Beans, Lentils, Oats, and Rice
Mass / Count as nominal subcategories

Distributional characteristics:

- No number distinction, typically singular: bean / beans vs. rice / *rices (singularetantum) *oat vs. oats (pluraletantum)
- Combination with numerals: one bean, three beans / *one rice, *three rice(s)
- Combination with quantifiers: every bean, all beans / *every rice, all rice
- Specific determiners: many, few beans / much, little rice
- Indefinite and definite determiners: a bean, the bean / *a rice, the rice
- Full DP: *Bean / Rice was spilled all over the floor.
  Similar to plural nouns: Beans were spilled all over the floor.

Clear evidence for two subcategories of nouns:

- Gerstenhofer 2007: From a randomly selected set of 600 nouns,
  - 35% are mass in Russian, 29% in German,
  - Inanimates: 50% are mass in Russian, about 30% are mass in German,
  - Abstract: 60% are mass in Russian, about 50% are mass in German;
  - In Russian, 50% of mass nouns are feminine;
  - in German, 40% of mass nouns are neuter.

Mass / Count as nominal subcategories

Some typological aspects (see Doejes 2012)

- In classifier languages distinction measure / count construction, e.g. Mandarin:
  liǎng bàng (de) ròu      liǎng pǐ (*de) luózì      sān wūzì *(de) rén
  ‘two pounds of meat’  ‘two mules’  ‘three roomful of people’
- Interacts with nominal classification, e.g. ma-class (Cl. 6), u-class (Cl. 11) in Bantu
  (Swahili maji ‘water’, mafuta ‘oil’; uji ‘porridge’, udongo ‘soil’)
- Plural agreement with number words not essential for mass/count distinction:
  e.g. Turkish: çocuk ‘child’, çocuklar ‘children’, yedi çocuk ‘seven children’
- Possible lack of distinction, e.g. Nez Perce (Deal 2013)

a. k’uyc heesu
   nine eel
   nine eels

b. k’uyc heecu
   nine wood
   nine pieces of wood

d. yi-yos-yi-yos kapoo
   PL-blue coat
   blue coats

e. yi-yos-yi-yos mayx
   PL-blue sand
   quantities of blue sand
Mass / Count and cognition

Cognitive characteristics:
- Substances are mass: gold, dust, dirt, porridge
- Fluids are mass: water, milk, glass (!)
- Small objects tend to be mass: silt, sand, gravel – stone(s), rock(s), boulders
- Entities low on the animacy scale tend to lack number distinction (Smith-Stark 1974; e.g. Manchu, ‘horse’ only animal term with SG/PL)
  - But: police, military, e.g. There was a lot of police everywhere
- Shape reference: count, e.g. ring, edge, corner
Arguably rooted in pre-linguistic categorization:
- Spelke 1985, other, for infants: Cars / drops bumping into each other, resulting in a bigger car (!) / drop
- Cognitive differentiation of substances / animals present with primates (e.g. Rhesus monkeys, Hauser 1996)
- Bootstrap for linguistic count / mass distinction

Mass / Count: Cognition is not everything

But cognitive characteristics are not sufficient:
- Differences between languages:
  - English leave, leaves, German Laub (next to Blatt, Blätter)
  - Middle English peasen to Modern English pea, peas
- Differences within a language:
  - Two types of mass nouns (Barner & Snedeker 2005):
    Mass / Count distinction motivated by ontological / cognitive considerations, but not fully determined by it – cf. Gender.
Mass / Count as a semantic distinction

Voluminous literature on mass/count in semantics, philosophy,
- e.g. F.J. Pelletier, Chierchia; Champollion & Krifka t.e.

Basic assumption:
- Sum individuals
- Part relation
- Mass and plural denotation closed under sum operation (cumulative), e.g. *rice*, *beans*
- Singular denotation, e.g. *bean*: atomic.
- Mass noun denotation: nonatomic? But rice has “atoms”, too!

Mass / Count as a semantic distinction

Krifka (1989 ff.):
- Mass nouns are predicates: \[[rice]\] = \lambda x[RICE(x)]
- Measure expressions as restrictores:
  \[[kilo(s)]\] = \lambda P\lambda n\lambda x[P(x) \land KG(x)=n] agreement plural
  \[[kilo(s) of rice]\] = \lambda n\lambda x[RICE(x) \land KG(x)=n]
  \[[three kilos of rice]\] = \lambda x[RICE(x) \land KG(x)=3]
- Classifiers refer to type-specific natural units (NU):
  \[[grain(s)]\] = \lambda P\lambda n\lambda x[P(x) \land NU(P)(x)=n], agreement plural
  \[[grain(s) of rice]\] = \lambda n\lambda x[RICE(x) \land NU(RICE)(x)=n]
  \[[three grains of rice]\] = \lambda x[RICE(x) \land NU(RICE)(x)=3]
- Count nouns have built-in classifiers:
  \[[bean]\] = \lambda x[BEAN(x)], not a lexical entry
  \[[bean(s)]\] = \lambda n\lambda x[BEAN(x) \land NU(BEAN)(x)=n] agreement plural
  \[[three beans]\] = \lambda x[BEAN(x) \land NU(BEAN)(x)=3]
- Bare plurals with count nouns:
  \[[bean-s]\] = [[PL][[bean]]] = \lambda x\exists n[BEAN(x) \land NU(x)=n] semantic plural
- NE requires internally connected “figures” that can be traced, move independently
  - E.g. solid detached objects, organisms,
  - but also entities with social, functional structure: *legion, cohort*
- Built-in NE is conventionalized, more likely if existence of an NU is particularly evident, or NU reference is frequent
**Mass / Count category changes**

Truly ambiguous nouns:
- German *Brot* ‘bread’
  - *Brote, ein Brot*: typical count noun use
  - *etwas Brot, Stück Brot*: typical Mass noun use
  - cf. English *cake, stone*
  - distribution in Google n-gram, 1900-2000

Non-ambiguous noun: German *Apfel* ‘apple’
- *Stück Apfel, ein Apfel, Äpfel*, no *etwas Apfel*

**Category changes: Mass to count, Containers**

Reference to portions of liquids:
- *etwas Kaffee* vs. *ein Kaffee, Kaffees*; *etwas Tee* vs. *ein Tee, Tees*

How does “packaging” work?
- By container, container is countable, substances are self-connected
  notice: service portions are self-connected
- Change from *coffee*$_{MN}$ to *coffee*$_{CN}$ \( \lambda n \lambda x \exists y \left[ \left( \text{coffee}_{MN}(x) \land \text{CONTAINER}(y)=n \land \text{FILL}(x,y) \right) \right] \)
- More specifically: container for coffee appropriate in the reference situation
- Packaging also relevant in *He put the coffee on the table.*
- Reverse process, from container to content: *He drank a bottle (of beer).*
Category changes: Mass to count, Subkinds

Reference to subkinds (taxonomic readings, cf. Krifka e.a. 1995)
- *Viele Tees aus ökologisch fairem Anbau!*
- *top three teas for weight control*
- *Morgenstund hat Gold im Mund. Was für ein Gold haben die Alten damit gemeint?*

Reference to subkinds in exclamatives (cf. Gorishneva 2014):
- *Das ist das “Sommerleuchten”, Was für ein tolles Gold, liebe Ellen!*
- *Oh, was für ein wunderbarer Kaffee, danke!*
- Implies a ranking of subkinds, expression of astonishment about the subkind.

How does reference to subkinds work?
- The specimens of a subkind share a distinctive property, hence are connected within the superkind
- This allows to form a counting operator SK with similar properties as NE
- which in turn allows for the formation of a count noun: coffee\textsubscript{MN} to coffee(s)\textsubscript{SK}, with $[[\text{coffee(s)}_{SK}]] = \lambda n \lambda x[[[\text{coffee}_{MN}]](x) \land \text{SK}([[\text{coffee}_{MN}]])(x)=n]$

Category change: Count to mass, Grinding

The “universal grinder” (D. Lewis, F.J. Pelletier)
- *I went to the site of the traffic accident, and there was dog lying all over the road.*
  (From the Wikipedia entry on the Universal Grinder)
- *How much chicken should we eat?*
- *This table is made of oak.*
- *Zuviel Ei im Mürbeteig – was tun?*

How the universal grinder works:
- The objects and the stuff they consist of may have different properties:
  *This ring was made in Prague, but I bought the gold it consists of in Brazil.*
- Link (1983 assumes) a function STUFF: concrete object $x \rightarrow$ stuff $x$ consist of.
- As belonging to the object is the only identifying criterion for the stuff, the stuff itself arguably has no other NE to rely on.
- Hence: mass use related to the universal grinder

Grinding is a rather complex procedure:
- *much chicken:* requires cumulative predicate $\lambda x[...], but [[\text{chicken}_{CN}]] = \lambda n \lambda x[...$
- cumulative predicate: $\lambda x[\exists x' \exists n[[\text{chicken}_{CN}]](x')(n) \land x' \sqsubset \text{STUFF}(x')]$

Not just: Recovery from CN denotation (cf. Rothstein 2010)
- $[[\text{chicken}_{CN}]] = \lambda n \lambda x[[\text{CHICKEN}(x) \land \text{NU}(\text{CHICKEN})(x)=n]]$ (plural denotation)
- Mandarin does not have this reading (cf. Cheng e.a. 2008), as bare noun can have a regular denotation (referring to one or more chickens).
Category change: Count to Mass, Product

From producer to product
- John read 700 pages of Tolstoy over the weekend.
- John hat 700 Seiten Tolstoy übers Wochenende gelesen.
- Klassik-Marathon: 100 Stunden Beethoven
- Das ist Beethoven!
- Die Welt ist voller Degussa.
- Mary has two original Klees in her living room.

How it works
- Derivation of a mass noun from a name
  \( \lambda x[\text{PRODUCT(Tolstoy)}(x)] \)
- Application of a measure phrase: 
  \( [\text{pages of Tolstoy}] = \lambda n \lambda x[\text{PRODUCT(Tolstoy)}(x) \land \text{PAGE}(x) = n] \)
- Application of NU operator if there is a natural unit, with fine arts:
  \( [\text{Klee(s)}] = \lambda n \lambda x[\text{PRODUCT(Klee)}(x) \land \text{NU(PRODUCT(Klee)}(x) = n] \)

Category change: Count to mass, Root

Internal structure, natural unit does not matter:
- A lot of house for the money.
- Viel Schlafsack für wenig Geld.
- Und das ZDF ist heute ein Routinebetrieb zur Erstellung von Programm
- Noch mehr U-Bahn ab 28. Mai

How it works (cf. Rothstein 2010):
- Distinction between roots and lexical entries
- Mass nouns:
  - Root: \( \lbrack \sqrt{\text{water}} \rbrack = \lambda x[\text{WATER}(x)] \), a cumulative predicate
  - The root is the lexical entry: \( \lbrack \lbrack \text{N water} \rbrack \rbrack = \lbrack \lbrack \sqrt{\text{water}} \rbrack \rbrack \)
- Count nouns:
  - Root: \( \sqrt{\text{house}} = \lambda x[\text{HOUSE}(x)] \), a cumulative predicate
  - Lexical entry derived from root by count operator:
    \( \lbrack \lbrack \text{N house} \rbrack \rbrack = \text{COUNT}(\lbrack \lbrack \sqrt{\text{house}} \rbrack \rbrack) = \lambda n \lambda x[\lbrack \lbrack \sqrt{\text{house}} \rbrack \rbrack(x) \land \text{NU}(\lbrack \lbrack \sqrt{\text{house}} \rbrack \rbrack) = n] \)
  - This is a lexical property that has to be learned (but there are recurrent features)
- Special uses: back to the root
  - a lot of house requires resorting to \( \sqrt{\text{house}} \), meaning \( \lambda x[\text{HOUSE}(x)] \)
  - hence not derived from the lexical entry meaning, but from its root
Count / Mass as a syntactic distinction

The fundamental representation of sortal nouns:

- **Kind individuals**
  - *rice*: r (oryza)
  - *beans*: b (fava)

- **Mass / Count distinction already with reference to kinds**
  - (*The) Rice was first cultivated in Asia.
  - *(The) bean was first cultivated in Africa. Beans were first cultivated in Africa.

- **No apparent semantic distinction, yet there is a syntactic distinction:**

```
NP     |     NP     |     NP     |     NP
       |     SpecNP |     SpecNP |     SpecNP |     SpecNP
rice   |       N    |       N    |       N    |       N
       |     bean   |     the   |     bean   |     the
       |     NP     |     NP     |     NP     |     NP
```

- **Distinct derivation of non-kind-referring uses:**
  - *rice*: \( \lambda x[R(r)(x)] \) where \( R \): Carlson’s realization relation
  - *bean*: \( \lambda n \lambda x[R(b)(x) \land NU(b)(x)=n] \)

Coercion

What is coercion?

- **Compositional interpretation of meanings**: \( \llbracket \alpha \beta \rrbracket = \llbracket \alpha \rrbracket (\llbracket \beta \rrbracket) \)
- **Sometimes there is a type mismatch or a sortal mismatch**: \( \ast \llbracket \alpha \rrbracket (\llbracket \beta \rrbracket) \)
- **There are coercion operators** \( C_1, C_2, \ldots, C_n \) that can be applied to fix things,
  - for example: \( \llbracket \alpha \rrbracket (C_i (\llbracket \beta \rrbracket)) \) is o.k.
  - Coercions appear to affect the argument of the predicate, not the predicate.
- **Extended compositionality (cf. Pustejovsky 2011):**
  - The meaning of a complex expression can be computed from its immediate parts, their mode of syntactic combination, and possibly the application of one of a fixed set of coercion operators.

**Standard examples for coercion:**

- Pustejovski 1995: Qualia structure of nouns, e.g. the telic or agentive role,
  - *John began a cigarette. / a movie. / a novel.* (consuming)
  - *The author began a new novel.* (producing)

- Moens & Steedman 1987, aspectual coercion
  - *The light flashed for an hour.* (iterative)
  - *John was reaching the top.* (preparatory phase)
  - *Suddenly it was dark.* (change)
Coercion and categories

How coercion helps the notion of categories:

- We assume a strict category distinction:
  - mass nouns, e.g. gold, water, rice
  - count nouns, e.g. bean, ring, boy
  - in rare cases, ambiguous nouns, e.g. bread, cake
- Coercion operators can map expressions from one category to another, the semantic effect on the argument satisfies the requirement of the functor.
- In contrast to typical cases of ambiguity, coercion is a rare phenomenon for any given argument; if frequent, it would lead to ambiguity in the lexicon (as e.g. with bread).

Hence with coercion as maps between linguistic categories: they become less fuzzy.

- We do not have to say that apple is 15% mass, 85% count
- Or that apple is ambiguous
- Rather: apple is a count noun that can be coerced to various mass nouns
  - Put some apple on the salad. (Quine): Grinder
  - Two apples, namely Granny Smith, and Pink Lady, were most popular: Subkind
  - That's a lot of apple! (Looking at heap of apples): Root
- apple is polysemous (where polysemy is generally a matter of coercion).

The crisp nature of syntactic categories

If syntactic categories were fuzzy, we would expect

- Non-prototypical items have only some of the formal properties associated with the syntactic category
- E.g., a pinguin as a non-prototypical bird:
  - does not fly
  - has a different posture
  - has different types of feathers
- Hypothetical examples:
  - Non-prototypical count nouns allows for indefinite article: an apple, but not for number word or quantifier: *every apple
  - Non-prototypical mass nouns allows for indefinite article: a beer but not for number word: *one beer, two beers
- Apparently, this does not hold
  - E.g. Bavarian: All mass nouns allow for indefinite article, e.g. a B’schteck, a Schnaps
- But possible cases: defective plurals,
  - e.g. sheep, three sheep, *sheeps, *three sheeps
The limits of coercion

Metonymy (cf. Nunberg 1979)
- The ham sandwich wants to pay his bill.
  ordered meal → person, more general: possessum → possessed, cf. bahuvrihi noun
- I am parked at parking lot 3.
  person → vehicle
  But: The valet parked me / my car in parking lot 3.
- Appears to be more restricted to particular situations.

Denominal verb derivations
- They housed the refugees (in tents).
- They watered the flowers (with cold tea).
- Denominal verb derivation is a more restricted process.
  *The tented the refugees.
  *They teaed the flowers.
- Notice that a coercion analysis would require a change of the functor, not the argument.

The brain signature of coercion

Coercion is visible in speech processing: Schumacher 2013, ERPs
- Container for Contained
  - Er hat den Becher hastig getrunken.
  - Er hat den Becher wie seinen Augapfel gehütet.
  - Result: Late positivities, reflect discourse updating, similar in eye tracking studies of reading.
- Contained for Container:
  - Er hat den Zaubertrank an seinem Gürtel festgeschmalt.
  - Er hat den Zaubertrank vor dem Eintreffen der Römer gebraut.
  - Result: No difference.
- Explanation:
  - Container for contained: Accesses the qualia structure of container nouns.
  - Contained for container: Reference to liquid object invokes container easily (perhaps especially with Trank ‘drink’).

Schumacher 2014: ham sandwich metonymies
- Thomas / The doctor asked Claudia who had called that early. Claudia responds that the hepatitis / the therapist had called that early.
- N400 after Thomas..., not The doctor...
- Hence; distinct brain reactions.

We need more studies for different coercion types!
A new case of coercion?

Embedded clauses with main clause features: V2, particles

- *Hans glaubt, Maria wird wohl zu spät kommen.*

Analysis as embedded illocutionary acts (Krifka 2014)

- *Hans glaubt [ActP Maria wird wohl zu spät kommen]*
- *Hans glaubt [CP dass Maria wohl zu spät gekommen ist]*

Problem: Particles occur also in prototypical embedded clauses:

- *Hans glaubt, dass Maria wohl zu spät kommen wird.*
- *Hans wollte wissen, ob Maria denn zu spät gekommen ist.*

Solution: Coercion of CP to ActP, triggered by particle

- *Hans glaubt, CActP ([CP dass Maria wohl zu spät kommen wird])*
- *Hans wollte wissen, CActP ([CP ob Maria denn zu spät gekommen ist])*

Derivation of ActP from proposition in general (Krifka 2014):

- *[ActP Maria ASSERT-ist [TP Maria zu spät gekommen t_ist]]*

References (selected)

- Gorishneva, Elena. 2014. The Variety of Functions of the Numeral and Indefinite Marker „One“ in Bulgarian and Russian.