

# Who Has More Furniture? An Exploration of the Bases for Comparison

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## Setting the Context

Grammatically non-countable nouns include well-behaved mass nouns (e.g. *water, butter, sand, sugar*) and some misfits.

- ▶ *furniture, mail, luggage, change, jewelry, ammunition, ...*

These “*furniture-nouns*” are attracting attention due to a surprising combination of properties, which straddles mass and count. (Wierzbicka 1985, Wisniewski & Murphy 1989, Chierchia 1998, Barner & Snedeker 2005, Mihatsch 2007, Rothstein 2010)

# Properties of Furniture-Nouns: Non-Countable Syntax

- ▶ Like core mass nouns, liquids and substances (e.g. *water*, *butter*, *sand*, *sugar*), they are non-countable:
  - ▶ furniture/\*furnitures, mail/\*mails
  - ▶ \*two furnitures, \*three mails
  - ▶ water/\*waters, gravel/\*gravels
  - ▶ \*two waters, \*three gravels

# Properties of Furniture-Nouns: Constituent Objects

- ▶ In contrast to core mass nouns, denotations of these nouns appear to include individual entities, which have their own names:
  - ▶ e.g. *furniture* may be comprised of *chairs*, *tables*, *beds*, *sofas* (compare *sand*/*grain of sand*)
  - ▶ hence, their apparent substitutability by nouns denoting their constituent objects (*furniture*  $\approx$  *tables* + *chairs*)

# Properties of Furniture-Nouns: Heterogeneity

- ▶ The individual constituent entities are of different types, e.g. tables, chairs, desks, sofas. . . for *furniture*.
- ▶ This heterogeneity is at odds with the standard observation that entities named by mass nouns are homogeneous (in the non-technical sense).

# Primary Research Question

## Key question addressed in this talk:

- ▶ What is in the denotation of *furniture*-nouns that allows them to have this puzzling conjunction of properties?
  - ▶ Non-countable syntax
  - ▶ Individuals in denotation
  - ▶ Heterogeneity

# Primary Research Questions

Previous studies have either emphasized:

- ▶ that *furniture*-nouns are like core mass nouns; that is, they are also “unindividuated” (Wisniewski et al. 1996);
- ▶ that the denotations of these nouns contain constituent objects; hence, Barner & Snedeker’s (2005) label *object*-mass nouns as opposed to *substance*-mass nouns (e.g. *sand* or *oil*).

Our analysis of *furniture*-nouns recognizes both facets.

# Our Proposal

**Key to the analysis:** *furniture*-nouns denote artifacts.

- ▶ Artifacts have a **function** and thus participate in some way in an **associated event**, e.g. furnishing for *furniture*

The special properties of *furniture*-nouns follow from the type of function, or associated event, at issue:

- ▶ The associated event canonically involves the participation of multiple, and often diverse, entities

Thus, *furniture*-nouns should be considered **functional aggregates** (cf. granular aggregates such as *sand*, *gravel*, *sugar*)



## Previous Approaches

The salient properties have motivated two previous approaches:

### **Heterogeneity:**

- ▶ *Mass Superordinate Approach*  
motivated by the recognition that the constituent objects have something in common despite their diversity (found in the categorization literature)

### **Individuals in denotation:**

- ▶ *Collection of Individuals Approach*  
motivated by substitutability of *furniture*-nouns by nouns denoting their constituent objects

## Collection of Individuals View

Evidence that the constituent objects are linguistically relevant:

- ▶ They are in principle countable
  - ▶ *Ed listed the furniture in the dining room.*
- ▶ They are modifiable (Schwarzschild 2006)
  - ▶ *big furniture* distributes over the individual pieces
- ▶ They provide for a dimension of comparison (Barner & Snedeker 2005)
  - ▶ If Ed has more pieces of furniture than Eva, then he may be considered to have more furniture.

## Collection of Individuals View

The visibility of the constituent objects has led to an analysis in which the denotation of *furniture*-nouns is simply composed of these objects (e.g. Chierchia 1998, Bale & Barner 2009)

- ▶ that is, they denote a collection of individuals
- ▶ under this view, *furniture*-nouns are synonymous and co-extensive with their component parts

## Collection of Individuals View

“What else can the denotation of *furniture* be, if not all the pieces of furniture (down to the single ones)?” (Chierchia 1998: 68)

- ▶ **Evidence:** the inter-substitutability of e.g. *mail* and *letters* or *living room furniture* and *sofa, coffee table, chairs*

John arranged { the furniture.  
the sofa, coffee table, chairs.

## Collection of Individuals View

- ▶ Non-countability is not a problem since proponents consider count vs. mass classification to be arbitrary (Chierchia 1998, Pelletier 1991, Rothstein 2010)  
  
“In fact, the same slice of reality can be classified as either count or as mass, as attested by the existence of near synonyms.” (Chierchia 1998: 56)
- ▶ Cross-linguistic variation in the status of certain translation equivalents lends plausibility to this view:
  - ▶ English *furniture* (uncountable) vs. French *meuble* (countable)

# Artifacts and Their Associated Events

However, there is another equally important dimension of meaning present in these nouns:

- ▶ *Furniture*-nouns designate artifacts

The artifact/natural kind distinction is an essential conceptual distinction among entities, as discussed by philosophers and cognitive and developmental psychologists (e.g. Aristotle, Wiggins 2001, Keil 1993, Wierzbicka 1985).

## Artifacts and Their Associated Events

Artifacts, unlike natural kinds, have a function, evoking what Nichols (2008) calls an 'associated event', cf. the 'telic' component of Pustejovsky's (1995) qualia structures

“two types of noun meaning

- a. nouns whose meaning is based on physical properties of the referent, and
- b. nouns whose meaning is represented by the canonical event associated with the referent” (Nichols 2008: 694)

## Artifacts and Their Associated Events

The artifact/natural kind distinction is grammatically relevant, having a linguistic manifestation in the names given to entities in the world (Wisniewski & Love 1998, Brown 1999, Kemler Nelson et al. 2003, Nichols 2008).

Artifacts and natural kinds show different naming patterns.

Further, these naming patterns underscore the importance of the associated event in the characterization of an artifact.

Brown (1999) studies how items imported from Europe are named in languages of the Americas:

- ▶ Reference to function is more prevalent in artifact names (63%) than natural kind names (10%).



## Artifacts and Their Associated Events

*Example: Head/modifier relations in compound names*  
(Wisniewski & Love 1998, Bloom 1999):

- ▶ For artifacts, this relation typically involves the function of the artifact (*coat hook* )
- ▶ For natural kinds, this relation typically involves perceptual properties of the natural kind (*snow goose*)

## Artifacts and Their Associated Events

The canonical associated events for *furniture*-nouns:

- ▶ *furniture*: furnishing a space
- ▶ *mail*: transmittal through the postal system
- ▶ *luggage*: pulling or carrying throughout a journey
- ▶ *change*: returned money from monetary transaction

## Artifacts and Their Associated Events

*Etymological Evidence for the Associated Event.:*

*Furniture*-nouns are often deverbal:

- ▶ *furniture* (< French *fournir* 'to furnish')
- ▶ *luggage* < *lug* (v.) + *-age*
- ▶ *change* < *change* (v.)

Or are closely tied to an event:

- ▶ *mail* is derived from bags used by couriers ("mail of letters"), cf. Modern French *malle* 'suitcase'

## Beyond Individuals

Two important components of *furniture*-noun meanings:

- ▶ The existence of an associated event which canonically involves multiple participants.
- ▶ The presence of constituent objects in the denotation.

## Beyond Individuals

Evidence that both components of meanings must be acknowledged:

*Furniture*-nouns and their purported constituents show different grammatical behavior:

- ▶ **Substitutability**: there are limits to substitutability
- ▶ **Adjectival Modification**: some adjectival modifiers occur more happily with the *furniture*-noun than its component parts, and vice versa
- ▶ **Comparison**: comparisons need not be based on component parts, but may involve the fulfillment of function

These differences arise because *furniture*-nouns and their constituents may have distinct functions.

# Substitutability

To the extent that a *furniture*-noun is a collection of individuals, its component parts might be expected to be substitutable for the whole.

However, the whole and the components parts may have distinct functions and, thus, are not always interchangeable.

**An example:** *Mail vs. letters and packages*

# Substitutability

**Mail:** a set of entities which have in common that they have been mailed and, thus, will travel together through the postal system

- ▶ may include letters, but also magazines, packages, postcards, and the like.

# Substitutability

**Letters and packages:** narrower classes of entities, that need not be mailed:

- ▶ Letters are written to convey information to some recipient(s)
- ▶ Packages are used to facilitate the transportation of goods

**Key point:** Not all letters or packages are mail, nor is all mail letters or packages.



# Substitutability

Still, *mail* or *letters* may in a particular situation be used to pick out the same set of entities—but this coincidence is not equivalence

In using one noun or the other, a speaker is choosing a specific description, with its own attributes, even if both nouns may pick out the same things in the world on a particular occasion

- ▶ analogous to the contrast drawn in the literature on aspect concerning events vs. event descriptions

# Adjectival Modification

Due to their function, *furniture*-nouns may lend themselves to modification patterns distinct from those of their component parts.

**Evidence:** An analysis of corpus data reveals real and systematic differences in the adjective types found with the two noun types.

Concomitantly, this study underscores the importance of the associated event.

# Adjectival Modification

## The Corpus Study

Extracted all adjective-noun pairs headed by *furniture*-nouns and plausible constituent objects from British National Corpus (BNC)

<i>Furniture</i> -Nouns	Tokens	Constituent Nouns	Tokens
Mail	364	Letters	587
Furniture	460	Chairs	283
		Tables	242
		Beds	200

Adjectives coded for one of the GermaNet semantic categories (approx. 50)

# Adjectival Modification

## Distribution of Adjective Types:

Type	Example	<i>Furniture</i>	<i>Chairs, tables, beds</i>
Total Spatial		6%	<b>18%</b>
Shape	<i>oblong, high-backed</i>	< 1%	<b>6%</b>
Dimension	<i>high, narrow</i>	0%	<b>4%</b>
Localization	<i>opposite, central</i>	0%	<b>2%</b>
Style/Period	<i>Victorian, Louis XV</i>	<b>14%</b>	1%

## Adjectival Modification

Some adjective-noun combinations specify properties of the event:

**Distribution of Adjective Types** (*mail vs. letters*):

Category	Example	<i>Mail</i>	<i>Letters</i>
Delivery	<i>express, international</i>	<b>45%</b>	2%
Behavior-Related	<i>malicious, poignant</i>	1%<	<b>21%</b>
Mood-Related	<i>cheery, dreadful</i>	1%<	<b>10%</b>

## Adjectival Modification: Mail/Letters

The distinct adjectival modification patterns reflect the distinct associated events:

- ▶ The adjectival modifiers for *mail* overwhelmingly concern the event tied to the noun, its delivery.
- ▶ The adjectival modifiers for *letters* often characterize the content of the letters, consistent with a letter's core function of conveying information.

## Comparison

Since there are two components to the meanings of *furniture*-nouns, both might be expected to enter into comparisons involving such a noun:

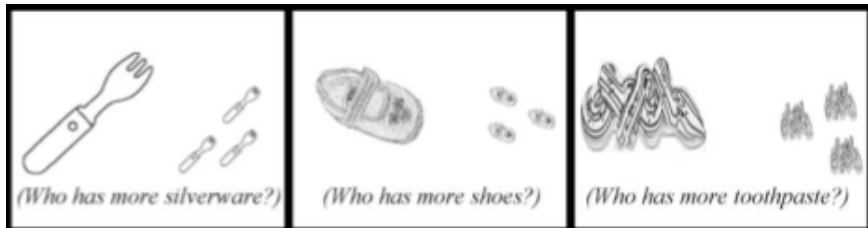
- ▶ comparisons that involve the number of constituent objects in the denotation
- ▶ comparisons that involve how well the constituent objects satisfy the associated event (McCawley 1975)

Only the first type of comparison has been previously investigated.

# Comparison

## Comparisons involving number of constituent objects

Barner & Snedeker (2005) illustrate such comparisons are made via a task involving making judgements about differing quantities of *furniture-nouns*, count nouns, and substance-mass nouns.





## Comparison

**The general finding:** The syntactic status of a noun, i.e. (non-)countability, does not determine how quantity judgements were made:

- ▶ For substance nouns, participants judge one large portion to be “more” than three tiny portions.
- ▶ For count nouns, participants judge according to number of physical objects.
- ▶ For *furniture*-nouns (their “object-mass” nouns), participants also judge according to number of physical objects.

## Comparison

While the experiment shows that individuals can be relevant:

- ▶ heterogeneity may not have been adequately controlled for
- ▶ there may be other relevant dimensions of comparison (Solt 2008, Rothstein 2010)
  - ▶ Specifically, we present three studies that show that the associated event provides another dimension for comparison.

## Comparison: The Experiments

The stimuli were presented on Amazon's Mechanical Turk.

Each item was seen by 20 participants.

50% or more of the items were fillers.

# Comparison

**Experiment 1** investigates whether comparison judgements may be affected by the degree of heterogeneity of constituent entities, given that heterogeneity is typical of certain associated events:

- ▶ Participants evaluated which counted as more furniture:
  - ▶ (i) five chairs
  - ▶ (ii) a sofa, two chairs, a coffee table, and a bookcase (five items)

# Comparison

## Experiment 1 results:

- ▶ 20 participants unanimously chose (ii) — the heterogeneous set
- ▶ many commented that this set better performed the function of furnishing

The results are problematic for a theory where the denotation of *furniture* is only equivalent to the constituents in the set.

## Comparison

**Experiment 2** investigates whether the degree of satisfaction of the associated event provides a dimension for comparison:

When a set of entities related to a *furniture*-noun fulfills the function better, will they be judged as “more” than a set which has greater cardinality?

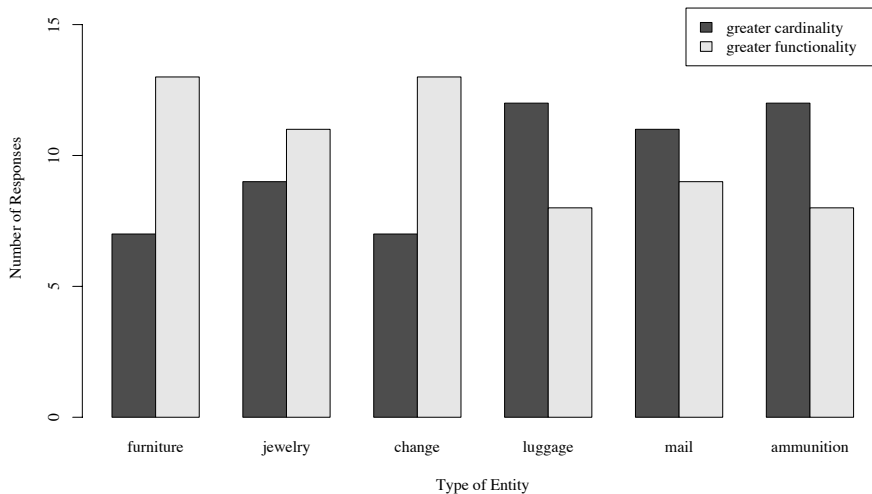
## Comparison

SAMPLE CONTEXT: Two women are at a gala event.

- ▶ Woman A is wearing two gold bracelets, a diamond tiara, and a ruby and emerald necklace. (4 items)
- ▶ Woman B is wearing three gold rings, a pearl necklace and a silver bracelet. (5 items)

Who has more jewelry?

# Comparison





## Comparison

The participants left comments, which showed that they were deciding between the cardinal and functional dimensions of comparison.

- ▶ **Jewelry:** “Although Woman B has one more piece of jewelry, Woman A’s jewelry appears to be more elaborate, with more jewels, probably larger, and probably more valuable.”
- ▶ **Furniture:** “Friend A has fewer pieces but a more diverse and practical collection”
- ▶ **Mail:** “The packages and boxes are generally bigger in mass, therefore it would appear to me that Resident B received more mail for the day.”

# Comparison

**Experiment 2 conclusion:** having more pieces is not always enough to count as “more”.

Multiple dimensions of comparison:

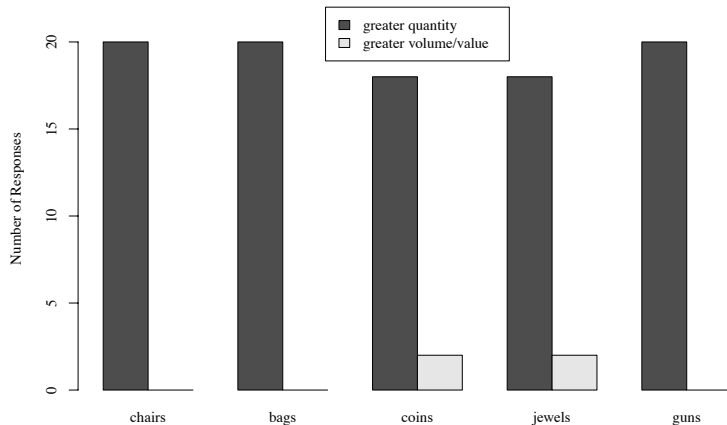
- ▶ number of pieces
- ▶ fulfillment of function

# Comparison

Two controls:

1. We presented participants with a version of this task where the items were the constituent objects of *furniture*-nouns (e.g. *jewels*, *chairs*)
  - ▶ they based their comparisons solely on quantity

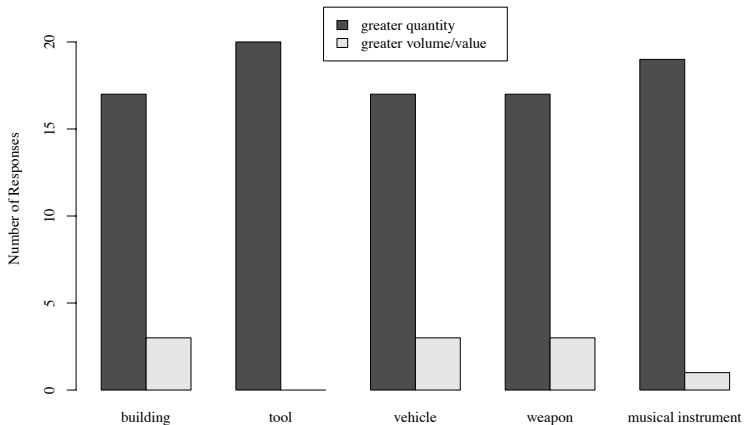
# Comparison



## Comparison

2. We presented participants with a version of this task where the items were countable superordinates (e.g. *vehicle*, *weapon*)
  - ▶ again, they based their comparisons solely on quantity

# Comparison



## Comparison

**Experiment 3** investigates the extent to which function plays a part.

Judgements along the “fulfillment of function” dimension should be sensitive to the immediate context, viz. whether the entities are engaged in that function or not.

# Comparison

## Function in effect:

CONTEXT: You are visiting different friends.

- ▶ Imagine upon entering Friend A's room, you see a sofa, an easy chair, a coffee table and a small bookcase. (4 items)
- ▶ Imagine upon entering Friend B's room, you see one table and four chairs. (5 items)

Whose room has more furniture?



# Comparison

## Function neutralized:

CONTEXT: Different dealers bought furniture at an antiques auction.

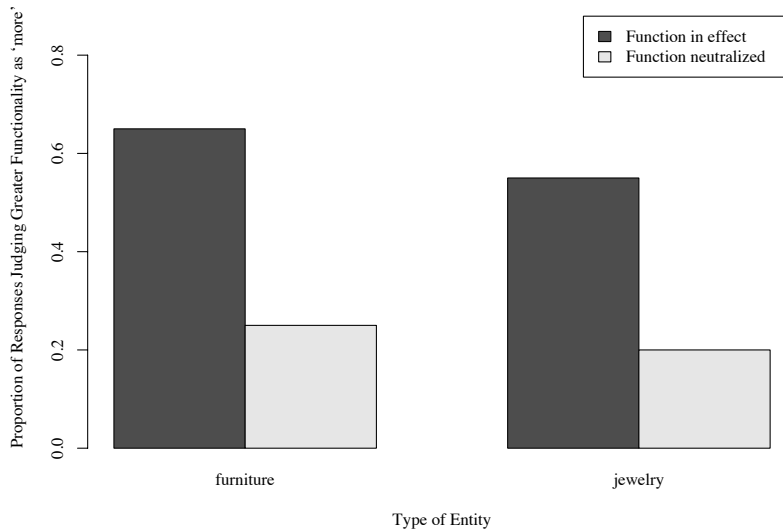
- ▶ Dealer A bought a sofa, an easy chair, a coffee table and a small bookcase. (4 items)
- ▶ Dealer B bought one table and four chairs. (5 items)

Which dealer bought more furniture at the auction?

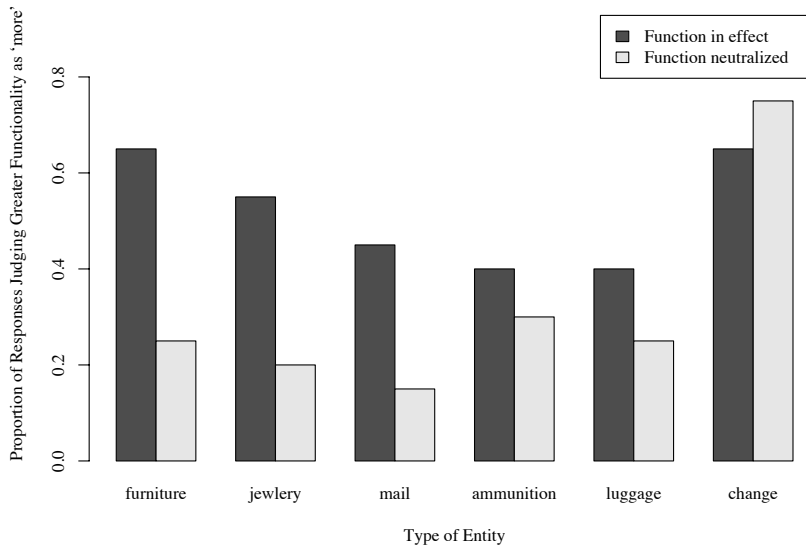
## Comparison

Results for <i>Furniture</i>	Function in effect	Function neutralized
Greater Functional Value	65%	25%
Greater Cardinal Value	35%	75%
	100%	100%

# Comparison



# Comparison



## Comparison

**Experiment 3 conclusion:** What counts as “more”—i.e. which dimension is used for comparison—is often dictated by the context in which the comparison takes place.

## Outline of Proposal: Functional Aggregates

Artifacts encode a relation between entities and a predicate designating the associated event.

*Furniture*-nouns are a specific type of artifact noun.

- ▶ They are special in that the associated event permits, and typically implies, a set of elements in the relevant relation.

Thus, our name “functional aggregates”.

## Outline of Proposal: Functional Aggregates

The name “functional aggregates” for *furniture*-nouns recognizes important parallels with granular aggregates (*gravel, rice, salt*).

Granular aggregates typically appear in connected clusters

- ▶ e.g. *rice* typically appears in clumps, not as single grains.

## Outline of Proposal: Functional Aggregates

Grimm (2012) uses a mereotopology, a type of spatial logic, to model the various types of concrete nouns relevant to number systems across languages:

- ▶ countable concrete nouns based on natural kinds (*dog*) designate maximal whole objects
- ▶ granular aggregate nouns (*rice*) designate sets of entities which are connected through one of a small set of spatial relations



## Outline of Proposal: Functional Aggregates

“Functional aggregate” nouns behave analogously to granular aggregates but with reference to the associated event:

- ▶ countable artifact nouns have associated events which canonically involve single entities
- ▶ functional aggregates have associated events which canonically involve sets of entities (see also Schwartzschild to appear), connected through the associated event

## Analysis

Once the artifactual nature of functional aggregates is recognized, the denotations are straightforward.

Denotation of *mail*: those entities which participate in the associated event of *being in the postal system*.

$$(1) \quad \textit{mail} := \lambda w \lambda x [\textit{In-the-postal-system}(x)(w)]$$

# Analysis

However, what constitutes identity for artifacts is often less simple:

- ▶ The relation between artifacts and the associated event is often *potential* rather than *actual*:
  - ▶ A hammer does not have to be involved in a hammering event at every moment to qualify as a hammer.
  - ▶ Similarly, furniture stacked in a hallway still qualifies as furniture even though it is not actively furnishing a space.
- ▶ Much of the literature on artifact identity discusses *intended function* (see contributions in Margolis & Laurence 2007)

# Analysis

A denotation of a functional aggregate involving a modal component:

$$(2) \textit{furniture} := \lambda w \lambda x \lambda loc \exists w' [wRw' \wedge \textit{furnishes}(x)(loc)(w')]$$

## Analysis: Consequences

**Countability:** Countability properties of artifact nouns follow from the nature of the associated event.

- ▶ artifact nouns with associated events which canonically involve single entities will lexicalize as countable nouns

*chair:* only use one chair at a time to sit on

- ▶ artifact nouns with associated events which canonically involve multiple entities will *not* lexicalize as countable nouns

*furniture:* use more than one piece at a time to furnish a room

## Analysis: Consequences

This perspective helps to make sense of the apparent arbitrariness in the world-to-word mapping within and across languages:

- ▶ *letters vs. mail*
  - ▶ Focus on the individual vs. the aggregate, as well as on different associated events.
- ▶ English *furniture* (uncountable) vs. French *meuble* (countable)
  - ▶ While these two nouns have similar referents, they are different *nominal descriptions*
  - ▶ they have different etymologies: *furniture* > 'to furnish' and *meuble* > 'movable object'.
  - ▶ they involve distinct associated events, whereby different countability properties

## Analysis: Consequences

### **Heterogeneity:**

Heterogeneity is a frequently noted property of functional aggregates, but not a necessary one.

Several different types of entities may participate in the same way in the associated event, hence the connotation of heterogeneity.

## Conclusion

- ▶ *Furniture*-nouns designate more than a collection of individuals.
- ▶ They are better characterized as *functional aggregates*.
- ▶ This characterization accounts for observed properties (collection of individuals, heterogeneity, reference to function, non-countable syntax).
- ▶ Functional aggregates merit a place in an ontology of nouns:
  - ▶ show similarities with core count and mass nouns, but
  - ▶ are distinct from both due to properties that reflect the nature of the associated event.



# Thank You

Thank you!

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## Countable artifacts

For countable artifacts, any given instance of the associated event is typically tied to a single entity:

- ▶ e.g. for *hammer*, the associated event is hammering, viz. force is applied to some instrument to make contact with some target location.
  - ▶ If two hammers are involved, two distinct points of contact are involved and, therefore, can be divided into two distinct events.

## Countable artifacts

For countable artifacts, given an associated event type, each (minimal) instance of the event yields a unique object:

- ▶ A set of minimal events then provides an atomic base for these nouns, parallel to typical countable nouns.

For functional aggregates, one (minimal) event typically yields multiple objects in the relevant relation to the event:

- ▶ The associated events of functional aggregates allows them to be number neutral: there is no requirement that a particular type of individual (singular, plural, group, . . . ) satisfy the associated event.



## Comparison

In Experiment 3, *change* behaved differently than the other nouns

- ▶ Participants largely used monetary value as the dimension of comparison

	Function in effect	Function neutralized
Greater cardinality	35%	25%
Greater value	65%	75%
	100%	100%