

Portions and countability

A crosslinguistic investigation

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Abstract

We examine three constructions across several languages in which a mass noun is embedded in what appears to be a count environment, but the construction as a whole remains mass. We argue that the discussed phenomena - ‘Q-noun’ constructions like *lots of water*, bare measure constructions like *kilos of sugar*, and pluralised mass nouns in languages like Greek and Persian - all involve portioning-out of the embedded mass denotation. Adopting an overlap-based approach to the mass/count distinction (e.g. Rothstein, 2011; Landman, 2011; Khrizman et al., 2015; Landman, 2016), we argue that the same portioning-out operator may result in either a count or a mass NP depending on the syntactic structure of the NP. We provide a compositional semantics to account for this.

The examined phenomena all share an inference of large quantity or abundance that, we argue, cannot be reduced to the lexical meaning of the portioning-out expression, nor to a multiplicity inference contributed by plural morphology. We show that our cases of mass portioning-out involve a total order \leq on portion size and propose to analyse the abundance inference in terms of an un informativity-based Quantity implicature, following the analysis of the positive form (*Mary is tall*) in Rett’s (2015) approach to adjectival gradability.

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Non-countable nouns - which cannot directly combine with numerals and/or count quantifiers such as *every* or *several* - are attested in most natural languages. Classifier languages like Mandarin treat all nouns in this way, while number marking languages like English generally distinguish non-countable 'mass nouns' from countable 'count nouns'. In languages of both types, there are various syntactic strategies available to transform these non-countable nouns into countable noun phrases. To begin with, *measuring* (exemplified in (1)) relies on standard units of measurement in order to express (not necessarily individuated) quantities of something:

- In addition, various kinds of individuated units bearing a particular relation to the embedded noun can be made available for counting through the use of *classifiers* (exemplified in (3)-(4)¹:

- ¹The list is non-exhaustive; for instance, Krifka (1995) also identifies ‘taxonomic classifiers’ such as Chinese *zhǒng* ‘species’ and English *sort*. It should also be noted that the classification here - or even our primary distinction between classifying and measuring, which we adopt following Rothstein (e.g. Rothstein, 2017) - is by no means universally agreed upon. For instance, in the typological literature a distinction is often made between *sortal* classifiers (corresponding to our ‘natural unit’ ones) and *mensural* classifiers, which include our container and portion classifiers but also measure words (Aikhenvald, 2003). The main purpose of our quick-and-dirty classification here is to enable us to make explicit what we mean by ‘portions’.

- b. several portions of soup
 - c. a few pieces of bread
 - d. a heap of fruit
 - e. vier rijen politie
four rows police
'four rows of police'
- (Dutch)

Each of the classifier types in ((6)-(4)) singles out a different kind of unit. In the natural unit constructions in (2), the noun is conceptually individuated despite being grammatically uncountable, and it is these inherent 'natural units' that are picked out by the classifier (Cheng & Sybesma, 1999). In the container constructions in (3) and the portion constructions in (4), the units are not naturally present but *created* by the classifier: container classifiers create individuated units by filling containers with stuff, and portion classifiers do so by dividing stuff into bits. The difference between (3) and (4) is that the former, but not the latter, introduces additional referents. *Three vans of police* doesn't just refer to police, but also to vans; *three beads of sweat*, on the other hand, is just sweat.

In this paper, we will focus on the phenomenon of 'portioning-out' as exemplified by (but not limited to) the constructions in (4) above. We define the notion of a *portion* more explicitly as follows:

- (5) A *portion* of a substance X is a quantity of X that is individuated according to some (non-inherent) individuation criterion.

Often, the individuation criteria involved in portioning-out are spatial: *beads*, *heaps*, and *rows* all refer to particular shapes or spatial configurations of matter. Sometimes it is quantity-related, as in e.g. *portion of soup* (a quantity of soup that constitutes a meal for one). Sometimes only a very general individuation criterion is imposed - portion classifiers like *piece*, *bit*, or *quantity* facilitate reference to any bit of stuff that qualifies as an 'individual' in the context². We will subsume all these types of individuation under our notion of 'portion' as long as they meet the definition in (5).

We have pointed out that portion constructions are distinct from measure constructions in that they involve individuation, not just measurement, and distinct from container constructions in that they do not introduce any additional referents. At the same time, it has often been noted (e.g. Doetjes, 1997; Rothstein, 2011; Partee & Borschev, 2012; Khrizman et al., 2015) that portion *readings* - that meet the definition in (5)- are available for both measure and container constructions:

- (6) a. John sewed the two metres of fabric neatly together.
(= metre-sized lengths of fabric)

²We will not make the notion of 'individual' formally explicit in this paper, but we take it to be grounded in language-independent cognitive principles and rely on spatiotemporal factors such as cohesion and boundedness. The analysis we will develop can be supplemented with more explicit formalisations of individuation such as the mereotopological analysis developed in Grimm (2012)

- b. Fill a small and a large glass with white wine and add the two glasses of wine into the soup.
(= the contents of the two glasses)

This means that portioning-out is at its core a type of *interpretation*, that cannot be reduced to a particular class of classifiers and might be expressed in a variety of ways both within and across languages. For instance, Khruzman et al. (2015) propose that some kind of covert portioning-out operation could be responsible for Dutch ‘restaurant talk’ (the term is due to Wiese & Maling 2005) like the following:

- (7) Drie shoarma alstublieft.
three shawarma please
‘Three (portions of) shawarma, please’ (Dutch)

Here, *shoarma* is not reinterpreted as a count noun (as it would be in English *Three shawarmas please*), as evidenced by the lack of pluralisation, which means that something else must be going on to make the construction countable (cf. Wiese & Maling, 2005, on similar data from German). Similarly, Deal (2013) relies on covert context-based portioning-out (she calls it *apportionment*) in order to account for the widespread acceptability of mass nouns in count contexts in Nez Perce:

- (8) a. lep-it kuus hi-sew-ne
two-SUF water 3SUBJ-fall-P.ASP-REM.PAST
‘two (drops of) water fell’
Speaker: “Like from a leaky roof!”
b. ki-kuckuc kuus
PL-small water
Speaker: “Like little puddles. Little streams.”

Throughout this paper, the observation that *portioning-out* is fundamentally *a type of interpretation* will allow us to analyse a range of superficially distinct phenomena in terms of portioning-out.

In (4), we introduced portioning-out as a way of individuating non-countable nouns, resulting in a countable noun phrase. However, in this paper we will argue that nouns can also be portioned-out *without becoming countable* and that this is in fact a systematic property of portioning-out constructions both within and across languages. For instance, compare (4) to (9)-(10), (6) to (11)³, and (8) to (12):

³We use a Dutch example here because Dutch conveniently makes a morphosyntactic distinction between true measure constructions and constructions in which measure words have been reinterpreted as portion classifiers (cf. (6)), which means there is no doubt that this particular example involves the latter use. We will make this point in a bit more detail later. This example is from <https://www.rtlnieuws.nl/nieuws/nederland/artikel/5168909/eenzame-huis-bloklanstraat-rotterdam-heleen-euwe-mike>, retrieved July 2020.

- (9) a. A load / loads of water was dripping from the ceiling.
 b. *Three loads of water were dripping from the ceiling.
- (10) You need to drink (*three) heaps of water to stay hydrated in this heat.
- (11) Iedere dag lag er (*drie) centimeters stof in het huis. (Dutch)
 Every day lay-SG there (three) centimetres dust in the house
 ‘Every day the house was covered in centimetres of dust.’
- (12) a. Trehun nera apo to tavani. (Greek)
 drip-3PL waters from the ceiling
 ‘Waters are dripping from the ceiling.’
 b. *Dio nera trehun apo to tavani.
 two waters drip-3PL from the ceiling
 ‘Two waters are dripping from the ceiling.’

On the surface, (9) and (10) resemble the portion classifier constructions in (4), but the resulting NPs are not countable, as their incompatibility with the numeral *three* attests. In addition, while *loads of water* seems plural, it agrees in the singular like a mass NP. Singular agreement and a lack of countability also characterise the Dutch example in (11), which otherwise parallels the portion construction in (6). Finally, Greek allows pluralisation of mass nouns in a way similar to the Nez Perce data in (8), but as (12-b) shows, such pluralised mass nouns are not countable (even though it is often claimed that pluralisation necessarily implies countability).

We will look at these and similar data in much more detail later on; the following is a preview of our argument and conclusions. Focusing our attention on the behaviour of (1) overt portion words (e.g. *heap*, *lot*, (2) ‘bare measures’ (e.g. *centimeters* in (11)), and (3) pluralised mass nouns (‘waters’) across languages, we will show that these phenomena share a cluster of properties. First, although there are individual gaps in the paradigm, as a class these expressions/constructions show a systematic alternation between a countable use and an uncountable one. Second, these two uses are associated with different syntactic structures, as evidenced by differences in agreement, distinct stress patterns, and (in some languages) the presence of additional morphosyntactic material. Third, the uncountable constructions are all associated with an inference of abundance or large quantity that cannot be reduced to either the lexical meaning of the expressions involved or a multiplicity inference associated with plural morphology.

Our main analytical claim is that the common core of these constructions is a syntactically flexible family of portioning-out functions from mass predicates into sets of non-overlapping sums. We show that the resulting complex nominal expression may be either countable or non-countable depending on its syntactic structure. We will argue that in countable portioning-out constructions like (*three*) *heaps of sand*, the phrase *heaps of sand* is a PortionP headed by the portion expression *heap*. On the semantic side, put simply, the PortionP is countable because portions are countable. In contrast, non-countable portioning-out constructions like (*heaps and*) *heaps of sand* are not PortionPs, but are headed by a functional element (covert in some languages, overt in others) instead. Semantically,

this functional element formalises the intuition that the phrase as a whole is non-countable because the substance that the portions consist of is non-countable. In this way, our proposal offers a unified account of the syntax and semantics of portions, which relies on just a few ingredients to cover a wide range of phenomena and does not require any type-shifting or systematic ambiguity.

Our syntactic and semantic analysis of portioning-out covers the first two properties mentioned above, but it does not yet account for the inference of abundance or large quantity shared by all addressed cases of non-countable portioning-out constructions. This property has been previously observed for Greek mass plurals by Tsoulas (2009), who treats the inference as a kind of manner implicature triggered by the semantic vacuousness (under his account) of the plural morpheme. Kane et al. (2015); Renans et al. (2018) propose that the abundance inference of mass plurals is a scalar implicature on a par with the multiplicity implicature triggered by plural number on count nouns (cf. Sauerland et al., 2005; Spector, 2007). However, the parallels with the tendency of expressions like *bunch*, *lot(s)*, *heaps* and *oodles*, as well as bare measures like *litres*, to support a similar abundance inference have not been noticed before. We will argue that abundance, in all these cases, cannot be reduced to either the lexical meaning of the noun involved or a multiplicity inference. Drawing on work on quality nouns by Tovenia (2001) and Francez & Koontz-Garboden (2017), we show that non-countable portioned-out NPs are ordered in terms of portion size. We suggest that this size ordering is responsible for the abundance inference, and develop an analysis along the lines of Rett's (2015) implicature-based account of degree constructions like *Mary is tall*, which support the inference that Mary's height exceeds some contextual standard.

The paper is structured as follows. In section 2, we introduce our data in more detail, deriving the basic criteria that our syntactic and semantic analysis should meet in order to account for the data properly. In section 3, we present the syntactic part of our analysis, while section 4 focuses on the semantics. In sections 5 and 6, we zoom in on the pragmatics of the abundance inference supported by all the investigated forms of portioning-out; we present our data and analysis in section 5 and some additional issues and suggestions for further research in section 6. Section 7 concludes the paper.

We end this introduction with a few practical notes. We will (eventually) refer to the countable portioning-out constructions exemplified in (4)-(8) as 'count portioning-out' and to their non-countable counterparts (exemplified in (9)-(12)) as 'mass portioning-out', primarily because 'count / mass' is less unwieldy than 'countable/non-countable', even though not all languages involved have a grammatical mass/count distinction. In general, we will be slightly sloppy and often use 'mass' as shorthand for 'non-countable'; this means that, in our terminology, complex phrases can have 'mass' or 'count' status, just like lexical nouns. In the parts of the paper where we are not directly concerned with the details of syntactic analysis, we will use 'NP' in a pre-theoretical, non-technical sense to mean 'complex nominal expression'.

We will illustrate most of our more general points using examples from English, Dutch and Greek (languages for which we have ready access to native speaker judgements). Wher-

ever possible, we will give an English example, but we will sometimes rely on Dutch or Greek if the point can be made more clearly based on either of these languages.

2 Q-nouns and bare measures as mass portioning-out

2.1 Q-nouns

In her recent dissertation, Klockmann (2017) devotes a chapter to the puzzling behaviour of a class of ‘semi-lexical’ nouns she calls *Q-nouns*: quantifier-like nominal expressions like *lot(s)*, *load(s)*, *oodles*, *scores* etc. (Klockmann’s work focuses mostly on *lot/s*, *number*, *bunch* and *ton*.) Such Q-nouns show some count noun-like behaviour in that they tend to be pluralised and sometimes occur with the indefinite determiner *a*. However, as (13-b) shows, when a Q-noun combines with a mass noun, the phrase as a whole remains mass (that is, incompatible with numerals and determiners that presuppose countability). Similarly, (13-c) and (14) shows that the number features of the NP as a whole are often determined by the embedded noun rather than the Q-noun itself:

- (13) a. Lots of water / a lot of water
 b. *Three/various/each lot(s) of water
 c. Lots of water was/*were dripping from the ceiling.
- (14) Een hoop mensen liep.en voor het einde van de film weg.
 A heap people walk-PAST.PL before the end of the film away
 ‘A heap of people walked out before the end of the film.’ (Dutch)

So, even though an NP like *lots of water* or *oodles of soup* appears count on the surface in that it has plural marking, it cannot actually be counted.

Given their unique properties, Klockmann treats Q-nouns as a distinct class of nominal expressions. However, we would like to propose that ‘Q-nouns’ are just classifiers or measure words, and the non-countable nature of the above NPs is not due to any special lexical properties of the ‘Q-nouns’ but triggered by other factors (which we will get to shortly).

First, consider the fact that most of the Q-nouns also have (or historically used to have) a countable use in which they function as a genuine portion classifier or measure word, along the lines of (1)-(4). That is, they serve to individuate a mass referent into countable units:

- (15) a. Today’s auction will feature various lots of furniture.
 b. John did three loads of laundry.
 c. Three scores and ten (i.e., $3 \times 20 + 10 = 70$)
 d. This factory processes 2500 tons of PET bottles every month.

(Klockmann, 2017, p.226) acknowledges this for *lot*, but takes it to be a matter of genuine lexical ambiguity. However, the data in (15), (16), and (17) show that there are many more examples of nouns very similar to *lot* that alternate in this way; this suggests, deviating

from Klockmann's view, that the behaviour of *lot(s)* is not an idiosyncrasy, but exemplifies a more general and systematic pattern that calls for an equally systematic and compositional analysis:

- (16) a. The geologists found several *masses* of Paleozoic rock.
b. These Victorian hairstyles required (*several) *masses* of hair.
- (17) a. Sort the toys into three *heaps*.
b. Drink (*three) *heaps* of water.
- (18) a. There's only two *reams* of printing paper left in the supply closet.
b. We need to analyse (*multiple) *reams* of data before we can draw any conclusions.

The general pattern here shows a sizeable class of nouns that alternate between a countable portion classifier use (denoting a particular quantity or spatial configuration of matter) and a non-countable 'Q-noun' use which is used to convey a general large quantity. (We will get back to words like *ton*, which show a similar alternation between Q-nouns and measure words, in the next section on what we'll call 'bare measures'.)

While we claim that Q-nouns are 'just' portion classifiers and not a distinct class of nominal expressions, we reject the suggestion (which can often be found in discussions of words like *lot(s)* on language advice boards) that they simply involve a vague or figurative interpretation of the classifier use ('a large quantity'). Crucially, this would fail to account for the difference in mass/count status between the two constructions, as we can easily count vague quantities:

- (19) You should drink three large quantities of water every day.

In addition, if (some) portion classifiers were simply ambiguous between a literal and a more figurative use, we would expect an NP like *two reams of paper* in (18-a) to be ambiguous between a literal meaning of '1,000 sheets of paper' and a figurative meaning of 'two large quantities of paper'. This ambiguity is not attested: when a portion classifier is used in its individuating use (as in (18-a)) it is necessarily interpreted literally, and the large quantity meaning only arises when the NP is mass (as in (18-b)).

Third, reducing the Q-noun interpretation of a portion classifier to a figurative interpretation does not account for the agreement facts; there is no reason why a non-literal interpretation of a plural classifier like *lots* would agree in the singular.

- (20) Large quantities of water (are/*is) dripping from the ceiling. (cf. (13-c))

To sum up, the widespread availability of non-countable 'Q-noun' interpretations for portion classifiers like *lot*, *load*, *heap*, *mass*, and *ream* shows that this alternation is not a matter of incidental lexical ambiguity, but a systematic linguistic pattern that suggests that portion classifiers and Q-nouns should be analysed as two sides of the same coin. In addition, the relation between the two cannot be a matter of literal versus figurative interpretation, since this would not explain the difference in mass/count status and agreement behaviour. In the

next section, we will consider a related set of data displaying the same alternating pattern, and argue that the two interpretations must correspond to distinct syntactic structures.

2.2 Bare measures

Consider the following:

- (21) a. LITRES of drinking water were wasted.
b. I spent thousands of pounds on this renovation.
c. The campus was miles and miles away from the city centre.

Unlike ‘ordinary’ bare plurals, (e.g. *Stray dogs roamed the neighbourhood*), such bare measures do not simply convey multiplicity (‘more than one’). Instead, like the Q-noun interpretations of portion classifiers, they support an inference of large quantity (relative to a context). Also, like Q-noun constructions (and unlike ‘normal’ measure phrase constructions), they are non-countable:

- (22) a. (*A few) LITRES of drinking water were wasted.
b. I spent (*three) thousands of pounds on this renovation.
c. The campus was (*several/*many/*ten) miles and miles away from the city centre.

While (22) shows that bare measure constructions are incompatible with numerals and count determiners like *several* and *many*, they happily accept neutral determiners like *more*, *no*, and *the*, suggesting that, like the Q-noun constructions from the previous section, these are mass NPs despite their superficial similarity to measure phrase constructions.⁴

- (23) a. And all that coal being burned adds **more tons and tons of CO2** to the atmosphere, warming the planet.⁵
b. That means no cream, **no heaps and heaps of mayonnaise**, and no 4:1 ratio of oil to vinegar.⁶

⁴Perhaps unexpectedly, however, the mass-only determiner *much* is out in this context. We can think of several possible explanations for this. One possibility is that *much* occurs lower in the nominal structure than the determiners in (23), and competes in this position with portion constructions, so the two cannot co-occur. Supporting the hypothesis that *much* is in complementary distribution with other elements close to the noun, note also that *much* is mostly incompatible with plural marking even if the noun in question is mass (e.g. **much groceries/funds/ashes*; see also Allan 1980 and Acquaviva 2008). Another option is to stipulate that Q-noun and bare measure constructions, as amalgams of both countable and non-countable nominal elements, involve some kind of feature clash where the portioned-out NP ends up being marked neither mass nor count; the result would be compatible with neutral determiners, but not with either mass-only or count-only ones. (Something very similar happens when mass and count nouns are coordinated: the resulting complex NP is compatible with neither *much* nor *many* (**much/*many [biscuits and milk]*).). This second hypothesis fits with the observation - which we will address in more detail later - that subject-verb agreement preferences for constructions like *tons of water* are inconsistent, varying across Q-nouns and individual speakers.

⁵Source: <http://environmentcontext.blogspot.co.uk/2012/07/mountaintop-removal-damage-goes-beyond.html>, accessed January 2018

⁶Source: <https://www.multiculturiosity.com/arugula-salad-with-shrimp>

The point is easier to make on the basis of Dutch, in which bare measure NPs have several properties which set them apart from true measure constructions. First, note that in Dutch, bare measure constructions pattern morphosyntactically with classifier constructions, not with measure constructions. In particular, in terms of number marking, the measure words in bare measure constructions behave like what Rothstein (2011); Khrizman et al. (2015) (see also Chierchia 1998a) analyse as *portion-shifted measure words*: a type of classifier derived from a measure word, with an enriched ‘portion of this particular size’ interpretation. As already observed by Doetjes (1997), Dutch distinguishes measure and portion uses of measure words morphosyntactically: the former are never marked for number, while the latter are. (In (24), we have starred ungrammatical number marking and hashed marking that does not result in the described interpretation.)

- (24) a. Ik heb 3 meter/#meters kaasdoek gekocht.
 I have 3 meter/meters cheesecloth bought
 ‘I have bought cheesecloth to the amount of 3 meters.’ (Dutch)
- b. Ik heb meter*(s) kaasdoek gekocht.
 I have meter(s) cheesecloth bought
 ‘I bought meters of cheesecloth.’
- c. Ik heb 3 #meter/meters kaasdoek gekocht.
 I have 3 meter(s) cheesecloth bought
 ‘I have bought 3 meter-sized lengths of cheesecloth.’

The sentences in (24) represent three meanings which are all truth-conditionally distinct from each other. The measure interpretation in (24-a) is true just in case I bought a length of cheesecloth measuring 3 meters. The portion interpretation in (24-c) is true just in case I bought 3 meter-sized lengths of cheesecloth. Sentence (24-b) has a reading corresponding to an ‘existential bare plural’ version of (24-c) (which is true just in case I bought an unspecified number ($n > 1$) of lengths of cheesecloth), but its most prominent reading by far is an abundant ‘large quantity of cheesecloth’ interpretation which is true just in case I bought lots of cheesecloth (possibly in one piece, possibly as multiple lengths).⁷

The ambiguity of (24-b) is reminiscent of the alternation between (countable) portion classifiers and (non-countable) Q-nouns. In line with our observations about Q-nouns, countable portion-shifted measure words always agree in number with the verb (as exemplified in (25)), while (26) shows that their abundance-conveying mass counterparts often occur with a singular verb (Broekhuis & den Dikken, 2012, ch4; cf. example (11)):

- (25) Die drie meters stof moeten/*moet in de lengte aan elkaar worden
 these three meters fabric must-PL/must-SG in the length to each-other be
 genaaid
 sewn

-and-grapes-6/, accessed January 2018

⁷While the sentence in (24-b) is ambiguous in written form, the two readings have very distinct prosodic profiles; see the discussion around examples (30)-(31) for more on the ambiguity of bare measure constructions.

‘These three meters of fabric need to be sewn together lengthwise.’

- (26) a. Er viel meters sneeuw.
 there fell_{SG} meters snow
 ‘Meters of snow fell.’
 b. Er droop liters zweet van het plafond naar beneden.
 there dripped_{SG} liters sweat off the ceiling to down
 ‘Liters of sweat dripped from the ceiling.’⁸

In conclusion, the Dutch data (summarised in table 1) show that in terms of both number marking and verbal agreement, bare measure constructions pattern with Q-nouns. In addition, like many Q-nouns, they have a countable counterpart which behaves like a classifier, with the interpretation ‘a particular quantity or portion of X’.

| | Measuring | Count portioning-out | | Mass portioning-out | |
|---------------------------|---------------------|---------------------------|--------------------------------|---------------------|---------------------|
| | <i>Measure word</i> | <i>Portion classifier</i> | <i>Portion-shifted measure</i> | <i>Q-noun</i> | <i>Bare measure</i> |
| Marked for number? | No | Yes | Yes | Yes | Yes |
| Sg. agreement? | Yes | No | No | Possible | Possible |
| Countable? | Yes | Yes | Yes | No | No |

Table 1: Summary of the grammatical behaviour of different elements in Dutch, that show them falling into three distinct classes.

Putting the data from this and the previous section together, we conclude that we are dealing with a single class of portion expressions (including both lexical portion classifiers and portion expressions that have been derived from measure words through a portion shift, following Rothstein 2011) that systematically alternate between a countable classifier use and a non-countable ‘large quantity’ use. We will refer to these two uses as *count portioning-out* and *mass portioning-out* in the rest of the paper.

We have seen that both Q-nouns and bare measures can agree in the singular even if they are themselves marked plural. However, it should be noted that depending on the Q-noun itself and individual speaker preference, plural agreement is possible too (the varying agreement preferences with Q-noun constructions are explored in depth in Klockmann, 2017). For instance, the following examples are from two different versions of the same news item on the arrival of two pandas in a Dutch zoo⁹

⁸Source: <https://partyflock.nl/topic/944543:Rocco-niet-blij-met-Pandemonium-in-Westergas>, accessed October 2018.

⁹Sources:

- <https://veenendaalsekrant.nl/lokaal/pandas-op-reis-naar-nederland-230549> (27-a)
- <https://www.sevendays.nl/nieuws/pandas-xing-ya-en-wu-wen-vliegen-naar-nederland> (27-b)

- (27) a. Een Chinese verzorger reist met ze mee en er zijn kilo's bamboe
 a Chinese carer travels with them along and there are kilos bamboo
 aanwezig om ervoor te zorgen dat de panda's niks tekort komt.
 present to there-of to care that the pandas nothing lack
 'A Chinese carer will travel with them and there are kilos of bamboo present to
 ensure the pandas lack nothing.'
- b. Tijdens de vlucht, die een kleine elf uur duurt, zal het ze aan
 during the flight, which a small eleven hours lasts, will it them of
 niks ontbreken. Er is kilo's bamboe aan boord!
 nothing lack. there is kilos bamboo on board
 'During the flight, which lasts nearly 11 hours, they will lack nothing. There is
 kilos of bamboo on board.'

Similar facts appear to apply in English; a simple Google search yields a similar number of hits for "There is kilos of" (254) and "There are kilos of" (323).

The fact that plural Q-nouns and bare measures can support either singular or plural agreement further sets them apart from both true measure expressions and classifiers (as table 1 shows). It indicates that at some point in the syntactic derivation both NPs (the one carrying a singular and the one carrying a plural feature) are accessible to the Agreement features of T. In contrast, in the count portioning-out constructions, only the plural feature is available, resulting in a DP that obligatorily agrees in the plural. (We will take up this issue again in section 3 and show that these facts fall out directly from the analysis of the syntax of these cases.)

2.3 Mass/count alternations and structural ambiguity

Given that mass and count portioning-out involve the same portion expressions, and we have already argued that an analysis in terms of lexical ambiguity is unlikely, we need to account for the alternations in some other way. In this section, we will present evidence that mass and count portioning-out involve distinct syntactic structures despite being string-identical. In section 3 we will consider in more detail the syntactic structures and we will propose specific derivations for each type which are syntactically sound, consistent with the data, and in line with common assumptions on the way headedness/labels determine the interpretation of constructions involving multiple nominal elements (Rothstein, 2011; Landman, 2011; Khrizman et al., 2015).

The first piece of evidence for structural differentiation involves coordination. As (28) shows, it is possible to coordinate measure phrases ((28-a)), classifiers ((28-b)), and mass portions ((28-c)) with another expression of the same category:

- (28) a. I drank two litres and 500 millilitres of water.
 b. I drank two bottles and one mouthful of water.
 c. I drank tons and heaps of water.

However, coordinations involving a combination of a mass portion expression with either a classifier or a measure phrase are ungrammatical:

- (29) *I drank $\left\{ \begin{array}{l} \text{litres and two cups} \\ \text{lots and one bottle} \\ \text{two buckets and oodles} \\ \text{several litres and heaps} \\ \dots \end{array} \right\}$ of water.

Note that this is not just a general ban on coordinating a bare with a non-bare NP; as (30) shows, such coordinations are fine in either order¹⁰.

- (30) a. John has three dogs and goldfish.
b. For lunch I ate biscuits and two pieces of cake.

Neither does the problem with coordinations like (29) seem purely semantic or pragmatic. While conjunctions of vague and precise quantities are certainly a bit odd, they are not ungrammatical in the same way that (29) is:

- (31) I drank a huge quantity and several drops of water.

All this suggests that the contrast between (28) and (29) is at least partly structural. (28) shows that all elements involved can, in principle, be coordinated with other elements of the same category. (30) shows that the problem is not due to bareness as such. And (31) shows that pragmatic considerations alone cannot account for the degree of ungrammaticality displayed in (29). Thus, the data suggest that coordinations like (29) fail because they represent a syntactic impossibility: mass portion constructions are not structurally equivalent to either measure or classifier constructions and hence cannot occur in coordination with them.

The second piece of evidence for this position involves prosody. As we have seen ((24) and surrounding discussion), portion words (including portion-shifted measure words) can appear in bare plural classifier constructions (*I bought meters of cheesecloth*) with the interpretation ‘unspecified number of portions of X’. In written form, these sentences appear identical to their mass counterparts with an abundance interpretation. However, both interpretations involve rather different stress patterns. Consider (32):

- (32) John distributed litres of water to the marathon runners.

As we have already seen, sentences like (32) have two possible readings. The first (count) reading is true in any situation in which John handed out litre-sized portions of water to the runners, regardless of the number of runners or portions involved. The second (mass) is true in any situation in which John handed out a huge amount of water to the runners, regardless of the size of the individual portions. The readings are truth-conditionally independent. In

¹⁰Suggesting perhaps that bare nouns too have a covert determiner.

a situation in which a total of two runners each receive a litre bottle of water, the former is true but the latter is false. In a situation in which 200 runners each receive a cup of water from John's tap, the latter is true but the former is false.

In spoken form, however, (32) is not ambiguous, as the two readings of *litres of water* are fully disambiguated by stress. For the count reading, the stress needs to fall on *water*; the mass reading requires stress on *litres*:

- (33) a. John distributed litres of wáter to the marathon runners.
 b. John distributed lítres of water to the marathon runners.

Given that stress patterns are affected by phrasal boundaries, this strongly suggests that the ambiguity of (32) is structural, and cannot be explained in terms of e.g. a literal versus a metaphorical interpretation of *litre(s)*.

Finally, there are languages in which mass and count portioning-out actually look distinct on the surface. German and Greek are cases in point. In German, count portioning-out constructions require the classifier to be directly adjacent to the noun, without the interference of *von* 'of'. Mass portioning-out constructions, however, require the addition of *von*.

- (34) a. *(Drei) Haufen Sand wurden angeliefert.
 (three) heaps sand were delivered
 'Three heaps of sand were delivered.'
 b. (*Drei) Haufen von Sand wurden angeliefert.
 (three) heaps of sand were delivered
 'Heaps of sand were delivered.'

Observations of a similar nature can be made also in Greek where mass portioning involves a definite DP following the portion word whereas in cases of count portioning the noun is necessarily bare (35):

- (35) a. Mas serviran (*tris/tria) sorus/vuna ta
 us-DAT served-3rd-PL (three) heaps/mountains the-NEUT-PL-ACC
 psaria
 fishNEUT-PL-ACC
 They served us heaps of fish
 b. Mas serviran (tris/tria) sorus/vuna psaria
 us-DAT served-3rd-PL (three) heaps/mountains fishNEUT-PL-ACC
 They served us (three) heaps of fish

Adding up our various observations from this and the previous section, we conclude that the similarities between Q-nouns and bare measures support a shared analysis with the following key points. First, both alternate between a true individuating use that results in a count NP, and a more vague 'high quantity' use that results in a mass NP. Second, with very few exceptions (e.g. *a lot of*) the two uses are in complementary distribution, with the former being triggered by numerals and count determiners, and the latter being triggered

by bareness combined with stress on the portion word. Third, the two uses correspond to distinct syntactic structures; moreover, the behaviour of count and mass portion constructions with respect to verbal agreement strongly suggests that the portion word is the syntactic head of the NP in the first case but not in the second.

Before we turn to the specifics of the analysis, in the next section, we will argue that this pattern goes beyond overt portioning-out.

2.4 Covert portioning-out and plural mass nouns

As Khrizman et al. (2015) argue, the classifiers involved in portioning-out do not always have to be overt ones like *slice*, *portion*, or (portion-shifted) *litre*.¹¹

The fact that languages may allow countable reference to substances via covert portioning-out has the potential to account for a wide range of crosslinguistic data that defy traditional wisdom about the nature of the mass/count distinction. For example, in languages like Yudja (Lima, 2014a), substance-denoting nouns are countable. Khrizman et al. analyse such data in terms of a covert portion classifier (note that the analysis in Lima (2014a) itself is slightly different, treating the portions as inherently present in the extension of the noun itself, rather than derived through a classifier).

- (36) Txabiü asa he wĩ he.
 three flour in port in
 ‘There are three (bags of) flour in the port.’ (Yudja)

Another such language is Nez Perce, which we have already seen in action in the introduction (8). Here is another Nez Perce example from Deal (2013):

- (37) hipinwees.pe lep.it xiŋay.xiŋayx̣ ’itx̣ hii.we.s ’inik.iin’
 table.LOC two.SUF PL.white clay 3SUBJ.be.PRES-SG place.PASSIVE-PART
 ‘There are two pieces of white clay placed on the table’ (Nez Perce)

Similarly, covert portioning-out may be involved in ‘restaurant talk’ in languages like Dutch and German (a proposal previously made, though not in formal detail, in Wiese & Maling, 2005):

- (38) a. Twee rode wijn(*en) alstublieft.
 two red wine(PL) please

¹¹At this point we should probably clarify that we do not view cases of ‘packaging’ coercion - e.g. English *Two coffees, please* - as portioning-out in the sense we are interested in. The available evidence points to packaging coercion as a lexical process in which the noun itself is reanalysed as countable (see *authors*, *in press* for an overview of the evidence), rather than a derivational process in which the embedded noun remains mass. While the two mechanisms (packaging coercion and covert portioning-out) may both result in NPs that look like pluralised mass nouns (*waters*, *sugars*), one key difference is that coercion is contextually very restricted (mostly ‘restaurant talk’) whereas portioning-out is generally productive in languages that have it. See also Lima (2014b) for a similar discussion of the differences between packaging coercion and reference to portions, based on Yudja.

- (Dutch)
- ‘Two (portions of) red wine, please.’
- b. Twee rode wijn.en alstublieft.
 two red wine.PL please
 ‘Two red wines (=kinds of red wine), please.’

As (38-b) shows, kind coercion in Dutch and German behaves like in English, involving a noun that behaves like a grammatical count noun in all respects. However, the ‘unit’ construction in (38-a) seems to preserve the mass status of the original noun, as shown by its incompatibility with plural marking. The countability of the NP in (38-b) must therefore have a different source, such as a covert portioning-out operator. Following Khrizman et al. and Landman (2016), we will call this operator *PORTION*.¹²

We argue that the covert *PORTION* operator plays a crucial role in accounting for a phenomenon that defies traditional wisdom on the morphosyntax and semantics of mass nouns and the mass/count distinction, namely pluralisation of mass nouns. The ban on pluralisation of mass nouns is generally a design feature of most theoretical accounts (see in particular Chierchia, 1998b; Borer, 2005), but is in fact attested in many languages. Assuming that covert portioning-out is a feature available in some but not all languages, we can account for the surprising pluralisation facts while still leaving the wider generalisation intact. Here is how: Let’s adopt for the purposes of this argument Chierchia’s (1998b) view under which mass nouns are incompatible with pluralisation because they are inherently (lexically) plural, meaning that they are closed under sum. Now, there is no reason to assume that a portioned-out mass noun would be closed under sum, hence nothing blocks the pluralisation of a portioned-out mass noun. If portioning-out is covert, we might expect plural number to show up on the mass noun. And finally, since *PORTION* is a portion classifier, we might even expect such plural mass nouns to alternate between mass and count portion interpretations, just like the portion classifiers from section 2.1 and the portion-shifted measure from section 2.2.

The latter is exactly what we find crosslinguistically. Languages such as Yudja, Nez Perce, Yup’ik (Corbett & Mithun, 1996), Ojibwe (Mathieu, 2012), Old High German (Carr, 1936)¹³, and Blackfoot (Wiltschko, 2012), allow pluralisation of mass nouns with the interpretation ‘bits or portions of X’.

- (39) a. uq.uq
 oil.SG
 ‘oil’ (Yup’ik)
- b. uq.uk
 oil.DU
 ‘two sealpokes or jars of oil’

¹²although we will not adopt Khrizman et al.’s intersective semantics for it; We return to the compositional semantics of portioning-out shortly.

¹³Carr gives few examples but notes that “[i]n OHG the plural names of substances may be used to denote things made of the substance or pieces of it where in Modern German the word *Stück* would be used.”

- c. uq.ut
oil.PL
'three or more sealpokes or jars of oil'
- (40) a. maandaamin
'corn' (Ojibwe)
b. maandaamin.ag
corn.PL
'pieces of corn'
- (41) a. aiksinoosak aiksinoosak.iksi
bacon bacon.PL
'bacon' 'slabs or slices of bacon' (Blackfoot)
b. kaatsi káatsi.istsi
driftwood driftwood.PL
'driftwood' 'pieces of driftwood'

On the other hand, while mass nouns can productively be pluralised in languages like Greek, Persian and Indonesian, they remain non-countable, supporting instead an inference of scatteredness and abundance.

- (42) a. Trehun nera apo to tavani.
drip-3PL water.PL from the ceiling
'Waters are dripping from the ceiling.' (Greek, repeated from (12))
b. *Dio nera trehun apo to tavani.
two water.PL drip-3PL from the ceiling
'Two waters are dripping from the ceiling.'
- (43) a. O Yanis patise se laspes
THE.MASC.SING Yanis step-PAST in mudPL
Yanis stepped in *muds*
b. *O Yanis patise se tris laspes
THE.MASC.SING Yanis step-PAST in three-FEM.PL mudPL
Yanis stepped in three *muds*
- (44) Mereka telah ke.masu.kan air laut terlalu banyak dan air.air itu
they have KE.enter.KAN water sea excessive many and water.REDUP that
sudah berhasil di.keluar.kan.
have successfully PASSIVE.exit.KAN
'They have ingested too much sea water, and those waters have successfully been
taken away.' (Indonesian; Dalrymple & Mofu 2012¹⁴)

¹⁴Note that our interpretation of these data differs from that of Dalrymple & Mofu themselves, who argue that Indonesian lacks a grammatical mass/count distinction, similarly to e.g. Yudja (Lima, 2014a). However, this claim is primarily based on the acceptability of pluralised substance-denoting nouns in Indonesian; as the present paper shows, the possibility of pluralisation is not a reliable diagnostic for countability. In our own corpus exploration and consultation with native speakers (Kiki Kushartanti and Budi Kadaryanto, p.c.)

- (45) âb.â.ro az kaf.e âšpazxune jam kon
water.PL.ACC from floor.PRT kitchen gathering do
'Wipe away the waters from the kitchen floor.' (Persian; Sharifan & Lofti 2003)

- (46) a. se:kse ‘blood’
b. se:ksel ‘a lot of blood’
c. singilgen ‘snow’
d. singilger ‘lots of snow’
e. ulle ‘meat’
f. ullel ‘multiple pieces of meat’ or ‘a lot of meat’
- (47) a. pimî
‘Oil’ (Innu-Aimun; C. Gillon 2010)
b. pimî.a
oil.INAN-PL
‘amounts of oil’ or ‘lots of oil’

we have not been able to find any examples of numerals occurring with (plural or singular) mass nouns in Indonesian. See also Chung (2000); Kadaryanto (2010).

that the two plurals encode different meanings:

- (48) There were two million locusts on the vast field of wheat

Clearly the locusts are numerous and spread over a large surface in a presumably disorderly fashion. From a Greek-specific point of view it is not viable to suggest that there is a *n* spelled out as the plural morpheme. If that were true then we would expect the morpheme to be spelled out next to the root and as a result show up in compounds, contrary to fact as plural never appears in compounds in Greek (CV in the glosses means compounding vowel, see Ralli (2013)).¹⁵

- (49) a. Ner - o - kouvalitis
 \sqrt{water}_N - CV - carrier
 Water carrier
 b. *Ner- a -o -psekastis
 \sqrt{water}_N - PL -CV -carrier
 Water carrier
 c. lasp- o -lutro
 \sqrt{mud}_N - CV -bath
 Mudbath
 d. *lasp- es -o -lutro
 \sqrt{mud}_N - PL -CV -bath
 Mudbath

Importantly, *spread over a surface* and *in a disorderly way* are separable components. Being distributed over a surface is trivially true of any physical object (bar certain subatomic particles). The water in a tank or in a swimming pool or even a lake is not distributed in a disorderly way and yet, in Greek at least we find example like the following:¹⁶

- (50) Me ton tropo pu hrisimopio ta nera
 with the.ACC.MASC REL use/1st.SG the.PL.NEUT water.PL.NEUT the.GEN.FEM
 tis dhexamenis, ine pliros ananeosima
 tank.GEN, be.3rd.PL fully recyclable.PL.NEUT
 The way I use the water of the tank, it is fully recyclable

Similar examples are easy to come by. Note finally that alongside the theoretical work in Tsoulas (2009); Kane et al. (2015) the experimental work reported in Renans et al. (2018) confirm that the inference of mass plurals patterns with the inference of count plurals and is best cast in terms of abundance. We conclude then that abundance is the best way to capture the patterns with scatterndeness being a sub-case of abundance and that, for Greek,

¹⁵The *Bare stem constraint* argued for by Ralli (2013); Ralli & Karasimos (2009a,b) stating that the left-hand member of a compound must be a bare stem only affects derivational morphemes. Furthermore, in these works the stem seems to be categorised so *root+n* in this case.

¹⁶source: http://energ.gr/index.php?option=com_kunena&view=topic&catid=15&id=57510&Itemid=74.

a syntax that places a special number feature on n is empirically unsupported.

Despite the fact that plural mass nouns do not always alternate between mass and count interpretations within a single language¹⁷, the general crosslinguistic pattern is strongly reminiscent of the kind of alternation we saw with Q-nouns and bare measures. It is therefore natural to treat pluralisation of mass nouns along the same lines, in terms of portioning-out and structural ambiguity.

3 Syntax

In this section, we will develop a more detailed analysis of the syntax of both mass and count portioning-out. In the next section (4), we will focus on the compositional semantics of portion constructions.

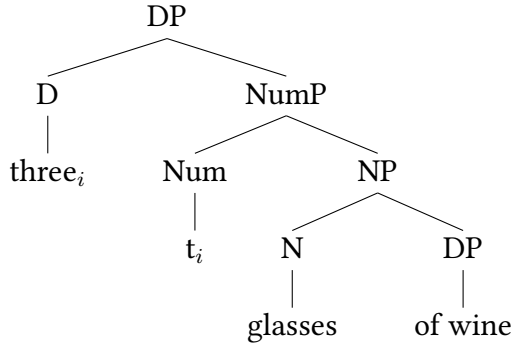
The proposal that we will formalise in this section is that count and mass portioning-out involve separate structures. As we share a number of syntactic and semantic assumptions with Rothstein (2011) - in particular, the notion of ‘portion-shifted measures’ as well as the key idea that structural ambiguity may be responsible for countability distinctions - we will take her proposal as our starting point. We will, however, end up making several adjustments. First, rather than treating count portioned-out expressions like *three loads of laundry* as NumPs in which *three* is an adjectival sister to the NP *loads of laundry*, we will propose that the NP is embedded inside a PortionP instead; as we will see in section 3.2, assuming that portioning-out operators head their own phrase will enable us to derive the desired syntax for mass portioning-out. Secondly, we will incorporate *of* into the structure.

3.1 Count portioning-out

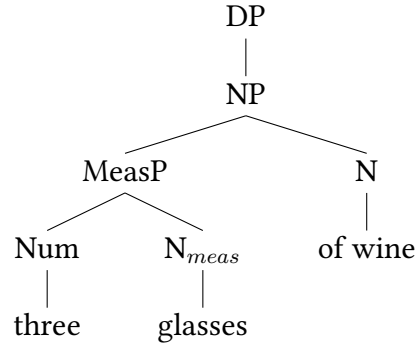
Rothstein’s (2011) primary concern is the ambiguity of nominal expressions like *three glasses of wine* between an individuating reading (‘three glasses filled with wine’) and a measure reading (‘a quantity of wine that would fill 3 glasses’). She proposes that these readings correspond to the following two structures (based on Landman, 2003, 2004):

¹⁷In Greek, for example, certain mass nouns can be ‘packaged’ in restaurant contexts just as they can in English (e.g. *three beers please*), but as in English, this option is fairly limited and context-dependent. In contrast, the ‘bits or portions of X’ appears to be fully productive in languages like Ojibwe, Innuttut and Nez Perce, and does not require a particular context or the availability of standardised units.

(51) The Individuating Reading



(52) The Measure Reading



(In the rest of this section we set aside the structure in (52), as we have shown in the previous section that none of the readings we are interested in are measure readings.) The structure in (51) involves an adjectival treatment of numerals; in addition, Rothstein claims that the numeral raises to D if D is empty. The evidence for the claim that numerals are adjectival is drawn from Landman (2003, 2004) and involves the following set of sentences:¹⁸

- (53) a. Fifty ferocious lions were shipped to Artis.
 b. #Ferocious fifty lions were shipped to Artis.
- (54) a. The animals in the shipment were fifty ferocious lions.
 b. #The animals in the shipment were ferocious fifty lions.
- (55) a. We shipped the fifty ferocious lions to Blijdorp, and the thirty meek lions to Artis.
 b. We shipped the ferocious fifty lions to Blijdorp, and the meek thirty lions to Artis.

The crucial point here is that within the DP as in (55) the numeral *three* can swap places with the adjective *ferocious*, unlike what happens with the determinerless NPs in either argument (53) or predicate (54) position.¹⁹ The semantic claim is that numerals have the semantics of **intersective** adjectives. The evidence, however, does not carry very far. With different adjectives the patterns are not reproducible casting doubt on the evidentiary weight of the contrast in (53) - (55) concerning the categorial status of numerals.

- (56) *We shipped the blue four cars to Blijdorp and the yellow three cars to Artis

An adjectival analysis under the structure in (51) would also have to stipulate that the *only* adjectives that raise to D are numerals as it is clearly not possible to suggest the same for (57) given that *surprisingly large* is not a head and as such cannot raise to D, assuming that there is an empty D in (57). But there is little reason to think that this is not also the case in general for the individuating reading of *three glasses of wine*.

- (57) The waiter was carrying surprisingly large glasses of wine

¹⁸The judgements are those reported by Landman.

¹⁹These examples were first discussed by Andrews (1983).

A more likely explanation for the reported patterns is that the numeral is the head of a functional projection within the nominal extended projection rather than an adjective. Adjective preposing is the result of focus movement within the DP as has been argued in detail among others by Ntelitheos (2004) and Szendrői (2012).

More generally, treating numerals as adjectives is implausible and runs counter to the available evidence: Numerals cannot be intensified (58)²⁰, they cannot form comparatives (59) and they behave like heads rather than phrases hosted in specifier positions as adjectives are generally accepted to be (Cinque, 2010, a.o), witness the fact that they allow ellipsis of their complement unlike adjectives in general (60)

- (58) a. *The very three girls ate pizza
b. The very rich girls ate pizza
- (59) a. *The more three glasses are on the shelf
b. the more expensive glasses are on the shelf
- (60) a. As far as ties are concerned, I always wear a blue *(one).
b. As far as new ties are concerned, I bought two (*ones)
c. As far as ties are concerned I have two brown *(ones)

Interestingly, numerals seem to pattern with some (but not all) subsecutive adjectives like *former* (61)-(62):

- (61) a. *The very three girls ate pizza
b. *The very former girls ate pizza
- (62) a. *The more three glasses are on the shelf
b. *The more former glasses are on the shelf

It is tempting to attribute this pattern to the non gradability of numerals but this is probably incorrect. Many scholars following Armstrong et al. (1983), including Rett (2013), and Burnett (2017) have observed that it is a surprising characteristic of non scalar adjectives that they can very easily be coerced, in context, to scalar interpretations:

- (63) a. Is three **more prime** than 6 ?
b. 3 is more odd than 447.
c. ?The window is not as locked as I expected it to be.
d. A: I met a one-armed man
B: How one-armed was he? Tell me when to stop (indicates increasingly high cut off points on his left arm)²¹

With numerals this is impossible:

- (64) a. *The girls on the right are more seven than those on the left.

²⁰Ordinal numerals can: *The very first time*.

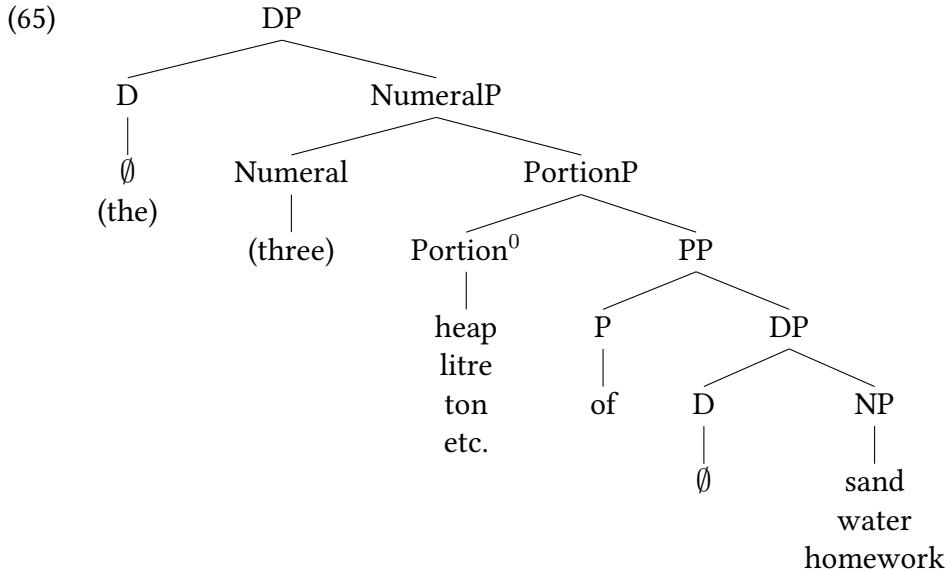
²¹Examples (63-a), (63-b), and (63-d) are from Burnett (2017).

- b. *Last night Real Madrid were less eleven than Barcelona and that is why they lost. (in a context where a Real Madrid player was sent off).

Further empirical evidence against the idea that (cardinal) numerals are adjectives in English is given in Huddleston & Pullum (2002), while Zamparelli (2000); Lyons (1999); Alexiadou et al. (2007) amongst many others provide further crosslinguistic evidence.

As a result, thinking carefully about this proposal one is led to the following conclusion: Maintaining that numerals are semantically intersective adjectives runs up against two significant empirical obstacles, (a) that numerals do not have the syntax of adjectives and (b) that the only adjectives they share properties with are some *non-intersective* adjectives. Given that we would like to keep our syntactic structures as closely aligned with semantic composition as possible, we conclude that numerals are not in the same natural class as adjectives and, as a consequence, the adjectival view of numerals is syntactically not tenable. Note that this conclusion does not necessarily mean that Landman's (2004) adjectival theory of indefinites falls with it. Semantically, the weaker, but compatible, view that the type of numerals is that of modifiers is perhaps still tenable. We do not have anything further specific to numerals to say in this paper.²²

This is a good result in fact as it allows us to retain a variant of Rothstein's (2011) structure in (51). As we pointed out, the structure as it stands is not adjectival but the behaviour of count portioning-out is consistent with a structure similar to what Rothstein (2011) proposes for both classifiers and portion-shifted measure words, in which the portion word takes a mass NP or DP as its complement; since the portion word heads the resulting complex phrase, we will label it PortionP. (65) is our take on the structure. It is similar but not identical to Rothstein's



²²For much more discussion of issues surrounding the grammar of numerals see Ionin & Matushansky (2006, 2018).

The phrase as a whole inherits its number features (and mass/count status) from its head, so the expression in Portion⁰ controls number agreement on the verb (66).

- (66) (The) three heaps of sand are/*is equidistant from the heap of cement

Apart from the introduction of PortionP, our main difference with Rothstein's structure is that we are assigning *of* its own syntactic position. We assume that, crosslinguistically, the complement of PortionP can be either a PP headed by *of*, or an NP. On the syntactic side of things, this allows us to analyse the following contrast from Dutch:

- (67) a. drie hopen (*van) zand
 three heaps (of) sand
 'three heaps of sand'
 b. drie hopen *(van) het zand
 three heaps (of) the sand
 'three heaps of the sand'

As (67) shows, *van* 'of' is only grammatical in Dutch portioning-out constructions when its complement is a DP; when there is no determiner, *van* needs to be left out as well. In section 4.2.2, we will argue that *of* effectively cancels out the semantic contribution of the DP head, rendering the *of*-PP semantically equivalent to the embedded NP.

3.2 Mass portioning-out

Turning now to mass portioning-out, we propose that the surface relation between the PortionP and the DP is mediated by an operator which we call MPOP (**Mass Portioning operator**). Morphosyntactically, this operator can be realised in different ways: *of* in English, *von* in German, the definite determiner in Greek, whereas in Dutch and elsewhere it is null. As we will show in section 4.2, the semantics of this operator is unified across all its realisations. The question is whether this semantic unity is also manifested in the relevant structure. Building on a number of ideas and analyses spanning a wide class of phenomena we propose that the unity is also syntactic. To begin with, consider Kayne's (1994) analysis of the English possessive where it is posited that *of* is inserted in the D position in (68) when the D is indefinite. Definiteness aside, this is a first indication that *of* and determiners may occupy the same position.

- (68) a. A friend **of** Miranda's
 b. $[_{DP} [_{QP} \text{A friend}]_i [_{D'} [_{D^0_{-def}} \text{of}] [_{AgrP} [_{DP} \text{Miranda}] [_{Agr'} [_{Agr^0} \text{'s}] [t_i]]]]]$

In later work (Kayne, 1997), Kayne proposed that there is a generalisation across examples like (69) and (70) in that the reduced vowel orthographically represented as *a* at the end of *buncha* and *shoulda* is the same element and it is a true **of**:

- (69) A bunch**a** grapes
 (70) Melinda should**a** married the mayor

Note that (69) is also possible with non-countable nouns:

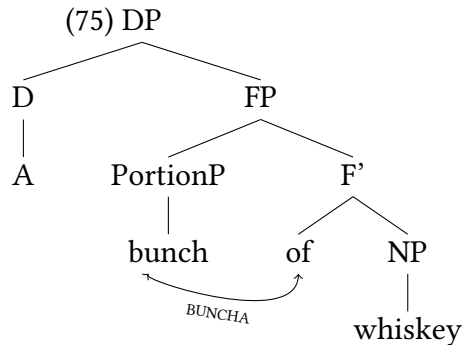
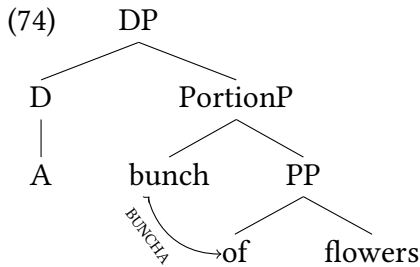
- (71) a. So my weekend plans of sauna and a buncha vodka is gonna cure the shit out of me?
 b. My friend & I brought in a buncha vodka when we were in Morocco and were glad to have done so.²³
 c. In today's video I ate a buncha food and I showed ya all of it!²⁴
 d. I drank a buncha whisky on my england/scotland trip.²⁵

Although none of the examples with *buncha* is compatible with numerals and pluralisation, count ones are compatible with quantifiers like *every* (72):

- (72) a. Every buncha flowers was delivered on time
 b. *Every buncha whiskey will help me
 (73) a. *Two buncha flowers
 b. *Two bunchas flowers
 c. *Two bunchesa flowers

Although (73-a) is ungrammatical because counting requires a plural, (73-b) shows that the contraction is an instance of post-syntactic morphological merger further supported by the fact that a copy can intervene and block contraction in (73-c).²⁶

In Kayne's analysis of (70), *of* is introduced in the derivation in the same position as infinitival *to* and is essentially a complementizer that takes a participial phrase as its complement. Roughly, the structures will be as follows (we return immediately to the structure of the mass portioning)

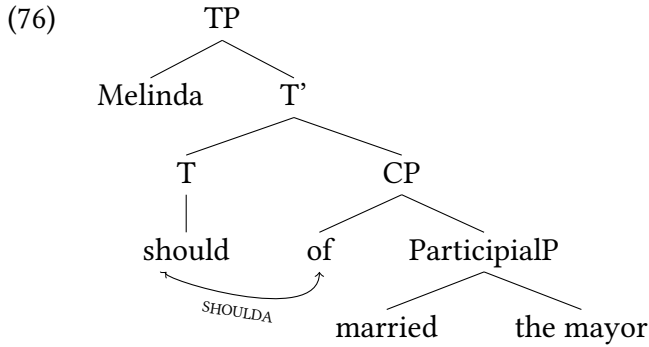


²³Source: <https://ishort.ink/1vEw>.

²⁴Source: <https://ishort.ink/gFkX>.

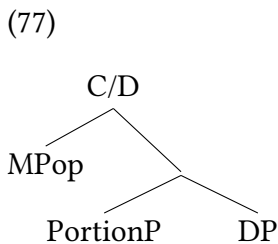
²⁵Source: <https://ishort.ink/4U21>.

²⁶For an analysis of other possessive constructions involving morphological merger, see Tsoulas & Woods (2019).



The details of the derivation of (76) are not relevant to our present concerns (specifically whether *of* is categorially a complementizer). The subject in (76) (*melinda*) has moved to its surface position from a ParticipialP internal position. From our perspective, as we will see immediately this property ties all these constructions together.

Building on these two proposals of Kayne's, we suggest that it would not be surprising to find D type elements in positions like that of *of* in (76) given also the similarities between D and C that have been observed since Szabolcsi (1983).²⁷ The next step is to generalise from the above ideas to *mass portioning-out*. We propose the following derivation: the PortionP and DP merge first to form a constituent akin to a small clause. Next, an external head, which has D and C exponents as we saw, merges with the *small clause* constituent [Portion DP] much like the *of* in (76), or, for that matter, the syntax generally assumed for copular constructions (Moro, 1997, et. seq). PortionP then moves to the specifier of the external head.²⁸ The reason for the movement of PortionP is that within the restrictive theory of structure building and labelling that we are assuming there is no label *small clause* for this constituent since this is not the label carried by any of the constituents in it. In fact, Chomsky (2013, 2015) suggests that the resulting constituent fails to receive a label altogether because the heads Portion⁰ and D⁰ are equidistant from the root and the labelling algorithm is essentially stuck. The only remedy is to modify the unlabellable constituent. In this case the relevant modification is moving the PortionP out of the unlabelled constituent, but as things stand there is nowhere to move it. This is where merging of the external D/C head comes in. The lexical content of this head is MPOP, the resulting structure is (77):



²⁷See also, among others Tsoulas (1994); Ogawa (2001)

²⁸We will label this head C/D to reflect its realisational possibilities. Nothing hinges on this choice. Under strictly Bare Phrase Structure assumptions (Chomsky, 1994) there is no need to make even a decision on that as the label would be the actual lexical element, i.e. MPOP/the/of/von \emptyset .

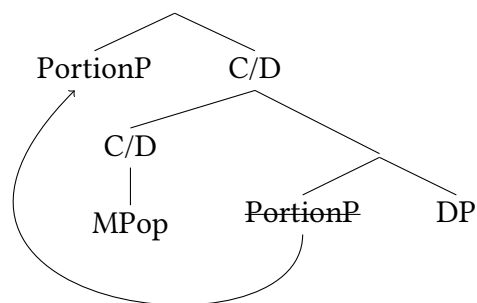
An analysis that posits a position external to the predication that can be filled by a determiner is reminiscent of the raising analysis of relative clauses where the determiner merges externally to the relative (first proposed by Vergnaud (1974) and further pursued, in slightly different ways, by Kayne (1994); Bianchi (1999); Zwart (2000); Bhatt (2002) among many others). The same idea has been developed for determiner spreading constructions in Greek (78) by Alexiadou & Wilder (1998).²⁹.

- (78) I kokini i simea
the red the flag
The red flag

Where [the flag] and [red] merge first followed by raising of [Red] and merging of an external determiner.

Further direct evidence for the proposal comes also from the variable agreement patterns observed for Dutch and English in examples (27) in section 2.2. Specifically, if the above is to be inserted in a copular structure, and T needs to be merged next, at the point of merging T both the PortionP and the DP will be equally accessible to T's φ -probe. This is so because labelling and movement are phase-based. The labelling algorithm will force raising of PortionP to the spec of C/D yielding (79).

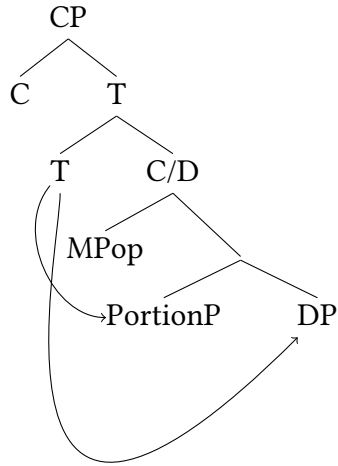
- (79)



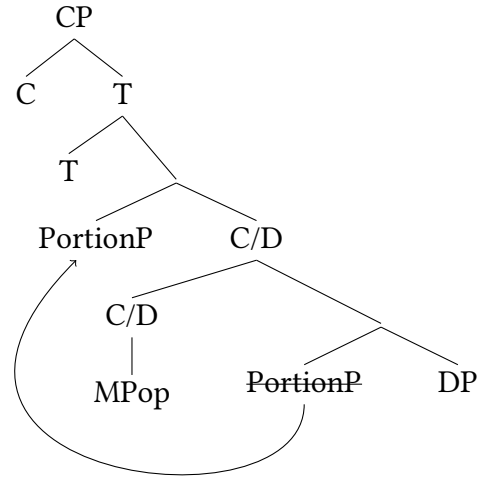
Movement will only happen once the higher phase head is merged. Assuming that head is C, then T will have access to both sets of ϕ -features. Schematically:

²⁹For the idea that the Determiner Spreading construction involves DP internal predication, see Manolessou (2000); Campos & Stavrou (2004); Panagiotidis & Marinis (2011).

(80) Agreement



(81) Movement/Labelling



The label of the sister of T is unclear but ultimately not relevant for our purposes. Presumably it would be derived along the lines that derive the label of TP as $\langle \varphi, \varphi \rangle$

An expletive would be inserted in Spec TP yielding:

- (82) a. There's tons of work to do.
b. There are tons of work to do.

Since the portion word is not the head of the phrase but part of a specifier, it does not influence the number or mass/count status of the constituent as a whole. Our account of the cases of 'uncertain' agreement is independent of the surface configuration; rather, we expect the matrix constituent to carry the same ϕ -features as the embedded DP and control agreement accordingly. The structure also allows us to account for the stress data in (33). Selkirk's (2011) Match theory provides a more explicit way to state the argument. Selkirk (2011, p. 441) proposes the following Match constraint for the identification of one of the relevant phonological domains:

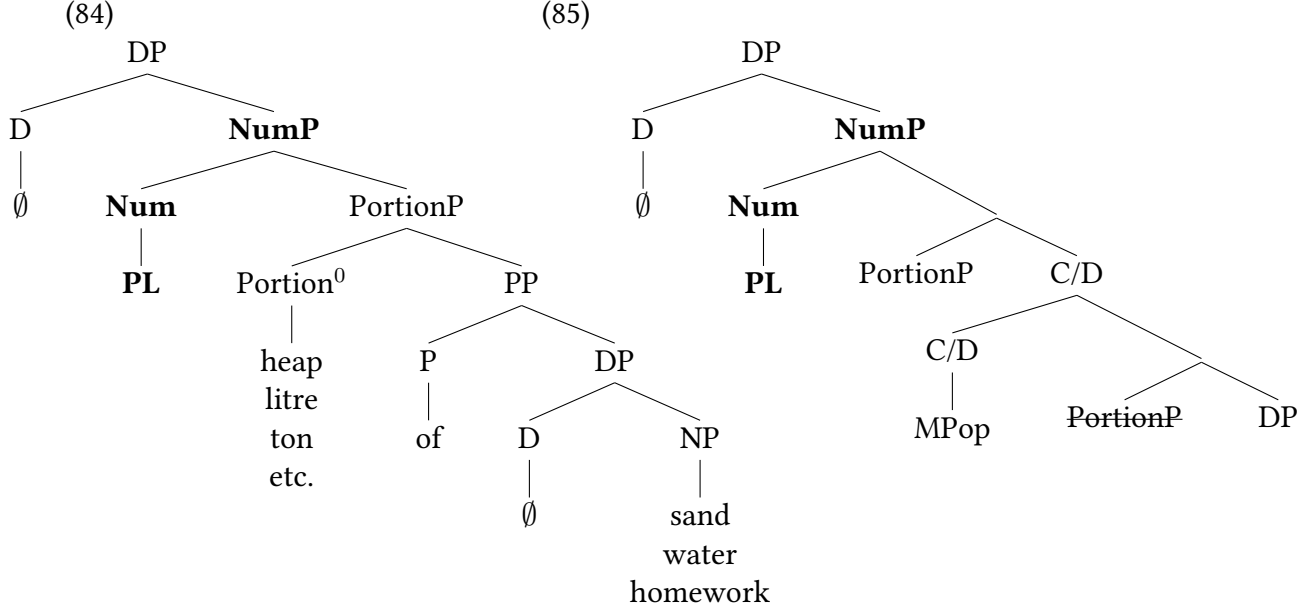
(83) **Match phrase**

A phrase in syntactic constituent structure must be matched by a corresponding prosodic constituent, call it ϕ , in phonological representation.

Stress is sensitive to ϕ and as a result, in (65) there is only one relevant phrase, PortionP, wherein the rightmost element receives primary stress (consistent with the Nuclear Stress Rule). In (79) in contrast, the Match Phrase constraint identifies two relevant phrases, PortionP on the left and C/D (which is also phrasal) on the right and stress is assigned accordingly.

Turning finally to the pluralisation strategies that we presented in section 2.4 given the

structures proposed in (65) and (80)/(81) we obtain (84) and (85). Languages of the Ojibwe type, in which plural mass nouns receive a ‘bits or portions of X’ interpretation, has the structure in (84) available, while the structure in (85) represents languages like Greek and Persian; languages of the Evenki type, in which plural mass nouns are ambiguous, allow both structures.



Where exactly plural marking will be realised morphologically is the result of different processes not directly relevant to the point here. Based now on the structures proposed in this section we now turn to the semantics of portioning-out constructions.

4 Semantics

4.1 Background: Overlap and disjointness

We will rely on a disjointness-based approach to the mass/count distinction in order to analyse the distinction between count and mass portioning-out. While the properties of disjointness and overlap have received some attention in the mass/count literature (Bunt e.g. 1985; B. Gillon e.g. 1992; Bale & Barner e.g. 2009; the ‘built-in measure’ approach to count nouns of Krifka 1989 is also a clear precursor of the present analysis), several more recent approaches to the mass/count distinction (Rothstein, 2010; Landman, 2011, 2016; Khrizman et al., 2015; Sutton & Filip, 2016; Rothstein, 2017; Landman, 2020, e.g) - treat disjointness as the central determinant of grammatical countability, providing an alternative to the atomicity-based framework most semanticists have relied on since Link (1983). A framework based on overlap and disjointness is particularly well-suited to analyse mass/count alternations, countable reference to substances, non-countable reference to objects, and

other ‘grey area’ phenomena without having to rely on systematic shifts between types and/or ontological domains.

Disjointness-based accounts continue the Linkian tradition of analysing nouns as sets of mereological entities (atoms or sums), where the mass/count distinction follows from the formal properties of these sets and entities. However, one key difference between Link (and Chierchia, 1998b, 2010) on the one hand and a disjointness-based account on the other, is that the latter does not assume that count nouns are countable because they range over atoms. Instead, both mass and count nouns are analysed in terms of predicates over mereological sums, with the difference between the two being that count nouns divide that stuff in a way that necessarily excludes any overlap, while mass nouns do not. Cats, for instance, are disjoint: the same bit of cat-stuff cannot simultaneously be part of multiple cats. As a consequence, there is only one way to divide a domain of cat-stuff such that it results in a predicate over things that are cats; this means that the cardinality of the count noun **cat** is non-arbitrary, enabling counting.³⁰ In contrast, the same bit of water can be part of (possibly infinitely) many water-sums; hence, the predicate **water** does not provide a non-arbitrary way to divide the sums of matter in its extension and therefore no ‘base’ of sums that ‘count as *one*’. As a result, **water** cannot be counted.

4.2 Portioning-out in a disjointness-based semantics

One of the advantages of a disjointness-based framework is that it enables a derivational and compositional account of countable complex NPs involving mass nouns, such as the portion constructions in (4). Where an approach that links countability to atomicity needs to assume either a high degree of lexical ambiguity or polysemy or a system of covert inter-domain mappings (e.g. Link’s ‘material part’ relation, or the ‘S-partition’ and ‘I-partition’ operators proposed in Chierchia 2010), a semantics based on overlap and disjointness allows countable reference to stuff and non-countable reference to objects without any additional ambiguity or domain-shifting. In doing so, it avoids philosophically unorthodox practices such as the breaking up of atoms into other atoms (as in Chierchia 2010), and allows us to account for equivalences like the ones in (86) without having to include in the model additional (and, in principle, arbitrary) mappings between atoms and their material parts.³¹

³⁰Note that disjointness, even though it is rooted in human perception of reality, is ultimately a grammatical property; it is not a claim about the actual physical properties of the objects we perceive. For example, if two of the cats that make up the extension of **cat** are conjoined twins, some of their physical ‘stuff’ might not clearly belong to one cat or the other, but that does not mean they cannot be represented as disjoint sums, just that there is some vagueness involved in the location of the boundary between the two cats; note also that no matter where we draw the line we will never end up with anything more or less than two cats. See also Rothstein (2010); Chierchia (2010); Landman (2011); Sutton & Filip (2016); Rothstein (2017) for related discussions, and Moltmann (1997) for an approach that does consider cases such as these a counterargument against a disjointness-based approach to countability, and rejects mereology in favour of an account based on ‘integrated wholes’.

³¹What we mean by ‘arbitrary’ is the following. Whatever the properties of cats are in our particular world - whether they are animals, or robots, or higher-dimensional angelic beings - it is a necessary linguistic truth that cats are made out of cat. A disjointness-based model captures this necessary truth while also leaving

- (86) a. Six 20g slices of cheese
 b. Cheese in 6 20g slices
 c. 120g sliced cheese
 d. Slices of cheese amounting to 120g

In Khrizman et al. (2015) and Landman (2016), portioning-out of mass nouns is treated as simple intersection.³²

- (87) a. $\llbracket \textit{slice} \rrbracket = \mathbf{slice}$ (the disjoint set of slice-shaped objects)
 b. $\llbracket \textit{cheese} \rrbracket = \mathbf{cheese}$ (the overlapping set of cheese-sums)
 $\llbracket \textit{slice of cheese} \rrbracket = \mathbf{slice} \cap \mathbf{cheese}$ (the disjoint set of cheese-sums that are slices)

Note that, even as we are dividing, counting up and otherwise semantically manipulating our cheese-sums, we never leave the domain of cheese; the counting of cheese-sums is enabled not because we have mapped them onto an independent atomic domain of slices, but because we have compositionally altered their overlap properties. Because **slice** is disjoint, the result of intersecting it with any other set is necessarily also disjoint, and hence portion constructions like *slice of cheese* are predicted to be countable.

Similarly, Khrizman et al. (2015); Landman (2016) assume intersective interpretations for both portion-shifted measures and covert portioning-out constructions. For example, on its portion interpretation (e.g. *We have various litres of mineral water in the fridge*), the denotation of *litre of water* is analysed as in (88).

- (88) $\llbracket \textit{litre of water} \rrbracket = \lambda x [\mathbf{portion}(x) \wedge \mathbf{water}(x) \wedge \mathbf{litre}(x) = 1]$

So, just as *slice of cheese* can be analysed as a set of sums that are both cheese and slices, the relevant reading of *litres of water* can be analysed as a set of sums that are both water and litre-sized portions. The result, again, behaves like a count NP since **portion** is disjoint:

- (89) In the course of the day, John drank many/several/each of these litres of mineral water.

As can be seen in (88), portion-shifting a measure construction relies on intersection with a set **portion** of contextually determined portions. Khrizman et al. assume that **portion** is also active in covert portioning-out constructions (as in the Yudja example from (36)), and can be directly intersected with the mass noun denotation to give a countable portioned-out interpretation.

room for arbitrary, model-specific properties of cat (for instance, whether it is angelic in nature or not). On the other hand, in an atomicity-based model, the extensions of \mathbf{cat}_{count} and \mathbf{cat}_{mass} are independent, only linked by an arbitrary mapping function. This means that in theory, nothing blocks a Linkian model in which cats are made out of dog, for instance. Of course, model-theoretic semanticists routinely dismiss non-intended models like these, but it seems to us that it would be better if their impossibility were hardwired into the system rather than stipulated. (NB: we are ignoring coerced examples in the vein of ‘stone lion’ here - they are an independent challenge for both Linkian and disjointness-based approaches.)

³²Landman’s formalism is rather more complex, treating noun denotations as pairs of sets with potentially distinct disjointness properties. Here, we will follow the simpler version from Khrizman et al. (2015)

4.2.1 Non-intersective portioning-out

We believe, however, that there are serious conceptual and empirical problems with the treatment of portioning-out as intersective. Such a treatment relies on the notion of a contextually definable set of sums x for which it holds that x is a portion in that context. But what does that mean? It seems impossible to decide whether or not a certain sum is ‘a portion’ without knowing what is supposed to be a portion *of*; in other words, the meaning of *portion* is not just determined by the context, but depends on the extension of its complement too. In this sense *portion* is like *part*, or like a subsecutive adjective (*skilful*, *former*): it can be defined as a function on some other set, but it does not itself characterise a set (see also Chierchia, 1998b, for a very similar argument). This is reflected in its linguistic behaviour, too: words like *portion* are marginal at best in constructions that make the intersection explicit, such as (90).

- (90) a. a silver ring / a ring that is silver
 b. delicious wine / wine that is delicious
 c. a portion of soup / ??a portion that is soup
 d. a quantity of cheese / ??cheese that is a quantity

Moreover, Khrizman et al.’s account crucially relies on the set **portion** being disjoint. However, if we look more closely at the meaning of the word *portion*, it does not seem that it should denote a disjoint set at all. Consider a single context in which we have three bowls of soup, three pieces of buttered bread, and three single-portion tubs of ice cream. How many portions are there in the context? We might say that there are nine portions; but it is equally valid to say that there are three (three portions of a two-course meal) or perhaps six (three portions of the main course, three of the pudding). This is exactly the kind of argument that Landman (2011) uses to explain why nouns like *furniture* are mass. In short, *portion* as a noun does not seem to have a stable cardinality; instead it is characterised by (vertical) overlap, which should make it mass.

Taken together, these two observations suggest that the analysis of portioning-out should not rely on intersectivity. We propose instead that portion expressions - including covert **PORTION** and portion-shifted measures - denote *subsecutive* functions from sets of sums to a disjoint subset of those sums. Semi-formally:

- (91) A portioning-out operator \mathcal{P}^C is a function of type $\langle et, et \rangle$ such that:
 $\mathcal{P}^C(X) := \{y \in X \mid y \text{ meets an individuation criterion } C\}$

As we have mentioned, the individuation criterion C can be anything from shape, to size, to spatial separation from other sums, or a combination of these factors.³³ We assume that

³³As we have mentioned informally in the introduction, we see the individuation criterion C as a kind of placeholder for one’s favourite formal model of individuation. For the purposes of this paper, we will not delve into the formalities of C any further, but just assume it does what it is supposed to do - that is, build a disjoint set of sums in a way that takes into account both general cognitive notions of individuation and lexically provided information such as shape or size. For a concrete (atomicity-based) application of mereotopology to portioning-out that could pretty straightforwardly be adapted to suit to our present family

the individuation criterion C contributes disjointness, and - relatedly - that C is defined in such a way that there is only one way to portion out a mass predicate according to C . (These choices make intuitive sense to us but nothing much hinges on them: one might also choose to build in a separate disjointness criterion, or define portioning operators in terms of choice functions over the set of possible portionings according to C . The result is much the same: a set of disjoint sums that is a subset of the original mass predicate.)

The very general definition we provided in (91) can be adjusted in various ways to accommodate the specific properties of different portioning-out expressions. There is one distinction we want to briefly highlight here: while some portioning-out expressions cover the entire domain of the mass noun, others only apply to a subset. So, with c a variable over contexts:

- (92) a. $\forall c$: all the water in $c \equiv$ all the quantities/bits/portions/... of water in c
 b. $\neg\forall c$: all the cheese in $c \equiv$ all the cubes/slices/crumbs/flakes/... of cheese in c

In other words, all water is necessarily part of a quantity of water, but not all cheese is necessarily part of a slice of cheese. We will refer to the first (92-a) category as *total* portioning-out, and to the second one (92-b) as *partial* portioning-out.³⁴

- (93) A portioning-out operator \mathcal{P}^C is *total* iff (for any context) $\sqcup(\mathcal{P}^C(X)) = \sqcup X$ and *partial* otherwise.

(This means that total portioning-out involves a *partition* of the set X ; see e.g. B. Gillon 1992). We will assume that covert PORTION is total and equip it with the following semi-formalised denotation:

- (94) $\text{PORTION}(X) :=$ the disjoint set of sums Y such that
 $\sqcup(Y) = \sqcup(X)$
 $\wedge \forall y \in Y[y \text{ is a contextually individuated quantity of } X]$

For instance, $\text{PORTION}(\mathbf{water})$ corresponds to the set of all individuated bodies of water in the context, which may include the Atlantic Ocean, the rain puddles on Main Street, and the handful of water I just scooped up to wash my face with. These portions do not overlap and together cover the entire domain of water.

4.2.2 Mass and count portioning-out

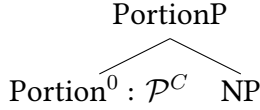
We are now in a position to put the semantics together with the syntactic structures we independently arrived at in section 3. Count portioning-out can be dealt with pretty straight-

of portion operators, see Lima (2014a).

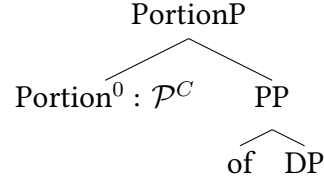
³⁴We hypothesise that only total portioning-out may be covertly expressed, while partial portioning-out requires overt expression of the individuation criterion, but we cannot verify this intuition without further research.

forwardly. As we have seen, the relevant structure is a PortionP headed by the portioning-out operator, with either an NP or a PP complement.

(95) NP complement:



PP complement:



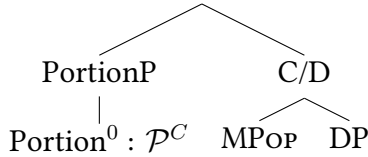
Since we have defined portioning-out operators as functions on sets of sums, we can derive the desired semantics for the first structure by simply applying \mathcal{P}^C to $\llbracket NP \rrbracket$. The second structure is somewhat more complex, as in order for the semantic computation to go through, the PP must denote a set of sums too. We propose that this set is made available by the application of $\llbracket of \rrbracket$ to the sum entity expressed by the embedded DP; the function of $\llbracket of \rrbracket$ in this position, then, is to access the *Boolean part set* of that sum (cf. Barker, 1998).

$$(96) \quad \llbracket of \rrbracket(x) = \{y : y \sqsubseteq x\}$$

If we assume that the DP denotation of a mass nominal like *water* is the maximal sum of water, this effectively means that D^0 and *of* cancel each other out, providing a semantic motivation for the pattern in (67).

In the case of mass portioning-out, the PortionP is in the specifier position of a phrase we have labelled C/D, the head of which may or may not be spelled out depending on the language and/or the construction. We have also proposed that C/D⁰ hosts an operator we have called MPOP (for ‘mass portion operator’). In (98), we provide our semantics for MPOP.

(97) Mass portioning-out:



$$(98) \quad \text{MPOP}(P)(Q) := \{x | x \in P \wedge \exists y[y \in Q(P) \wedge x \sqsubseteq y]\}$$

where P is a set of sums and Q a function from sets of sums to sets of sums. (final version in (122))

In words, the result of applying MPOP to a predicate P and a portioning-out operation Q is the set of all sums that are both P and a Boolean part of some member of the portioned-out predicate $Q(P)$.³⁵

³⁵The specification that these sums be P seems redundant given our present purposes, but is necessary to derive the appropriate results in cases where the embedded noun denotation is not closed under Boolean parthood. For example, consider an NP like *lots of boys*, which we want to analyse as a predicate over boys and not as a predicate over all possible bits of boy-stuff. In other words, we do not want all possible Boolean parts of our boy-lots to end up in the denotation of *lots of boys*, only the parts that correspond to individual

The function of MPOP is to mediate between a mass predicate and the portioning-out operator, and ensure that the denotation of the phrase as a whole inherits the overlap properties of the embedded NP.

For example, suppose that **water** = $\{a \oplus b \oplus c, a \oplus b, a \oplus c, b \oplus c, a, b, c, \dots\}$ and **PORTION(water)** = $\{a \oplus b, c\}$. Then, the denotation of **MPOP(water)(PORTION)** is the set $\{a \oplus b, a, b, c, \dots\}$. In this set, the portioned-out structure is preserved in the form of partial disjointness: the set does not contain any sums $x \oplus y$ such that x is part of one portion, and y part of another. However, the set as a whole overlaps and is mass; its meaning can be paraphrased as ‘water that is part of a contextually individuated quantity’.³⁶

In languages such as Dutch, the MPOP operator is covert, but nothing prevents it from being overtly realised in other languages (or in certain constructions within languages). This fits with our findings in section 2.3 and 3.2. In German (see data in section 2.3), mass (but not count) portioning-out constructions require an intervening element *von* ‘of’ between the portion word and the mass predicate. That *of* can be used to spell out MPOP is intuitively reasonable since, at its denotational core, MPOP is a function that accesses some predicate’s Boolean part set just like ‘ordinary’ *of* (as we have defined it in (96)).

An important property of mass portioned-out predicates is that they overlap, but are not closed under sum. As we have discussed before, this means that they can be non-vacuously pluralised with Link’s star operator $*$. If the portioning-out is total, it follows that the result of pluralising a mass portioned-out noun is equivalent to the original mass noun denotation (since mass portioned-out predicates are divisive, i.e. closed under parthood). For example, closing the above predicate $[[\text{MPOP}(\text{PORTION})(\text{water})]]$ under sum gives us again our original predicate **water**. This formal fact sets the stage for the next part of our paper: an analysis of the ‘high quantity’ inference of mass portioning-out in terms of implicated rather than asserted meaning.

For the sake of formal explicitness, we end this part of the paper with a full derivation of the sentence *Mary spilled lots of water*.

- (99) a. $[[\text{lot of water}]] = \text{MPOP}(\text{water})(\text{LOT}) =$
 $\{x | x \in \text{water} \wedge \exists y[y \in \text{LOT}(\text{water}) \wedge x \sqsubseteq y]\}$
 (the set of all water-sums that are part of a lot-portion of water)

boys.

³⁶It is reasonable to ask whether it would not be equally possible to implement this approach in a more traditional atomicity-based framework, with the portioning-out operator incorporating a domain shift from non-atomic (or vague-atomic) mass stuff to an atomic domain of portions, and the MPOP operator optionally shifting these portions back into their material parts. For a philosophical reason not to take this route, see footnote 14. For an empirical reason, consider again NPs like *lots of boys*, whose non-countability (**three lots of boys*) would not follow under such an implementation; implementing mass portioning-out in the way described above entails that such constructions always end up referring in the domain of the embedded noun, and if this is atomic (e.g. *boys*), the result is predicted to be countable. To account for the non-countability of *lots of boys*, then, we need a way to refer to boys in a non-countable way, such as (only) provided by a disjointness-based implementation of mass portioning-out.

- b. $\llbracket \text{lots of water} \rrbracket = * \llbracket \text{lot of water} \rrbracket =$
 $\{\bigoplus(x_1 \dots x_n) \mid \forall x \in \{x_1 \dots x_n\} [x \in \mathbf{water} \wedge \exists y [y \in \text{LOT}(\mathbf{water}) \wedge x \sqsubseteq y]]\}$
 (the set of all water-sums that are a sum of parts of a lot-portion of water)
- c. $\llbracket \text{spilled lots of water} \rrbracket = \lambda z \exists w [w \in \llbracket \text{lots of water} \rrbracket \wedge \mathbf{spill}(w)(z)]$
 $= \lambda z \exists w [w \in \{\bigoplus(x_1 \dots x_n) \mid \forall x \in \{x_1 \dots x_n\} [x \in \mathbf{water} \wedge \exists y [y \in \text{LOT}(\mathbf{water}) \wedge x \sqsubseteq y]]\} \wedge \mathbf{spill}(w)(z)]$
 (existential closure of the set $\llbracket \text{lots of water} \rrbracket$ at VP level, following e.g. Diesing 1992)
- d. $\llbracket \text{Mary spilled lots of water} \rrbracket = \lambda z \exists w [w \in \{\bigoplus(x_1 \dots x_n) \mid \forall x \in \{x_1 \dots x_n\} [x \in \mathbf{water} \wedge \exists y [y \in \text{LOT}(\mathbf{water}) \wedge x \sqsubseteq y]]\} \wedge \mathbf{spill}(w)(z)](\mathbf{m})$
 $= \exists w [w \in \{\bigoplus(x_1 \dots x_n) \mid \forall x \in \{x_1 \dots x_n\} [x \in \mathbf{water} \wedge \exists y [y \in \text{LOT}(\mathbf{water}) \wedge x \sqsubseteq y]]\} \wedge \mathbf{spill}(w)(\mathbf{m})]$
 ‘There exists a water-sum that is a sum of parts of a lot-portion of water, and was spilled by Mary.’

Note that the set defined in (99-b) is equivalent to the set $\{x \mid x \in \mathbf{water} \wedge \exists y [y \in *(\text{LOT}(\mathbf{water})) \wedge x \sqsubseteq y]\}$ - the set of all water-sums that are part of a sum of lot-portions of water. Since this is slightly less cumbersome to write and read we will use this formula in the next section of the paper.

5 Abundance as a degree-based inference

As we have seen, all the phenomena for which an analysis in terms of mass portions seems appropriate share an inference of abundance or high quantity. In this section we will examine the abundance inference more closely. Section 5.1 focuses on the properties of the abundance inference. We will follow Tsoulas (2009); Kane et al. (2015); Renans et al. (2018) in assuming that it is an implicature, but also point out some data that appear to go against the latter two’s analysis of abundance as a scalar implicature on a par with multiplicity in count nouns. In section 5.2 we will instead propose an alternative analysis inspired by the approach to quality nouns (e.g. *courage*, *wisdom*) in Francez & Koontz-Garboden (2017) (who build on work by Tovenia 2001), combined with Rett’s (2015) implicature-based analysis of the ‘positive form’ of gradable adjectives (e.g. *Mary is tall*). By assuming that mass portioning-out introduces a size ordering on portions, our analysis ties the abundance inference to the semantics of portioning-out.

5.1 A closer look at the abundance inference

Considering that, under our proposal, portioned-out mass predicates contain more semantic ingredients than ordinary mass predicates - there’s the portion operator and, usually, a plural - a natural way of accounting for the abundance inference is to build it into the semantics of either of these elements. Such approaches have been pursued by Alexiadou (2011b) for mass plurals and Klockmann (2017) for Q-nouns. In the following two sections, we will examine each proposal in turn.

5.1.1 Abundance cannot be reduced to the semantics of the plural

Alexiadou (2011b) locates the abundance inference in the semantics of the plural morpheme itself. She proposes that the Greek plural is ambiguous between a compositional version and a more idiosyncratic lexical one (cf. Acquaviva, 2008); the abundance inference is part of the semantics of the latter type of plural. In principle, it seems that such an account could be extended more or less straightforwardly to our other cases of mass portioning-out, as these either obligatorily (bare measures) or tendentially (Q-nouns) involve pluralisation as well. However, there are both syntactic and semantic reasons not to adopt such a view. As for the first, a property of lexical plurals is that they occupy a very low syntactic position, close to the root. This ‘lexical’ position allows them to express a more idiosyncratic operation on their complement. But both Q-nouns and bare measures involve intervening material between the mass noun and the plural, suggesting the plural expresses its ‘ordinary’ compositional meaning here. In addition, Kane et al. (2015) provide several semantic/pragmatic arguments against Alexiadou’s lexical plural approach by showing that the abundance inference only arises in certain contexts. For example, in downward entailing and nonveridical environments, the meaning of a plural mass noun is identical to its singular equivalent.

- (100) O Yanis den ehise nera.
 the John not spill waters
 ‘John didn’t spill any water.’

This is unexpected if ‘much X’ were the literal meaning of a plural mass noun, as in that case, (100) would be true if John spilled a little water. In addition, the abundance inference from plural mass nouns can be explicitly contradicted (‘...but not much’) with a perfectly felicitous result.

Such data lead Kane et al. to conclude that the abundance inference cannot be part of the literal meaning of the plural. Instead, they argue that the patterns exemplified here are characteristic of scalar implicature. Since scalar implicature is also argued to be involved in deriving the more-than-one interpretation of plurality in count nouns (e.g. Sauerland et al., 2005; Spector, 2007), it makes sense to derive abundance on mass nouns in a parallel way. Following Spector’s (2007) analysis of multiplicity in count nouns, Kane et al. assume that in Greek, singular *water* is enriched with the implicated meaning ‘not much water’ through pragmatic competition with the alternative *much water*; subsequently, the plural *waters* gains the meaning ‘much water’ through competition with the enriched singular. In an experimental study of Greek-speaking children and adults, Renans et al. (2018) confirm that Greek children generally fail to derive the abundance inference, which conforms to the general acquisition pattern of scalar implicatures.

At first glance, the analysis of portioning-out as proposed in this paper seems to confirm and even strengthen Kane et al.’s intuition on the parallel between abundance and multiplicity, as under our analysis, the contribution of the plural in *cats* and *waters* is fully identical (closure under sum) and the interpretation can be stated in terms of multiplicity in both cases. Thus, the enriched meaning of *waters* may be paraphrased as ‘water in two

or more contextually individuated portions’. Presumably, this enriched meaning can be satisfied in a context in which the water is scattered (Alexiadou, 2011b), but also if there is so much of it that we would hesitate to describe it as a single portion. While this analysis is tempting in its simplicity, we will argue that it is not accurate, and that the abundance inference arises independently from multiplicity. But before we move on to that argument, we will briefly evaluate a different type of semantic approach to abundance, one that locates it in the literal meaning of the portioning-out operator.

5.1.2 Abundance cannot be reduced to the meaning of the portion word

In the case of bare measures, Q-nouns like *lot* and perhaps shape-based portion classifiers such as *blob*, *chunk*, and *slab*³⁷, an intuitive approach - which may be found on many an online English usage forum - is to assume that the ‘large quantity’ interpretation simply involves a more ‘figurative’ use of the portion word. We have already considered this option in section 2.1 and objected that this does not account for the co-occurrence of abundance with non-countability (and, conversely, the lack of an abundance inference in countable NPs). More importantly for our present argument, it can be shown that the abundance inference also surfaces in contexts where the portion word does not express a high quantity. Consider for example the contrast in (101):

- (101) a. I have budgeted thousands of euros for healthcare this year. (A private citizen commenting on their family finances.)
 b. #I have budgeted thousands of euros for healthcare this year. (The minister of finance introducing the national budget.)

Note that both sentences are technically true if the budgeted amount exceeds a few thousand euros, regardless of whether that is a lot of money in the context. However, while (101-a) is both true and felicitous in the context (since *thousands of euros* is a lot of money

³⁷Unlike most of the portion classifiers we have discussed so far, these last three classifiers do not occur with plurals but only with mass nouns. At least some of them display the familiar alternating pattern:

- (iii) a. If you came for **slabs and slabs of meat**, you came to the right place.
 (Source: <https://www.skyscanner.net/trip/irvine-ca/restaurants/1-1-hawaiian-barbecue>, accessed February 2018.)
 b. Nobody likes reading **chunks and chunks of text** – not even me and I love reading. We like it broken up with photos, infographics, things that make us laugh out loud.
 (Source: <https://www.childcareexpo.co.uk/4393-2/>, accessed February 2018.)

Here, (iii-b) shows particularly clearly that *chunks and chunks of text* is mass despite the appearance of individuation: the author’s continuation makes it clear that, to her, *chunks and chunks of text* refers to a large quantity of text that is *not* broken up into distinct chunks. A general observation about shape-based classifiers seems to be that the more specific and well-defined the expressed shape is, the less compatible it is with mass portioning-out. Thus, #*I ate cubes and cubes of cheese* is distinctly odd. So, even though we argue that the lexical meaning of the portion expression is not the source of the abundance inference, it definitely plays a role in the acceptability of the expression within a mass portioning-out construction. We will leave issues like this for further research.

for a single European family to spend on medical care in a year), the same sentence is inappropriate in the context of (101-b), in which a couple of thousands of euros is in fact an insignificant sum of money. In short, the reason (101-b) is bad is not because it is false; it is because it wrongly implies that thousands of euros is a lot of money for a country to spend on its health budget. In sum, abundance arises because a portion word is used in a mass portioning-out construction, not because the portion word lexically expresses a large quantity.

5.1.3 Abundance cannot be reduced to multiplicity

Back to our earlier hypothesis that abundance is a type of multiplicity inference paraphrasable as (for instance) ‘water that’s part of a sum of multiple portions’. The data in the previous subsection support the observation that plural mass portioned-out predicates carry a multiplicity inference: even though predicates like *loads of laundry* or Greek *nera* ‘waters’ are mass, they are only appropriate in a context in which multiple quantities of laundry or water can be distinguished. However, it can be shown that abundance arises independently of this multiplicity inference. If multiplicity is made explicit, as in (102), the abundance inference disappears. For instance, (102-a) can be felicitously uttered by a very fiscally conservative minister of finance; (102-b) does not imply that the quantity of laundry is unusually large; (102-c) (unlike its bare measure counterpart) is fine in combination with the minimiser *just*, and so on.

- (102) a. I have budgeted several thousands of euros for healthcare this year.
 b. I need to do multiple loads of laundry today; all in a normal Saturday’s work.
 c. John spilled just a couple of litres of water today.

A second argument against unifying multiplicity and abundance may be derived from the observation that abundance does not always need to be interpreted as ‘a high quantity’ - in the right context, it may contribute ‘a (surprisingly) small quantity’, too. For example, in sentence (103) (from an article on the handling of sexual harassment complaints in academia), the bare measure *feet away* clearly implies multiplicity (i.e. a distance of more than 1 foot); in addition, it carries an inference of excessiveness or extremity but, in the particular context, it is the *shortness* of the distance that is excessive.

- (103) One stepped down, but the other, despite having been found to have violated the code, remained employed and in an office **feet away** for six months from one of the women who filed the complaint.³⁸

Similarly:

³⁸Source: http://www.slate.com/articles/health_and_science/science/2016/07/sexual_harassment_has_devastating_consequences_on_victims_ability_to_perform.html, accessed September 2017

- (104) Yet if polls are right [the Labour party] is days away from utter collapse north of Hadrian's Wall.³⁹

The same effect arises with some shape classifiers that inherently express a small quantity, such as *drop*:

- (105) Although it may take two or three weeks to get even drops of milk, the fact that the adopting mother starts to get even drops can be very reassuring.⁴⁰

The co-occurrence of these two inferences - multiple feet, days, or drops, but at the same time a particularly *small* distance, quantity or amount of time - is hard to account for if we collapse abundance and multiplicity into a single quantity-related implicature, as under Kane et al.'s approach. Of course, the sentences in (104) and (105) have more pragmatic ingredients than the Greek mass plurals Kane et al. are interested in. *Foot* and *day* compete with larger alternative units of measure like *yard*, *miles*, *week* or *month*, such that upon hearing that an event is *days away* we will probably infer that it is less than a week away. But while such a scalar implicature might well play a role in the 'reversal' of the abundance inference⁴¹, the abundance inference itself cannot be reduced to it. Note that these scalar implicatures are not limited to bare measures: they also arise with the full measure phrases in (106-a-c), but the abundance inference does not.

- (106) a. The harasser remained in an office several feet away from one of the women who filed the complaint.
b. The Labour party is a couple of days away from utter collapse north of Hadrian's Wall.
c. It may take two or three weeks for the adopting mother to get (??even) multiple drops of milk.

So, for instance, while (106-b) still supports the inference that the collapse of the Labour party is less than a week away, unlike (104) it does not imply that this is a shockingly short amount of time. This means that, just as abundance cannot be reduced to multiplicity, it cannot be reduced to a scalar implicature about the size of the measure unit either.

Let's take stock. We have examined a couple of possible origins for the abundance inference (a lexical plural, the lexical contribution of the portion word, a multiplicity implicature, and a scalar implicature based on competition with alternative portion words) and argued in each case that abundance arises independently. One of the weaknesses of the approaches examined above is that most of them fail to account for the fact that abundance only arises with mass portioning-out, not with their countable equivalents. In the next section, we will

³⁹Source: <https://www.economist.com/news/britain/21650147-why-labour-party-campaign-has-gone-surprisingly-well-meaning-mr-miliband>, accessed February 2018

⁴⁰Source: <https://www.facebook.com/DrJackNewman/posts/315997418551311>, accessed February 2018

⁴¹We will briefly return to this suggestion in section 6.2.

provide an account of abundance that ties it to mass portioning-out.

5.2 Abundance as a tautology-based Quantity implicature

5.2.1 Mass portioned-out predicates are size ordered

Tovena (2001) observes that certain abstract mass nouns in Italian and French are acceptable in contexts that are normally restricted to singular count nouns. For example:

- (107) a. Il n'a pris aucun livre.
 he not-has taken any book
 'He did not take any book.' (French; Tovena 2001)
- b. Il n'a montré aucune pitié.
 he not-has shown any mercy
 'He didn't show any mercy.'
- c. *Il n'a vu aucun étudiants.
 he not-has seen any students
 'He didn't see any students.'
- d. *Il n'utilise aucun sable.
 he not-uses any sand
 'He uses no sand.'

Following van de Velde (1996), she identifies the relevant class of nouns as nouns denoting 'intensive quantities' - nouns that are measured by intensity, not by extension (i.e. the amount of space they take up). She proposes to associate these nouns with a degree scale that provides a weak form of individuation by partitioning the domain on the basis of intensity. As weakly individuated nouns, intensive quantity nouns are compatible with certain 'count' determiners like *aucun* and *every* ('I have every confidence in his ability'); at the same time, they are mass since their structure does not distinguish any individual entities (only degrees).

Francez & Koontz-Garboden (2017) take a similar approach to what they call 'property concept nouns', but in a way that does not rely on the rather fuzzy distinction between 'intensive' and 'extensive' measurement. They propose that nouns like *courage* and *mercy* are mereologically ordered in terms of (abstract) quantities, like concrete mass nouns, but in addition involve a size ordering \leq that groups portions of the relevant quality in size-based equivalence classes. Drawing on Tovena (2001) as well as Morzycki's (2009; 2012) work on nominal gradability, Francez & Koontz-Garboden (2017) list several tests to detect the presence of such a size ordering, which we reproduce here as given:

- (108) Exclamatives
- a. What water she drank!
 cannot mean How much water she drank!
- b. What courage she has!
 does mean How much courage she has / how courageous she is!

The exclamative in (108-a) indicates that there is something noteworthy about the water; this noteworthiness may pertain to various aspects of the water (taste, appearance, rarity...), but crucially not its quantity. In contrast, the ‘noteworthy quantity’ interpretation is the only available interpretation for exclamatives that involve a size-ordered mass noun, such as (108-b).

Secondly, unlike ordinary mass nouns, size-ordered mass nouns tend to be compatible with various classes of degree-modifying adjectives:

(109) Size modification (cf. Morzycki, 2009)

- a. *She drank major/enormous water.
- b. She is a major/enormous idiot.
- c. She has major/enormous courage.

(110) Intensifiers (cf. Morzycki, 2012)

- a. *She drank utter/total/absolute water.
- b. She is an utter/total/absolute nerd.
- c. She has absolute conviction.
- d. She is a person of utter beauty.

The same (although this is not mentioned by Francez & Koontz-Garboden) holds for evaluative (speaker attitude) modification with adjectives like *incredible*, *astounding*, or *terrible*, which allow a ‘high degree’ interpretation in (111-b-c) but not in (111-a):

(111) Evaluative modification (cf. de Vries, 2010)

- a. I’ve seen incredible/astounding water.
- b. He is an incredible/astounding idiot.
- c. He has incredible/astounding wisdom.

Thirdly, predicates that are size-ordered enable targeting of a particular quantity with *such*, while in ordinary mass nouns *such* only triggers a subkind reading:

(112) *Such*

- a. Drinking such water is bad for your health.
- b. *cannot mean* Drinking so much water is bad for your health.
- c. Such wisdom is rarely seen in someone so young.
- d. *can mean* So much wisdom is rarely seen in someone so young.

Thus, we see that quality-denoting mass nouns like *courage* and *wisdom* involve a quantity-based ordering relation that may be targeted by expressions or constructions that normally operate on degrees.

We observe that our cases of mass portioning-out pattern with quality nouns in the tests listed above, indicating that they too involve a size ordering. (Note that the point is not that such sentences are always grammatical - for instance, the English equivalent of (114) sounds decidedly odd - but that, in contrast to the ‘plain’ mass nouns in (63)-(67), these

mass portioned-out NPs *may* receive a ‘high degree’ interpretation in these contexts.)

(113) English

- a. And, **what heaps of gear** you can pack in this roof top carrier!⁴²
- b. O **what floods of turtle-soup; what tons of turbot and lobster-sauce** must have been sacrificed to make those sinners properly miserable.⁴³
- c. If only more states (...) had realized in 1915 the truth that lay in those words, what vandalism of irreplaceable assets, what obnoxious inholdings, **what miles of tawdry summer shacks** along a precious seashore would have been avoided!⁴⁴

(114) Dutch

- a. **Wat een liters water** verdwijnen er in een lijf, en komen er
What a litres water disappear there into a body, and come there
nooit meer uit terug, per dag, met deze temperatuur.
never again from back, per day, with this temperature.
‘What litres of water disappear into a body, never to return, every day, with
this temperature.’⁴⁵

(115) Greek

- a. **Poses skones, posa nera** dhen ehun bi mesa dhen
how-much dusts how-much waters not have entered inside not
katalaveni tipota
understand anything
‘So much dust and water have gone into it and it does not break. (The speaker
here is referring to a power tool)’

The exclamatives in (113) - (115) do not serve to draw our attention to, say, some particularly high-quality gear or strikingly delicious lobster sauce; rather, in all examples, the exclamative expresses a high quantity of something.⁴⁶

Similarly, we find examples of modifiers like *major*, *utter* and *incredible* and the relevant counterparts in the other languages targeting the quantity of their mass portioned-out complements

(116) English

- a. I’ve also talked to my [hybrid striped bass] supplier who goes through **major tons of [AquaMax fish feed]** and he said there is a noticeable difference in

⁴²Source: <http://www.autoanything.com/roof-racks/77A1400A6489405.aspx>

⁴³Source: William Makepeace Thackeray (1840): *An Essay on the Genius of George Cruikshank*.

⁴⁴Source: Freeman Tilden (1962): *The State Parks: their meaning in American life*.

⁴⁵Source: <http://bosch.reislogger.nl/27-juni-zion.200517>, accessed December 2017

⁴⁶Bolinger (1972, p82) and Rett (2015) notice this fact for *What a lot!*; in her discussion of Bolinger’s data, Rett (2015, pp 167-168) speculates that *lot* involves a lexicalised Quantity implicature. As we hope to have shown (and show again in this section), the behaviour of *lot* is part of a general pattern that cannot satisfactorily be explained in terms of lexical properties of certain individual words.

the new feed.⁴⁷

- b. Stay away from **massive heaps of sugar and alcohol**.⁴⁸
- c. Dogs can consume **a massive lot of chocolate** before their system starts to respond to that.⁴⁹
- d. Damnation upon both of you and all your offspring into eternity for making me remember that **utter pile of bovine excrement**.⁵⁰
- e. **Absolute tons of soft drinks, wines, beers and food** included.⁵¹
- f. I've seen these rules do more to affect change, maximize progress and boost confidence than any other attribute, including **outright years of experience**.⁵²
- g. Australia is a huge country – after all, it's also its very own continent – with cities dotted along **its incredible miles** of coastline. But it's not just big in terms of square miles.⁵³

(117) Dutch

- a. Kies voor Alpe d'Huez en Les Deux Alpes en combineer de **enorme** choose for Alpe d'Huez and Les Deux Alpes and combine the enormous **kilometers aan pistes** met een combi skipas. kilometers of slopes with a combo ski-pass 'Choose Alpe d'Huez and Les Deux Alpes and combine the enormous kilometers of slope with a combo ski pass.'⁵⁴
- b. Ook Romar speelde erg sterk en was vaak aanspeelbaar en heeft Also Romar played very strong and was often towardsplayable and has **ongelofelijke meters** afgelegd. unbelievable meters covered. 'Romar, too, played a strong match and was often free and has covered an unbelievable distance.'⁵⁵

⁴⁷Source: <http://forums.pondboss.com/ubbthreads.php?ubb=showflat\&Number=304332>.

⁴⁸Source: <http://www.sosuave.net/forum/threads/just-about-to-start-gym-need-different-ideas-training-plans-for-3-days-a-week.240087/>

⁴⁹Source: <https://answers.yahoo.com/question/index?qid=20120127185601AAua1fR>

⁵⁰Source: <http://forum.nasaspaceflight.com/index.php?topic=43620.35;wap2>, accessed February 2018

⁵¹Source: https://www.tripadvisor.co.uk/ShowUserReviews-g1955842-d300038-r555644412-Center_Parcs_Sherwood_Forest-Rufford_Nottinghamshire_England.html, accessed February 2018

⁵²Source: <https://www.pilates.com/BBAPP/V/pilates/library/COREterly/2015/fall-winter/teaching-and-learning.html>, accessed December 2018.

⁵³Source: <https://www.oyster.com/articles/61477-the-best-time-to-visit-australia/>

⁵⁴Source: <https://www.travelaroundwithme.com/wintersport-in-frankrijk-3-skigebieden-vergeleken>, accessed February 2018

⁵⁵Source: <https://www.jongekracht.nl/113/4968/uitslagen/wedstrijd-details/?tab=3>

- c. [D]at de prijzen zo konden ontploffen had ook te maken met het steeds
 That the prices so could explode had also to make with the still
 grotere gemak waarmee mensen **ontzettende hopen geld** konden
 bigger ease where-with people shocking heaps money could
 lenen.
 borrow
 ‘That the prices could explode in this way also had to do with the increasing
 ease with which people were able to borrow shocking heaps of money.’⁵⁶
- (118) Greek
- a. To karavi evaze **hodra nera**.
 The ship was-taking fat waters
 ‘The ship was taking huge amounts of water.’
- b. #To karavi evaze **hodro nero**.
 The ship was-taking fat water
 (Intended but unavailable) ‘The ship was taking huge amounts of water.’

And finally, mass portioned-out predicates pattern with quality nouns in allowing *such* to target quantities rather than subkinds.

- (119) English
- a. M. Zola went on to say that he was astonished at the extent of the outlying districts of London. He had never seen **such miles of monotonous brick and mortar**.⁵⁷
- b. Really? You wanted to post **such tons of text** because you don’t like this game?⁵⁸
- c. why have the artistic gymnasts put on **such oodles of makeup**?⁵⁹
- d. Added to soot, **such heaps of dust, mud, ash, horse-dung and other detritus** littered the city’s thoroughfares that the rich were also sullied.⁶⁰

We conclude that mass portioning-out results in a predicate that is size-ordered, just like quality nouns. Note that the same does not hold for count portioning-out: insofar the sentences in (120) are grammatical, they lack the quantity-oriented interpretation of their mass portioned-out counterparts.

⁵⁶Source: <http://forum.fok.nl/topic/1822710/2/151#p115590836>, accessed February 2018

⁵⁷Source: <https://www.theguardian.com/theguardian/2012/oct/03/london-emile-zola-archive-1893>

⁵⁸Source: <https://forum.worldofwarships.eu/topic/75312-only-witless-fools-allowed/>

⁵⁹Source: <https://in.news.yahoo.com/dipa-karmakar-explains-why-artistic-122051924.html>, accessed December 2017

⁶⁰Source: <http://www.independent.co.uk/arts-entertainment/books/reviews/dirty-old-london-the-victorian-fight-against-filth-by-lee-jackson-book-review-9826858.html>

- (120) a. *What several miles of depressing apartment blocks!
 b. *I have to do such multiple loads of laundry that I expect to be at it all day.
 c. *Nothing made a difference, including outright 5 years of experience.

In the next section, we will use this observation to provide an account of the abundance inference.

5.2.2 Abundance as a ‘positive form’ inference

We have seen that ordering a mass noun denotation by portion size leads it to display behaviour similar to gradable predicates like *tall* and *idiot*. It is well-known that, in the absence of degree morphology, such gradable predicates are interpreted as ‘X to an above-average degree’ - the so-called *positive form* (121-a).

- (121) a. John is tall.
 b. John is 5 feet tall.

Since gradable predicates do not always support this inference (for example, it does not follow from (121-b) that John is taller than average), it is generally assumed that it is not part of the lexical meaning of the adjective. While most of the literature follows Cresswell (1976) in assuming that the positive inference is contributed by a covert morpheme (generally called *pos*), Jessica Rett argues in recent work (2011, 2015) that it could be derived through a pragmatic process.

There is a clear parallel between the positive inference triggered by gradable predicates and the abundance inference supported by our cases of mass portioning-out. Mass portioned-out predicates involve a size ordering that can be targeted by degree modifiers and similar environments; in the absence of any such material, they support the inference that the expressed quantity exceeds some contextual standard. We therefore propose that the abundance inference triggered by mass portioning-out should be analysed in parallel to the positive form of a gradable predicate. Since we have already seen that the abundance inference shows properties characteristic of implicature, we will base our analysis directly on Rett’s (2015) pragmatic account of positive inferences.⁶¹

Rett proposes that both Manner and Quantity implicatures are active in the interpretation of degree constructions. In the case of the positive form, she derives the positive inference through a Quantity implicature triggered by the un informativity of the non-enriched meaning. According to Rett, the semantics of (121-a) is simply ‘John has a height’; but uttering something that is trivially true violates Grice’s maxim of Quantity (according to which our discourse contributions need to be informative to an appropriate degree). Since a cooperative speaker would not violate Quantity, the hearer infers that the intended meaning is stronger than the utterance’s logical meaning. So, rather than the trivial claim

⁶¹Rett (2015) uses the term ‘evaluative’ for such ‘more X than average’ inferences, but we will not use this term here to avoid confusion with the evaluative modification we discussed in section 5.2.1 (*terribly tall*, *an astounding idiot*, *incredible heaps of rubbish*) and use ‘positive inference’ instead since it is most famously attested in the context of the positive form.

that John’s height falls somewhere on the tallness scale, sentence (121-a) is strengthened to the informative claim that John’s height falls on the *higher* end of the tallness scale. (Why not the lower end? A crucial assumption underpinning much work on degree semantics is that gradable predicates are *monotone* in the sense that if you are tall to degree d , you are also tall to all lower degrees $d' < d$ (e.g. Heim, 2000). This means that *everyone* is tall to a degree on the lower end of the tallness scale. Thus, only degrees on the higher end lead to a non-trivial result.)

In order to formalise our parallel between the positive form of gradable adjectives and the abundance inference of mass portioned-out predicates, we enrich our operator MPOP with a degree scale, as follows:

- (122) $\text{MPOP}(P)(Q) := \{x | x \in P \wedge \exists y[y \in Q(P) \wedge x \sqsubseteq y] \wedge \exists d[\mathbf{size}(d)(x)]\}$
 where **size** expresses a relation between individuals and degrees on a size scale (a tuple $\langle \text{size}, D, \leq \rangle$, with **size** a dimension, D a set of degrees and \leq an ordering relation)

The size scale provides a total ordering under \leq of the portions in the predicate’s extension, but it does not affect the predicate’s membership itself, since the condition it imposes (i.e., having a size) is one that members trivially meet.⁶² While the addition of the size ordering has no truth-conditional effect on the denotation of mass portioned-out predicates, it provides the compositional material required for the portioned-out noun to participate in degree modification constructions (see e.g. Morzycki, 2009; de Vries, 2010; Francez & Koontz-Garboden, 2017, for compositional details on the analysis of gradable nouns), as well as the basis for an uninformativity-based Quantity implicature more or less along the lines of Rett⁶³ The reason for the latter is precisely the fact that the addition of the size scale is trivial. If, say, John spilled any quantity of water, then the water-sum he spilled has a certain size. In order to render the addition of the size scale meaningful, then, we infer that the size of the portion of water spilled by John falls on the higher, informative end of the scale. Following standard practice, we formalise this reference to the ‘higher end of the scale’ in terms of a contextually determined ‘standard degree’ s_{size} which the portion in question is inferred to exceed.⁶⁴

⁶²Providing a definition of the measure function **size** itself is not trivial, and we will leave it aside for now, but we assume its effect is fairly intuitive.

⁶³Note that there is not a full parallel between the process proposed by Rett for utterances like *John is tall* and the kind of sentences discussed here: the former are trivially true as a whole (as long as the presuppositions carried by the proper name - that is, John exists and he is a human man - are met or accommodated), while the latter involve a conjunction whose second member is trivially true if the first conjunct is. This is not a problem for our analysis as long as we assume some mechanism through which (some) implicatures can be calculated locally; Rett herself shows at length that local calculation of the positive inference of sentences such as *John is tall* is possible in cases where this sentence is embedded, and accounts for this within the assumptions of her theory. In section 6.1, we discuss some cases of local implicature calculation, and include a further comparison between Rett’s sentences and our various cases of mass portioning-out.

⁶⁴Our present focus is on the common mechanisms underlying different forms of portioning-out; we have deliberately abstracted away from lexical differences between different portion words. However, given

- (123) $\llbracket \text{John spilled waters/John spilled lots of water/John spilled litres of water} \rrbracket =$
- a. $\exists x[\mathbf{spill}(x)(j) \wedge x \in \mathbf{water} \wedge \exists y[y \in *PORTION/LOT/LITRE(\mathbf{water}) \wedge x \sqsubseteq y] \wedge \exists d[\mathbf{size}(d)(x)]]$
 ‘There exists a sum of water that’s part of a sum of portions/lots/litres of water and was spilled by John and has a size.’
 - b. Pragmatically strengthened interpretation:
 $\exists x[\mathbf{spill}(x)(j) \wedge x \in \mathbf{water} \wedge \exists y[y \in *PORTION/LOT/LITRE(\mathbf{water}) \wedge x \sqsubseteq y] \wedge \exists d[\mathbf{size}(d)(x) \wedge d > s_{size}]]$
 ‘There exists a sum of water that’s part of a sum of portions/lots/litres of water and was spilled by John and *has an above-standard size*.’

This gives us our abundance implicature. By introducing the size scale as part of the operator MPop, which is involved in mass portioning-out but not count portioning-out, we account for the observation that abundance only arises in the former case.

6 Remaining issues

In this section, we will briefly address some remaining issues and directions for further research. In subsection 6.1 we will point out some ways in which the different kinds of mass portioning-out do not behave uniformly with respect to inference patterns, and discuss whether or not these observations pose a challenge to a unified analysis of these phenomena. In subsection 6.2 we return to the phenomenon of ‘reverse abundance’ that was briefly discussed in section 5.1.3.

that our semantics for mass portioning-out essentially undoes the contribution of the portion word by re-introducing the portions’ Boolean parts into the resulting predicate, it is reasonable to ask whether we would even be able to account for those lexical differences. Surely, while *John wasted inches of precious fabric* and *John wasted meters of precious fabric* both imply that John wasted more fabric than I believe reasonable, he wasted more fabric in the latter case. However, this does not automatically follow from our present semantics; both sentences correspond to a logical form whose first conjunct can be verified by the existence of a fabric-sum of any size. We believe this property of our semantics is actually not undesirable: clearly we do not want the truth value of *John wasted tons of fabric* to depend on the actual value of the measurement *ton*. What we need, it would seem, is a way to *potentially constrain* the implied portion size via the lexical meaning of the portion word, without hardwiring this into the semantics in a way that is non-defeasible. Here is a sketch of a proposal, that further extends the analogy between our cases of mass portioning-out and the semantics and pragmatics of degree predicates. The usual assumption about the latter is that the standard degree is calculated with respect to a contextually specified comparison class; thus, *John (an adult man) is tall* is evaluated with respect to a different standard than *Mary (a toddler) is tall*. The comparison class can be expressed overtly, extracted from the (extra)linguistic context, or a combination of both. In the case of mass portioning-out, which under our assumptions also involves a favourable comparison to a standard degree, it seems natural to assume that the portion word used is one of the factors influencing the members of the comparison class, and that the standard degree can be affected by the portion word in this way. From this it follows that *John wasted inches of fabric* is evaluated with respect to a different size standard than *John wasted meters of fabric*, and what counts as an ‘above-average’ quantity in the former case is different from the latter. Addressing this hypothesis will require further research into the precise implications of mass portioning-out constructions with different portion words, which we leave for future work.

6.1 Pragmatic differences between different portioning-out phenomena

While we have briefly mentioned negation in section 5.1.1, we have not systematically discussed its effects on different forms of portioning-out. When we do, it turns out that the different forms of mass portioning-out we discussed in this paper do not all behave in the same way; nor do all of them pattern with the behaviour of gradable adjectives under negation, which we might predict on the basis of the analysis in 5.2. First, recall that one of the observations at the core of Kane et al.’s (2015) implicature-based approach to Greek mass plurals is that pluralised mass nouns in downward entailing environments are semantically equivalent to their singular counterparts.

- (124) O Yanis den ehise nera. (repeated from (100))
 the John not spill waters
 ‘John didn’t spill any water.’

In contrast, (125) appears to support the inference that John spilled some water (as shown by the naturalness of the continuation, in which this inference is cancelled).

- (125) John didn’t spill litres/oodles of water. (In fact he didn’t spill any.)

In this respect, the Q-noun and bare measure constructions pattern with the interpretation of adjectives like *tall* under negation:

- (126) John is not tall.
 $\nRightarrow \neg[\text{John has a height}]$.
 $\Rightarrow \neg[\text{John has a height} \wedge \text{it exceeds the standard}]$.

What (125) and (126) have in common is that, under the current assumptions, it seems to be the *implicated* meaning that is targeted by negation. In (126), it is not the asserted meaning (‘John has a height’) that is negated, but the positive implicature that John’s height exceeds the standard. Similarly, in (125), the negation targets the implicated meaning that the quantity of water John spilled is larger than average.

We propose that negation targets the asserted meaning in (124) but the enriched meaning in (125) and (126) because in the case of the latter two, targeting the asserted meaning violates pragmatic principles (cf. Rett, 2015, p.48, p.128). Thus, in (126), computing a positive implicature below negation prevents a Quality violation (i.e., falsely asserting that someone could lack a height). In the case of (125), negating the asserted meaning ($\neg[\text{John spilled water that was part of an oodle-sized quantity of water}]$) results in a meaning that could have been expressed in a much simpler way (*John didn’t spill water*), and hence in a Manner violation. Again, local computation of the abundance inference ($\neg[\text{John spilled water that was part of an oodle-sized quantity of water} \wedge \text{it was a lot of water}]$) turns an utterance that would otherwise be uncooperative into one that complies with pragmatic principles.

On the other hand, pluralisation where it is not strictly necessary does not seem to count as a Manner violation; for example, *I saw no boys* is truth-conditionally equivalent

to the strictly simpler *I saw no boy*, but using it does not seem to result in any pragmatic consequences (for example, it does not trigger a local computation of the multiplicity implicature ‘more than one boy’). It therefore appears that in the case of pluralised mass nouns, there is no reason to force local computation of the abundance inference in order to ‘save’ the utterance from uncooperativity; as a consequence, negation just targets the asserted meaning.⁶⁵

The behaviour under negation is not the only difference between pluralised mass nouns on the one hand and Q-noun/bare measure constructions (and evaluative adjectives) on the other. For example, while the abundance inference of Greek mass plurals can be cancelled (Kane et al., 2015), the same does not appear to hold for other cases of mass portioning-out.

- (127) a. O Yanis ehise nera... ala oxí tipota spoudeo.
 the John spill waters... but no anything important
 ‘John spilled waters.. but nothing important.’
 b. #John spilled litres of water but nothing much.
 c. #I like to put heaps of sugar in my coffee, but I don’t think it’s a lot.

As van Kuppevelt (1996) and Rett (2015) discuss, whether an implicature is cancellable strongly depends on its role in the discourse: if implicated content is at issue, it behaves more like a (non-cancellable) entailment. We speculate that more marked forms are more likely to be perceived as at-issue content, at least in sentences that are uttered out of the blue. If sentences like (127-b) are uttered in answer to an explicit QUD that makes it clear that the quantity of the spill is not at issue, they improve significantly:

- (128) Who of you spilled litres of water on the kitchen floor?
 - I did, but it really wasn’t that much.

Again, we conclude that the attested pragmatic differences between different kinds of mass portioning-out have similarly pragmatic origins, and do not invalidate our unified analysis of these different phenomena.

6.2 ‘Reverse abundance’ and scale reversal

As we have seen in section 5.1.3, the abundance inference may be ‘reversed’ in some contexts, indicating a particularly small quantity of something rather than a particularly large one. This can be modelled fairly easily under our analysis: we simply assume that the ordering relation of the size scale is reversed in these contexts (i.e., \geq instead of \leq). This results in portions being ordered along a ‘smallness scale’ rather than a ‘largeness scale’ (see e.g. Kennedy & McNally, 2005); in all other respects, the derivation of the abundance inference

⁶⁵There is a non-trivial assumption here that is important to spell out, in that we are assuming that covert material is not active in fuelling Manner implicatures; in other words, markedness of form is evaluated purely based on the material that is spelled out overtly. We are not aware of any literature that explicitly addresses this issue but believe it is generally tacitly assumed in (neo-)Gricean accounts of implicature calculation.

proceeds along the lines described in section 5.2, with un informativity-based pragmatic strengthening to the higher end of the scale.

However, this does not explain why and how some contexts trigger such a scale reversal. In section 5.1.3, we considered one potential factor: the choice of a small unit of measure instead of a competing larger one. Thus, in (104) (repeated here), we assume that *day* as a measure of time competes with scalar alternatives like *week* and *month*; from the fact that the speaker does not choose a larger measure, the hearer infers that there is an upper bound to the amount of time that separates the Labour party from utter collapse.

- (129) Yet if polls are right [the Labour party] is days away from utter collapse north of Hadrian's Wall. (repeated from (104))

Perhaps, then, scale reversal is triggered by the incompatibility of this scalar implicature (an upper-bound small quantity) with the non-reversed abundance implicature (a quantity on the higher end of the scale). In cases that do not involve scalar competition between different measures or portioning operators, scale reversal may be aided by the inclusion of focus-sensitive minimisers like *only*, *just* or *even* (as in (105)), which (combined with focus) also function to introduce a set of alternatives and, through their negation, an upper bound to the quantity. In this case, too, scale reversal reconciles the different pragmatic inferences supported by the sentence.

The idea of a reversed size ordering - a 'smallness scale'- might also prove useful to the analysis of the semantics and pragmatics of the diminutive. The diminutive resembles the plural in the sense that diminutive mass nouns are obligatorily interpreted as count in some languages (such as Dutch) but remain mass in others (such as Mexican Spanish) (Wiltschko & Steriopo, 2007). In the former case, it is fairly neutral in terms of portion size (without further specification, (130) refers to a standard unit of beer, not necessarily a small one) while in the latter case it refers to a small quantity of something.

- (130) Een bier.tje alstublieft.
A beer.DIM please
'A (portion of) beer, please.' (Dutch)
- (131) Esta cubeta contiene aguïta.
This bucket contains water-DIM
'This bucket contains a little water.' (Mexican Spanish, Ana Aguilar p.c.)

Further research will have to determine whether an analysis of mass diminutives in terms of portioning-out, along the lines argued for in this paper, fits the crosslinguistic data; in particular, whether the 'small quantity' inference supported by mass diminutives might feasibly be analysed in pragmatic rather than semantic terms.

7 Conclusions

In this paper we have drawn a comparison between various kinds of plural mass nouns and portion constructions in various languages. We have argued that plural mass nouns of abundance, such as attested in Greek, should be analysed on a par with overt portion constructions like English *lots of soup* or *kilos (and kilos) of sugar*. The various constructions share several formal and interpretational similarities; most strikingly, they involve ‘count’ morphology (plurals, classifiers and/or measure words) yet lack countability.

We have proposed that the different interpretations stem from structural ambiguity. While count portioning-out constructions are analysed fairly straightforwardly as classifier constructions headed by the portion expression, mass portioning-out involves an extra operator MPOP, whose presence we have justified syntactically, and whose semantics involves mediating between the embedded NP and the portion word in such a way that the countability properties of the construction as a whole are inherited from the former rather than the latter. Because our analysis involves structural ambiguity, we do not have to resort to systematic lexical ambiguity (cf. Klockmann 2017 on expressions like *lot*, or Alexiadou 2011 on Greek mass plurals) or ‘figurative language’ handwaving (which leaves the countability facts unexplained).

With regard to the abundance inference supported by all our discussed cases of mass portioning-out, we depart from previous accounts in not treating it as a property of the plural. Instead, we have argued that mass portioning-out introduces a size ordering on predicates, which groups them with gradable nouns like *idiot* and quality-denoting abstract mass nouns like *courage*. The abundance inference, then, is treated as a Quantity inference rooted in the avoidance of triviality, along the lines of Rett (2015).

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