftrightarrow$	$[\sqrt{\text{ROOT}} \text{ N}[\text{IND}] ]$	$\leftrightarrow$	#	<i>2 tsos</i>

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