1. INTRODUCTION

Cross-linguistically measure nouns in plural NPs may fail to bear plural morphology despite the existence of a plural form:

(1) a. xamiša kilo kemax
    five kilo flour
    *five kilos of flour
    Hebrew, Rothstein 2009

   b. sidzi bərčɔqa əyoši
    four glassful milk
    *four glasses of milk
    Agaw, Hetzron 1967

(2) a. pump o geiniogau
     five of penny.PL
     five pennies (coins)

   b. pum ceiniog
      five penny.SG
      five pence (amount of money)

(3) a. zwei Glas Wasser
     two glass water
     *two glasses of water (quantity)
     German, Grestenberger 2015

   b. zwei Gläs er Wasser
      two glass.PL water
      *two glasses of water (container)

The failure may be related to a particular cardinal or vague cardinal, as in Dutch:

(4) a. drie liter wijn
     three liter.SG wine
     *three liters of wine
     Dutch, Ruys 2017

   b. drie liters wijn
      three liter.PL wine
      *three one-liter units of wine

   c. vele liters wijn
      many liter.PL wine
      *many liters of wine

Or affect only a subset of measure nouns (Klooster 1972:9-10), with minimal pairs like jaar ‘year’ vs. maand ‘month’; uur ‘hour’ vs. minuut ‘minute’:

(5) a. twee jaar/maanden geleden
     two year/month.PL ago
     two years/months ago
     Dutch

   b. vijf uur/minuten
      five hour/minute.PL
      five hours/minutes

Similar facts in Western Armenian (Donabédian 1993:185-187): while plural marking is only possible in specific (or definite) NPs, measure nouns are singular even in definite NPs

Questions:
- What is this plural marking failure due to: syntax, semantics or morphology?
- Why does it affect measure nouns?
Answers:

- It is primarily syntax
- It is about phi-feature deficiency

General conclusion: the need for an additional phi-feature

2. **The Irrelevance of Morphology**

The plural form is available, e.g., in plurals of abundance (a.k.a. the greater plural in Corbett 2000:31-35), as in (6a),(7), with vague cardinals, as in (4c), or in non-measure readings:

(6) a. kilo's en kilo's zand
   kilo.PL and kilo.PL sand
   *kilos and kilos of sand*

   b. Die kilo's die ik ben aangekomen zitten voornamelijk op mijn heupen.
   the kilo.PL that I am gained sit.PL mostly on my hips
   *The kilos that I have gained are mostly on my hips.*

   c. Kilo's zijn zwaarder dan ponden.
   kilo.PL are heavier than pound.PL
   *Kilos are heavier than pounds.*

(7) a. ĸasarot kilogramey zehav
ten.F.PL(CS) kilogram.M.PL.CS gold
   *tens of kilograms of gold*

   b. milyoney dunamey adama
   million.M.PL.CS dunam.M.PL.CS ground
   *millions of dunams of land*

Acquaviva 2008: the plural of abundance as a lexical plural (see also Alexiadou 2011):

(8) a. The river discharges its water/waters into the lake.
   Acquaviva 2008:109

   b. hithikan nera sto patoma.
   Greek, Alexiadou 2011
   *dripped water.PL on floor
   A lot of water dripped on the floor.*

Not likely lexical for measure nouns and lexical powers: fully productive

3. **The Irrelevance of Semantics**

What does the lack of plural marking with measure nouns tell us about the plurality of the NP combining with a cardinal?

- standard view: cardinals combine with plural lexical NPs
- modified standard view: cardinals as measures of cardinality

The plural approach to the semantics of cardinals:

(9) a. \[[\text{three}]\] = \(\lambda x \in D_e \cdot |x|=3\)  
    predicate analysis

   b. \[[\text{three}]\] = \(\lambda f \in D_{(e,t)} \cdot \lambda x \in D_e \cdot f(x) \wedge |x|=3\)  
    modifier analysis

   c. \[[\text{three}]\] = \(\lambda f \in D_{(e,t)} \cdot \lambda g \in D_{(e,t)} \cdot \exists x \ f(x) \wedge g(x) \wedge |x|=3\)  
    quantifier analysis

In all these proposals the cardinal combines with a plural, the only major innovations are the separation of the existential force and cardinality (Landman 2003 et seq.) and the reanalysis of cardinals as degrees (Scontras 2013, 2014, Kennedy 2013, 2015, Rothstein 2013, 2016, [to appear], and Ouwayda 2014)
Why this doesn’t work: because in many languages **cardinals can require a singular lexical NP** (see Ionin and Matushansky [submitted] for more evidence):

(11) **Yhdeksän omena-a puto-si maa-han.** Finnish, Nelson and Toivonen 2000

nine.NOM apple-SG.PART fall-3SG.PAST earth-ILL

*Nine apples fell to earth.*

Finnish has no general number/numberlessness/transnumerality:

(12) a. Luin kirjan/kirjaan. Finnish

read.1SG book.ACC/PART

*I read a book/the book. (≠ I read (the) books)*

b. Luin kirjat/kirjoja.

read.1SG book.PL.ACC/PART

*I read the books/books. (≠ I read a/the book)*

c. Olemme suomalaisia.

be.1PL.PRES Finnish.N.PL.PART

*We’re Finnish.*

If #° encodes semantic plurality (Link’s (1983) *-operator), **a higher cardinal should have no effect on number marking**

There is also conditioned plurality with cardinals (see Ionin and Matushansky [submitted] for more examples):

- conditioned by the choice of the cardinal (e.g., Arabic)
- conditioned by the features of the NP (e.g., Miya: animacy; **Dutch**: measures)
- conditioned by both (e.g., Scottish Gaelic, Irish)

Scottish Gaelic (Greene 1992, more data in Acquaviva 2006):

- the cardinals *one* and *two* combine with a singular lexical NP
- other lower simplex cardinals (‘three’ through ‘ten’) combine with a plural lexical NP, except if merging with the cardinals *fichead* ‘twenty’, *ceud* ‘hundred’ and *mile* ‘thousand’, as well as with the nouns *dusan* ‘dozen’, *duine* ‘person’, *latha* ‘day’ and *bliadhna* ‘year’ (much dialectal variation in the choice), which remain singular
- the higher simplex cardinals (*twenty*, *hundred*, etc.) combine with a singular lexical NP

Such patterns indicate a very narrow connection between the cardinal and the plural marking on the lexical NP

Further evidence: word-internal plurals, semantics of modifiers (which would also have to be plural)

+ Ruys 2017: “if Link’s (1983) standard operation of semantic pluralization were to apply to liters of wine, this would yield the set of all individual sums of one-liter portions of wine (not necessarily measuring multiple liters, since the original portions may overlap materially).”

**Ionin and Matushansky 2006:** cardinals combine with singular lexical NPs

Where does plural morphology come from?
4. **Nominal Number Agreement in Dutch**

Proposal (cf. Krifka 1995): plural marking on the noun in a plural NP results from agreement:

- with a cardinal
- with a *-operator
- with the subject (for predicates)

(13) a. We are doctor*(s).


Jan and Karel spoke as vicar

*Jan and Karel spoke in their capacity of vicar.*

A noun is normally endowed with a [u#] feature (obvious exception: pluralia tantum)

Problem: the uninterpretable unvalued number feature on N does not c-command its valued counterpart:

(14) \[ \begin{array}{c}
\text{DP} \\
\text{D°} & \text{#P/\text{CardP}} \\
\text{#°/\text{Card°}} & \text{NP [u#]} \\
\end{array} \]

Two ways of resolving this problem:

- appeal to more general solutions (e.g., Béjar 2003, Rezac 2003, Béjar and Rezac 2009, etc.)
- introduce an agreement trigger on #° (but potentially not on Card°)

Conditioned agreement for number is possible, especially with cardinals

**4.1. Conditioned Agreement for Number**

Proposal: Card° can be endowed with an uninterpretable feature triggering agreement

Estonian Swedish (Rendahl 2001:156, Koptjevskaja-Tamm and Wälchli 2001:701): feminine nouns take on the plural form in cardinal-containing NPs, while masculine and neuter nouns remain singular:

(15) a. trie man. M.SG

three man. M.SG

Estonian Swedish, Koptjevskaja-Tamm and Wälchli 2001:701

b. fem bärdi-ar

five birch. F-PL. INDEF

five birches

(16) Han gik e lada ø kep gris-ar.

He went into market Ø buy pig. M-PL. INDEF

*He went to the market to buy pigs.*

Core intuition: agreement for one phi-feature can be conditional on the presence of another

Solution: Card° probes for [uγ] (or [uF]) in Estonian Swedish, #° probes for [uN]

Similar patterns: animacy, specificity; distinctions for different types of cardinals

Agreement failure leads to default realizations (Preminger 2011)

Issue: how can you probe for a privative feature?
4.2. The phi-feature lacking in measure nouns

What is needed: the morphosyntactic counterpart of the core semantic property distinguishing measure nouns from regular nouns

Matushansky and Ruys 2014, 2015a, b: **individuation** ([ind])

Problems: remains intuitive, confusion with the notion of individuation used in the literature on prominence hierarchies

Is this a purely diacritic feature?

Alternative proposal: location in concrete space (abbreviated as [3D]) following the proposal by Matushansky and Zwarts 2016 that measure nouns denote containers in one dimensional space

Advantage: multi-modal connection between the measure and container readings of nouns such as bottle or glass:

- semantically: concrete (object) vs. abstract container
- morphosyntactically: a semantically rooted phi-feature [3D]: all nouns that do not denote measures are [+3D]

Natural non-semantic explanation for plural-marked measure nouns, such as maand ‘month’ and minuut ‘minute’: **lexical specification as [-3D]**

(17) a. cardinal + lexical NP
   \[\text{CardP} \quad \text{Card}^{-3D}[\text{pl}] \quad \text{NP}^{-3D}[\#][+3D]\]
   b. cardinal + exceptional measure NP
   \[\text{CardP} \quad \text{Card}^{-3D}[\text{pl}] \quad \text{NP}^{-3D}[\#][-3D]\]
   c. cardinal + measure NP
   \[\text{CardP} \quad \text{Card}^{-3D}[\text{pl}] \quad \text{NP}^{-3D}[\#]\]
   d. *-operator + any NP
   \[\#^{-3D}[\text{pl}] \quad \text{NP}^{-3D}[\#]\]

Assuming that cardinals are specified for the uninterpretable feature that measure nouns lack and all other nouns have (whereas #*, as well as vague cardinals, probe for [uφ], hence for any noun) entails that most measure nouns will not show plural marking under cardinals yet will be marked as plural with vague cardinals and when functioning as a regular noun

The [-3D] specification of the “integer-dependent” (plural with cardinals higher than ‘one’) measure nouns listed by Klooster 1972 is not unintuitive and allows us to use the distinction between the lack of a feature and its negative specification

What happens with vague cardinals, such as many, and the definite article, which both require plural marking on the NP?

D° is specified as [u#] and therefore agrees unconditionally

For vague cardinals two options are available:

- vague cardinals combine with a semantic plural, i.e., with a #P, as in (17d)
- vague cardinals are just like cardinals (i.e., combine with a semantic singular) but have the featural specification that has [uφ] rather than [3D], i.e., as in (17d)

Given the incompatibility of measure nouns with a semantic plural, (ii) is better
4.3. Evidence for a new phi-feature

There is nothing inherently odd about an extra semantically-based phi-feature, cf.:

- noun class categories in Bantu and odd gender classes
- animacy, humanity, rationality…
- classifiers (arising from regular nouns)

The feature involved also interacts with referential hierarchies (Silverstein 1976), being very low on the individuation scale.

Carlson 1977, Heim 1987, Grosu and Landman 1988, Rothstein 2011: the measure reading or denotation affects the choice of the relative pronoun:

(18) …the liters of wine Ø/that/*which they bought for the party

Some property is necessary not only to distinguish measure nouns from non-measure, but to explain also what it means to pass from measure to non-measure and back:

(19) a. zwei Glas Wasser
    two glass water
    two glasses of water (quantity)

    b. zwei Gläser Wasser
    two glass.PL water
    two glasses of water (container)

(20) a. drie liter wijn
    three liter.SG wine
    three liters of wine

    b. drie liters wijn
    three liter.PL wine
    three one-liter units of wine

There is furthermore evidence that some feature distinguishing measure nouns from all others is necessary independently of NP-internal number marking because measure denotation can also affect predicate agreement

5. Predicate number agreement in Dutch

Several cases should be distinguished:

- there-construction
- indefinite preverbal subject (necessarily referential): apparently irrelevant/unclear
- definite preverbal subject

5.1. Number agreement in there-construction

Baseline: plural agreement for plural NPs without a measure noun or with a derived measure noun (obligatorily marked plural):

(21) a. Er liggen/*ligt drie boeken op tafel.
    there lie.PL/SG three books on table
    There are three books on the table.

    b. Er *?zit/zitten twee glazen wijn in de kaasfondue.
    there sit.SG/PL two glass.PL wine in the cheese-fondue
    There are two glasses of wine in the cheese fondue.

Doetjes 1997: distinction between obligatorily singular measure nouns and all other nouns in there-construction:
(22) a. Er zit/*zitten twee liter wijn in de kaasfondue.  
There are two liters of wine in the cheese fondue.  
Doetjes 1997:189
b. Er *?zit/zitten twee glazen wijn in de kaasfondue.  
There are two glasses of wine in the cheese fondue.  
Doetjes 1997:190

Actually, two dialects:

(23) a. Er werd/*werden vijf pond uitgegeven aan kleren.  
£5 were spent on clothes.  
Doetjes 1997:189
b. Er %werd/%werden vijf maanden uitgetrokken voor dit project.  
Five months were reserved for this project.

Not attested: plural predicate agreement with an obligatorily singular measure noun

<table>
<thead>
<tr>
<th>Er GO drie … voorbij.</th>
<th>dialect 1</th>
<th>dialect 2</th>
<th>not attested</th>
<th>not attested</th>
</tr>
</thead>
<tbody>
<tr>
<td>jaar</td>
<td>ging</td>
<td>ging</td>
<td>ging</td>
<td>ging</td>
</tr>
<tr>
<td>maanden</td>
<td>ging</td>
<td>gingen</td>
<td>gingen</td>
<td>gingen</td>
</tr>
</tbody>
</table>

Potential solution: formal [3D] feature in dialect 2 and its semantic counterpart in dialect 1

Further evidence for the relevance of formal features comes from coordinated measure NPs:

(24) Er zit een liter wijn en een liter appelsap in de cocktail.  
There is a liter of wine and a liter of apple juice in the cocktail.

There is no way for a sum to not be semantically plural

5.2. Number agreement with definite measure subjects

Needless to say, plural agreement is obligatory for non-measure nouns

Obligatorily singular measure nouns trigger singular agreement on the verb, except when in a pseudo-partitive:

(25) a. Die vijf pond werd/*werden uitgegeven aan kleren.  
Those five pounds (sterling) were spent on clothes.

b. Deze vijf pond brood ligt/*liggen me zwaar op de maag.  
These five pounds of bread are hard for me to stomach.

c. Deze vijf pond bonen %ligt/liggen me zwaar op de maag.  
These five pounds of beans are hard for me to stomach.

The number of the substance NP appears to influence the number marking on the predicate

Obligatorily plural measure nouns allow both singular and plural agreement (possible for the same speaker):

(26) Die vijf maanden %ging/gingen heel snel voorbij.  
Those five months went by very fast.
But unclear if the plural agreement retains the measure reading

5.3. The source of plural marking on the predicate

If the derivation above is correct, there is a [plural] feature on all numeral NPs (interpretable number on the cardinal)

The obligatorily plural determiner confirms this

The lack of plural agreement on the predicate therefore suggests agreement failure for DPs headed by a measure noun: conditioned agreement again

Same solution: a feature bundle containing an uninterpretable [3D] feature but this time the number feature on the predicate is also uninterpretable:

\[
\begin{array}{c}
\text{TP} \\
\text{[u#][u3D]} \\
\text{VP} \\
\text{[u3D]} \\
\text{DP} \\
\text{[u#][u3D][u3D=α]} \\
\text{CardP} \\
\text{[u#][u3D][u3D=α]} \\
\text{NP} \\
\text{[u#][u3D][u3D=α]} \\
\end{array}
\]

Two features in the same bundle cannot probe separately (Chomsky 2001), so D° (lacking the [3D] feature) won’t do as a goal

NB: Is D° a defective intervener? See below

If the [i3D] feature on the noun is specified as positive (for regular nouns) or negative (for plural measure nouns), the feature bundle on T° is valued and plural agreement arises

If the noun does not carry the [i3D] feature (for singular measure nouns), then probing by [u3D] on T° fails, the feature bundle on T° cannot find an appropriate goal and all agreement fails

In pseudo-partititives, the substance NP can determine agreement:

(28) a. Deze vijf pond bonen %ligt/liggen me zwaar op de maag.
   this.PL five pound beans lie.SG/PL me heavy on the stomach
   These five pounds of beans are hard for me to stomach.

b. Deze vijf pond brood lig%ligt/liggen me zwaar op de maag.
   this.PL five pound bread lie.SG/PL me heavy on the stomach
   These five pounds of bread are hard for me to stomach.

(29) a. Deze kilo snoepjes %kost/kosten vijf euro.
    this.C kilo.C sweets cost.SG/PL five euro
    The kilo of candies costs five euros.

b. Deze kilo snoep kost/%kosten vijf euro.
   this.C kilo.C sweets.N cost.SG/PL five euro
   This kilo of candies costs five euros.

Intuition: the pseudo-partitive as a whole can acquire number and [3D] specification in virtue of its denotation rather than inherit them (i.e., as semantically determined phi-features, giving rise to semantic agreement (cf. Corbett 1979 et seq.))

Remaining issue: optional singular predicate agreement with plural measure nouns:
(30) a. Er ging/gingen drie minuten voorbij.
there go.SG/PL three minute.PL over
Three minutes passed.

b. Die vijf maanden?ging/gingen heel snel voorbij.
that.PL five month.PL go.SG/PL very fast over
Those five months went by very fast.

Issue: which is it that requires explanation: the singular marking or the plural?

5.4. Semantic agreement with measure NPs

Question: what is the phi-featural specification of the DP as a whole?

Possibilities:

i. the phi-feature bundle on D° probes and inherits the feature values of its goal
   ➢ D° does not have [u3D], must not be an intervener, agreement is with N° or Card°/#°

ii. phi-feature values on D° are semantically determined (cf. Sauerland's (2004) φP)
   ➢ in function of the denotation of the DP as a whole, D° is either specified as [+3D] (concrete entity), or not specified for the [3D] feature (measure)
   ➢ in pseudo-partitives, other feature values are determined by the properties of the substance NP

(i) corresponds to syntactic/formal agreement, (ii) corresponds to semantic agreement
(i) yields plural marking on the predicate for plural measure nouns, (ii) predicts singular

6. CONCLUSION

In order to account for plural marking patterns with Dutch measure nouns it is necessary to:
➢ introduce a feature distinguishing measure nouns from all others
➢ make number agreement conditional on that feature

Proposal: the semantically based [α3D] phi-feature:
➢ boek 'book': [+3D]
➢ jaar ‘year’: no [3D]
➢ maand ‘month’: [-3D]

Assuming that number agreement takes place concurrently with valuing the [u3D] feature on the probe yields correct results

Measure nouns can then be regarded as deficient: for the most part they do not bear the [3D] feature

Extensions
➢ classifiers are probably unspecified for [3D], predicting number impoverishment
➢ cardinals are all unspecified for [3D], even when they seem to be nominal (but this need not be there only deficiency)

7. APPENDICES

7.1. More on the plural of abundance

In some languages the plural of abundance (Corbett 2000) is not restricted to measure nouns

Special morphology in Norwegian (Kinn 2004) and in Syrian Arabic (Corbett 2000):
(31) a. million-vis/million-ar av student-ar Norwegian, Kinn 2004
    million-ABU/million-PL.INDEF of student-PL.INDEF
    millions of students

b. liter-vis med vatn
    litre-ABU with water
    litres of water

(32) a. dabbān 'flies (collective)'
    Syrian Arabic (Corbett 2000:32)

b. dabbāne 'a fly (singulative)'

c. dabbānāt 'flies (plural)'

d. dababīn 'many flies'

Double plural marking in Miya (Schuh 1998):

(33) a. sbā 'people' : sābabāw 'large number of people'
    Schuh 1998:199

b. kūta 'thing (pluralia tantum)' : kūtatāw 'large number of things'

In other languages it is lexically restricted (e.g., waters, skies, heavens vs. wines, grounds)

Strikingly, the plural of abundance seems to be possible on measure nouns only when part of a pseudo-partitive

7.2. Conditional agreement extensions: other phi-features

Western Armenian: overt plural marking only possible with specific or definite NPs (Sigler 1992, 1996, Donabédian 1993):

(34) a. gentanapanagan bardezin meč pirr(∅er) desak Sigler 1996
    zoological garden.GEN.DEF in elephant(PL) see.AOR.2PL
    Did you see elephants at the zoo?

b. gentanapanagan bardezin meč pirr-(er)-∅ desak
    zoological garden.GEN.DEF in elephant.PL.DEF see.AOR.2PL
    Did you see the elephants at the zoo?

Donabédian 1993:185-187: measure nouns are singular even in definite NPs:

NB: plural marking on the measure noun is not ungrammatical, but yields the interpretation of excessive quantity

(35) mayrak’a lak-∅ T’ōnnēr-∅-n bažnol 180 k’ilometrō-n
capital-DEF Tonnerre-from-DEF separating 180 kilometer-DEF
the 180 km separating the capital from Tonnerre

Assuming an interpretable number feature on D and sensitivity to [3D]:

(36) \[ D^\circ \quad \text{DP} \quad \text{CardP} \quad \text{Card}^\circ \quad \text{NP} \]

Number marking is sensitive to the presence of the D-layer; Card^\circ/#^\circ is inactive

The sensitivity of number marking to definiteness/specificity is syntactic rather than semantic

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