Portions and countability: a crosslinguistic investigation

Hanna de Vries
University of York
hanna.devries@york.ac.uk

George Tsoulas
University of York
george.tsoulas@york.ac.uk

2nd revised version, December 2018

Comments Welcome.

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 whether (count) or not (mass) it is the syntactic head of the portion phrase. 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 uninformativity-based Quantity implicature, following the analysis of the positive form (*Mary is tall*) in Rett's (2015) approach to adjectival gradability.

1 Introduction

In recent years, the semantics of portioned-out mass predicates, as exemplified in (1) and (2), has been receiving increased attention in the semantic literature (e.g. Wiese & Maling, 2005; Partee & Borschev, 2012; Deal, 2013; Khrizman et al., 2015; Landman, 2016; Rothstein, 2017):

(1) a. Three drops of wine
b. A slice of apple
c. Several portions of soup

(2) Drie bier alstublieft.
three beer please
'Three (portions/units of) beer, please' (Dutch)

Intuitively, portion NPs refer to quantities of a substance that are individuated based on some shape or size criterion. Like classifiers (3), portioning-out (whether overtly as in (1), or covertly as in (2)) divides the reference of the mass noun into countable individuals:

(3) a. Many pieces of jewellery
b. Twee stuks fruit
two pieces fruit
'two pieces of fruit' (Dutch)
c. san ben shu
three CL book
'three books' (Mandarin; from Cheng & Sybesma (1999))

Although the absence of 'natural units' in the case of (1)-(2) means that portion words generally have more lexical content than classifiers (as they need to specify a particular individuation criterion), the underlying process seems much the same; this parallel has prompted e.g. Khrizman et al. (2015); Landman (2016) to analyse portion words (including covert ones, as in (2)) as a type of classifier, that map mass denotations to countable individuals. Khrizman et al.'s (2015) and Landman's (2016) analysis predicts that the complex NPs resulting from portioning-out are always count. To them, this is a welcome result, which they present in contrast to previous work by Partee & Borschev (2012), who tentatively, and not entirely happily, conclude that portion constructions like those in (1) are best analysed as a subclass of measure constructions (and, accordingly, mass NPs).[1]

In this paper, we show that in a significant number of cases, portioned-out mass predicates sometimes do retain the mass characteristics of the embedded mass noun; in other words, they behave neither like classifier nor like measure constructions. This is unexpected under either Khrizman et al.'s (2015) or Partee & Borschev's (2012) accounts. The phenomena we will be concerned with are pluralised mass nouns in languages like Greek, Persian and Indonesian, e.g (4), English 'Q-nouns' such as *lot* and *heap* (5), and 'bare measure' constructions like *liters of water* (6).

(4) Trexoun nera apo to tavani
drip-3rd-pl water*s*-pl-neut-nom from the ceiling-neut-sg
'Waters are dripping from the ceiling.' (Greek)

(5) a. A lot / lots of water was dripping from the ceiling.
b. *Three lots of water were dripping from the ceiling.

[1]Note that some portion NPs may occasionally behave like a measure phrase, (an *ad hoc measure* in Partee & Borschev's (2012) terminology), as in (i), where it is understood that *portion* and *pinch* represent certain (not necessarily individuated) quantities.

(i) a. This can contains four portions of soup.
b. Add four pinches of salt to the stew.

These ad hoc measure readings are distinct from the individuating, classifier-like portion readings exemplified in (1) and (2); crucially, portion constructions like (1) and (2) but not ad hoc measure constructions like (3) can felicitously be used if the different portions (or drops, or slices, or beers) have different sizes. See also Landman (2016); Rothstein (2011, 2017, :219vv). We will ignore the ad hoc measure readings in the rest of this paper and focus on the individuating portion constructions identified by Partee & Borschev (2012); Khrizman et al. (2015).

(6) Liters (and liters) of water were dripping from the ceiling.

These NPs/DPs share a cluster of properties: first, they resist count determiners and numerals despite their superficial similarity to typically countable NPs (classifier phrases, measure phrases or plurals). Second, the portion words they involve often function as genuine measure words or classifiers in different contexts (e.g. *lot* in *Three lots of antique furniture*). Third, while measure words and classifiers head their respective phrases, the same does not appear to hold for the portion words in the above examples. Fourth, all the above NPs are 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 carried by plural morphology.

We will claim 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 portioning-out may result in either a mass or a count NP depending on the syntactic position of the portion operator. The count interpretation surfaces when the portion word is the head of a complex Portion Phrase taking the mass NP/DP as a complement, as in *John auctioned off three lots of furniture* or *There were various liters of mineral water in the fridge*. The head status of the portion word is reflected in the labelling of the PortionP as well as the ϕ-features and countability properties inherited by the phrase: put simply, the PortionP is countable because portions are countable. In contrast, we argue that the mass interpretation results when the portion word occupies a non-head position within the complex phrase. In this case, it is the ϕ-features of the embedded NP/DP itself, as well as its mass/count status, that are inherited by the matrix phrase. Put simply, if the embedded predicate is mass (as in (4)-(6)), 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 three properties mentioned above, but it does not yet account for the inference of abundance or large quantity shared by all addressed cases of mass portioning-out. 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 Q-nouns like *bunch, lot(s), heaps* and *oodles*, as well as bare measures like *liters*, 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 Tovena (2001) and Francez & Koontz-Garboden (2017), we show that portioned-out mass 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 sections 2 and 3, we introduce the core phenomena on which our semantics of portioning-out is based, focusing on the various syntactic and semantic parallels between them - Q-nouns and bare measures in section 2, mass plurals in section 3. In section 4, we present our analysis first informally, then more formally; we also take the opportunity to critically examine the intersective approach to portioning-out proposed in Khrizman et al. (2015) and Landman (2016).

In sections 5 and 6, we zoom in on the pragmatics of the abundance inference supported by all three 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. The two main parts of the paper (sections 2-4 and section 5-6) can be read independently from each other. Section 7 concludes the paper.

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*, or *scores*. Such Q-nouns are usually diachronically or synchronically related to a countable noun expressing a certain unit or quantity, and still show some count noun-like behaviour in that they tend to be pluralised and sometimes occur with *a*. However, as (7-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, (7-c) and (8) shows that the number features of the NP as a whole are usually determined by the embedded noun, not the Q-noun. :

(7) 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.

(8) 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. This lack of countability is not a property of the Q-noun per se: the examples in (9) demonstrate that several Q-nouns also have (or used to have) a countable use in which they function as a genuine measure or unit word. (We will refer to these countable uses as 'classifier uses'; like the portion words and classifiers discussed at the beginning of this paper, they serve to individuate a mass referent into countable units.)

(9) 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 x 20 + 10 = 70)

While Klockmann (2017:226) considers this classifier/Q-noun alternation only for *lot*, and claims that it is a matter of genuine lexical ambiguity, the data in (10) and (11) show that there are many more examples of alternating Q-nouns; this suggests, contra Klockmann, that the behaviour of *lot(s)* is not an idiosyncracy, but exemplifies a more general and systematic pattern that calls for a compositional analysis:

(10) a. The geologists found several masses of Paleozoic rock.
b. These Victorian hairstyles required (*several) masses of hair.

(11) a. Sort the toys into three heaps.
b. Drink (*three) heaps of water.

(12) 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 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. Moreover, the difference in mass/count status between the two constructions suggest that the Q-noun use does not simply involve a vague or figurative interpretation of the classifier use ('a large quantity'), as we can easily count vague quantities:

(13) Drink three large quantities of water.

In addition, if Q-nouns were simply ambiguous between a literal and a more figurative use, we would expect an NP like *two reams of paper* in (12-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 Q-noun is used as a classifier (as in (12-a)) it is interpreted literally, and the large quantity meaning only arises when the NP is mass (as in (12-b)).

In short, we find that the uncountable nature of NPs such as the ones in (7-a),(7-c), and (10-b)-(12) cannot be reduced to any lexical properties of the Q-noun. Rather, there seems to be something about the syntactic configuration in these sentences that causes the countability and number properties of the Q-noun to be ignored in favour of the embedded noun. The same pattern is found with bare measures to which we now turn.

2.2 Bare measures

Consider the following:

(14) a. LITERS 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 center.

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 mass Q-nouns, they support an inference of large quantity (relative to a context). Also, like mass Q-noun constructions (and unlike 'normal' measure phrase constructions), they are non-countable:

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

While (15) 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*, leading us to conclude that, like the Q-noun constructions from the previous section, they are mass.[2]

(16) a. And all that coal being burned adds **more tons and tons of CO2** to the atmosphere, warming the planet.[3]
b. That means no cream, **no heaps and heaps of mayonnaise**, and no 4:1 ratio of oil to vinegar.[4]

As shown by their incompatibility with numerals and count determiners, the measure words in sentences like (14) do not appear to be part of measure phrases. Additional evidence for this conclusion comes from Dutch, in which 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) 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 (17), we have starred ungrammatical number marking and hashed marking that does not result in the described interpretation.)

(17) 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)

[2]Perhaps 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 (16), 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 would fit with the observation (explored in more depth in Klockmann 2017; see also footnote 6) that subject-verb agreement preferences for constructions like *tons of water* are inconsistent, varying across Q-nouns and individual speakers.

[3]Source: `http://environmentcontext.blogspot.co.uk/2012/07/mountaintop-removal-damage-goes-beyond.html`, accessed January 2018

[4]Source: `https://www.multiculturiosity.com/arugula-salad-with-shrimp-and-grapes-6/`, accessed January 2018

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 (17) represent three meanings which are all truth-conditionally distinct from each other. The measure interpretation in (17-a) is true just in case I bought a length of cheesecloth measuring 3 meters. The portion interpretation in (17-c) is true just in case I bought 3 meter-sized lengths of cheesecloth. Sentence (17-b) is ambiguous between a bare version of (17-c) (which is true just in case I bought multiple meter-sized lengths of cheesecloth) and a more prominent, abundant 'large quantity of cheesecloth' interpretation which is true just in case I bought lots of cheesecloth.[5]

The ambiguity of (17-b) is reminiscent of the behaviour of Q-nouns, which also have a dual use as either a (countable) classifier or a (non-countable) expression of large quantity. In line with our observations about Q-nouns, countable portion-shifted measure words always agree in number with the verb (as exemplified in (18)), while (19) shows that their abundance-conveying mass counterparts may occur with a singular verb (Broekhuis & den Dikken, 2012, ch4):[6]

(18) 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

[5]While the sentence in (17-b) is ambiguous in written form, the two readings have very distinct prosodic profiles; see the discussion around examples (23)-(24) for more on the ambiguity of bare measure constructions.

[6]Although it should be noted that plural agreement is acceptable too and, as with some Q-nouns (Klockmann 2017), different speakers have different preferences. For instance, the following examples are from two different versions of the same news item on the arrival of two pandas in a Dutch zoo (`https://veenendaalsekrant.nl/lokaal/pandas-op-reis-naar-nederland-230549` and `https://www.sevendays.nl/nieuws/pandas-xing-ya-en-wu-wen-vliegen-naar-nederland`, respectively):

ii. a. Een Chinese verzorger reist met ze mee en er zijn kilo's bamboe aanwezig om ervoor te zorgen dat de panda's niks tekort komt.
a Chinese carer travels with them along and there are kilos bamboo 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 niks ontbreken. Er is kilo's bamboe aan boord!
during the flight, which a small eleven hours lasts, will it them of 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; we did not obtain introspective grammaticality judgements, but a Google search yields a similar number of hits for "There is kilos of" (254) and "There are kilos of" (323). While singular existential *there's* is compatible with plural nouns in some dialects of English, this requires the reduced form. (For instance, Google yields 1,180,000 results for *there's people* and zero results for *there is people*.) The acceptability of non-reduced *there is* with plural bare measure constructions therefore suggests that such constructions, while plural-looking on the surface, do not carry a plural number feature.

genaaid
sewn
'These three meters of fabric need to be sewn together lengthwise.'

(19) 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.'[7]

In conclusion, the Dutch data show that in terms of both number marking and verbal agreement, bare measure constructions pattern with mass 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'. Given this, we assume that we are dealing with a single class of portion expressions (which may be either lexical or, following Rothstein 2011, derived from a measure term through a portion shift) that systematically alternate between a countable classifier use and a non-countable 'large quantity' use. Following this assumption we will refer to these two uses as 'count portioning-out' and 'mass portioning-out' in the rest of the paper.

2.3 Mass/count alternations as structural ambiguity

Given that we are assuming that mass and count portioning-out involve the same portion expressions (that is, no lexical ambiguity), we need to account for the alternations in some other way. In this section, we will present some evidence that mass and count portioning-out involve distinct syntactic structures despite being string-identical. We will propose a basic syntactic structure for each that is consistent with our data, and in line with common assumptions on the way headedness determines the interpretation of constructions involving multiple nominal elements (Rothstein, 2011; Landman, 2011; Khrizman et al., 2015).

The first piece of evidence involves coordination. As (20) shows, it is possible to coordinate measure phrases ((20-a)), classifiers ((20-b)), and mass portions ((20-c)) with another expression of the same category:

(20) a. I drank two liters and 500 milliliters 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:

[7]Source: `https://partyflock.nl/topic/944543:Rocco-niet-blij-met-Pandemonium-in-Westergas`, accessed October 2018.

(21) *I drank { liters and two cups / lots and one bottle / two buckets and oodles / several liters and heaps / ... } of water.

Note that this is not just a general ban on coordinating a bare with a non-bare noun; as (22) shows, such coordinations are fine in either order suggesting also that bare nouns have a covert determiner.

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

The contrast between (20) and (21) is unexpected if the mass portion constructions we are interested in are structurally identical to either measure constructions or classifier constructions: coordination of two expressions should be fine if they are both of the same syntactic category. But since coordinations of a mass portion word with either a measure or a classifier is out, we conclude that mass portion constructions are not structurally equivalent to either measure or classifier constructions.

The second piece of evidence for this position involves prosody. As we have seen ((17) and surrounding discussion), portion words (including portion-shifted measure words) can appear in bare 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 (23):

(23) John distributed liters of water to the marathon runners.

As we have already seen, sentences like (23) have two possible readings. The first (count) reading is true in any situation in which John handed out liter-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 independent. In a situation in which a total of two runners each receive a liter 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.

When (23) is spoken out loud, however, it is not ambiguous, as the two readings of *liters of water* are fully disambiguated by stress. For the count reading, the stress needs to fall on *water*; the mass reading requires stress on *liters*:

(24) a. John distributed liters of WATER to the marathon runners.
b. John distributed LITERS of water to the marathon runners.

Given that stress patterns are affected by phrasal boundaries, this strongly suggests that the ambiguity of (23) is structural, and cannot be explained in terms of e.g. a literal versus a metaphorical interpretation of *liter(s)*.

Finally, there are languages in which mass and count portioning-out actually look dis-

tinct on the surface.[8] 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*.

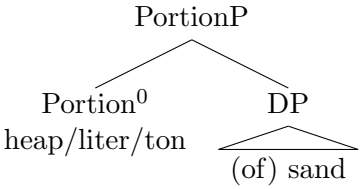
(25) a. *(Drei) Haufen Sand wurden angeliefert.
(three) heaps sand were delivered
'Three heaps of sand were delivered.'
b. (*Drei) Haufen von Sand wurden angeliefert.
(three) heaps of sand were delivered
'Heaps of sand were delivered.'

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 (26):

(26) a. Mas serviran (*tris) 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

We conclude that the evidence supports an analysis of mass and count portioning-out as involving two distinct syntactic structures. The behaviour of count portioning-out is consistent with the structure 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.

(27)



Technically, Portion^0 is introduced via set-merge and the label of the projection is determined by it. The rightmost element receives phrasal stress (consistent with general English stress rules), accounting for the pattern in (24); the phrase as a whole inherits its number features (and mass/count status) from its head, so the expression in Portion^0 controls number agreement on the verb.

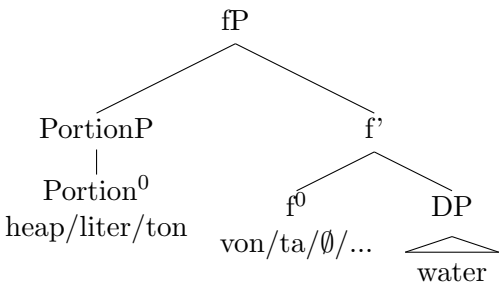
For mass portioning-out, we propose the following structure, in which PortionP occupies the specifier position of a phrase on whose syntactic category we will remain agnostic, labelling it 'fP' ('functional phrase').[9] (Our motivation for the inclusion of a f^0 head is

[8] We are very grateful to an anonymous reviewer for providing us with these German data.

[9] The syntax of these constructions presents a number of interesting issues that we cannot go into in this paper in any detail. Briefly, while on the one hand the fact that the F head can be realised by a

partially semantic; we will make its function more explicit in section 4.2.2.)

(28)



Since the portion word is not the head of the phrase but part of a specifier, we do not expect it to influence the number or mass/count status of the fP as a whole; rather, we expect the matrix fP to carry the same ϕ−features as the embedded DP and control agreement accordingly.[10] The structure also appears to be consistent with the stress data in (24), as it embeds the portion word in a PortionP with no other overt elements, allowing it to bear its own phrasal stress.

2.4 Intermediate summary

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 a 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, it can be shown that the two uses correspond to distinct syntactic structures; moreover, the behaviour of count and mass portion constructions with respect to VP agreement strongly suggests that the portion word is the syntactic head of the NP in the first case but not in the second case. We propose that the portion word in mass portion constructions is part of an adjunct, with the NP as a whole headed by the embedded mass noun.

In the next section, we will argue that this pattern goes beyond overt expressions.

preposition or a definite determiner might lend support to Kayne's (1994) analysis of the English possessive where he proposed that English *of* is inserted in the D position when the D is indefinite, it would be, from a semantic standpoint undesirable to identify F with D given the pluralisation strategies mentioned in (41). However, it has been shown by a number of authors including Alexiadou & Wilder (1998); Manolessou (2000); Campos & Stavrou (2004); Panagiotidis & Marinis (2011), the so-called determiner spreading construction in Greek involves DP-internal predication. We take the portion construction to derive from the same type of underlying structure, namely: PortionP and NP merge first is a small clause, the determiner, spelling out F, is then merged followed by raising of the PortionP (predicate preposing) to the specifier of F. The derivation mirrors that of copular constructions. This derivation matches the proposed semantics, we leave, however, a more detailed investigation of these for future work.

[10] Although see footnotes 2 and 6.

3 Covert portioning-out and plural mass nouns

As Khrizman et al. (2015) argue, portioning-out does not always have to involve overt classifiers like *slice*, *portion*, or *liter*. Assuming 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, 2014), substance-denoting nouns are countable. Khrizman et al. analyse such data in terms of a covert portion classifier.

(29) Txabïu asa he wï he.
three flour in port in
'There are three (bags of) flour in the port.' (Yudja)

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):

(30) a. Twee rode wijn(*en) alstublieft.
two red wine(PL) please
'Two (portions of) red wine, please.' (Dutch)
b. Twee rode wijn.en alstublieft.
two red wine.PL please
'Two red wines (=kinds of red wine), please.'

As (30-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 (30-a) arguably preserves the mass status of the original noun, as evidenced by its incompatibility with plural marking. The countability of the NP 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 (although we will not adopt Khrizman et al.'s intersective semantics for it; more on the compositional semantics of portioning-out in a bit).

One phenomenon that defies traditional wisdom on the morphosyntax of mass and count is pluralisation of mass nouns, which is generally assumed to be impossible in theoretical accounts of the mass/count distinction (see in particular Chierchia, 1998a; Borer, 2005), but is in fact attested in many languages. Assuming the wide crosslinguistic availability of a mechanism of covert portioning-out, this observation can be accounted for while still leaving the wider generalisation intact. Let's assume a Chierchian view under which mass nouns are incompatible with pluralisation because they are already inherently plural (i.e., closed under sum). 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; in line with the pattern observed in the previous section, we might even expect such plural mass nouns to alternate between mass and count portion interpretations.

The latter is in fact exactly what we find crosslinguistically. Languages such as Yup'ik

(Corbett & Mithun, 1996), Ojibwe (Mathieu, 2012), Old High German (Carr, 1936)[11], Blackfoot (Wiltschko, 2012), and Nez Perce (Deal, 2013), allow pluralisation of mass nouns with the interpretation 'bits or portions of X'.

(31) a. uq.uq
oil.SG
'oil' (Yup'ik)

b. uq.uk
oil.DU
'two sealpokes or jars of oil'

c. uq.ut
oil.PL
'three or more sealpokes or jars of oil'

(32) a. maandaamin
'corn' (Ojibwe)

b. maandaamin.ag
corn.PL
'pieces of corn'

(33) 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'

(34) hipinwees.pe lep.it xîxˆay.xîxˆayxˆ 'itxˆ hii.we.s
table.LOC two.SUF PL.white clay 3SUBJ.be.PRES-SG
'inik.iin'
place.PASSIVE-PART
'There are two pieces of white clay placed on the table' (Nez Perce)

In Greek, Persian and Indonesian, mass nouns may be pluralised - supporting an inference of scatteredness or abundance - while remaining uncountable.

(35) a. Trexoun nera apo to tavani.
drip-3PL water.PL from the ceiling
'Waters are dripping from the ceiling.' (Greek, repeated from (4))

b. *Dio nera trexoun apo to tavani.
two water.PL drip-3PL from the ceiling
'Two waters are dripping from the ceiling.'

(36) a. O Yanis patise se laspes
THE.MASC.SING Yanis step-PAST in mudPL
Yanis stepped in *muds*

[11] Carr 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."

b. *O Yanis patise se tris laspes
THE.MASC.SING Yanis step-PAST in three-FEM.PL mudPL
Yanis stepped in three *muds*

(37) 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 2012[12])

(38) 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)

In some languages, such as Evenki (Nedjalkov, 1997), Innuttut (C. Gillon, 2012), and Innu-Aimun (C. Gillon, 2010), pluralised mass nouns are ambiguous between a countable portioned-out interpretation and an uncountable 'high quantity' one, parallel to the pattern we have seen in the previous section.

(39) 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'

(40) a. pimî
'Oil' (Innu-Aimun; C. Gillon 2010)
b. pimî.a
oil.INAN-PL
'amounts of oil' or 'lots of oil'

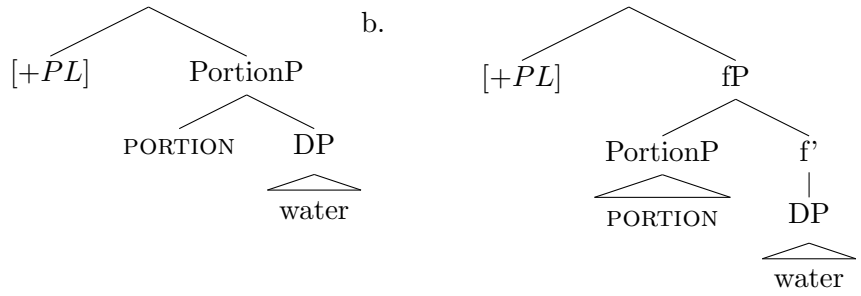
Despite the fact that plural mass nouns do not always alternate between mass and count interpretations within a single language[13], the general crosslinguistic pattern is strongly reminiscent of the kind of alternation we saw with Q-nouns and bare measures. We therefore propose to treat pluralisation of mass nouns along the same lines, in terms of portioning-out and structural ambiguity. This means that languages of the Ojibwe type, in which plural mass nouns receive a 'bits or portions of X' interpretation, has the structure in (41-a) avail-

[12]Note 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, 2014). 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.) 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).

[13]In 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.

able, while the structure in (41-b) represents languages like Greek and Persian; languages of the Evenki type, in which plural mass nouns are ambiguous, allow both structures.

(41) a. b.



4 Analysis

In this section, we will develop a more detailed analysis of both mass and count portioning-out, focusing on the compositional semantics of our portion operators. We have claimed that the difference between mass and count portioning-out essentially boils down to the syntactic structure in which they appear: if the head of the NP is the portion operator, the NP as a whole is count, and if it is the embedded mass noun, the NP as a whole remains mass. While this sounds fairly intuitive, it is not immediately obvious how this should work on the semantic side of things, given that the rules of semantic composition do not care about such structural concerns.

4.1 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 (e.g. Bunt & Bunt, 1985; B. Gillon, 1992; Bale & Barner, 2009), an approach that has lately been gaining popularity - most recently advocated in a series of talks and papers by Susan Rothstein, Fred Landman and some associates (Rothstein, 2010; Landman, 2011, 2016; Khrizman et al., 2015; Sutton & Filip, 2016; Rothstein, 2017, e.g) - treats 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, uncountable reference to objects, and other 'grey area' phenomena without having to rely on systematic type- or domain-shifting.

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, 1998a, 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 stable and non-arbitrary, enabling counting.[14] In contrast, the predicate **water** does not provide a stable and non-arbitrary division of its extension; lacking a stable cardinality, it cannot be counted. Thus, countability is sensitive to disjointness.

4.2 Portioning-out in a disjointness-based semantics

One of the advantages of a disjointness-based framework that it enables a derivational and compositional account of countable complex NPs involving mass nouns, such as the portion constructions in (1). 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 uncountable 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 (42) without having to include in the model additional (and, in principle, arbitrary) mappings between atoms and their material parts.[15]

(42) 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 (for example, with shape classifiers) is treated as simple intersection. (Landman's formalism is rather more

[14]Note that disjointness, even though it is rooted in human perception, is ultimately a grammatical property; it is not a claim about the actual physical properties of the objects we perceive. As such, there may be a certain degree of vagueness involved. 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 no matter where we draw the line we will never end up with anything more or less than two cats. Similarly, note that trick questions like 'How many triangles are in this picture?' (where the picture shows a large triangle composed of four smaller ones) are hard to answer 'correctly' precisely because of the discrepancy between physical reality (5 triangular shapes) and human perception, which ignores the overlapping large triangle in favour of the four non-overlapping smaller ones. 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'.

[15]What 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 room for arbitrary, model-specific properties of cat (for instance, whether it is organic 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 such non-intended models, 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.)

complex, treating noun denotations as pairs of sets with potentially distinct disjointness properties. Here, we will follow the simpler version from Khrizman et al.)

(43) a. $[\![\textit{slice}]\!] = \textbf{slice}$ (the disjoint set of slice-shaped objects)
b. $[\![\textit{cheese}]\!] = \textbf{cheese}$ (the overlapping set of cheese-sums)
$[\![\textit{slice of cheese}]\!] = \textbf{slice} \cap \textbf{cheese}$ (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 liters of mineral water in the fridge*), the denotation of *liter of water* is analysed as in (44).

(44) $[\![\textit{liter of water}]\!] = \lambda x[\textbf{portion}(x) \wedge \textbf{water}(x) \wedge \textbf{liter}(x) = 1]$

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

(45) In the course of the day, John drank many/several/each of these liters of mineral water.

As can be seen in (44), 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 (29)), and can be directly intersected with the mass noun denotation to give a countable portioned-out interpretation.

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 subsective adjective (*skillful, former*): it can be defined as a function on some other set, but it does not itself characterise a set (see also Chierchia, 1998a, 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 (46).

(46) 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). 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. Instead, we will assume that portion expressions - including covert PORTION and portion-shifted measures - denote *subsective* functions from sets of sums to a disjoint subset of those sums. Semi-formally:

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

Here, C can be anything from shape, to size, to spatial separation from other sums, or a combination of these factors.[16] For the sake of simplicity, we are assuming that 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. (Alternatively, we could choose to build in a separate disjointness criterion, and define our portioning operators as 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 (47) 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:

(48) a. $\forall c$: all the water in $c \equiv$ all the quantities/bits/portions/... of water in c
b. $\not\forall c$: 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 (a) category as *total* portioning-out,

[16] We see the individuation criterion C as a kind of placeholder for one's favourite formal model of individuation (for example, the mereotypology of individuation developed in Grimm 2012). 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 of portion operators, see Lima (2014).

and to the (b) category as *partial* portioning-out.[17]

(49) A portioning-out operator $\mathcal{P}^C$ is *total* iff (for any context) $\sqcup(\mathcal{P}^{\mathcal{C}}(X)) = \sqcup X$ 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:

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

For instance, PORTION(**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

Recall from the previous two sections that we want our analysis to cover both mass and count portioning-out in terms of the same portioning-out operations, with the locus of variation being head versus non-head status of the portion operator. In the present section, we have added an additional piece to the puzzle: since we are analysing the mass/count distinction in terms of overlap versus disjointness, we need to ensure that count portioned-out NPs denote disjoint predicates, while mass portioned-out NPs overlap.

The intuition behind the analysis we will present here is as follows. If the portioning-out operator $\mathcal{P}$ is the head of the phrase - in other words, if the portioned-out predicate corresponds to a PortionP - the complex predicate's countability status will be determined by the disjointness properties of the portions. Since we have built disjointness into the semantics of portioning-out, this can be a matter of straightforward function application. However, if the portioned-out predicate corresponds to an extended fP with the mass noun as its lexical head, the predicate's countability status will be determined by the disjointness properties of the mass stuff that the portions consist of. Crucially, this stuff overlaps even if the portions themselves do not.

We could semi-formally state this as follows:

(51) A complex predicate Z formed by composing a predicate X and a non-head portion operator Y is mass iff the set of parts of Z that are also X is overlapping.

More concretely, if we have a set of portions of water and **water** is the head of the phrase, the set of sums that are part of a water-portion and are also water[18] will overlap and the

[17] We 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.

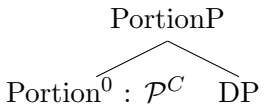
[18] The specification that these sums be water seems redundant given our present purposes, but is necessary to derive the appropriate results in cases where the embedded noun denotation is not closed under Boolean parthood. For example, consider an NP like *lots of boys*, which we want to analyse as a predicate over boys

NP as a whole will be mass following (51).

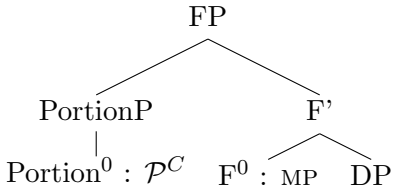
Converting (51) to a compositional analysis is not a trivial move. One possible implementation involves adopting the 'Head Principle' proposed in Landman (2011, 2016), which is essentially a formalisation of the intuition in (51). However, the Head Principle relies on intersective composition of multiple set-denoting expressions, which means it will not work (without further stipulations) for our non-intersective version of portioning-out. In addition, it is formulated within a specific semantic framework, and as such relies on several assumptions and implementational idiosyncracies that we would prefer not to depend on.[19]

In section 2.3, we have proposed that both mass and count portioning-out involve a Portion Phrase headed by a portioning-out operator. In the case of count portioning-out, the mass DP serves as the complement of the PortionP, and the semantics of the portioned-out phrase is derived compositionally through direct application of the portioning-out operator to the mass predicate. In the case of mass portioning-out, the PortionP is in the specifier position of a functional head F, which may or may not be spelled out depending on the language and/or the construction. On the semantic side of things, we will propose that F^0 hosts an operator we will call MP (for 'mass portion') which mediates between a mass predicate and the portioning-out function. We assign MP the denotation in (53).

(52) a. Count portioning-out:



b. Mass portioning-out:



(53) $\text{MP}(P)(\mathcal{Q}) := \{x | x \in P \wedge \exists y[y \in \mathcal{Q}(P) \wedge x \sqsubseteq y]\}$
where P is a set of sums[20] and $\mathcal{Q}$ a function from sets of sums to sets of sums. (final version in (77))

---

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 boys.

[19] A major advantage of Landman's formalism, which he calls 'Iceberg Semantics', is the way it keeps track of the original 'building blocks' of a predicate even as its extension is compositionally modified. This makes it more suitable to deal with pluralisation and related phenomena such as distributivity than the simplified formalisation we will present here. For example, in the present system, the link between countability and disjointness falls apart when we consider e.g. pluralised count predicates (which overlap by definition, but are still countable). We will leave this problem aside for now, since it does not directly affect our proposed semantics for portioning-out.

[20] Note that nothing hinges on the assumption that MP and portion operators operate on sets of sums; if we prefer the denotation of our mass DP to be of some other semantic type - say, a maximal sum - the denotations of both MP and the $\mathcal{P}^C$-family can easily be reformulated accordingly.

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

For example, suppose that **water** $= \{a \oplus b \oplus c, a \oplus b, a \oplus c, b \oplus c, a, b, c, ...\}$ and PORTION(**water**) $= \{a \oplus b, c\}$. Then, the denotation of MP(**water**)(PORTION) is the set $\{a \oplus b, a, b, c, ...\}$. 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'.[21]

In languages such as Dutch, the MP 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. 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 MP is intuitively reasonable since, at its denotational core, MP is a function that accesses some predicate's Boolean part set. Moreover, the observation that this same syntactic position may host a definite determiner in other languages (as we have seen, Greek sometimes allows this, in which case the resulting construction is necessarily interpreted as mass) is in line with independently motivated proposals such as Kayne's (1994) analysis of English possessives, in which he proposes that *of* is inserted in D^0 when it is not definite.

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 the Linkian 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 [[MP(PORTION)(**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.

We end the syntactic-semantic part of our paper with a full derivation of the sentence *Mary spilled lots of water*, just to be formally explicit. As we have shown, we are assuming that both *water* and *lots of water* denote sets of sums, but if any reader would rather treat them as the maximal sums corresponding to those sets, the semantics can be modified accordingly in a pretty straightforward way. In this case, a DKP-like mechanism (Chierchia, 1998b) may be used in the derivation instead of existential closure.

[21] It 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 MP 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 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.

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

b. $[\![\textit{lots of water}]\!] = {}^*[\![\textit{lot of water}]\!] =$
$\{\bigoplus(x_1...x_n)|\forall x_{\in\{x_1...x_n\}}[x \in \textbf{water} \wedge \exists y[y \in \text{LOT}(\textbf{water}) \wedge x \sqsubseteq y]]\}$
(the set of all water-sums that are a sum of parts of a lot-portion of water)

c. $[\![\textit{spilled lots of water}]\!] = \lambda z \exists w[w \in [\![\textit{lots of water}]\!] \wedge \textbf{spill}(w)(z)]$
$= \lambda z \exists w[w \in \{\bigoplus(x_1...x_n)|\forall x_{\in\{x_1...x_n\}}[x \in \textbf{water} \wedge \exists y[y \in \text{LOT}(\textbf{water}) \wedge x \sqsubseteq y]]\} \wedge \textbf{spill}(w)(z)]$
(existential closure of the set $[\![\textit{lots of water}]\!]$ at VP level, following e.g. Diesing 1992)

d. $[\![\textit{Mary spilled lots of water}]\!] = \lambda z \exists w[w \in \{\bigoplus(x_1...x_n)|\forall x_{\in\{x_1...x_n\}}[x \in \textbf{water} \wedge \exists y[y \in \text{LOT}(\textbf{water}) \wedge x \sqsubseteq y]]\} \wedge \textbf{spill}(w)(z)](\textbf{m})$
$= \exists w[w \in \{\bigoplus(x_1...x_n)|\forall x_{\in\{x_1...x_n\}}[x \in \textbf{water} \wedge \exists y[y \in \text{LOT}(\textbf{water}) \wedge x \sqsubseteq y]]\} \wedge \textbf{spill}(w)(\textbf{m})]$
'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 (54-b) is equivalent to the set $\{x|x \in \textbf{water} \wedge \exists y[y \in {}^*(\text{LOT}(\textbf{water})) \wedge x \sqsubseteq y]]\}$ - 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 discussed phenomena for which an analysis in terms of mass portions seems appropriate share an inference of abundance or high quantity. In this section of the paper 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 Tovena 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 (2011) 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 (2011) 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.

(55) 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, (55) 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, 2011), 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, 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 Q-nouns, bare measures and perhaps some shape classifiers (*blob*, *chunk*, *slab*)[22], 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 (56):

(56) 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 (56-a) is both true and felicitous in the context (since *thousands of euros* is a lot of money for a single European family to spend on medical care in a year), the same sentence is inappropriate in the context of (56-b), in which a couple of thousands of euros is in fact an insignificant sum of money. In short, the reason (56-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

[22] We have not discussed shape classifiers explicitly, but 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/l-l-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 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.

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 (57), the abundance inference disappears. For instance, (57-a) can be felicitously uttered by a very fiscally conservative minister of finance; (57-b) does not imply that the quantity of laundry is unusually large; (57-c) (unlike its bare measure counterpart) is fine in combination with the minimiser *just*, and so on.

(57) 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 liters 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 (58) (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.

(58) 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.[23]

Similarly:

(59) Yet if polls are right [the Labour party] is days away from utter collapse north of Hadrian's Wall.[24]

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

(60) Although it may take two or three weeks to get even drops of milk, the fact that

[23] Source: `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

[24] Source: `https://www.economist.com/news/britain/21650147-why-labour-partys-campaign-has-gone-surprisingly-well-meaning-mr-miliband`, accessed February 2018

the adopting mother starts to get even drops can be very reassuring.[25]

The co-occurrence of these two inferences - multiple feet, days, or drops, but at the same time a particularly *small* distance, quantity or 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 (59) and (60) 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 inference[26], 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 (61-a-c), but the abundance inference does not.

(61) 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 (61-b) still supports the inference that the collapse of the Labour party is less than a week away, unlike (59) 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 provide an account of abundance that ties it to mass portioning-out.

5.2 Abundance as a tautology-based Quantity implicature

(all sources in this section accessed December 2017)

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:

(62) a. Il n'a pris aucun livre.
he not-has taken any book

[25]Source: `https://www.facebook.com/DrJackNewman/posts/315997418551311`, accessed February 2018
[26]We will briefly return to this suggestion in section 6.2.

(French; Tovena 2001)

'He did not take any book.'

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 Marcin Morzycki's work on nominal gradability, Francez & Koontz-Garboden list several tests to detect the presence of such a size ordering, which we reproduce here as given:

(63) 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 (63-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 (63-b).

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

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

a. *She drank major/enormous water.

b. He is a major/enormous idiot.

c. She has major/enormous courage.

(65) Intensifiers (cf. Morzycki, 2012)

a. *She drank utter/total/absolute water.
b. He is an utter/total/absolute nerd.
c. He 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 (66-b-c) but not in (66-a):

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

a. I've seen incredible/astounding water.
b. She 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:

(67) *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 (69) 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.)

(68) English

a. And, **what heaps of gear** you can pack in this roof top carrier![27]
b. O **what floods of turtle-soup; what tons of turbot and lobster-sauce** must have been sacrificed to make those sinners properly miserable.[28]
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![29]

(69) Dutch

[27]Source: `http://www.autoanything.com/roof-racks/77A1400A6489405.aspx`
[28]Source: William Makepeace Thackeray (1840): *An Essay on the Genius of George Cruikshank.*
[29]Source: Freeman Tilden (1962): *The State Parks: their meaning in American life.*

a. **Wat een liters water** verdwijnen er in een lijf, en komen er
What a liters 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 liters of water disappear into a body, never to return, every day, with this temperature.'[30]

(70) 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
'However much dust and water have gone into it (a tool) it does not break.'

The exclamatives in (68) - (70) 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.[31]

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

(71) 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 the new feed.[32]
b. Stay away from **massive heaps of sugar and alcohol**.[33]
c. Dogs can consume **a massive lot of chocolate** before their system starts to respond to that.[34]
d. Damnation upon both of you and all your offspring into eternity for making me remember that **utter pile of bovine excrement**.[35]
e. **Absolute tons of soft drinks, wines, beers and food** included.[36]
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**.[37]

[30]Source: `http://bosch.reislogger.nl/27-juni-zion.200517`, accessed December 2017

[31]Bolinger (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.

[32]Source: `http://forums.pondboss.com/ubbthreads.php?ubb=showflat\&Number=304332`.

[33]Source: `http://www.sosuave.net/forum/threads/just-about-to-start-gym-need-different-ideas-training-plans-for-3-days-a-week.240087/`

[34]Source: `https://answers.yahoo.com/question/index?qid=20120127185601AAua1fR`

[35]Source: `http://forum.nasaspaceflight.com/index.php?topic=43620.35;wap2`, accessed February 2018

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

[37]Source: `https://www.pilates.com/BBAPP/V/pilates/library/COREterly/2015/fall-winter/`

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.[38]

(72) Dutch

a. Kies voor Alpe d'Huez en Les Deux Alpes en combineer de **enorme kilometers aan pistes** met een combi skipas.
choose for Alpe d'Huez and Les Deux Alpes and combine the enormous 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.'[39]

b. Ook Romar speelde erg sterk en was vaak aanspeelbaar en heeft **ongelofelijke meters** afgelegd.
Also Romar played very strong and was often towardsplayable and has unbelievable meters covered.
'Romar, too, played a strong match and was often free and has covered an unbelievable distance.'[40]

c. [D]at de prijzen zo konden ontploffen had ook te maken met het steeds grotere gemak waarmee mensen **ontzettende hopen geld** konden lenen.
That the prices so could explode had also to make with the still bigger ease where-with people shocking heaps money could 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.'[41]

(73) 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.

(74) 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**

`teaching-and-learning.html`, accessed December 2018.

[38] Source: `https://www.oyster.com/articles/61477-the-best-time-to-visit-australia/`

[39] Source: `https://www.travelaroundwithme.com/wintersport-in-frankrijk-3-skigebieden-vergeleken`, accessed February 2018

[40] Source: `https://www.jongekracht.nl/113/4968/uitslagen/wedstrijd-details/?tab=3`

[41] Source: `http://forum.fok.nl/topic/1822710/2/151#p115590836`, accessed February 2018

and mortar.[42]

b. Really? You wanted to post **such tons of text** because you don't like this game?[43]

c. why have the artistic gymnasts put on **such oodles of makeup**?[44]

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.[45]

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 (75) are grammatical, they lack the quantity-oriented interpretation of their mass portioned-out counterparts.[46]

(75) 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* (76-a).

(76) 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 (76-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

[42]Source: `https://www.theguardian.com/theguardian/2012/oct/03/london-emile-zola-archive-1893`

[43]Source: `https://forum.worldofwarships.eu/topic/75312-only-witless-fools-allowed/`

[44]Source: `https://in.news.yahoo.com/dipa-karmakar-explains-why-artistic-122051924.html`, accessed December 2017

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

[46]One anonymous reviewer states that they consider sentences like the ones in (75) grammatical in their dialect of English, but they do not report whether they are able to assign a 'high quantity' interpretation to them. Nevertheless, this suggests that our analysis might not be universally applicable. We leave this for future research.

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.[47]

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 uninformativity of the non-enriched meaning. According to Rett, the semantics of (76-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 meaning is stronger than the utterance's logical meaning. So, rather than the trivial claim that John's height falls somewhere on the tallness scale, sentence (76-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 MP with a degree scale, as follows:

(77) $\text{MP}(P)(\mathcal{Q}) := \{x | x \in P \wedge \exists y[y \in \mathcal{Q}(P) \wedge x \sqsubseteq y] \wedge \exists d[\textbf{size}(d)(x)]\}$
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.[48] 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

[47] Rett (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.

[48] Providing 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.

lines of Rett[49] 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.[50]

(78) $[\![$*John spilled waters/John spilled lots of water/John spilled liters of water*$]\!] =$

a. $\exists x[\mathbf{spill}(x)(\mathbf{j}) \wedge x \in \mathbf{water} \wedge \exists y[y \in *\text{PORTION/LOT/LITER}(\mathbf{water}) \wedge x \sqsubseteq y] \wedge \exists d[\mathbf{size}(d)(x)]]$
'There exists a sum of water that's part of a sum of portions/lots/liters of water and was spilled by John and has a size.'

b. Pragmatically strengthened interpretation:
$\exists x[\mathbf{spill}(x)(\mathbf{j}) \wedge x \in \mathbf{water} \wedge \exists y[y \in *\text{PORTION/LOT/LITER}(\mathbf{water}) \wedge x \sqsubseteq y] \wedge \exists d[\mathbf{size}(d)(x) \wedge d > s_{size}]]$

[49]Note 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.

[50]Our 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 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 (as one anonymous reviewer did) 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.

'There exists a sum of water that's part of a sum of portions/lots/liters 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 MP, 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.

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.

(79) O Yanis den ehise nera. (repeated from (55))
the John not spill waters
'John didn't spill any water.'

In contrast, (80) appears to support the inference that John spilled some water (as shown by the naturalness of the continuation, in which this inference is cancelled).

(80) John didn't spill liters/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:

(81) John is not tall.
$\not\Rightarrow \neg$[John has a height].
$\Rightarrow \neg$[John has a height $\wedge$ it exceeds the standard].

What (80) and (81) have in common is that, under the current assumptions, it seems to be the *implicated* meaning that is targeted by negation. In (81), it is not the asserted meaning ('John has a height') that is negated, but the evaluative implicature that John's height

exceeds the standard. Similarly, in (80), 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 (55) but the enriched meaning in (80) and (81) because in the case of the latter two, targeting the asserted meaning violates pragmatic principles (cf. Rett, 2015, p.48, p128). Thus, in (81), computing an evaluative implicature below negation prevents a Quality violation (i.e., falsely asserting that someone could lack a height). In the case of (80), negating the asserted meaning (¬[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 Quantity violation. Again, local computation of the abundance inference (¬[John spilled water that was part of an oodle-sized quantity of water ∧ 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 Quantity 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'). So, we assume 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.[51]

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.

(82) a. O Yanis ehise nera... ala oxi tipota spoudeo.
the John spill waters... but no anything important
'John spilled waters.. but nothing important.'
b. #John spilled liters 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 (82-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:

(83) Who of you spilled liters 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

[51] There is a non-trivial assumption here that is important to spell out (we thank an anonymous reviewer for bringing it up), in that we are assuming that covert material is not active in fuelling Quantity 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 assumption but believe it is generally tacitly assumed in (neo-)Gricean accounts of implicature calculation.

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. In principle, 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 proceeds along the lines described in section 5.2, with uninformativity-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 (59) (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.

(84) Yet if polls are right [the Labour party] is days away from utter collapse north of Hadrian's Wall. (repeated from (59))

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 (60)), 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 & Steriopolo, 2007). In the former case, it is fairly neutral in terms of portion size (without further specification, (85) 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.

(85) Een bier.tje alstublieft.
A beer.DIM please
'A (portion of) beer, please.' (Dutch)

(86) 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 covert 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.

At the core of our analysis is the intuition that the (lack of) countability of a complex phrase is determined by the (lack of) countability of its head. We assume that our cases of uncountable portioning-out involve the same lexical ingredients as their countable counterparts (discussed recently in e.g. Deal 2013, Khrizman et al. 2015, Landman 2016, and Rothstein 2017), but a distinct syntactic structure in which the portioning-out operator is not the head of the construction, but part of a specifier. As a consequence, we do not have to resort to 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 like 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).

References

Acquaviva, P. (2008). *Lexical plurals: A morphosemantic approach*. OUP Oxford. Retrieved from `https://books.google.co.uk/books?id=C8FoAAAAMAAJ`

Alexiadou, A. (2011). Plural mass nouns and the morpho-syntax of number. In M. B. Washburn, K. McKinney-Bock, E. Varis, A. Sawyer, & B. Tomaszewicz (Eds.), *Proceedings of the 28th west coast conference on formal linguistics* (pp. 33–41). Cascadilla Press.

Alexiadou, A., & Wilder, C. (1998). Adjectival modification and multiple determiners. In A. Alexiadou & C. Wilder (Eds.), *Possessors, predicates and movement in the dp* (pp. 303–332). Amsterdam: John Benjamins.

Allan, K. (1980). Nouns and countability. *Language*, *56*(3), 541-567. Retrieved from http://www.jstor.org/stable/414449

Bale, A. C., & Barner, D. (2009). The interpretation of functional heads: Using comparatives to explore the mass/count distinction. *Journal of Semantics*, *26*(3), 217-252. Retrieved from http://dx.doi.org/10.1093/jos/ffp003 doi: 10.1093/jos/ffp003

Bolinger, D. (1972). *Degree words*. The Hague: Mouton.

Borer, H. (2005). *In name only (structuring sense vol. i)*. Oxford: Oxford University Press.

Broekhuis, H., & den Dikken, M. (2012). *Syntax of dutch: Nouns and noun phrases: volume 2*. Amsterdam: Amsterdam University Press.

Bunt, H., & Bunt, H. (1985). *Mass terms and model-theoretic semantics*. Cambridge University Press.

Campos, H., & Stavrou, M. (2004). Polydefinite constructions in modern greek and in aromanian. In O. M. Tomić (Ed.), *Balkan syntax and semantics* (pp. 136–173). Amsterdam: John Benjamins Publishing Company. Retrieved from https://doi.org/10.1075/la.67.09cam doi: 10.1075/la.67.09cam

Carr, C. (1936). Number in Old High German. *The Journal of English and Germanic Philology*, *35*(2), 214-242.

Cheng, L. L.-S., & Sybesma, R. (1999). Bare and not-so-bare nouns and the structure of NP. *Linguistic Inquiry*, *30*(4), 509-542.

Chierchia, G. (1998a). Plurality of mass nouns and the notion of 'semantic parameter'. In S. Rothstein (Ed.), *Events and grammar.* Dordrecht: Kluwer.

Chierchia, G. (1998b). Reference to kinds across languages. *Natural Language Semantics*, *6*, 339-405.

Chierchia, G. (2010). Mass nouns, vagueness and semantic variation. *Synthese*, *174*, 99–149.

Chung, S. (2000). On reference to kinds in Indonesian. *Natural Language Semantics*, *8*(2), 157-171.

Corbett, G. G., & Mithun, M. (1996). Associative forms in a typology of number systems: Evidence from yup'ik. *Journal of Linguistics*, *32*(1), 1-17. Retrieved from http://www.jstor.org/stable/4176343

Cresswell, M. (1976). The semantics of degree. In B. Partee (Ed.), *Montague grammar.* New York: Academic Press.

Dalrymple, M., & Mofu, S. (2012). Plural semantics, reduplication, and numeral modification in Indonesian. *Journal of Semantics*, *29*(2), 229–260.

Deal, A. R. (2013). *Apportionment and the mass-count distinction in Nez Perce.* (Ms., UC Santa Cruz)

de Vries, H. (2010). *Evaluative degree modification of adjectives and nouns.* (Unpublished MA thesis, Utrecht University)

Diesing, M. (1992). *Indefinites.* Cambridge Mass.: MIT Press.

Doetjes, J. (1997). *Quantifiers and selection: on the distribution of quantifying espressions in french, dutch and english.* HIL Dissertation #32 (Leiden).

Francez, I., & Koontz-Garboden, A. (2017). *Semantics and morphosyntactic variation: Qualities and the meaning of property concepts.* Oxford: Oxford University Press.

Gillon, B. (1992). Towards a common semantics for english count and mass nouns. *Linguistics and Philosophy*, *15*(6), 537-639.

Gillon, C. (2010). The mass-count distinction in Innu-aimun: implications for the meaning of plurality. In *Proceedings of the 15th Workshop on Structure and Constituency in Languages of the Americas* (p. 12-29).

Gillon, C. (2012). Evidence for mass and count in inuttut. *Linguistic Variation*, *12*, 211–246.

Grimm, S. (2012). *Number and individuation* (Unpublished doctoral dissertation). Stanford University.

Heim, I. (2000). Degree operators and scope. In B. Jackson & T. Matthews (Eds.), *Proceedings of SALT 10.*

Kadaryanto, B. (2010). *Numeral classifiers and plural in Indonesian nominals.* (Unpublished MA thesis, Utrecht University)

Kane, F., Tsoulas, G., Folli, R., Alexopoulou, T., & Romoli, J. (2015). A scalar implicature-based account of the inference of pluralized mass (and count) nouns. In *Proceedings of CLS 51* (p. 317-331).

Kayne, R. (1994). *The antisymmetry of syntax.* Cambridge, MA: MIT Press.

Kennedy, C., & McNally, L. (2005). Scale structure, degree modification, and the semantics of gradable predicates. *Language*, *81*(2), 345-381.

Khrizman, K., Landman, F., Lima, S., Rothstein, S., & Schvarcz, B. (2015). Portion readings are count readings, not measure readings. In *Proceedings of the 20th Amsterdam Colloquium* (p. 197-206).

Klockmann, H. (2017). *The design of semi-lexicality.* Utrecht: LOT Publications.

Landman, F. (2011). Count nouns - mass nouns - neat nouns - mess nouns. In B. H. Partee, M. Glanzberg, & J. Škilters (Eds.), *Formal semantics and pragmatics: discourse, context and models. the Baltic international yearbook of cognition, logic and communication, vol. 6.* Manhattan (KS): New Prairie Press.

Landman, F. (2016). Iceberg semantics for count nouns and mass nouns: classifiers, measures and portions. In S. Rothstein & J. Škilters (Eds.), *Number: Cognitive, semantic and crosslinguistic approaches. the Baltic international yearbook of cognition, logic and communication, vol. 11.* Manhattan (KS): New Prairie Press.

Lima, S. (2014). All notional mass nouns are count nouns in Yudja. In *Proceedings of SALT 24.*

Link, G. (1983). The logical analysis of plurals and mass terms: a lattice-theoretical approach. In R. Bäuerle, C. Schwarze, & A. von Stechow (Eds.), *Meaning, use and interpretation of language* (p. 302-323). Berlin: De Gruyter.

Manolessou, I. (2000). *Greek noun phrase structure: a study in syntactic evolution.* (Unpublished doctoral dissertation). University of Cambridge.

Mathieu, E. (2012). Flavors of division. *Linguistic Inquiry*, *43*(4), 650-679.

Moltmann, F. (1997). *Parts and wholes in semantics.* Oxford: Oxford University Press.

Morzycki, M. (2009). Degree modification of gradable nouns: size adjectives and adnominal degree morphemes. *Natural Language Semantics*, *17*, 175-203.

Morzycki, M. (2012). The several faces of adnominal degree modification. In J. Choi, E. A. Hogue, J. Punske, D. Tat, J. Schertz, & A. Trueman (Eds.), *Proceedings of the West Coast Conference on Formal Linguistics (WCCFL) 29* (pp. 187–195). Somerville, MA: Cascadilla Press.

Nedjalkov, I. (1997). *Evenki.* London/New York: Routledge.

Panagiotidis, F., & Marinis, T. (2011). Determiner spreading as dp-predication*. *Studia Linguistica*, *65*(3), 268-298. Retrieved from `https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1467-9582.2011.01186.x` doi: 10.1111/j.1467-9582.2011.01186.x

Partee, B., & Borschev, V. (2012). Sortal, relational, and functional interpretations of nouns and Russian container constructions. *Journal of Semantics*, *29*(4), 445-486.

Renans, A., Romoli, J., Makri, M., Tieu, L., de Vries, H., Folli, R., & Tsoulas, G. (2018). *The abundance inference of pluralised mass nouns is an implicature: Evidence from Greek.* (To appear in *Glossa*)

Rett, J. (2015). *The semantics of evaluativity.* Oxford: Oxford University Press.

Rothstein, S. (2010). Counting and the mass/count distinction. *Journal of Semantics*, *27*(3), 343. Retrieved from `+http://dx.doi.org/10.1093/jos/ffq007` doi: 10.1093/jos/ffq007

Rothstein, S. (2011). Counting, measuring and the semantics of classifiers. In B. Partee, M. Glanzberg, & J. Škilters (Eds.), *Formal semantics and pragmatics: discourse, context and models. the Baltic international yearbook of cognition, logic and communication, vol. 6.* Manhattan (KS): New Prairie Press.

Rothstein, S. (2017). *Semantics for counting and measuring.* Cambridge: Cambridge University Press.

Sauerland, U., Anderssen, J., & Yatsushiro, K. (2005). The plural is semantically unmarked. In S. Kesper & M. Reis (Eds.), *Linguistic evidence.* Berlin: Mouton de Gruyter.

Sharifan, F., & Lofti, A. R. (2003). "rices" and "waters". the mass-count distinction in modern persian. *Anthropological Linguistics*, *45*, 226-244.

Spector, B. (2007). Aspects of the pragmatics of plural morphology: On higher-order implicatures. In U. Sauerland & P. Stateva (Eds.), *Presupposition and implicature in compositional semantics.* Palgrave.

Sutton, P., & Filip, H. (2016). Mass/count variation: a mereological, two-dimensional semantics. In S. Rothstein & J. Škilters (Eds.), *The baltic international yearbook of cognition, logic and communication, volume 11: Number: Cognitive, semantic and crosslinguistic approaches.* Manhattan (KS): New Prairie Press.

Tovena, L. M. (2001). Between mass and count. In K. Megerdoomian & L. Bar-el (Eds.), *Proceedings of WCCFL 20* (p. 565–578). Somerville, MA: Cascadilla Press.

Tsoulas, G. (2009). On the grammar of number and mass terms in Greek. In C. Halpert, J. Hartman, & D. Hill (Eds.), *Proceedings of the 2007 workshop in Greek syntax and semantics at MIT.* MIT Working Papers in Linguistics.

van Kuppevelt, J. (1996). Inferring from topics: Scalar implicatures as topic-dependent inferences. *Linguistics and Philosophy*, *19*(4), 393-443.

van de Velde, D. (1996). *Le spectre nominal. des noms de matières aux noms d'abstractions.* Leuven: Peeters.

Wiese, H., & Maling, J. (2005). Beers, Kaffi, and Schnaps: Different grammatical options for restaurant talk coercions in three Germanic languages. *Journal of Germanic Linguistics*, *17*(1), 1-38.

Wiltschko, M. (2012). Decomposing the mass/count distinction. evidence from languages that lack it. In D. Massam (Ed.), *Count and mass across languages.* Oxford University Press.

Wiltschko, M., & Steriopolo, O. (2007). Parameters of variation in the syntax of diminutives. In *Proceedings of the annual conference of the Canadian Linguistic Association.*