A measure based analysis of plural mass nouns in Greek[1]

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Abstract. This paper explores the feasibility of accounting for plural mass nouns in Greek via a measure function that is assumed to be part of the meaning of plural nouns. Such an approach is used to account for the readings of plural count nouns in Krifka (1989, 1995) and Grimm (2013). The characteristics of plural mass nouns in Greek, however, present a particular challenge that cannot be straightforwardly applied to previous measure based analyses. Greek plural mass nouns are used to discuss amounts of a substance, sometimes small and sometimes large, and are accompanied by a particular inference that disappears in certain contexts. These characteristics have been analyzed in a variety of ways (Tsoulas, 2009; Alexiadou, 2011; Chierchia, 2015; Kane et al., 2015; Kouneli, 2019) though never in terms of measurement. I argue that a measure based analysis that incorporates a structure of discourse based on questions under discussion (Grimm, 2013; Roberts, 1996) can account for the characteristics of plural mass nouns in Greek. I build this analysis on the rich, context sensitive lexical structures in Sutton and Filip (2017), as they can straightforwardly accommodate a notion of context-sensitive measurement that can apply to both count and mass nouns in Greek.

Keywords: plurality, count/mass, Greek, measurement, context-sensitivity.

1. Introduction

The point of departure for this paper is the assumption that mass nouns in number marking languages, e.g. English, do not straightforwardly take number morphology (Pelletier, 1975; Allan, 1980; Chierchia, 1998, 2010, 2015) unless shifted to portion or kind readings. This assumption is supported by the fact that (1) is deemed ungrammatical while (2) is not.

(1)   *There are bloods on the wall.   (Chierchia, 1998: p. 55)

(2)   In this lab we store three bloods. ⇒
         In this lab we store three kinds of blood.   (Chierchia, 1998: p. 57)

The inability to straightforwardly pluralize mass nouns is sometimes predicted on related assumptions, for example Chierchia (1998) assumes that mass nouns are semantically plural, so they cannot take plural morphology.

In contrast to this assumption is the fact that some number marking languages allow mass nouns to take plural morphology without being shifted to a kind or portion interpretation. This phenomenon has been documented in Greek (Tsoulas, 2009), Persian (Sharifian and Lotfi, 2003), Hebrew (Doron and Müller, 2013), Halkomelem Salish (Wiltschko, 2008), Ojibwe (Mathieu, 2012; Wiltschko, 2012), and Blackfoot (Wiltschko, 2012).

(3)   Trehoun   nera   apo to tavani.
         drip.3RD.PL water.PL.NEUT.NOM from the ceiling.NEUT.SG
         'Water is dripping from the ceiling'   (Tsoulas 2008 p. 133)

The un-shifted plural mass nouns in Greek, (3), have been associated with a particular inference that has been described as a 'much' inference by Tsoulas (2009) and Alexiadou (2011), an abundance inference by Kane et al. (2015), and more recently as a 'spread/scattered' inference by Kouneli (2019) given the amounts described can be very small, and they are often spread or scattered across a surface. This inference has also been shown to disappear in certain cases by Kane et al. (2015). These have led to typological claims about number marking and several different analyses of formally marked plurals. Tsoulas (2009), for example, argues that plural morphology is sum-creating for count nouns but redundant plurals on mass nouns, Acquaviva (2008); Alexiadou (2011) and Kouneli (2019) distinguish between grammatical plurals (plural count nouns) and lexical plurals (the sort seen in (3)), and Chierchia (2015) defines distinct systems of number marking where that in English is strong and that in Greek is weak.

This paper discusses the feasibility of accounting for these mass nouns via a measure function that is assumed to be part of the meaning of plural nouns. Such an approach is used in Krifka (1989, 1995) and Grimm (2013) to account for the readings of plural count nouns. Combined with the QUD-based approach to the analysis of the readings of plural nouns argued for by Grimm (2013), this paper shows that a measure based analysis of plurals allows a more uniform treatment of Greek plural nouns than has been previously proposed and it also accounts for the 'spread/scattered' interpretation argued for by Kouneli (2019).

2. Background: Greek Data

While Greek has a straightforward mass/count distinction similar to that in other number marking languages—e.g. English—Greek is unlike most other number marking languages in that it has plural mass nouns that are true mass nouns (Tsoulas, 2009). The mass/count distinction in Greek can be uncovered using the sort of tests outlined by Chierchia (1998), such as the ability of nouns to directly combine numericals. As is typical in number marking languages, object denoting nouns like *molyvi* ('pencil') can directly combine with numericals like *dio* ('two') and are therefore reveled to be count, while substance denoting nouns like *melani* ('ink') cannot straightforwardly combine with a numerical—i.e. they cannot combine with a numerical outside of a context that enforces a kind or portion interpretation—and are therefore revealed to be mass.

(4) a. dio molyvia   b. dio melania
         two pencil.PL   two ink.PL
         'two pencils'   #'two inks'

At the same time, plural morphology is straightforwardly infelicitous on mass nouns in English (Chierchia, 1998), but plural morphology is acceptable on mass nouns in Greek as in (3). The interpretation of a plural mass noun like *nera* ('waters') in (3) has been described as one in which there is an abundance of water (Tsoulas, 2009; Alexiadou, 2011; Kane et al., 2015), though it has recently been argued that 'spread/scattered' better captures the notion (Kouneli, 2019). Crucially, examples like (3) do not involve a shift to portions or kinds, which is shown in the fact that these plural mass nouns cannot be counted as in (5).

(5) *Dio nera   trehun apo to tavani.
       two water.PL run   from the ceiling
       'Two waters dripped from the ceiling   (Tsoulas, 2009: p. 135)

Because these nouns cannot be counted, they are true mass nouns, and are here referred to as

plural mass nouns.

It has been claimed that Greek mass nouns can freely pluralize (Kouneli, 2019). At the same time, it has been noted that there are some lexical restrictions on Greek plural mass nouns (Alexiadou, 2011) and contextual restrictions as well Tsoulas (2009).

Alexiadou (2011) claims there are lexical restrictions on Greek plural mass nouns, in respect to how freely certain nouns pluralize and which predicates they occur with. In particular, *nero* ('water'), *ladi* ('oil'), *laspi* ('mud'), *ammos* ('sand'), *rizi* ('rice'), *chioni* ('snow') seem better in plural form than *meli* ('honey'), *chymos* ('juice'), *kykloforia* ('traffic') (Alexiadou, 2011: p. 36). At the same time, Greek plural mass nouns are often found with *spray/load* predicates like 'fall', 'spray', 'drip', 'gather'. These restrictions on plural mass nouns suggest that, though pluralization of mass nouns may be free according to Kouneli (2019), there is nevertheless a relationship between the nouns themselves and the predicates with which they occur.

Additionally, Tsoulas (2009) shows that there are contextual restrictions on Greek plural mass nouns. For example, it would be perfectly felicitous to use *nera* ('waters') when there is water covering the kitchen floor (6) or *amous* ('sands') when someone has tracked sand into their house (7), but it would be infelicitous for a bricklayer to use *laspes* ('muds') to refer to the mortar in a mixer to be used for bricklaying (8).

(6) To patoma itan gemato nera.
     the floor was full water.PL
     'The floor was full of water.'   (Tsoulas, 2006: p. 5)

(7) Irthe katefthian apo tin amoudia mesa ke mas gemise amous.
     came-he straight from the beach inside and us.CL filled sand.PL
     'He came from the beach straight inside and filled the place with sand.'
                                                                       (Tsoulas, 2006: p. 5)

(8) *I laspes eginan.
     The mud.PL are-done
     'The mortar is ready.'
     (when pointed to by a brick-layer who is mixing mortar)   (Tsoulas, 2009: p. 134)

The intuition that arises from such examples is that contained or collected substances are less acceptable than spread or scattered substances when it comes to the use of plural mass nouns (Tsoulas, PC).

The intuition that plural mass nouns encode a notion of 'spread/scattered' has been argued for by Kouneli (2019). To argue in favor for 'spread/scattered' as opposed to 'much', Kouneli (2019) provides contexts in which larger volumes—i.e. abundances—of substances correspond to infelicitous uses of plural mass nouns relative to contexts with smaller, but nevertheless spread/scattered amounts of a substances. For example, when a pan is full of rice, cooked for a meal and ready to serve, only the singular is appropriate in a sentence like (9a). If a pan has a handful of grains of rice scattered across its surface after a meal has been eaten, for instance, then it is appropriate to use the singular or plural (9b).

(9) a. I   katsarola   exi   rizi.
         the.NOM pan.NOM.SG has.3SG rice.ACC.SG
         'The pan has rice.'

    b.   I   katsarola   exi   rizia.
         the.NOM pan.NOM.SG has.3SG rice.ACC.PL
         'The pan has rice all over its surface.'   (Kouneli, 2019: p. 241)

Similar to a pan of rice, when someone fills a tub with water in preparation for a bath, the tub full of water can only be described as such with *nera* ('water') in the singular (10a). On the other hand, before the bathtub has been filled, if that person walks into the bathroom expecting to find a dry tub, but instead finds one with a bit of water in the bottom and on the upper edge, it can be described as full of *nera* ('water') or *nero* ('waters') as in (10b).

(10)   a.   I   baniera   ine   gemati   nero.
            the.NOM bathtub.NOM.SG is.3SG full.NOM.SG water.ACC.SG
            'The bathtub is full of water.'
    b.   I   baniera   ine   gemati   nera.
            the.NOM bathtub.NOM.SG is.3SG full.NOM.SG water.ACC.PL
            'There is water all over the bathtub's surface.'(Kouneli, 2019: p. 241)

Kouneli (2019) argues that these examples show that the interpretation of the plural mass noun is "spread over a surface in a disorderly way", rather than "a great amount of".

3. Previous Analyses

Kane et al. (2015) lay out two challenges that plural mass nouns in Greek pose:

(A) THE CROSSLINGUISTIC CHALLENGE:
    What distinguishes languages, like Greek, which allow pluralized mass nouns, from those like English which do not?

(B) THE INFERENCE CHALLENGE:
    How should we account for the inference that pluralized mass nouns give rise to in those languages in which they are allowed?   (Kane et al., 2015: p. 318)

These challenges encompass much of what needs to be answered in an analyses of plural mass nouns, namely what is it about Greek that permits the use of plural morphology on mass nouns, and what is the nature of the accompanying inference. In light of the more recent data from Kouneli (2019), I propose that there is one more challenge that must also be met with respect to the use of plural mass nouns in Greek.

(C) THE CONTEXTUAL CHALLENGE:
    How should we account for the fact that certain amounts/distributions of substances are necessary for a plural mass noun to be acceptable in a given context?

Each of these challenges have been addressed by previous analyses of plural mass nouns in Greek, though as will be discussed none of these analyses have comprehensively answered the associated questions.

3.1. Tsoulas (2009) and Chierchia (2015)

Tsoulas (2009), argues that Greek number marking is unlike number marking in English, which, according to Chierchia (1998), maps a set of atoms onto the set of sums of those atoms. Rather than being tied to the semantic pluralization operation as is the case with plural morphology in

English, Tsoulas (2009) argues that Greek plural morphology results in a structure more like intersective adjectival modification, where plural morphology contributes a quantity implicature.

(11)   Waters = water(x) ∧ plural(x) (or nonsingular)   (Tsoulas, 2009: p. 143)

The sort of modification in (11) is freely able to occur on mass nouns, unlike semantic pluralization, which would be redundant on a mass noun that already denotes an atomic semi-lattice.

Chierchia (2015) formalizes the difference between Greek and English with respect to number marking in a different manner. In Chierchia's (2015) most recent analysis of number marking and the mass/count distinction across languages, he assumes Greek number marking is weak, and therefore allows plural mass nouns, while English number marking is strong, and therefore does not allow plural mass nouns. Weak number marking is that in which the *-operator (12), plural predicates, and singular predicates, (14), are all defined with respect to a non-modal notion of atomicity, (13). These atoms are entities in the denotation of a predicate, in world *w*, which have no parts that are also in the denotation of the predicate.

(12)   *: $\lambda w \lambda x \exists Y[Y \subseteq AT(P)_w \wedge = \sqcup Y]$ (Chierchia, 2015: p. 155)

(13) $AT(P) = \lambda w \lambda x[P_w(x) \wedge \forall z[P_w(z) \wedge z \leq x \rightarrow z = x]]$ (Chierchia, 2015: p. 155)

(14)   a. $SG(P) = P$ if $\forall w \forall x [P_w(x) \rightarrow \forall z[P_{w'}(z) \wedge z \leq x \rightarrow z = x]]^2$
         b. $PL(P) = P$ if $*P = P$ (Chierchia, 2015: p. 164)

For Chierchia (2015), Greek mass nouns refer to (unstable) minimal quantities of the entities in the denotation of the noun. An unstable minimal quantity, or atom, is that which may be an atom with respect to a predicate in one world, but not in all accessible worlds as in (15).

(15) $MASS.(P) = \forall w \forall x [P_w(x) \wedge \forall z[P_w(z) \wedge z \leq x \rightarrow z = x] \rightarrow \neg \Box \forall y[P(y) \wedge y \leq x \rightarrow y = x]]$
         If x is a P-atom in w it is consistent with what is known in w that x may be a plurality of smaller Ps.   (Chierchia, 2015: p. 159)

English, on the other hand, has strong number marking, (16), which is defined with respect to a stronger, modal notion of atomicity, namely the definition of stable atoms. An atomic predicate, (17), is one whose atoms are atoms in in every accessible world.

(16)   a.   PL(P)=P if *AT(P)=P
         b.   SG(P)=P if AT(P)=P   (Chierchia, 2015: p. 164)

(17) $AT(P) = \lambda w \lambda x[P_w(x) \wedge \forall w' \in K_w \forall z[P_{w'}(z) \wedge z \leq x \rightarrow z = x]]$ (Chierchia, 2015: p. 161)

Because this definition of number marking requires singular nouns to denote stable atoms, but mass nouns denote unstable atoms, (15), Chierchia (2015) assumes that English encodes mass nouns as a singleton property, namely the maximal plural individual that results from the closure of unstable minimal entities under '⊔ via the *-operator. The same cannot happen in Greek, however, since singular nouns, by definition, are not stably atomic.

The assumption that Greek number marking is weak results in the predication that mass nouns can straightforwardly take plural morphology, just like count nouns, resulting in the closure under sum of (unstable) atoms. This analysis also predicts that Greek should have no object

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^{2}I assume that the prime on the second P_w is a typo rather than unbound.

mass nouns, which Tsoulas (2009) reports to be the case: Greek nouns that might be object mass are, in fact, count, e.g. *epiplo* ('piece of furniture'), *asimiko* ('piece of silverware'), and *maheropiruno* ('piece of cutlery'). These nouns cannot be mass, under this analysis of number marking, because object mass nouns only result as a matter of lexical choice in strong number marking languages, which have a means of encoding mass nouns a singleton properties in order to satisfy the requirement that singular nouns are stably atomic. Since Greek is not a strong number marking language and does not have a definition of singular nouns that acts as a driving force for encoding mass nouns a singleton properties, lexical choice does not occur in Greek, and object mass nouns should not exist. In sum, Chierchia's (2015) account of number marking in Greek and English ties the existence of both plural mass nouns and object mass nouns in a particular language to the particular type of number marking that language has, weak or strong.

3.2. Alexiadou (2011, 2015) and Kouneli (2019)

Alexiadou (2011) and Kouneli (2019) both argue for a lexical approach to the analysis of plural mass nouns in Greek. They assume a lexical inference is in the literal meaning of sentences containing plural mass nouns, with (Alexiadou, 2011) arguing for a 'much' inference, and (Kouneli, 2019) arguing for a 'spread/scattered' inference. Both Alexiadou (2011) and Kouneli (2019) follow Acquaviva (2008) in assuming a split analysis of plural morphology.

Acquaviva's (2008) split analysis involves two realizations of plural morphology, grammatical and lexical. Grammatical pluralization corresponds to semantic pluralization, such as that in Chierchia (2015), which has been widely assumed since Link (1983). The assumption is that the use of plural morphology corresponds to a semantic operation on the singular noun that results in reference to sums of individuals (and sometimes the individuals themselves depending on whether or not an inclusive or exclusive analysis of the plural is being argued for). Lexical pluralization, on the other hand, is the result of plural morphology combing with a root before it is nominalized, thereby encoding plurality into the meaning of the noun, though not in the sense of "many an *x*". Lexical plurals, Acquaviva (2008) argues, belong to a class of nouns that is nuanced and varied with respect to plural meaning. This class includes nouns like *scissors*, for which plural morphology makes reference to the component parts, and it includes *brethren*, for which the irregular plural form of *brother* takes on a meaning more like *confrères* in French.

Rather than arguing that Greek number marking as a whole is different from that in English as Tsoulas (2009) and Chierchia (2015) argue, Alexiadou (2011) and Kouneli (2019) argue that Greek differs from English in having these lexical plurals that are used to refer to 'much' or 'spread/scattered' respectively. By not tying plural mass nouns in Greek to semantic plurality, or singular number marking, Alexiadou (2011) and Kouneli (2019) make no commitment to a relationship between plural mass nouns and object mass nouns in Greek.

Alexiadou (2015) shows there is reason to believe Greek does, in fact, have object mass nouns. *Epiplosi* ('furniture'), for example, can refer to one or more objects without plural morphology, (18), and it can felicitously be modified by stubbornly distributive predicates, (19), thereby showing it denotes objects (Schwarzschild, 2011; Rothstein, 2010).

(18)   Agorasa   kenuria epiplosi ja to   grafio mu
          bought-1SG new   furniture for DEF office my
          I bought new furniture for my office.   (Alexiadou, 2015: p. 14)

(19)   I   epiplosi sto domatio ine strogili.
        the furniture in room   is round
        'The furniture in the room is round.'   (Alexiadou, 2015: p. 15)

Alexiadou (2015) provides a morphosyntactic analysis of object mass nouns in Greek using Distributional Morphology. Following Harley (2005) roots can be categorized into ontological types—e.g. things/entities and states—and following Borer (2013) affixes categorize—e.g. nominalize roots—and carry semantic content as well (Borer, 2013). Words are formed by category defining heads—e.g. n (N) or v (verb)—in two ways: (i) they combine directly with a root—e.g. root nominalization—or (ii) they occur with a stem—e.g. deverbal nominalization (20).

(20) $[_{nP}$ m $[_v$ iz $[_{\sqrt{}}$ ruh $]]]$ *rohismos* ('clothing')   (Alexiadou, 2015: p. 19)

Object mass nouns are therefore interpreted as a collectivity of entities or a bundled aggregate, e.g. (20). As collectivities/bundles, object mass nouns cannot be individuated, meaning they cannot serve as input to morphosyntax where individuation is assumed to occur—e.g. they cannot take grammatical plural morphology. This analysis of object mass nouns in Greek, not being tied to number marking, is therefore compatible with the lexical approach to plural mass nouns in Greek, argued for by both Alexiadou (2011) and Kouneli (2019).

3.3. Kane et al. (2015)

Kane et al. (2015) aim to provide a proof of concept for a scalar implicature based approach to the meaning of plural mass nouns in Greek. While they follow the approach to scalar implicature of Spector (2007), it is meant to be compatible with other approaches as well. Kane et al. (2015) argue that a scalar implicature based approach is preferable to the lexical approach (Alexiadou, 2011) where the inference is encoded directly in the noun. The problem with the lexical approach is that, while positive statements with plural mass nouns are equivalent to those with, e.g. 'much', explicitly stated, negative statements, conditionals, and questions are not. For example, *nera* ('waters') in (21), is argued to be equivalent to *much water* by Alexiadou (2011).

(21)   O Yanis ehise nera.
        'John spilled waters.'
        ⇝ *John spilled much water.*   (Kane et al., 2015: p. 328)

This equivalency does not hold, however, in downward entailing environments such as the negative statement in (22), where it cannot be the case that John spilled even a little water, which would be true if the utterance were actually "John didn't spill much water".

(22)   O Ynis den ehise nera.
        'John didn't spill waters'
        ⇸ *John didn't spill much water.*
        ⇝ *John didn't spill any water.*   (Kane et al., 2015: p. 328)

Kane et al. (2015) show that the existence of the inference in upward entailing environments and its disappearance in downward entailing environments parallels the exclusive inference on plural count nouns. In (23), *giraffes* is interpreted as an exclusive plural, meaning that John saw two or more giraffes.

(23) John saw giraffes.
      ⤳ *John saw two or more giraffes.*   exclusive reading (Kane et al., 2015: p. 326)

In the negative statement in (24), however, *giraffes* must be interpreted as an inclusive plural meaning that John cannot have seen even one giraffe.

(24) John didn't see giraffes.
      ⇸ *John didn't see two or more giraffes.*
      ⤳ *John didn't see one or more giraffes.*   inclusive reading (Kane et al., 2015: p. 326)

Because the 'much' inference of plural mass nouns patterns with the exclusive inference associated with plural count nouns, Kane et al. (2015) analyze the former as arising via the same mechanism as the latter, namely scalar implicature based on exhaustification of alternatives, (25), where the competitors are $\{$PL, SG$\}$; $\{$SG$_{COUNT}$, two or more $\}$; $\{$SG$_{MASS}$, much $\}$. Exhaustification negates and excludes alternative utterances derived from competitor sets.

(25) $[\![\text{EXH}p]\!]^w = [\![p]\!]^w \forall q \in \text{EXCL}(p, Alt(p))[\neg [\![p]\!]]^w$
      $\text{EXCL}(p, X) = \{q \in X : p \nsubseteq q \wedge \neg \exists r[(p \wedge \neg q) \subseteq r]\}$ (Kane et al., 2015: p. 325)

According to Kane et al. (2015), the interpretation of the the plural mass noun in (21) beings with the assumption that it is equivalent to the singular, which is paraphrased in English along with its alternatives in (26). Exhaustification of the singular leads to the interpretation in (27).

(26) Alt(John spilled water) = $\left\{ \begin{array}{l} \text{John spilled water} \\ \text{John spilled much water} \end{array} \right\}$ (Kane et al., 2015: p. 328)

(27) $[\![\text{EXH}]\!]^w(\text{John spilled water}) = [\![\text{John spilled water}]\!]^w \wedge \neg [\![\text{John spilled much water}]\!]^w$
      $= [\![\text{John spilled little waters}]\!]^w$ (Kane et al., 2015: p. 328)

The plural sentence is doubly exhaustified, (28), resulting in a 'much' inference.

(28) $[\![\text{EXH}]\!]^w([\![\text{EXH}]\!]^w(\text{John spilled waters})) =$
      $[\![\text{John spilled waters}]\!]^w \wedge \neg [\![\text{John spilled little water}]\!]^w =$
      $[\![\text{John spilled much waters}]\!]^w$ (Kane et al., 2015: p. 328)

Semantically, Kane et al. (2015) assume that singular count nouns denote atomic individuals, plural count nouns denote atoms and sums thereof, and mass nouns are inherently semantically plural, denoting atoms and sums thereof. Following Chierchia (2010), they assume that mass noun atoms are unstable thereby distinguishing them from plural count nouns. Kane et al. (2015) assume that plural morphology corresponds to the closure of individuals under sum, explaining the correspondence of plural count nouns to singular count nouns. However, because mass nouns are inherently semantically plural, the closure under sum associated with morphological pluralization is semantically redundant on mass nouns. At the same time, however, pluralization triggers a scalar implicature on both count nouns and mass nouns, where the inference associated with count nouns is 'two or more' and the inference associated with mass nouns is 'much'.

3.4. Discussion of previous analyses

The analyses of Tsoulas (2009); Chierchia (2015); Kane et al. (2015); Alexiadou (2011, 2015) and Kouneli (2019) are each able to answer some of the questions that have been raised regarding plural mass nouns in Greek, though other questions are left unanswered.

The approaches of Tsoulas (2009) and Chierchia (2015), for example, distinguish Greek number marking as weaker than that of English, answering the question why Greek has plural mass nouns while English does not. Chierchia (2015), however, provides no account of the inference associated with plural mass nouns, and neither Chierchia (2015) nor Tsoulas (2009) address the contextual restrictions on when plural mass nouns are (not) appropriate. Furthermore, these approaches predict that Greek has no object mass nouns, which might be unwanted given Alexiadou's (2015) argument that Greek has object mass nouns.

The approaches of Alexiadou (2011) and Kouneli (2019) distinguish plural mass nouns in Greek as lexical plurals that simply do not occur in languages like English. The inference is accounted for as part of idiosyncratic meaning of this type of lexical plural, either meaning 'much' (Alexiadou, 2011) or 'spread/scattered' (Kouneli, 2019). The fact that a singular mass noun and its lexically plural counterpart are fundamentally two different nouns that share a common root can address the contextual challenge, via the respective lexical semantics of the nouns. This sort of approach, however, does not seem compatible with the evidence from Kane et al. (2015), that the inference disappears in downward entailing contexts.

The scalar implicature approach of Kane et al. (2015) straightforwardly accounts for when an inference accompanies plural mass nouns and when it disappears. The semantic basis of this account, however, requires morphological pluralization to be semantically redundant on mass nouns, though this does serve to characterize the distinction between Greek and English, though it is unclear why Greek would accept this redundancy and English would not. Lastly, is unclear how Kane et al. (2015) would account for the contextual restrictions on plural mass nouns, namely that a 'much' inference might occur on when describing rice scattered across a pan after a meal, but not when the pan is full of rice before the meal begins.

4. Proposal

In this section I motivate a novel approach to the analysis of plural morphology in Greek to account for the accompanying inference and contextual restrictions on usage. I argue that Greek plural morphology involves a context sensitive measure function, which is similar in spirit to the analysis of English count nouns by Grimm (2013), who builds on the analysis of nouns by Krifka (1989, 1995) in which count nouns are measured for cardinality of individuals. Extending this to Greek, the idea that will be developed in this section is that mass nouns are measured for *magnitude*—i.e. size/extent. This is meant to capture the notion of 'spread/scattered' (Kouneli, 2019) as opposed to, e.g. volume, which is insufficient given the relevant data.

I build this analysis on Filip & Sutton's (2017) semantic analysis of nouns in which lexical entries are ordered tuples (Landman, 2016; Sutton and Filip, 2016a). The different parts of the tuple represent different aspects of the meaning of nouns, and motivate their combinatorial properties, e.g. counting and pseudo-partitive constructions. This context sensitive analysis of the mass/count distinction provides the necessary criteria, namely the formalization of compositional preconditions and sufficiently rich lexical structures, to build a measure based analysis of plural nouns that accounts for the Greek data.

4.1. Measure based plurals

Grimm (2013) reviews the main arguments for the scalar implicature approach to plurals and

produces evidence and arguments against such an approach. As an alternative, he argues for a Question Under Discussion (QUD) based approach to the analysis of plural nouns, that builds on the analysis in Krifka (1995). Grimm (2013) argues that exclusive and inclusive readings of plural nouns are due to whether the immediate Question Under Discussion (QUD) is concerned with a number of concrete entities greater than or equal to two and therefore exclusive, or concerned with the type of thing named and therefore an inclusive, generic interpretation. The data supporting this argument includes Negative Polarity Item (NPI) licensing environments and others that aren't downward entailing yet nevertheless get inclusive interpretation, which is not predicted to be the case according to previous analyses of the interpretation of plural predicates. The analysis builds on the analysis of nouns in Krifka (1995) and the structure of discourse in Roberts (1996).

Grimm (2013) argues against the recent analyses of plural interpretation and in favor of his own with data that shows the inclusive interpretation is sometimes available in NPI-licensing environments and environments that aren't downward entailing, and therefore not strictly a matter of scalar reasoning.

(29)   Sherlock Holmes should question local residents to find the thief.   (Grimm, 2013)

(30)   I am looking for houses to try to find someone to give us directions.

In both of the above examples, the plurals get inclusive interpretation though they are not downward entailing environments. In neither case does the subject require the object to denote sums if it turns out that the first individual meeting the description satisfies the rest of the context. The case is similar for NPIs, which also do not align with inclusive interpretation.

(31)   a.   I am surprised that anything was there.   [NPI OK]
            b.   I am surprised that boxes were in the office.   [exclusive plural only]

(32)   a.   #Both students who saw *anybody* reported to the police.   [NPI not OK]
            b.   Both students who saw *spies* reported to the police.   [inclusive plural]
                                                                                                    (Grimm, 2013)

If inclusive plurals aligned with NPIs, then it should not be the case that the data above are true. Given that inclusive readings fail to align with downward entailing environments and NPI-licensing environments, Grimm (2013) argues that inclusive plurals do align with generic interpretations. He supports this arguments with experimental evidence in which participants are seen to more strongly prefer inclusive interpretations in generic constructions while exclusive interpretations are preferred in existential constructions.

Grimm's (2013) formal analysis builds on Krifka (1995) in respect to the denotation of nouns and it builds on Roberts (1996) in respect to the structure of discourse. From Krifka (1995), Grimm (2013) builds on the idea that nouns make reference to concepts via the realization relation, R_i, objects via the OU_i function, and number, where i is a variable of type s ranging over possible worlds:

(33) $\lambda y.\lambda i.\lambda n.\lambda x.[R_i(x,y) \wedge OU_i(y)(x) = n]$ (Grimm, 2013)

The difference between the quantified object and instances of a concept, then is whether or not n takes a specific number. If n is ≥ 2 then the noun references a quantified object and the

interpretation is exclusive. If n is not specified, rather it is under existential quantification, then the noun references an instance of a concept and the interpretation is inclusive.

(34a) $\llbracket \text{dogs} \rrbracket := \lambda i.\lambda x.[\text{R}_i(x, DOG) \wedge \text{OU}_i(DOG)(x) \geq 2]$

(34b) $\llbracket \text{dogs} \rrbracket := \lambda i.\lambda x.\exists n[\text{R}_i(x, DOG) \wedge \text{OU}_i(DOG)(x) = n]$ (Grimm, 2013)

Whether *dogs* gets an exclusive or inclusive interpretation depends on which QUD is assumed, following the theory of discourse in Roberts (1996). This QUD based approach allows both existential and generic interpretations of *Ed saw dogs*, polar interrogatives, conditionals, sentences under negation. Grimm (2013) also assumes that the answers to the QUD are strongly exhaustive since the meaning of a question, $?p$, is given by a partition theory of questions (Groenendijk and Stokhof, 1984). In (35), the positive statement corresponds to the QUDs in (a.) and (b.), and the Quantitative QUD is assumed in a situation where reference to particular entities is determined.

(35)   Ed saw dogs.
    a.   Did Ed see dogs? (Existential QUD)
        $?(\lambda i \exists x \exists n[\text{Ed see } x \text{ in } i \wedge R_i(x, DOG) \wedge OU_i(DOG)(x) = n])$
    b.   Did Ed see dogs? (Quantitative QUD)
        $?(\lambda i \exists x[\text{Ed see } x \text{ in } i \wedge R_i(x, DOG) \wedge OU_i(DOG)(x) \geq 2])$ (Grimm, 2013)

For negative statements, the Existential QUD is assumed because it is consonant with denying the existence of entities designated by the noun.

(36)   Ed didn't see dogs.
    a.   *Existential QUD*: Did Ed see any dogs?
    b.   ?*Quantitative QUD*: Did Ed see a plurality of dogs?   (Grimm, 2013)

This approach to the readings of plural nouns accommodates the inferences associated with count nouns, but it is unclear exactly how the inferences associated with plural mass nouns would be accommodated in this system. In particular, for Krifka (1995) the interpretation of mass nouns is not relational and therefore cannot be applied to numbers.

4.2. Counting, measuring, and quantization

Filip and Sutton (2017) present an account of the mass/count distinction that can capture the distribution of nouns in measure phrases. This is achieved, in part, by combining elements of the proposals by Sutton and Filip (2016a, b) and Landman (2011, 2016), who treat the lexical entries of nouns as ordered pairs whose parts motivate the combinatorial properties of nouns. For Filip and Sutton (2017), lexical entries of nouns consist of tuples of the kind $\langle$**extension, c_base$_P$, preconditions**$\rangle$ as in (37). The first slot of the tuple is a predicate for the extension of the noun, and the second slot contains a predicate for the counting base of the noun, which specifies the individuals that can be counted relative to a particular counting schema. The third slot contains preconditions for composition, such as the restriction of Krifka (1989) that requires non-quantized predicates in extensive measure phrases.

The lexical entries of substance and object nouns are semantically distinguished, by Filip and Sutton (2017); Sutton and Filip (2016a, b), with an individuation function, $\textbf{IND}_{\langle\langle e,t\rangle,\langle e,t\rangle\rangle}$, which identifies countable individuals. In (37a) **IND**(CAT) identifies all objects counted as an individual cat, while **IND** is omitted from (37b) because **IND**(MUD) is null given it does

not denote objects. Such a distinction is supported by the ability of pre-linguistic infants to distinguish substances from objects (Soja et al., 1991).

(37a) $[\![cats]\!]^{c_i} = \lambda x.\langle {}^*c_i(\mathbf{IND}(\mathrm{CAT}))(x),\ \lambda y.c_i(\mathbf{IND}(\mathrm{CAT}))(y),\ \varnothing \rangle$

(37b) $[\![mud]\!]^{c_i} = \lambda x.\langle {}^*c_0(\mathrm{MUD})(x),\ \lambda y.c_0(\mathrm{MUD})(y),\ \varnothing \rangle$

The predicates CAT and MUD are number-neutral predicates, which stand in for bundles of properties, perceptual, functional, and otherwise.

The $c_{\langle\langle e,t\rangle,\langle e,t\rangle\rangle}$ function in nominal lexical entries identifies individuals to be counted according to a certain schema. *Specific counting schemas*, c_i, denote maximally disjoint subsets of individuals, and the *null counting schema*, c_0, denotes a set of all, possibly overlapping individuals. The specification of both counting schema and individuation are both necessary to account for, among other things, why it is the case that a noun like *fence* can straightforwardly occur in both counting constructions and pseudo-partitive measure DPs, while a noun like *cat* cannot. In counting constructions, numericals denote numerals and require modification to directly combine with nouns. This modifying function *MOD* contains the precondition that the noun to be counted has a quantized counting base. Following Krifka (1989, 1995), a predicate is quantized iff it holds of something but not of that thing's proper parts.

(38)   QUANTIZED P : $\forall P[\mathrm{QUA}(P) \leftrightarrow \forall x\forall y[P(x) \wedge P(y) \rightarrow \neg(x \sqsubset y)]]$ (Krifka, 1989: p. 78)

Interpreted at a specific counting schema, c_i, both *fence* and *cat* have disjoint counting bases. Counting constructions are composed as in (39).

(39a) $[\![\mathrm{three}]\!]^{c_i} = 3$

(39b) $\mathrm{MOD} = \lambda n.\lambda P.\lambda x.\langle \pi_1(P(x)),\ \mu_{card}(x,\pi_2(P(x)) = n,\ \mathrm{QUA}(\pi_2(P(x))) \rangle$

(39c) $\mathrm{MOD}([\![\mathrm{three}]\!]^{c_i}) = \lambda P.\lambda x.\langle \pi_1(P(x)),\mu_{card}(x,\pi_2(P(x)) = 3,\mathrm{QUA}(\pi_2(P(x))) \rangle$

(39d) $[\![\mathrm{fences}]\!]^{c_i} = \lambda x.\langle {}^*c_i(\mathbf{IND}(\mathrm{FENCE}))(x),\ \lambda y.c_i(\mathbf{IND}(\mathrm{FENCE}))(y),\varnothing \rangle$

(39e) $[\![\mathrm{three\ fences}]\!]^{c_i} = \mathrm{MOD}([\![\mathrm{three}]\!]^{c_i})([\![\mathrm{fence(s)}]\!]^{c_i}) =$

$\qquad \lambda x.\langle {}^*c_i(\mathbf{IND}(\mathrm{FENCE}))(x),\mu_{card}(x,\lambda y.c_i(\mathbf{IND}(\mathrm{FENCE})(y)) = 3,$

$\qquad\qquad \mathrm{QUA}(\lambda y.c_i(\mathbf{IND}(\mathrm{FENCE}))(y)) \rangle$ (Filip and Sutton, 2017: p. 352)

In pseudo-partitive measure DPs, which apply the null counting schema to the nominal argument, *fence* has a non-quantized extension, while *cat*, which denotes the same, countable individuals in every counting schema, still has a quantized extension and is therefore infelicitous. The idea is that what counts as one fence varies from schema to schema (Rothstein, 2010): while the fencing surrounding a rectangular property could be counted as one fence according to one schema, it could be counted as four fences according to another schema. The null counting schema, therefore denotes a set of overlapping individuals. This sort of null schema is not

quantized and is a precondition for composition in pseudo-partitive measure DPs:

(40a) $[\![\text{three}]\!]^{c_i} = 3$

(40b) $[\![\text{meters of}]\!]^{c_i} = \lambda n.\lambda P.\lambda d.\lambda x.$

$\langle \pi_1(P(c_0)(x)), \mu_m(x,d) = n, \neg\text{QUA}(\lambda y.\pi_1(P(c_0)(y))) \rangle$

(40c) $[\![\text{fence}]\!] = \lambda c.\lambda x.\langle c(\textbf{IND}(\text{FENCE}))(x), \lambda y.c(\textbf{IND}(\text{FENCE}))(y), \varnothing \rangle$

(40d) $[\![\text{three meters of fence}]\!]^{c_i} = [\![\text{meters of}]\!]^{c_i}([\![\text{three}]\!]^{c_i})([\![\text{fence}]\!]) = \lambda d.\lambda x.$

$\langle c_0(\textbf{IND}(\text{FENCE}))(x), \mu_m(x,d) = 3, \neg\text{QUA}(\lambda y.c_0(\textbf{IND}(\text{FENCE}))(y)) \rangle$

(Filip and Sutton, 2017: p. 353)

This analysis of nominal structure is able to account for why nouns like *cat* are countable but cannot occur in pseudo-partitive measure DPs without a shift. This shows that quantization is useful for distinguishing different measurable properties, and that rich lexical structures are necessary to straightforwardly capture the distribution of nouns across different DPs.

4.3. Measure based plural nouns in Greek

The analysis of Greek number marking proposed here combines the lexical structure of nouns from Filip and Sutton (2017) and the approach to the interpretation of plurality in Grimm (2013). Extending the analysis of English singular nouns in Filip and Sutton (2017) to Greek, the lexical entries of *gata* ('cat') and *laspi* ('mud') resemble their English counterparts with respect to countability.

(41a) $[\![\textit{gata}]\!]^{c_i} = \lambda x.\langle c_i(\textbf{IND}(\text{CAT}))(x), \lambda y.c_i(\textbf{IND}(\text{CAT}))(y), \varnothing \rangle$

(41b) $[\![\textit{laspi}]\!]^{c_i} = \lambda x.\langle {}^*c_0(\text{MUD})(x), \lambda y.c_0(\text{MUD})(y), \varnothing \rangle$

Greek plural morphology builds on the denotations of all singular nouns in the same way, (42). The *qualities* slot of plural morphology selects that of the singular noun via the projection function π_1 and closes it under sum with the *-operation, though without specifying atoms as done by Chierchia (2015), because, following Filip and Sutton (2017); Sutton and Filip (2016a); Landman (2016); Krifka (1989), a non-atomic mereology is assumed. The c_base_P of the plural noun is identical to that of the singular via the projection function π_2. The preconditions slot contains a function that measures the singular noun's counting base.

(42) $[\![\text{PL}]\!] = \lambda P.\lambda x.\langle {}^*\pi_1(P(x)), \pi_2(P(x)), \mu_{PL}(x.\lambda y.\pi_2(P(x)(y))) > n_k \rangle$

(43a) $[\![\textit{gates}]\!]^{c_i} = \lambda x.\langle {}^*c_i(\textbf{IND}(\text{CAT}))(x), \lambda y.c_i(\textbf{IND}(\text{CAT}))(y),$

$\mu_{PL}(x.\lambda y.c(\textbf{IND}(\text{CAT}))(y)) > n_k \rangle$

(43b) $[\![\textit{laspes}]\!]^{c_i} = \lambda x.\langle {}^*c_0(\text{MUD})(x), \lambda y.c_0(\text{MUD})(y),$

$\mu_{PL}(x.\lambda y.c(\textbf{IND}(\text{MUD}))(y)) > n_k \rangle$

Similar to the analysis proposed by Kane et al. (2015) the extension of mass nouns is already closed under sum, (41b), so the *-operation in the definition of plural morphology, (42), is redundant on mass nouns. However, instead of prompting a scalar implicature as in the account

of Kane et al. (2015), in the present account, plural morphology carries the precondition that the counting base is greater than a contextually specified amount n_k.

While the idea of the measure function can be uniformly applied to both count and mass nouns in Greek, the difference in denotation and interpretation between the two classes of nouns requires further specification of exactly what is being measured. Following Krifka (1989, 1995) and Grimm (2013), count nouns are measured for cardinality of countable individuals. The way that mass nouns are measured, however, is not as straightforward. A simple measure of surface area or volume of the substance will not suffice because an amount of sand in pile does not necessarily sanction the use of the plural mass noun, while that same amount scattered across a floor is enough. Instead, the size or extent of the substance in a certain context is the relevant dimension, which I will gloss as MAGNITUDE, intending to capture the 'spread/scattered' sense argued for by Kouneli (2019). The plural measure function, μ_{PL}, therefore, is sensitive to whether the counting base is quantized.

$$(44) \qquad \mu_{PL} = \left\{ \begin{array}{ll} \mathrm{QUA}(\pi_2(P(x))) & \rightarrow \quad \mu_{CARDINALITY} \\ else & \mu_{MAGNITUDE} \end{array} \right.$$

Sensitivity to quantized counting bases prevents magnitude measurement of count nouns like *gates* ('cats'), and it prevents infelicitous cardinality measurement of mass nouns like *laspes* ('muds'). With the specification in (44), the lexical entries of *gates* ('cats') and *laspes* ('muds') can be further specified:

$$(45a) \qquad [\![gates]\!]^{c_i} = \lambda x.\langle {}^*c_i(\mathbf{IND}(\mathrm{CAT}))(x),\ \lambda y.c_i(\mathbf{IND}(\mathrm{CAT}))(y),$$
$$\mu_{CARDINALITY}(x,\ \lambda y.c_i(\mathbf{IND}(\mathrm{CAT})(y))) > n_k\rangle$$

$$(45b) \qquad [\![laspes]\!]^{c_i} = \lambda x.\langle {}^*c_0(\mathrm{MUD})(x),\ \lambda y.c_0(\mathrm{MUD})(y),$$
$$\mu_{MAGNITUDE}(x,\ \lambda y.c_0(\mathrm{MUD}(y))) > n_k\rangle$$

Crucially, with analysis of the semantic contribution of morphological pluralization, because the counting base of count and mass nouns remain unchanged, the analysis of counting in Filip and Sutton (2017) can be upheld. This means that plural mass nouns are still mass and cannot be counted.

5. Discussion

As has been seen in the background of Greek data, the interpretation of a plural noun varies depending on the context of its use: a plural count noun might get an inclusive or exclusive reading, and a plural mass noun might get an inclusive reading or a spread/scattered reading. While Kane et al. (2015) analyzed these interpretations as the result of scalar implicature, Grimm (2013) argued for a QUD based approach to the interpretation of plural count nouns in English. By building a measure function into the lexical entries of both count and mass nouns in Greek, it is possible to specify the amount measured in a given context, n_k, with the QUD based approach argued for by Grimm (2013).

If plural noun gets an inclusive reading, then it is the case that a Existential QUD has been assumed, asking about any amount greater than zero, $n_k = 0$. If a plural count gets an exclusive reading, then a Quantitative QUD is assumed, asking if the cardinality is larger than one, $n_k = 1$. If a plural mass noun gets a spread/scattered reading, the assumed Quantitative QUD is asking

if the magnitude is large enough to warrant the use of plural in that particular context. These amounts cannot be straightforwardly specified in terms of cardinality, as in the case of count nouns, rather they are determined relative to the context at hand. With respect to (9b), where *rizia* ('rices') is used to describe several grains of rice scattered across a pan, the context is the conclusion of a meal when dishes are typically expected to be empty. The question under discussion introduces a relevant magnitude, $n_{k.empty}$, that is relatively low: the magnitude of the several grains of rice scattered across the pan that should be empty is greater than $n_{k.empty}$, and it is therefore enough to sanction the use of the plural mass noun, (46). With respect to (9a), the context is the conclusion of the rice cooking when a pan is typically expected to be full of rice; the relevant magnitude, $n_{k.full}$, introduced by the QUD is relatively high, so a pan that is full of rice in the usual way is not greater than $n_{k.full}$ and therefore not enough to sanction the use of the plural mass noun, (47).

(46)   Several grains of rice scattered across an empty pan.
$$\mu_{PL}(x.\lambda y.c_0(RICE(y))) > n_{k.empty}$$

(47)   The rice in a full pan.
$$\mu_{PL}(x.\lambda y.c_0(RICE(y))) \not> n_{k.full}.$$

While it is unclear why the 'much' inference argued for by Tsoulas (2009); Alexiadou (2011) and Kane et al. (2015) would be appropriate for certain quantities that are smaller than others that require the singular, the context sensitivity in this QUD based approach straightforwardly accounts for it: relevant magnitudes are introduced by the QUD. Importantly, the relevant quantity for both count and mass nouns can sometimes be zero, thereby prompting an inclusive readings as in negative statements like (22). At the same time, however, the notion of magnitude, spreadedness, and/or scatteredness are relatively unclear, and future work must seek to understand the specifications of the quantities and distributions that warrant plural mass nouns in particular contexts.

5.1. Extending measure based number

Plural morphology is often assumed to correspond to the closure under sum via *, or some variation thereof (e.g. Link, 1983; Chierchia, 1998, 2010, 2015; Tsoulas, 2009; Rothstein, 2010, 2017; Kane et al., 2015). With such an approach to plural morphology, it is unclear exactly how other forms of number marking would be accommodated, such as the dual in Hebrew (48) and paucal in Avar (49).

(48)   a. yom-ayim   b. yom-im   Hebrew
            day-DU   day-PL
            'two days'   'days'   (Corbett, 2000)

(49)   a. nús-al   b. nus-ábi   Avar
            daughter.in.law-PAUC daughter.in.law-PL
            'a few daughters in law' 'daughters in law'   (Corbett, 2000)

Similar to Link (1983) and Chierchia (1998) who define exclusive plurals by defining the pluralization operation as the relative complement of the denotation of a predicate in its upward closure under *, it would in theory be possible to define a series of similar operations that result in the predicate denoting only two, a few, or one entities. Extending measure based number as

in (50), on the other hand, would make these morphemes look much more uniform in analysis: dual morphology would require that the counting base has a cardinality of two, and paucal morphology would require that the cardinality is smaller than a contextually specified amount. Future work is needed to see if such an analysis is, in fact, feasible in such languages.

(50a) $[\![\text{DU}]\!] = \lambda P.\lambda x.\langle {}^*\pi_1(P(x)),\ \pi_2(P(x)),\ \mu_{PL}(x.\lambda y.\pi_2(P(x)(y))) = 2\rangle$

(50b) $[\![\text{PAUC}]\!] = \lambda P.\lambda x.\langle {}^*\pi_1(P(x)),\ \pi_2(P(x)),\ \mu_{PL}(x.\lambda y.\pi_2(P(x)(y))) < n_k\rangle$

Another instance of number marking that might be accounted for with measure based plural morphology is the often unaddressed use of plural morphology on mass nouns in English, where the mass nouns like *water*, *sand*, and *snow* take plural morphology, but do not shift to a kind or portion interpretation as in (51a)–(51c).

(51)   a.   Both waders immediately filled and I caught my breath as freezing April waters
              began to stimulate sensitive nether regions.   (BNC)
        b.   We were in the midst of sands, brushwood, and huge pieces of rock.   (OED)
        c.   one of the first major Alpine highways opened in 1935 to see Austria's highest
              mountain, set amidst the everlasting snows of the Pasterze glacier   (BNC)

Examples such as these are mentioned by Acquaviva (2008), who categorizes them as lexical plurals, and by Krifka (2008), who notes that the phenomenon is not as productive as that in Greek. Recall that Alexiadou (2011) and Kouneli (2019) treat plural mass nouns in Greek as lexical plurals in the same way that Acquaviva (2008) treats examples like those in English immediately above. In these English examples, a notion of 'abundance' seems much more relevant than the notion of 'spread/scattered' recently argued for in Greek. It might be said, then, that Greek lexical plural mass nouns encode this notion of 'spread/scattered', while those in English encode abundance, but this analysis would be premature since Greek also uses mass nouns with plural morphology in the way demonstrated in the English examples above:

(52)   Tzóni efthýmise anakalóntas sti mními tou to pálai poté kinitó tou kai tin olympiakón
        epidóseon voutiá pou ékane sta nerá tou Saronikoú.   (Corpus of Modern Greek)
        'Johnny was right in recalling his dive into the waters of the Saronic Gulf.'

The lexical approach would therefore have to assume that either (i) 'spread/scattered' plural mass nouns are distinct from these 'abundance' plural mass nouns—in which case there are two distinct, but homonymous lexical plurals *nera* ('waters')—or, (ii) that both are the same sort of lexical plural, albeit with one that varies from context to context.

In a measure based approach, both options are likewise available: it might be the case that there are distinct lexical entries where the notion of what is measured is distinct when *nera* ('waters') is used with respect to water splashed around the surface of a bathtub and when it is used with respect to the water of the Saronic Gulf. Alternatively it might be that there is one lexical entry, and context is doing all of the work, determining when *nera* ('waters') is appropriate, be it when it is scattered/spread across the surface of a bath tub or the water of the Saronic Gulf. Under this approach, the English examples would also be considered plural mass nouns, and it would seem that English restricts plural mass nouns to very large amounts, those larger than lakes or gulfs, which would predict why *waters* is never used for spills or splashes, and why *honeys* and *juices* are never used as plural mass nouns—i.e. they never occur in large enough amounts to warrant the use of plural morphology. As a third alternative, it might be the most straightforward to say

that these 'abundance' cases referring to the water in lakes, gulfs, etc. are lexical plurals, while the 'spread/scattered' cases are grammatical, measure based plurals. This approach would have the most potential explanatory power: English and Greek both have lexical plural mass nouns, while grammatical plurals in Greek are based on measurement and those in English are not.

6. Conclusion

This paper has discussed the feasibility of a measure based approach to plural mass nouns in Greek, as opposed to a scalar implicature or lexical plural approach. Greek plural morphology can be treated as introducing a measure function into the NP, where count and mass nouns both take the same, context sensitive plural morpheme. In this approach, it is not the case that plural morphology is straightforwardly semantically redundant on plural mass nouns, rather context sensitive measurement gives rise to contextual restrictions the use of plural mass nouns discussed by Kouneli (2019). This approach, in tandem with a QUD-based analysis of plural nouns based on Grimm (2013), provides the ability to account for inclusive and exclusive readings discussed by Kane et al. (2015). Lastly, because this approach does not tie the existence of object mass nouns to the sort of number marking in English, as done by Chierchia (2015), this analysis leaves open the possibility that Greek does have object mass nouns, as Alexiadou (2015) argues.

With respect to the three challenges posed by plural mass nouns in Greek, a measure based approach provides the following answers: (i) Greek is distinguished from English by having measure based plurality that allows plural mass nouns to be used for describing even small amounts of a given substance, (ii) the inference that plural mass nouns give rise to can be accounted for with this measure based plurality and a QUD-based analysis of the readings of plural nouns, and (iii) the certain amounts/distributions of substances that warrant the use of plural mass nouns are strictly tied to context, which this measure function is sensitive to. These answers and the alternative answers argued for by Tsoulas (2009); Alexiadou (2011); Chierchia (2015); Kane et al. (2015) and Kouneli (2019), however, each inspire more fine-grained questions: What is it about the nature of the Greek DP (or even on a larger scale) that allows for plural mass nouns to describe even small amounts of a substance? And, how can the contextual specifications and measurement of these plural mass nouns be further clarified?

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