

Witnessing Nominal Mass-Count Coercions: Finding Rare Events in Big Data

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Nominal Countability

Research on nominal semantics often partitions nouns into the categories COUNTABLE and NON-COUNTABLE

- ▶ Countable nouns in English like *apple*, *dog*, and *textbook* occur with plural syntax, combine directly with numerals, and combine with count determiners like *many*
- ▶ Non-countable nouns like *mud*, *faith*, and *beer* do not combine with plural syntax or numerals and occur with determiners like *much*

Nominal Countability

However, as all of these researchers have pointed out, the situation is not so simple

- ▶ Many nouns—at least as lexemes—may belong to both classes, and are often called DUAL-LIFE or flexible nouns (Rothstein 2010; Pelletier 2011; Kiss, Pelletier, Husic, and Poppek 2017)

DUAL-LIFE Nouns

DUAL-LIFE nouns manifest both countable and non-countable readings, often with related senses

- (1) a. A few times I was offered more beer but had already drank *two ales* and found that sufficient.
b. *Ale* is a type of beer brewed from malted barley using a warm fermentation with a strain of brewers' yeast.
- (2) a. The cars on the highway are still making *too much noise*.
b. She heard *four noises* but was unable to definitively say if they were gunshots.

COERCED Count Reading

Many non-countable nouns which, in out-of-the-blue contexts, are hardly conceivable as having countable uses display exactly that in very specific contexts

▶ often termed COERCED readings

- (3) They have challenged both the *optimisms* and the *pessimisms* developed in the West.
- (4) The timing of the two *eradications* is important.
- (5) Don't even bother trying to decipher these *graffitis*.

Understanding the Landscape

We attempted to answer some questions to determine the empirical landscape of a noun's uses across different countability categories

- ▶ Can every noun be coerced or are there limitations?
- ▶ What is the meaning difference, or meaning differences, between 'regular' and coerced uses of a noun?
- ▶ Are there a limited number of these polysemy relations or is it only bound by speaker creativity?
- ▶ If we accept the categories COUNTABLE and NON-COUNTABLE, how do we account for DUAL-LIFE nouns and nominal COERCION? Are these a third class of nouns entirely?

Flexibility of Nominal Countability

Nominal flexibility—infidelity to a particular countability class—is usually taken to be either a **bug** or a **feature** of a semantic system.

As a **bug** of nominal semantic systems

- ▶ may be effectively ignored (often practiced, rarely argued for)
- ▶ may be patched via a few specialized functions such as the UNIVERSAL GRINDER/PACKAGER/SORTER (Pelletier 1975; Bunt 1985; Bach 1986; Zamparelli 2020)
- ▶ can be treated as a handful of regular polysemy relations (Ostler and Atkins 1992; Copestake and Briscoe 1995)

Flexibility of Nominal Countability

Nominal flexibility—infidelity to a particular countability class—is usually taken to be either a **bug** or a **feature** of a semantic system.

As a **feature** of nominal semantic systems

- ▶ may be considered as “nominal elasticity” (Chierchia 2010) and one of the “Universal Properties” of mass nouns
- ▶ could be taken as data that there is no underlying count/non-count divide (Borer 2005)

Flexibility of Nominal Countability

Our research suggests a third possibility for how to approach this nominal flexibility, as an **exploitation** speakers employ

- ▶ there exist regular sense alternations between countable and non-countable instances, where the ultimate interpretation is informed by the domain of the noun (substances, events, etc.)
- ▶ for some lexemes this is clearly conventionalized
- ▶ for others, these general sense alternation can be exploited in creative ways in new domains (for a related proposal see Falkum 2017)

These sense relations are not “universal functions” but rather regular alternations that can also extend to novel cases.

Outline

Introduction: Nominal Countability

Background: Approaches to Coercion

Data and Methodology

Coercion

- Types of Coercion

- Triggers of Coercion

Quantitative Summary and Discussion

Conclusion

Approaches to Coercion

Many different coercion operations have been proposed (see also Husić 2020 and Zamparelli 2020 for further discussion), including but not limited to:

- ▶ UNIVERSAL GRINDER (Pelletier 1975)
- ▶ UNIVERSAL PACKAGER (Bach 1986)
- ▶ UNIVERSAL SORTER (Bunt 1981, 1985)
- ▶ “Nonce substances” and “Abstracts and Event Instantiation” (Payne and Huddleston 2002)
- ▶ “Event Packaging” (Grimm 2014)

However, there seems to be no consensus or a clear understanding of how all the different coercion functions relate, if at all.

Cross-Linguistic Puzzles

Although phenomena like PACKAGING and GRINDING are purportedly “universal,” there are many cross-linguistic differences

- ▶ Wiese and Maling (2005) show that even closely-related languages (English, German, and Icelandic) show clear differences in how and what can be “packaged”
- ▶ Grimm and Dočekal (2021) show that in Czech nominal flexibility is severely limited
- ▶ Lima (2014) shows that Yudja seems to be, with very few exceptions (human referents), unrestricted

While we are focusing on English data, the empirical results will have implications for coercion phenomena cross-linguistically.

Motivations

To better understand the range of meaning relationships between non-countable lexemes and countable instances of those lexemes, we wanted to compile a large-scale dataset of corpus examples of coercion in English.

We specifically wanted to get beyond “restaurant talk” and other standard food and drink portioning examples.

We also wanted to annotate our data in a way that allowed us to get a quantitative picture of the frequency and types of coercion.

Challenges

Bringing evidence to bear on these questions requires novel methodologies to develop corpus heuristics to discover what are often vanishingly rare uses of nouns, i.e., data mining for rare events.

- ▶ corpus studies are exceptionally helpful for determining the normal grammatical behavior of nouns but they flounder, by their very construction, in predicting rare events.
- ▶ introspection about whether a noun can be coerced is of course confounded with biases towards the most common contexts in which such nouns may appear

Data Collection

Our data collection builds off of work in Grimm and Wahlang (2021) which used machine learning methods over the COCA corpus to isolate different countability classes of nouns

- ▶ most classes contained a set of nouns which had both countable and non-countable uses
- ▶ one class we dubbed “strongly non-countable” since effectively no countable instances were found
- ▶ Grimm, Moon, and Richman (2021) investigated this class more in detail, puzzling over the source of non-countability in nouns like *coriander*, *parenthood*, *fun*, or *sportsmanship*

Data Collection

We combined two datasets, extending the data gathered in some of our previous research

- ▶ Nouns from our dataset of strongly non-countable nouns (SNC) (Grimm, Moon, and Richman 2021) for which at least some context-specific count instances could be found
- ▶ Nouns labeled as “both mass and count” from the Bochum English Countability Lexicon (BECL 2.1) (Kiss, Pelletier, Husic, Simunic, et al. 2016).

Goal: Compare meaning relations found in coerced uses of strongly non-countable nouns with meaning relations found in “dual life” nouns

Data Collection

We made some adjustments to the data so the formatting was equivalent

- ▶ As nouns from BECL had been labeled with WordNet senses (Princeton University 2010), we added sense data to the examples for the SNC data
- ▶ We removed a few examples, which were from the SNC data, for which we could not identify a relevant WordNet sense

Data Collection

We then found examples of coercions for all noun-sense pairs from the BECL data, as well as additional examples for the SNC data

- ▶ We focused solely on non-countable to countable coercions, not UNIVERSAL GRINDER type coercions

Data Collection

- ▶ For each noun, we performed searches across Google Books, COCA (Davies 2009) and Google to find examples of the noun with count morphosyntax like *two* and *several*.
- ▶ For each SNC noun, we often need a more extensive Google search and searched for occurrences with the definite article *the*, plural demonstratives *these* and *those*, numerals *two* and *three*, as well as quantifiers *some*, *many*, and *multiple* — limiting ourselves to inspecting the first five pages of results per search (50 results per search)
- ▶ The resulting dataset contains 1,465 example sentences of 832 noun-sense pairs, with direct links to the source of each example and the annotation for the coercion type and trigger

Data Collection

noun	sense	definition	example	example source	example reading
abolition	1	the act of abolishi	Thirty-two abolitions against the death penalty took place in Europe from 1980 to 2007, with 28	https://en.wikipedia.org/wiki/Abolition	(ad hoc, plural)
abolition	1	the act of abolishi	New oral traditions developed throughout the period of slavery as slaves were forbidden to read	https://www.journals.sagepub.com/doi/10.1177/0014180103254281	(ad hoc, plural)
abolition	1	the act of abolishi	Secondly, what does the timing of this shift, if definable, suggest about its causes: how far in ot	https://cercles.com/fr/abolition	(type, plural)
absence	4	the occurrence of	This is a reliable test for the diagnosis of absence seizures: a patient suspected of typical absenc	https://en.wikipedia.org/wiki/Absence_seizure	(mod ind, ellipsis)
abstinence	1	the trait of abstair	alcoholics can undergo multiple abstinences from alcohol in their lifetime.	https://www.ncbi.nlm.nih.gov/pubmed/15551111	(ad hoc, plural)
abstinence	1	the trait of abstair	One subject significantly decreased drinking on the ethanol spout during all three abstinences.	https://www.ncbi.nlm.nih.gov/pubmed/15551111	(ad hoc, plural)
abstinence	1	the trait of abstair	Some were isolated and monitored and their abstinences confirmed.	https://pubmed.ncbi.nlm.nih.gov/15551111/	(ad hoc, plural)
acceptability	1	satisfactoriness by	It is to be emphasized however, that in Equation (13.5) the acceptabilities from the experiment	https://books.google.com/books?id=UW0tAAAAMAAJ	(degree, value)
acceptability	1	satisfactoriness by	The relative acceptabilities of these formulations may influence patient adherence	https://www.researchgate.net/publication/236011111	(degree, value)
acclimation	1	adaptation to a ne	...even though the plant exhibits several acclimations to CO2 enrichment which result in a reduc	https://www.ncbi.nlm.nih.gov/pubmed/15551111	(ad hoc, plural)
acclimation	1	adaptation to a ne	Acclimations to low and high light levels are located in opposite extremes.	https://www.sciencedirect.com/science/article/pii/S0022272003001111	(type, relational)
accordance	1	concurrence of op	Although no attempt will be made here to describe what constitutes 'acceptable accordances' b	https://books.google.com/books?id=UW0tAAAAMAAJ	(type, plural)
accordance	1	concurrence of op	The CAU has generated agreements and accordances with different countries of the world that	https://issuu.com/uslissuu	(type, relational)
accretion	1	an increase by nat	The results obtained show that a single normal galaxy begins to resemble a cD giant after sever	https://ui.adsabs.harvard.edu/abs/2003MNRAS...342..101H	(ad hoc, plural)
accretion	3	(astronomy) the f	We present a numerical simulation for the evolution of massive cluster galaxies due to the accre	https://inis.iaea.org/records/15551111	(ad hoc, plural)
accrual	1	the act of accumu	Laurence acquired the items while doing research for his 1981 book "Hemingway and the movie	https://opspecialcollection.org/	(ad hoc, plural)
accumulation	3	the act of accumu	If several accumulations are used, phase cycling schemes can be applied to suppress unwanted	https://onlinelibrary.wiley.com/doi/10.1002/anie.200300111	(ad hoc, plural)
acetate	1	a salt or ester of a	Many industrial solvents are acetates, including methyl acetate, ethyl acetate, isopropyl acetate	https://en.wikipedia.org/wiki/Acetate	(type, plural)
acid	1	any of various wat	Acids form aqueous solutions with a sour taste, can turn blue litmus red, and react with bases a	https://en.wikipedia.org/wiki/Acid	(type, plural)
acidity	3	pH values below 7	The relative acidities of water and methanol have been a nagging issue.	https://eric.ed.gov/?id=EJ700111	(degree, value)

Figure: screenshot of a portion of the final dataset

Annotation

We built off the annotation schema previously developed for the SNC data, but the larger variety of examples challenged us to generalize some of the coercion types previously identified

- ▶ We included examples previously labeled as JARGON, since we are now directly interested in these coercions specific to contexts (law, religion, sciences, math, etc.)
- ▶ Once we'd finalized an annotation schema, we assigned each of the examples a coercion type and a trigger of that coercion

Annotation

Annotations are split into types and triggers of coercion

- ▶ The **type of coercion** corresponds to the semantic shift in meaning of a noun from the non-countable use to the countable use
- ▶ The **trigger of coercion** is the morphosyntactic features of a noun in a given context
- ▶ Not all triggers are found with all coercions, and vice-versa

Distinguishing the type of coercion from the trigger allowed us to look more broadly at the types of meaning shifts in the data.

coercion	trigger
ad hoc	pluralization possession relational
inalienable possessor	possession
natural atom	pluralization
type	pluralization possession relational
degree	value
individuation modification	ellipsis

Ad Hoc Coercion

AD HOC coercion is a general expansion of the UNIVERSAL PACKAGER (Bach 1986) to include all types of portioning and packaging

It thus covers any coercion which creates ‘ad hoc’ units, either based on standard portions or context-specific portioning (including event ‘units’ bound by distinct points in time)

- (6) Safeway has a great deal on Barilla products: buy two sauces and get two *pastas* free!
- (7) It took several *emigrations* to get us to the four corners of the earth.

Ad Hoc Coercion

- ▶ Previously the literature has restricted packaging and portioning primarily to concrete nouns, often “standard units” of food and drink nouns (see discussion in Zamparelli 2020)
- ▶ Our previous work (Grimm, Moon, and Richman 2021) identified separate PACKAGING and EVENT coercions; however, we found no reason to distinguish ad hoc unit portioning in space vs. in time so we collapsed these categories.
- ▶ AD HOC is a productive coercion, applying to concrete nouns, abstract nouns, and event nouns

Inalienable Possession

A similar, but distinct type of coercion is INALIENABLE POSSESSION.

This coercion applies to cases where the noun coerced refers to some body part or state of being of an animate possessor.

- (8) The *skins* of different people vary in susceptibilities to irritation.
- (9) When Aileen had barely reached puberty herself she claimed the *virginities* of a number of Troy and Rochester's neighbourhood boys.

Inalienable Possession

- ▶ While we initially considered these examples as just AD HOC coercion, we realized they have a unique relationship with the trigger of coercion—plural possessive constructions
 - ▶ While INALIENABLE POSSESSION can be thought of as a type of portioning, the ‘unit’ provided is not ad hoc, but always some number of distinct, animate individuals which provide ‘natural units’ for counting a non-countable property or substance
- (10) These cows had to be washed regularly, because if they happened to lie in dung, their *hides* could stain.

Natural Atom

The NATURAL ATOM coercion applies only to the kinds of nouns which refer to elements, chemical compounds, viruses, or bacteria.

These nouns can be coerced from their standard non-countable substance reading to a countable reading referring to individual atoms, molecules, or cells, but only in ‘microscopic’ contexts.

(11) Calcium chloride has two *chlorines* for each calcium.

(12) Maltose is created by condensation reaction of the two *glucoses*, forming a α -1,4-O-glycosidic linkage.

Natural Atom

- ▶ This coercion is not just AD HOC as there is nothing ad hoc about the identification of a ‘standard unit’ since these nouns already contain a ‘unit’ in their minimal atomic parts
- ▶ This type of coercion is likely a type of regular polysemy, though infrequent outside of scientific contexts and perhaps thus unfamiliar to many speakers

Type Coercion

TYPE is the most productive coercion, with very few restrictions on classes of nouns that it can apply to.

- (13) Jobs require multiple *proficiencies* and teamwork.
- (14) *Cyanides* are produced by certain bacteria, fungi, and algae.
- (15) Whitening *toothpastes* are also a good choice for reducing stains.
- (16) This study attempts to investigate the comparison of these *folklores* using a comparative literary theory.

Type Coercion

- ▶ Our previous work distinguished ENTITY TYPE and EVENT TYPE, but here we found no linguistic basis for separating these, as the shift in meaning is the same regardless of noun class
- ▶ This coercion is very prolific, and accounts for around two-thirds of our dataset (1016 of 1465 examples)
- ▶ While familiar cases (e.g. *wines*) may have established ‘types’ familiar to speakers (e.g. *red*, *white*, *rosé*), most instances of this coercion involve types only familiar within a given context

Degree Coercion

DEGREE coercion occurs when values of some unit of measurement are identified in context, creating units for counting.

- (17) The *heats* of formation of trimanganous phosphate and trimagnesium phosphate.
- (18) Barley was germinated in soils of two *moistures* (40 and 50 percent).
- (19) Sailors call the *latitudes* between 40 and 50 degrees south of the equator the Roaring Forties.

Degree Coercion

- ▶ DEGREE coercion only applies to a few nouns, those which refer to measurement systems or properties which can be quantitatively measured (location, time, temperature, motion)
- ▶ DEGREE coercion is only triggered in contexts where multiple values (e.g. percents of moisture, degrees of temperature) have been established, often specific numerical values
- ▶ This coercion is unique in that the non-countable noun undergoing coercion to a count reading is a property or system of measurement itself, not a substance, object, or concept

Modification Indivuation

Modification indivuation occurs when a modifier takes on the plural morphology of an elided count noun.

- (20) If there really were 6 vanilla and 6 peanut butter candies in the box, what is the probability that you would have picked three *vanillas* in a row?

Pluralization

The most frequent and versatile trigger of coercion, pluralization triggers AD HOC, NATURAL ATOM, and TYPE coercions.

- (21) There are a variety of different fruit *juices* that a person can drink.
- (22) In six *redistributions*, the team has distributed more than 100kg of food.
- (23) Two *ozones* can combine to form three *oxygens*, and that is what happens.

Possession

Possessive constructions can trigger AD HOC and TYPE coercions, and always is the trigger for INALIENABLE POSSESSION, using the genitive 's ending, 'of' constructions, or possessive pronouns

- (24) Underinsurance is what greatly amplifies these countries' *recessions*.
- (25) The aim of this study was to analyze the differences between the *handwritings* of schizophrenia patients and healthy subjects.
- (26) In 1951 she married Tony Curtis when their *stardoms* were at a peak.

Relational

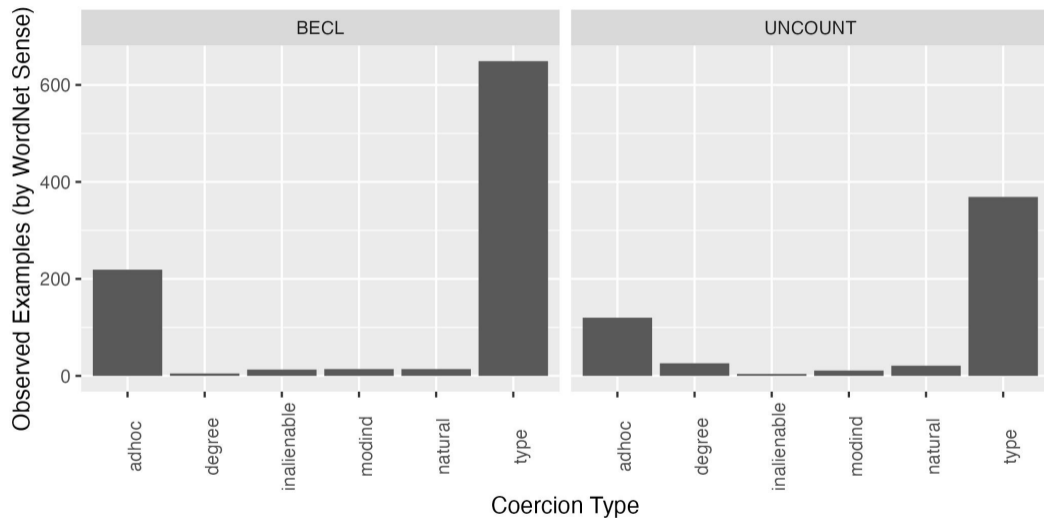
Relational constructions trigger TYPE coercions and, less frequently, AD HOC coercions.

- (27) His *loves* for his family and for his country are musts, and he will bring all of the memories he can with him.
- (28) *Communities* of interest bring together several *communities* of practice that represent groups of practitioners from different domains.

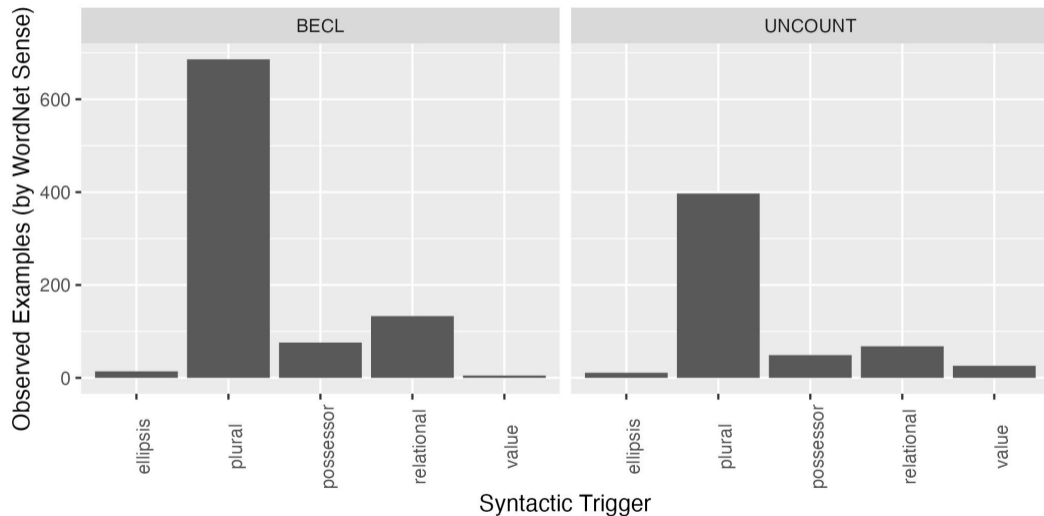
Quantitative Summary

Taking stock of the overall occurrences of different meanings expressed in “dual life” nouns and in nominal coercions, we see similar tendencies across both data sets

Quantitative Summary



Quantitative Summary



Discussion

While the focus of many previous proposals for mass-count meaning shifts have been on specific functions such as the UNIVERSAL SORTER and UNIVERSAL PACKAGER

- ▶ these are presented as total functions, mapping denotations from one category to the other

The view resulting from our study indicates that mass-to-count coercions are often more flexible and creative endeavors, also involving a much wider range of semantic domains that usually considered

Discussion

The patterns of coercion adhere to the semantic domain of the lexeme in question.

- ▶ we did not observe idiosyncratic or arbitrary coercions, but those that sensibly extended facets of the noun's meaning

While the robustness of coercion supports theories which emphasize nominal flexibility, it also does not rule out an account emphasizing systemic or regular polysemy

Discussion

All types of meaning relationships which were found in the BECL dataset of “dual life” nouns were also found to be meaning relationships guiding coercion (and vice versa)

For some this was rare:

- ▶ we observed a handful of degree-based coercions but very few degree-based dual life nouns (*bandwidth*, *thickness*)
- ▶ but this is an artifact of our sampling method, in the English lexicon at large this type of polysemy is well attested
- ▶ McNally (2022) investigates this polysemy for *-th* words, such as *length*

Discussion

Working Hypothesis: nominal flexibility in a language is intertwined with patterns of polysemy

- ▶ nominal coercion is an analogical extension of pre-existing nominal polysemy patterns (often creative and spontaneous extensions)

Cross-Linguistic Prediction: it has been a puzzle why certain languages lack, e.g., grinding

- ▶ this view predicts that languages that lack a particular type of polysemy will also lack the corresponding coercion

Lots of work ahead to confirm/falsify this!

Conclusion

Leveraging large-scale corpus resources, we developed a testing bed for the rare events of countability, occurrences of nominal coercion

- ▶ Gathered a large amount of new data that allowed for both a fine-grained look at individual examples as well as broad patterns of coercion.
- ▶ While a countable use was not witnessed for every strongly non-countable noun, coercion was shown to be extremely robust, given the vast data of the internet.
- ▶ Despite the large number of coercion occurrences discovered, they cohered to a relatively small number of meaning-shift patterns.

Conclusion

- ▶ We discovered and detailed coercions previously undiscussed in the literature, including DEGREE and NATURAL ATOM.
- ▶ Separating **type of coercion** from the syntactic **trigger of coercion** allowed us to summarize the ways in which meaning is shifted between non-countable and countable instances.
- ▶ While we certainly haven't found all instances, our dataset is large enough to capture the major coercion types their frequencies.

Conclusion

Countability shifts may be viewed as neither a **bug** nor a **feature**, but an oft-conventionalized and sometimes creative **exploitation** of interpretations associated with (domain-specific) countable and non-countable meaning types.

Thank You!

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