

The curious case of measure semantics

Yağmur Sağ
Rutgers University

1 Introduction

This paper explores the syntax and semantics of measuring in English and Turkish, which together yield some novel predictions about its nature. The object of study is the constructions that are composed of a numeral, a functional element which is generally identified as ‘quantizing noun’ (e.g., *kilo, cup*, etc.), and a lexical noun. In languages like English, they are called ‘pseudo-partitives’ due to their resemblance to canonical partitive constructions in featuring the preposition ‘of’ (e.g., *two kilos of apples*, Selkirk 1977). However, in Turkish, the lexical noun directly combines with the quantizing noun without recourse to a particle on a par with ‘of’ (e.g., *iki kilo elma* ‘two kilo apple’). Despite this disparity, in this paper, I will follow the convention for English and refer to these expressions as ‘pseudo-partitives’.

Pseudo-partitives are associated with two main roles: (i) individuating for counting and (ii) measuring. This paper focuses on pseudo-partitives playing the role of measuring, which I interchangeably refer to as ‘measure expressions’. I propose that they are composed of two parts, the part with the lexical noun denotation, i.e., a set of count or mass individuals, and the part with its material equivalent, i.e., a set of portions of matter that constitute the individuals in that set. I argue that measurement universally operates at the domain of portions of matter, and the link between the two parts is established by a *constitution relation*, in the sense of Link (1983) (cf. Schwarzschild 2006; Partee & Borschev 2012; Rothstein 2011; 2017; Scontras 2014; among others).

Intriguingly, while English measure expressions take the material component as the basis of reference, hence refer to the measured amount, Turkish measure expressions take the denotation of the lexical noun as the basis of reference. This two-way representation, which will be shown to have effects on distributivity and mass/count quantification, stems from two different structures that pseudo-partitives can have. They are either headed by the quantizing noun (English), or by the lexical noun (Turkish). This variation correlates with the headedness properties of the two languages, the presence/absence of ‘of’ being a determining factor in what their pseudo-partitives are headed by. Although the main focus is on measuring, the individuating interpretation of pseudo-partitives will also be briefly examined and shown to be sensitive to the same kind of variation in structural composition.

The structure of the paper is as follows: Section 2 reviews the two interpretations that pseudo-partitives are associated with. Section 3 discusses the diagnostics introduced in Rothstein (2011) to distinguish between these, and outlines the differences between English and Turkish pseudo-partitives. Section 4 overviews the previous accounts for measurement and Section 5 presents the analysis. Section 6 discusses further issues like the individuating reading. Section 7 concludes.

2 The different readings of pseudo-partitives

The two types of quantizing nouns that this paper is concerned with are measure terms (e.g. *kilo*, *liter*, and *pound*) and container nouns (e.g. *cup*, *glass*, and *bottle*), as exemplified below in both English and Turkish.¹ The terminology is directly adopted from Scontras (2014), but the origins go back to Lønning (1987), Chierchia (1998a), Rothstein (2011), and Partee & Borschev (2012).

- | | | | |
|-----|---|-----|--|
| (1) | Measure Terms | (2) | Container Nouns |
| | a. two <i>liters</i> of water | | a. two <i>glasses</i> of water |
| | b. iki <i>litre</i> su
two liter water | | b. iki <i>bardak</i> su
two glass water |

There are two main interpretations that measure terms and container nouns are associated with: ‘the individuating reading’ and ‘the measure reading’. The individuating reading is either realized as ‘the container reading’ or ‘the portion reading’ (Greenberg 1972; Selkirk 1977; Doetjes 1997; Chierchia 1998a; Landman 2004; Partee & Borschev 2012; Rothstein 2011; 2017; among others). To help get gist of the picture, each reading is exemplified below in English.

(3) Individuating Readings

a. Container Reading

Mary brought two cups/liters of water on the tray. They were blue.

b. Portion Reading

Mary drank two cups/liters of water, one in the morning, the other in the evening.

(4) Measure Reading

Mary added two cups/liters of water to the soup.

In the container reading, as in (3a), Mary brings two separate cups/one-liter containers on the tray, each filled with some amount of water. The reference is to the containers, as evidenced by the felicity of the follow-up sentence ‘They were blue.’ In the portion reading, as in (3b), Mary drinks two portions of water each of which would fill up a cup/measure one liter. In this case, though, the reference is to the portions of water. Finally, in the measure reading, as in (4), Mary adds to the soup a quantity of water that equals two standard cupful amounts/two liters. While in the portion reading the containers might be of different sizes (e.g., different sizes of cups in (3b)), they would be expected to be standardized in the measure reading (e.g., standard cup size in (4)) (Partee & Borschev 2012).

Turkish pseudo-partitives differ from English ones in lacking the container reading in the individuating side. Deferring its discussion until Section 6, what we will be mainly concerned about is the fact that the measure reading, though equally available in both languages, shows variation in its character. To show this, below I will discuss the diagnostics introduced in Rothstein (2011, 2017) to distinguish between the individuating and measure readings of pseudo-partitives, which also reveal the disparity between English and Turkish measure expressions.

¹One other type of quantizing nouns is atomizers like *grain*, *drop*, etc., which are excluded here for they are not compatible with the measure reading. See Chierchia (1998a) and Scontras (2014).

3 On our way to the semantics of measurement

Rothstein (2011, 2017) offers several diagnostics to differentiate between the individuating reading and the measure reading of a pseudo-partitive. Among them, we will discuss (i) the (in) compatibility with distributive elements and (ii) the (in)compatibility with count vs. mass quantifiers. These tests are intended for the comparison of the container reading and the measure reading in Rothstein (2011, 2017). However, the behavior of the container reading under these tests can also be attributed to the portion reading, since the tests distinguish between the measure and individuating readings in a more general sense.²

3.1 Distributivity

Rothstein (2011, 2017) shows that distributive elements such as reciprocals and *each* are only compatible with the individuating readings of pseudo-partitives, as exemplified below with a container noun, first:

- (5) The twenty bottles of wine that we had not opened yet stood next to each other on the shelf.

The sentence in (5) has only an individuating reading, most naturally realized as the container reading. Namely, it describes a situation where there are twenty bottles filled with some amount of wine and these bottles stand next to each other on the shelf. It is infelicitous in the measure reading since we cannot imagine a situation where there is a twenty-bottle amount of wine, maybe inside a giant pot, and each one-bottle amount is standing next to each other. The infelicity is expected because the pseudo-partitive in the measure reading refers to a single unit of wine, and *wine*, having a mass denotation, cannot provide an antecedent for reciprocals.

A more interesting case is revealed when a pseudo-partitive has a count lexical noun. Even in that case, distributivity is only possible in the individuating reading, but still not available in the measure reading. Consider the example in (6).

- (6) We put the three boxes of books next to each other on the shelf.
box1, box2, box3
 Not: *book1, book2, book3, book4 ...*

The sentence in (6) describes a situation where there are three boxes filled with books and these boxes are put next to each other on the shelf. This interpretation most naturally represents the container reading, but the portion reading is available, too. In the latter case, the three book-groups each coming in boxes stand next to each other. However, the individual books are still not available for distributivity although we refer to the books this time, not the containers. This is because the reference is to the units/groups of books rather than a plurality of books, and groups are incompatible with distributivity (Barker 1992; Schwarzschild 1996).

What about the measure reading? It has been reported in Rothstein (2011, 2017) that this sentence does not describe a situation where the books are taken out of their

²The other tests are (i) inducing singular vs. plural agreement on the verb, (ii) the (in)ability of plural anaphora, and (iii) the (in)compatibility with the suffix *-ful*. The first two do not apply to Turkish, and the last one does not distinguish between Turkish and English pseudo-partitives, therefore they will not be discussed.

boxes and put next to each other on the shelf, referring to ‘three boxes’ as a way of measuring the amount of books. Namely, the measure reading in English is not compatible with distributivity over atomic individuals although what is referred to seems to be a set of (pluralities of) books that have the intended amount in this case.

Although this observation has been confirmed by most of the speakers that I have consulted with, it should be noted that some speakers of English differ on this. For one group of speakers, distributivity over individual books is possible in the measure reading, though it comes with some question marks. In an aim of representing this divergence, I will refer to the grammar where this reading is missing as Grammar A and this is the grammar discussed in Rothstein (2011, 2017). On the other hand, I will refer to the grammar where it is available as Grammar B.

These facts also hold for measure terms. Considering Grammar A first, distributivity is only possible under the individuating readings, as shown in (7). This sentence is judged to be true in a situation where three kilo-packs of apples are lying on top of each other on the ground. This can either be considered as the container reading or the portion reading, but similar to the case of container nouns, distributivity over individual apples is not available, as shown in (7). On the other hand, for Grammar B speakers, this interpretation is allowed with some question marks.

- (7) Three kilos of apples are lying on top of each other on the ground.
kilo-bag1, kilo-bag2, kilo-bag3
 Not: *apple1, apple2, apple3, apple4 ...*

Turkish is similar to Grammar B of English in allowing distributivity in the measure reading. Therefore, from now on I will take Turkish as the representative of Grammar B, and English as the representative of Grammar A. The relevant examples are illustrated below. In fact, as is clear in (9), distributivity over atoms is the preferred reading with measure terms.³

- (8) Üç kutu kitab-ı dolap-ta *birbiri-nin yan-ı-na/ yan*
 three box book-ACC closet-LOC each.other-GEN next-3SGPOSS-DAT next
yan-a yerleştirdi-k.
 next-DAT put-PAST-1PL
 ‘We put the three boxes of books next to each other in the closet.’
box1, box2, box3
book1, book2, book3, book4 ...
- (9) Üç kilo elma yer-de *üst üst-e* yığılı dur-uyor.
 three kilo apple ground-LOC top top-DAT piled lie-PROG
 ‘Three kilos of apples are lying on top of each other on the ground.’
apple1, apple2, apple3, apple4 ...
 Marginally: *kilo-bag1, kilo-bag2, kilo-bag3*

In sum, distributivity is available in Turkish (and Grammar B) pseudo-partitives in the measure reading, but not in English pseudo-partitives (Grammar A).

³Recall that Turkish pseudo-partitives lack the container reading, therefore the individuating reading is only available as the portion reading in (8) and (9).

3.2 (In)compatibility with mass and count quantifiers

The other test to distinguish between the individuating and measure readings is to check the compatibility of pseudo-partitives with count and mass quantifiers. As Rothstein (2011, 2017) shows, English pseudo-partitives can be embedded under mass quantifiers, such as *much* and *a little*, in their measure reading (Rothstein 2011:23).

- (10) a. *A little* of the twenty boxes/kilos of oranges that we picked was/#were enough to satisfy our desire to eat citrus fruit.
 b. I haven't read *much* of the twenty boxes/kilos of books in our house.

As is the case with the distributivity test, investigating the behavior of pseudo-partitives with count nouns rather than mass ones benefits us here, for the compatibility of mass nouns with mass quantifiers is already expected. What is intriguing is the compatibility of a supposedly count denotation with mass quantification.

On the other hand, pseudo-partitives can only be embedded under count quantifiers such as *many* and *a few* in their individuating reading, as exemplified in (11).

- (11) a. We gave *a few* of the twenty boxes/kilos of oranges to the child we saw on the street.
 b. We have read *many* of the twenty boxes/kilos of books in our house.

In the sentences given in (10), the referent of the pseudo-partitive that is quantified over is the amount of oranges/books, whereas in the examples shown in (11), it is the boxes or units of oranges/books. For example, (11a) is true in a situation where a few boxes/kilos of the twenty boxes/kilos of oranges are given to the child, not a few oranges. Additionally, (10b) and (11b) do not entail each other as pointed out by Rothstein (2011, 2017). She presents a context where most of the boxes of books are small and have only a few books in them while only a few of the boxes are big and have a lot of books in them. If I have read all the books in the big boxes and a few of the books in the small boxes, then *I haven't read many of the twenty boxes of books* is true, and *I haven't read much of the twenty boxes of books* is false.

What is intriguing is the fact that count quantification is not available for the individual oranges/books in (11). That is, *a few of the twenty boxes/kilos of oranges* does not refer to a few oranges from the given set.⁴ This is also the case even if the number that is conveyed by the measurement is smaller as in *a few of the three boxes/kilos of oranges*. Based on this and also considering the facts of distributivity, Rothstein concludes that English pseudo-partitives have a mass denotation in the measure reading.

Now, let us consider Turkish pseudo-partitives. Although most quantificational elements in Turkish are neutral in that they are compatible with both count and mass nouns (e.g., *çok* corresponds to the translation of *many*, *much*, and *a lot of*), there is a distinction between *birkaç* 'a few' and *biraz* 'a little'. The former combines with count nouns, whereas the latter combines with mass nouns, as shown below.

⁴Of course, this is the case only for Grammar A speakers of English. For Grammar B speakers, this reading is possible.

- (12) a. birkaç çocuk
a.few child
'a few children'
- b. *birkaç su
a.few water
- c. biraz su
a.little water
'a little water'
- d. *biraz çocuk
a.little child

However, when *biraz* is used in the partitive construction, it can be neutralized to mean 'some'. This is exemplified in (13) (cf. (12d)).

- (13) *Çocuk-lar-in biraz-ı* yurt-lar-da kal-ıyor.
child-PL-GEN a.little-3SGPOSS dorm-PL-LOC stay-PROG
'Some of the children stay in the dorms.'

Turkish pseudo-partitives can be embedded under both *birkaç* and *biraz* as in (14), but the neutrality of *biraz* in the partitive construction does not inform us about the (in)compatibility of Turkish pseudo-partitives with mass quantifiers.

- (14) Aldığımız yirmi kilo elma-nın *birkaç-in-i*
that.we.bought twenty kilo apple-GEN a.few-3SGPOSS-ACC
biraz-in-i çocuğ-a ver-di-k.
a.little-3SGPOSS-ACC child-DAT give-PAST-1PL
'We a gave the child a few/some apples from the twenty kilos of apples that we bought.'

What is striking, though, is the availability of the missing reading of English for Turkish pseudo-partitives. Namely, as represented in the translation of (14), *birkaç* quantifies over apples, not kilo-units, so *a few of the twenty kilos of apples* in Turkish refers to a few apples from the given set, not a few kilos/kilo-bags.

We cannot test whether Turkish pseudo-partitives can be embedded under mass quantifiers. However, considering the availability of this reading, together with the facts of distributivity, we can conclude that their denotation is count in the measure reading if the lexical noun is count. This contrasts with Rothstein's conclusion for English pseudo-partitives that they have a mass denotation in the measure reading. Although English pseudo-partitives are count in the individuating reading, since the reference is either to containers (container reading) or quantized units/groups of the lexical noun denotation (portion reading), the atomic level of the lexical noun is not available for distributivity and count quantifiers in that case, either.

It should be noted that the portion reading is not accessible when Turkish pseudo-partitives are quantified over by *birkaç* 'a few', regardless whether the quantizing noun is a container noun or a measure term. Namely, it is impossible to get the 'a few kilos of the twenty kilos of apples' reading although *birkaç* is compatible with measure terms directly (e.g., *birkaç kilo elma* 'a few kilos of apples'). At present, I do not have an explanation for this, but the distinction between English and Turkish pseudo-partitives in the measure reading needs explanation. While the measure reading of the former is somehow associated with a mass denotation (Rothstein 2011, 2017), the measure reading of the latter yields a count interpretation. Table 1, which summarizes the different readings of pseudo-partitives, shows this contrast.

	English <i>two boxes of books</i>	Turkish <i>two box book</i>
Individuating	count (a set of boxes filled with books) (a set of book-units in boxes)	count N/A (a set of book-units in boxes)
Measure	mass (to be explored below)	count (a set of books measuring two boxes)

Table 1: The denotation of pseudo-partitives in English and Turkish

Below, I will first discuss the existing analyses of measure expressions, and then introduce my analysis.

4 The previous accounts of measurement

Generally, measure expressions are taken to denote sets of plural or mass individuals that measure the appropriate amount along a dimension, depending on the type of the lexical noun (e.g. Krifka 1989; Schwarzschild 2006; Ionin *et al.* 2006; Champollion 2010; Partee & Borschev 2012; Scontras 2014; cf. Brasoveanu 2008; Ojeda 2003). These theories diverge in the structure of pseudo-partitives as well as in the semantic status of ‘of’, which is treated as either a semantically inactive or contentful element.

As representative of these theories, Scontras (2014) claims that lexical nouns occurring in pseudo-partitives are kind terms and a pseudo-partitive in the measure reading denotes a set of entities that instantiate a kind and measure n with respect to a unit function (e.g., *kilo*) in a dimension (e.g., *weight*). In Chierchia’s (1998b) system, English kind terms are derived via the *nominalization* operator (\ulcorner), which, applying to a plural or mass property, returns a function from situations to the maximal entity satisfying that property in that situation. The instantiation operator *predicativization* (\lrcorner) takes the extension of the kind and returns the set of entities that instantiate the kind in a given situation. In the case of a plural kind term, it is a number neutral set inclusive of atomic and plural individuals.

Scontras claims that ‘of’ is syntactically and semantically inactive in the measure reading and argues that numerals are individual denoting expressions of type n referring to numbers as in Landman (2004). Additionally, he takes pseudo-partitives to be headed by a measure head that hosts a measure term or a container noun in the measure reading.

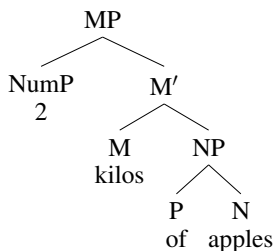
Alternatively, Rothstein (2011, 2017) claims that when the lexical noun is a count noun, it must shift from the count type to the mass type since in Rothstein’s theory, measurement operates at the mass domain only. Thus, the result of measurement is a set of mass individuals that measure the appropriate amount. We will not go into the details of how shifting from count to mass type occurs in her account, but she basically claims that all nouns are associated with a mass root denotation, which is the input to operations deriving count and mass nouns. In measure expressions, a plural count noun simply shifts back to its original root denotation.

Rothstein further claims that in English and in fact all languages, measure expressions are headed by the lexical noun in the measure reading as opposed to the

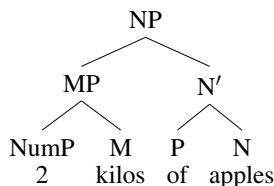
individuating reading in which the quantizing noun is the head. Additionally, she treats ‘of’ to be a semantically and syntactically inactive element and takes numerals to be of n type in pseudo-partitives with the measure reading.

The structure and semantics of measure expressions in these accounts are illustrated below.

(15) Scontras (2014):



(16) Rothstein (2011, 2017):



- (17) a. $\llbracket(15)\rrbracket = \lambda x. \cup \text{apple}(x) \wedge \mu_{kg}(x) = 2$
 b. $\llbracket(16)\rrbracket = \lambda x. \text{apples}_{mass}(x) \wedge \mu_{kg}(x) = 2$

The problem with Scontras’s theory is that English pseudo-partitives with a plural lexical noun have a count denotation in the measure reading, since the instantiation set of a plural kind term consists of count individuals. This does not explain the mass behavior of English measure expressions presented above, and interestingly, although developed for English, it accounts for Turkish straightforwardly. However, what we need is a theory which captures the mass-count distinction between English and Turkish measure expressions simultaneously.

Rothstein’s view captures the massness of English measure expressions, but it cannot capture the facts of Turkish measure expressions unless for some reason the count lexical noun does not shift to the mass type in Turkish. However, this would be an ad hoc solution. In addition, although I follow the idea that measurement operates at the mass domain as will be discussed below, the motivation behind the shift of count nouns to the mass type remains vague under this account. Instead, I derive the different denotations in the two languages by structural variation.

5 The two-part semantics of measurement

I argue that measurement universally operates at the domain of *portions of matter*, and inside the derivation a *constitution relation* is established between the denotation of the lexical noun and its material equivalent, i.e., corresponding portions of matter that convey the information about the amount measured. In other words, measure expressions are composed of two parts, the part with the lexical noun denotation, and the part with the measured amount.

The denotation of Turkish pseudo-partitives is the reverse of the denotation of English pseudo-partitives. English pseudo-partitives take the material component of measure expressions as the basis of reference, hence refer to the measured amount.

Turkish pseudo-partitives take the denotation of the lexical noun as the basis of reference, hence refer to a set of plural or mass individuals that have a constitution relation with the measured amount. These two reverse representations are dependent on two possibilities regarding what can head the structure.

5.1 Portions of matter and the constitution relation

The notions of *portions of matter* and the *constitution relation* go back to Link (1983). This section summarizes the particulars of Link's theory.

If two expressions a and b refer to entities in space and time but have different sets of predicates that can be true of them, then $a \neq b$. The famous example of this is a ring recently made up from some old gold. While *the ring* is new, *the gold in the ring* is old. The distinctive properties of these two linguistic expressions reveal that even if *the ring* and *the gold in the ring* share the portion of matter they are made of, they are not the same entities.

Within the domain of entities E , there are two different sub-domains: the domain A of atomic individuals and the domain D of portions of matter. Plural entities are the closure of atomic individuals under the sum operator, \oplus . E can be defined as a complete join semilattice: $\langle E, \oplus \rangle$. For example, the complete atomic join semilattice with a , b , and c as singular individuals include the atoms a , b , c , and the pluralities $a \oplus b$, $a \oplus c$, $b \oplus c$, and $a \oplus b \oplus c$. Similarly, the complete join semilattice (not necessarily atomic) with g_1 , g_2 , g_3 as portions of matter include these portions g_1 , g_2 , g_3 , and their closure under sum $g_1 + g_2$, $g_1 + g_3$, $g_2 + g_3$, and $g_1 + g_2 + g_3$. In Link (1983), the sum operator applying in this domain is *material fusion*, $+$.

Even though D is the subset of A , which in return is the subset of E , the algebra of the domain of individuals and portions of matter are different structures, and elements in D and $E \setminus D$ are connected by a *constitution relation*. h is the *materialization function* denoting the constitution relation. It maps every individual of E to its corresponding portion of matter in D . For example, two rings, a and b are made of portions of old gold g_1 and g_2 , respectively. Then the rings $a \oplus b$ are made of $g_1 + g_2$. Even though $g_1 + g_2$ shares the same material component with $a \oplus b$, $g_1 + g_2$ constitutes but is not equal to $a \oplus b$, as represented below.

- (18) a. $g_1 + g_2 = h(a \oplus b)$
 b. $g_1 + g_2 \neq a \oplus b$

Building on h , a semantic interpretation for the constitution relation can be provided, denoted by C in the object language.⁵ So, for the ring example, if a is the ring and g_1 is the gold in a , then $C(g_1, a)$. $C(a, b)$ is true iff $a = h(b)$.⁶

If $a, b \in D$, the semantic fact follows trivially because h denotes the identity function on D . In other words, the material equivalent of a mass term corresponds to itself, i.e., for all $x \in D$, $h(x) = x$. So, every predicate P has a mass term correspondent mP , and if P is already a mass term, it follows that $\llbracket P \rrbracket \subseteq \llbracket {}^mP \rrbracket$.⁷

⁵In Link (1983), it is represented as \triangleright , but here I will represent it as C for ease of convention.

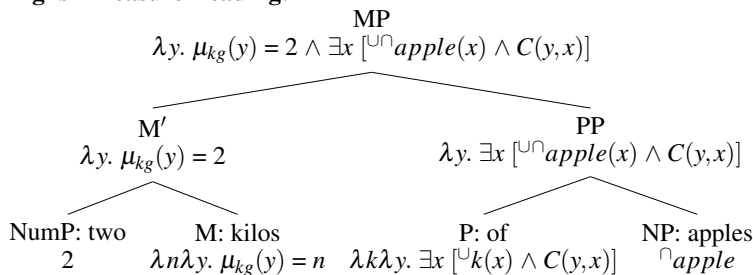
⁶The C relation is considered to be distinct from Universal Grinder, which is not available for all languages and restricted to some nouns only.

⁷It is not obvious where mass nouns like *furniture* fit in Link's theory. Such nouns are special in sharing the properties of both count and mass nouns. For example, they are mass in terms of

5.2 English measure expressions

In Section 3, we have seen that English pseudo-partitives have a mass denotation in the measure reading. I propose the following structure and semantics for English measure expressions to capture this fact:

(19) **English Measure Reading:**



I follow Scontras in that lexical nouns of English pseudo-partitives enter the derivation as kind terms and get instantiated inside. In the case of count nouns, this instantiation results in a count denotation, i.e., a number neutral set inclusive of atoms and their pluralities. However, measurement happens with the material equivalents of these individuals. The mapping between the two domains is ensured by the *C* relation formed inside the derivation. If the lexical noun is already mass, the *C* relation is still formed between the mass term and its material equivalent, which corresponds to itself due to the fact that *h* is an identity function on *D*.

I also follow the idea that numerals in measurement are individual denoting expressions of type *n* referring to a point in a scale of measurement. Additionally, plural marking on the measure term is treated as a phenomenon of number agreement (Ionin Matushansky 2006).

One important thing to note here is that ‘of’ is both syntactically and semantically active (see also Schwarzschild 2006). It introduces the *C* relation between the lexical noun and the measured amount. A measure phrase like *two kilos* denotes a set of portions of matter which measure the appropriate amount, in our case two kilos. It combines with *of apples*, i.e., the set of portions of matter that constitute a plurality of apples, via predicate modification. Overall, *two kilos of apples* denotes a set of portions of matter that amount to 2 kilos in weight and constitute a plurality of apples. In other words, it denotes the amount part of the measure expression and the denotation of the lexical noun is existentially closed inside the derivation.

The choice of reference lines up with the structure of the construction. Given that ‘of’ is a syntactically active element, it takes the lexical noun as its complement, which means that the pseudo-partitive cannot be headed by the lexical noun, leaving the measure term (or the container noun acting as a measure term) as the only candidate for this. Under the natural assumption that the referents of the expressions are determined by their heads, English pseudo-partitives do not refer to

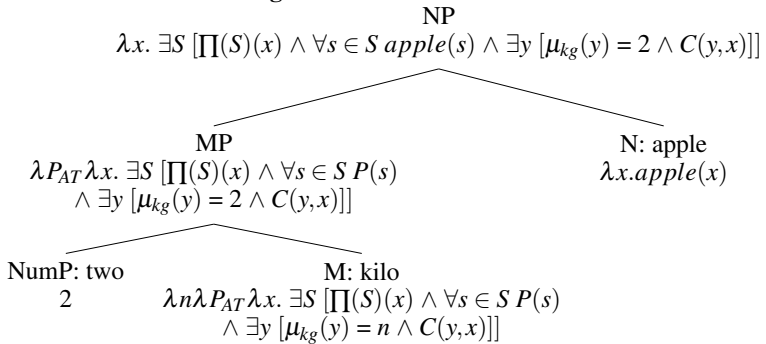
being cumulative, and count in terms of being not divisible. I believe that even if one treats them as a distinct variety of noun denotation (e.g. Deal 2017; Doetjes 1997; Schwarzschild 2011; among others), we can still assume that a *C* relation holds between them and their material parts.

the denotation of the lexical noun, but to the corresponding amount conveyed by the measure term. This results in a mass denotation, which eventually makes it possible for them to be embedded under mass quantifiers. Since amounts are mass, distributive elements like reciprocals are not compatible with them. Additionally, when the lexical noun is count, since the set denoted by it is existentially closed, it is not accessible for distributive elements and count quantifiers.

5.3 Turkish measure expressions

In Section 3, we have seen that as opposed to English, Turkish measure expressions have a count denotation. I propose the following structure and semantics for Turkish measure expressions to capture this fact:

(20) **Turkish Measure Reading:**



Basically, the denotation of Turkish measure expressions is the reverse of the choice of English. Namely, Turkish measure expressions take the lexical noun denotation as the basis of reference, resulting in a count denotation when the lexical noun is count. More precisely, *iki kilo elma* ‘two kilos of apples’ denotes a set of pluralities, atoms of which are apples, and these pluralities are constituted by portions of matter that have an amount of 2 kilos. Therefore, Turkish measure expressions are compatible with distributive elements and count quantifiers. As is the case with English, this way of interpretation aligns with their structural composition, which is the reverse of English in the sense that they are headed by the lexical noun, rather than the measure term.

Besides the disparity in the basis of reference, Turkish pseudo-partitives also diverge from English pseudo-partitives in the way the pluralities of apples are formed in the derivation.⁸ In English, the lexical noun is either mass or plural and it enters the derivation as a kind term and gets instantiated inside. However, this cannot hold for the lexical noun in Turkish given that it is in the singular form. Sağ (2018, 2019) shows that Turkish plurals denote a number neutral set and can be kind terms via \sqcap and that singulars are ambiguous between atomic properties and singular kind terms which cannot be instantiated, just like in English (Dayal 2004).⁹ Based on

⁸Additionally, Turkish pseudo-partitives lack the plural number agreement on the measure term.

⁹In Dayal’s analysis, singular kind terms like *the dinosaur* in ‘The dinosaur is extinct.’ are

the fact that singular kind terms cannot be instantiated, the lexical noun in Turkish pseudo-partitives cannot be a kind term, at least when it is count. Instead, I claim that it is the simplest form of a predicate, atomic if count, mass otherwise, as shown in (21). The presuppositional content is represented with AT as a subscript on P .

$$(21) \quad \llbracket kilo \rrbracket = \begin{cases} \lambda n \lambda P_{AT} \lambda x. \exists S [\prod(S)(x) \wedge \forall s \in S P(s) \wedge \exists y [\mu_{kg}(y) = n \wedge \\ C(y, x)]], \text{ if } P \text{ is count.} \\ \lambda n \lambda P \lambda x. P(x) \wedge \exists y [\mu_{kg}(y) = n \wedge C(y, x)], \text{ otherwise.} \end{cases}$$

So, in English pseudo-partitives, the pluralities of apples are formed by instantiating a plural kind term, but in Turkish, they are derived from an atomic predicate. To represent the latter, I resort to the notion of *partition* the definition of which is adopted from Ionin Matushansky (2006:321). As shown in (22), S is a partition \prod of an entity x if it is a cover of x and its cells do not overlap.

$$(22) \quad \begin{array}{l} \text{a. } \prod(S)(x) = 1 \text{ iff} \\ \quad S \text{ is a cover of } x, \text{ and} \\ \quad \forall z, y \in S [z = y \vee \neg \exists a [a \leq_i z \wedge a \leq_i y]] \\ \text{b. } \text{A set of individuals } C \text{ is a cover of a plural individual } X \text{ iff } X \text{ is the} \\ \quad \text{sum of all members of } C: \sqcup C = X \end{array}$$

Notice that in Turkish pseudo-partitives there is no equivalent of ‘of’, hence quantizing nouns combine with the lexical noun directly. Considering that Turkish is a strictly head-final language, it is not implausible to assume that pseudo-partitives are headed by the lexical noun, and this lines up with their reversal behavior in contrast to their English kin. In fact, we will see in Section 6 that this goes beyond a mere assumption because Turkish pseudo-partitives lack the container reading due to a similar kind of structural alignment. The absence of ‘of’ also means that the C relation has to be hard-wired into the semantics of the measure term. This means that while in English *kilo* is of $\langle n, \langle e, t \rangle \rangle$ type, in Turkish it is of type $\langle n, \langle \langle e, t \rangle, \langle e, t \rangle \rangle \rangle$.

5.4 Interim summary

Wrapping up, measure expressions are composed of two parts: the portion of matter associated with the measured amount and the lexical noun denotation that has a constitution relation with it. Depending on the structural composition of these parts, measure expressions can have two ways of representation. In one way, the basis of reference is the lexical noun as in Turkish, and in the other, it is the amount part of the measure expression as in English. Table 2 summarizes this variation.

derived by the combination of the definite article *the* with a singular noun denoting a taxonomic property, and these kind terms are impure atomic in nature, disallowing \cup to apply on them. Turkish lacks an overt definite article, hence a bare singular can be a kind term via *iota* type-shifting, instead.

	English	Turkish
	<i>two kilos of apples</i>	<i>two kilo apple</i>
Amount	✓	
Lexical Noun		✓

Table 2: The choice of reference in English and Turkish measure expressions

6 Remaining issues

In this section, I address two remaining issues: how Grammar B of English is possible and why Turkish pseudo-partitives lack the container reading.

Recall that in Grammar B of English, pseudo-partitives in the measure reading allow distributive readings and are compatible with count quantifiers, like in Turkish. I suggest that in this case ‘of’ is reanalyzed as a semantically and syntactically inactive element. This makes it possible for the head to be shifted from the measure term to the lexical noun, in which case the *C* relation is hard-wired into the semantics of measure terms as in Turkish. In other words, for Grammar B speakers of English, there is both a structural and semantic ambiguity for measure expressions, where measure terms are both $\langle n, \langle e, t \rangle \rangle$ and $\langle n, \langle k, \langle e, t \rangle \rangle \rangle$ types (*k* standing for kinds). Of course, it remains unclear why this ambiguity is not available to all English speakers, but only a subset of them. However, notice that a similar case holds for the individuating readings of English pseudo-partitives discussed in Section 3. Namely, the ambiguity between the container and portion readings can be derived in the same way: pseudo-partitives in the container reading are headed by the quantizing noun, whereas in the portion reading they are headed by the lexical noun by the re-analysis of ‘of’ (see also Partee & Borschev 2012; Scontras 2014). However, the re-analysis strategy is not subject to speaker variation in this case.

Now let us discuss why Turkish pseudo-partitives do not convey the container reading. While English (3a), repeated here as (23a), can refer to the containers as evidenced by the felicity of a follow-up as ‘They were blue.’, such a follow-up can only refer to the water in Turkish, as evidenced by its infelicity in (23b).

- (23) a. Mary brought two cups/liters of water on the tray. They were blue.
 b. Mary tepsi-de iki bardak/litre su getir-di. #Renk-(1er)i
 Mary tray-LOC two glass liter water bring-PAST color-3POSS
 mavi-y-di.
 blue-COP-PAST

This is basically because Turkish pseudo-partitives are always headed by the lexical noun since Turkish is a head-final language and there there is no ‘of’ in the structure. Therefore, only the portion reading is available for them. One possibility would be a reanalysis strategy similar to the case for Grammar B of English, which would require an insertion of a silent ‘of’ to the structure, shifting the head from the lexical noun to the quantizing noun. However, it does not hold. I speculate the fact that it must be harder to reanalyze a structure inserting a null element that is not there than reanalyzing a structure by deleting (or ignoring) an already existing

element. Instead, for the container reading, a different structure is formed where the order of the container and the lexical nouns is reversed, as shown below, complying with the strict head-final property of Turkish.

- (24) iki su dolu bardak
 two water full glass
 ‘two glasses filled with water’

Finally, note that while ‘of’ is an indicator of the structural difference between English and Turkish pseudo-partitives, its absence does not always implicate a Turkish-like behavior. What is actually at stake is which element the construction is/can be headed by. Namely, depending on the headedness properties of the language in question it is possible for its pseudo-partitives to lack ‘of’ but be headed by the quantizing noun. For example, German and Dutch pseudo-partitives lack ‘of’, yet still pattern with English both in the individuating and measure readings. Under the current proposal, this is expected if they have an English-like structural alignment, not Turkish-like. Confirming this, Grestenberger (2015) and Ruys (2017) respectively show that German and Dutch pseudo-partitives are headed by the quantizing noun in the measure and container readings as in English.

In a nutshell, the headedness properties of the two languages determine the referents of pseudo-partitives not only in the measure reading, but also in their individuating readings.

7 Conclusion

To conclude, I have discussed the differences between English and Turkish pseudo-partitives in the measure reading and argued that the variation is regulated by what heads/can head the structure: the quantizing noun or the lexical noun. The indicator factor has been the presence/absence of ‘of’, which also reserves the possibility of being reanalyzed as an inactive element in English.

Specifically, I have claimed that measure expressions consist of two parts, the part with the lexical noun denotation and the part with the corresponding portions of matter conveying the measured amount. English measure expressions are headed by the measure term, therefore, they take the amount part of the measurement as the basis of reference while Turkish measure expressions are headed by the lexical noun, therefore, they take the lexical noun denotation as the basis of reference. The choice of English results in a mass denotation regardless of the type of the lexical noun, in contrast to the choice of Turkish, the result of which is always dependent on the type of the lexical noun. We have further seen that the findings gain support from the variation in the individuating role of pseudo-partitives.

While the account presented so far requires a more extensive cross-linguistic examination, it gives considerable insight into the form-meaning mapping in general. It keeps the semantics of measurement constant across languages, reducing the cross-linguistic variation to the differences in structural composition.