**RESEARCH**

# Classifiers, partitions, and measurements: Exploring the syntax and semantics of sortal classifiers

Alan Bale[1], Jessica Coon[2] and Nicolás Arcos López[3]

[1] Concordia University, Montreal, QC, CA

[2] McGill University, Montreal, QC, CA

[3] U. Intercultural de Tabasco, Tacotalpa, Tab., MX

Corresponding author: Alan Bale (alan.bale@concordia.ca)

In many languages, measure terms like *item* and *kilo*, as in *two items of furniture* and *two kilos of rice*, can be used either to partition the nominal denotation into countable units, or to measure a denotation without inducing a partition. These two types of measurements are associated with two different syntactic structures: a partition-structure where the measure term forms a constituent with the noun independent of the numeral, and a measure-structure where the measure term forms a constituent with the numeral. Some researchers have claimed that in classifier languages, sortal classifiers are (most often) used in a partition-structure—hence the classifier forms a constituent with the noun independent of the numeral. In contrast, non-sortal classifiers (i.e., measure classifiers) are often used in a measure-structure—the classifier forms a constituent with the numeral and this constituent modifies the noun. Contrary to these claims, we demonstrate that in Ch'ol (Mayan) all classifiers, sortal and non-sortal alike, are used in a measure-structure independent of the types of readings that are available with respect to the measure term. As a result, the correlation between partitioned meanings and partition-structures is not universal. We review several diagnostics that support this claim. These diagnostics can be used as a template to test the constituency structure in other classifier languages.
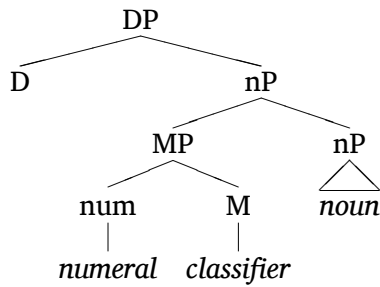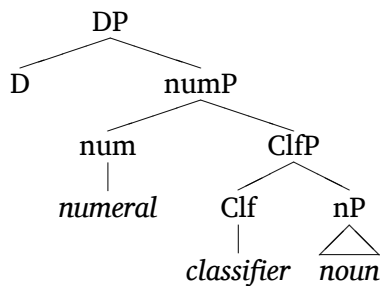
## 1 Introduction

In this paper, we argue that in Ch'ol, the numeral and classifier together form a constituent, which is adjoined to the *n*P. We refer to this structure as a *measure structure*, for reasons that will become apparent in section 2.[1] Such a hypothesis is not without controversy. In previous work, Landman (2004), Rothstein (2009; 2011) and Li (2011) propose that classifiers appear in two different types of structures. According to them, so-called *measured readings* of measure terms and classifiers in English and Mandarin have the structure in (1). However, these authors argue for a different structure for so-called *partitioned readings*, shown in (2) below. (The terms *measured* and *partitioned* readings are discussed in section 2.)

---

[1] Throughout this paper, we represent the classifier as the head of the MP, though the internal structure of MP is not a critical part of the analysis below, and different alternative analyses may be possible. What is crucial for our analysis is that the numeral and classifier together constitute a maximal projection.

(1)     MEASURE STRUCTURE

```
                 DP
              ╱      ╲
            D          nP
                    ╱      ╲
                  MP         nP
                ╱    ╲        △
              num     M      noun
               │      │
            numeral  classifier
```

(2)     PARTITION STRUCTURE

```
                 DP
              ╱      ╲
            D          numP
                    ╱      ╲
                  num       ClfP
                   │      ╱    ╲
               numeral  Clf     nP
                         │      △
                     classifier noun
```

To understand these claims and how they relate to classifier languages, it is important to make a distinction between two types of classifiers: those that provide a unit of measurement (non-sortal or "measure" classifiers), and those that seem to rely on a natural "divided reference" inherent to the noun (sortal classifiers).[2] Non-sortal classifiers, such as the Ch'ol classifiers *-chäjk'* and *-lojch'*, specify a vague or precise way of measuring and partitioning the nominal denotation, such as by drops or scoops, as reflected in the glosses in (3) and (4).[3]

(3)     ux-**chäjk'** ja'
        three-CLF  water
        'three drops of water'

(4)     ux-**lojch'** ja'
        three-CLF  water
        'three scoops of water'

In contrast, sortal classifiers, like the Ch'ol classifiers *-kojty* and *-p'ej* in (5) and (6), cannot be so easily glossed. The classifier *-kojty* is used for counting four-legged things, but also chili peppers; *-p'ej* is used for spherical objects, but is also a generic or default classifier.[4] The partition/measurement that is relevant for counting tomatoes in (6a), for example, is completely different from the one that is relevant for counting beliefs in (6b).

(5)     a.   cha'-**kojty** mis
             two-CLF    cat
             'two cats'

---

[2] Sometimes the term *classifier* is reserved for what we call sortal classifiers. The non-sortal classifiers are often called measure terms or "massifiers".
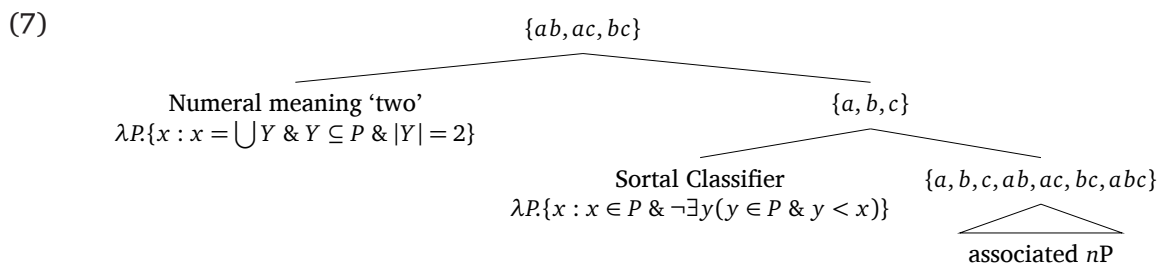
[3] Ch'ol is written in a Spanish-based practical orthography (INALI 2011). Unless otherwise noted, Ch'ol data in this paper comes from the third author, confirmed with other native speakers in the municipalities of Salto de Agua and Tila in Chiapas, Mexico. Abbreviations used in glosses are listed at the end of the article.

[4] Greenberg (1972) notes that spherical classifiers often serve as the default classifiers cross-linguistically.
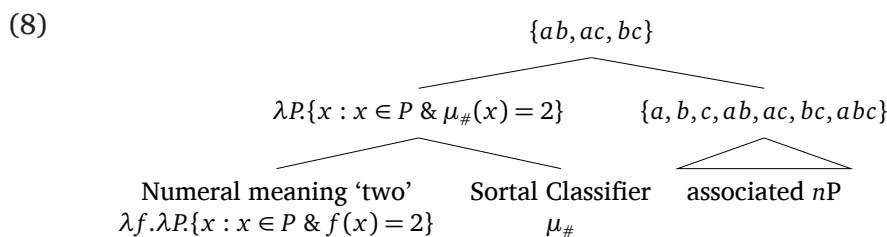
      b.   cha'-**kojty** ich
            two-CLF    pepper
            'two peppers'

(6)   a.   cha'-**p'ej** koya'
            two-CLF  tomato
            'two tomatoes'

      b.   cha'-**p'ej** ñopbal
            two-CLF  belief
            'two beliefs'

Because they do not specify a unit of measurement, Li (2011) suggests that sortal classifiers are (almost always) used to communicate a partitioned reading and thus (almost always) appear as part of a partition structure, as in (2).[5] In contrast, we propose that all numeral classifier constructions in Ch'ol, sortal and non-sortal alike, whether used to convey a measured or partitioned reading, have the measure structure illustrated in (1) above. Thus, the correlation between partitioned meanings and partition structures is not universal.

   This analysis of Ch'ol has welcome consequences for the semantic composition of classifier phrases. As thoroughly discussed in Krifka (1995) and reviewed in Bale and Coon (2014), there are two possible semantics for sortal classifiers. They might function like the English terms *item* and *piece*, combining with their associate nouns to yield a set of minimal parts which can then combine with numerals. A version of this type of interpretation is given in (7), which is consistent with the partitioned structure in (2).[6]

(7)
$$\{ab, ac, bc\}$$

Numeral meaning 'two'
$\lambda P.\{x : x = \bigcup Y \ \& \ Y \subseteq P \ \& \ |Y| = 2\}$

$\{a, b, c\}$

Sortal Classifier
$\lambda P.\{x : x \in P \ \& \ \neg \exists y (y \in P \ \& \ y < x)\}$

$\{a, b, c, ab, ac, bc, abc\}$

associated $n$P

Alternatively, sortal classifiers may combine with numerals and together serve to restrict the denotation of a head noun, as shown in (8).

(8)
$$\{ab, ac, bc\}$$

$\lambda P.\{x : x \in P \ \& \ \mu_{\#}(x) = 2\}$

$\{a, b, c, ab, ac, bc, abc\}$

Numeral meaning 'two'
$\lambda f.\lambda P.\{x : x \in P \ \& \ f(x) = 2\}$

Sortal Classifier
$\mu_{\#}$

associated $n$P

---

[5] Cheng & Sybesma (1999) argue for the this type of partition structure for classifier constructions more generally. Likewise Svenonius (2008) proposes a partition-like structure for all classifiers, modulo the labelling of syntactic nodes (the classifier is the head of a Unit phrase—UnitP—whose maximal projection is sister to D, whereas the numeral occupies the specifier position of this Unit phrase).

[6] The exact details on how the measure term maps the associate noun to the set of atoms is not important for our purposes (see the discussions in Krifka 1995; Doetjes 1996; Chierchia 2010; Li 2011; Rothstein 2011; Li & Rothstein 2012, among others).

In such structures, the classifier could denote a measure function much like non-sortal classifiers. Importantly, this interpretation of sortal classifiers conveys a partitioned meaning even though the syntax is consistent with the measure structure in (1).

The outline of this paper is as follows. In section 2, we review some of the syntactic and semantic distinctions among different types of measurement constructions in more well-studied languages (English and Mandarin) in order to provide some background on the potential syntactic and semantic structures for interpreting Ch'ol classifiers. In section 3, we provide a broad overview of the grammatical nature of counting expressions in Ch'ol which will help in understanding the main sources of evidence presented in section 4. In section 4, we argue that classifier constructions in Ch'ol share a single syntactic structure, regardless of whether the classifier is sortal or non-sortal—specifically, we argue that the numeral and classifier together form a constituent which adjoins to a nominal phrase. It is our goal that the arguments we advance in section 4 will provide a template to investigate the syntactic status of sortal and non-sortal classifiers across a variety of different classifier languages to see if they differ critically from Ch'ol. In section 5, we discuss some empirical limitations when testing different types of readings in Ch'ol. Section 6 concludes.

## 2 Partitioning versus measuring

Before discussing Ch'ol, it is important to review some of the syntactic hypotheses surrounding measurement constructions in English. Such hypotheses will provide context for our discussion of the syntactic analysis of classifiers in Ch'ol. In English, there is evidence for a semantic and syntactic difference between measure terms that participate in a measurement, versus those that participate in a partition. Intuitively, a measurement involves the potential of dividing a nominal denotation into units like *litres*, *grams*, or *seconds*, without actually partitioning it (at least not in a contextually salient way). In contrast, when a noun is partitioned, the division of the nominal denotation is apparent, usually because there is a physical separation of "stuff/things" into "containers/objects".

This contrast is best understood with an example. Take the English noun *cups*. The sentence in (9) is ambiguous. It can be understood as indicating that Mary put four separate cups on the table, each filled with water, or it can be understood as indicating that Mary put one container on the table filled with four cups-worth of water. The relevant contexts that can be used to establish the ambiguity are given in (9).[7]

(9)     Mary put four cups of water on the table.
    i.   **Context 1** (PARTITION): Mary put four different cups on the table—each
         filled with water.
    ii.  **Context 2** (MEASURE): Mary took a cup from the cupboard and filled it
         with water four times, each time dumping the water into a bowl. She then
         put the bowl on the table.

The former interpretation is a partitioned reading whereas the latter is a measured reading. The key difference here is that in contexts that support a measured reading, the contents being measured need not be spatially separated into different objects and furthermore there need not be more than one container that is used to make the measurement—for instance, the same cup can be used each time. In fact, in some contexts there need not be a measuring container at all—for example, the bowl could have lines on it that indicate when the contents have reached four cups-worth. In contrast, contexts that

---

[7] The sentence is ambiguous because it can be simultaneously true and false in the context in (9ii). See the discussion in Gillon (2004) where it is argued that intuitions of truth and falsity in one and the same context provides the best evidence that a string is ambiguous.

support a partitioned reading require that the contents be spatially separated into units and often that each unit is contained in its own separate container.

The division of these readings into only two types is perhaps a little too coarse. As noted by Partee & Borschev (2012), container nouns like *cup* provide some evidence for a finer-grained distinction among partitioned and measured readings. For example, measured readings can be either ad hoc or based on a standard measure.[8] Similarly, there is some evidence for a reading that hovers between a partitioned and measured reading, sometimes called a *concrete-portions* reading. Such readings foreground the contents rather than the container, much like a measured reading, but require that the contents be physically partitioned, much like a partitioned reading (see Partee & Borschev 2012 for a discussion).[9] However, as we discuss in section 5, there are certain factors that limit the types of readings that are available and/or detectable when using Ch'ol classifier constructions.[10] Classifiers in Ch'ol tend to be used in contexts that support either an ad hoc measure reading or a containerless partitioned reading (i.e., partitioned readings where there is no physical container separate from the contents, as exemplified by the measure terms *head, item* and *piece* in *head of cattle, item of clothing* and *piece of equipment*). Terms that refer to standard measures or containers are represented as nouns, not classifiers (see section 5 for details). Thus, for the purposes of this paper, we will concentrate on the broad semantic and syntactic distinctions between measured and partitioned readings, mentioning finer-grained distinctions when it is relevant.

Terms that are predominantly used in contexts that support a measured reading include *litres, grams, pounds, tonnes, inches, hours,* and *seconds*. Examples of terms that are typically used in contexts that support a partitioned reading include *items, pieces, baskets, buckets,* and *boxes*. To some degree, all terms can be used to indicate either reading although some terms are more flexible than others, such as those that refer to containers like *cups, teaspoons,* and *barrels*.

(10)   TERMS PREFERENTIALLY USED IN CONTEXTS THAT SUPPORT A MEASURED
        READING
        a.   I put 500 **grams** of sugar in the pot.
        b.   We observed ten **seconds** of silence.

(11)   TERMS PREFERENTIALLY USED IN CONTEXTS THAT SUPPORT A PARTITIONED
        READING
        a.   I put four **items** of furniture in the hallway.
        b.   I put four **baskets** of books in the hallway.

---

[8] The ambiguity of such readings comes about when considering situations where a regular cup is used to measure water that is poured into a pot. In such cases, it can be both true and false to say *There are three cups of water in the pot*: false under a reading where *cup* is an agreed upon standard measure (i.e., the imperial *cup*); true where *cup* is treated as a contextually determined measure (i.e., three cups-worth of water as measured by the actual cup in the context of utterance). Partee & Borschev (2012) hypothesize a theoretical distinction between these two readings. Standard measure readings involve a lexical item that is stored as a measure function whereas ad hoc measure readings involve a lexical rule that converts container nouns into a measure function.
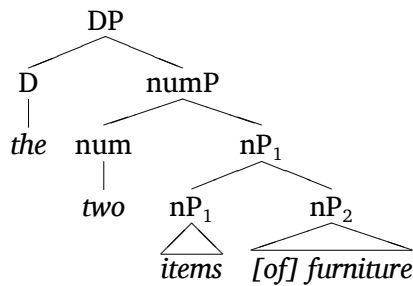
[9] Such a reading is exhibited by sentences like *Mary wants to drink those two glasses of milk*, where the verb *drink* requires that its object be a liquid of some kind, but *those two* expresses and refers to the glasses that contain the liquid. It is critical to note that this reading is incompatible with contexts that typically support a measured reading. For example, the previous sentence is incoherent if the contents of the glasses are poured into a bowl and Mary wants to drink the milk out of the bowl.

[10] It is important to note that the full range of readings is attested in Ch'ol. However some readings that critically rely on container terms involve the use of a default classifier with a container noun instead of a classifier that refers to the container.
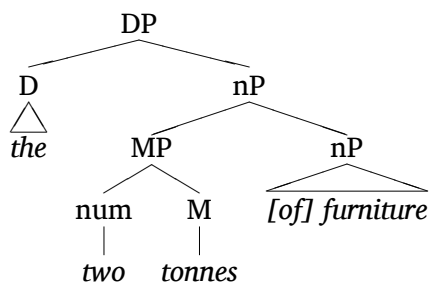
(12)　Terms without any preferential use
    a.　I put four **cups** of water in the fridge.
    b.　I put four **teaspoons** of sugar on the table.

Landman (2004) and Rothstein (2009; 2011) propose that there is a syntactic distinction (and hence a syntactic ambiguity) that corresponds to the differences between the measured readings on the one hand, and the partitioned reading on the other. According to these authors, partitioned readings have a structure where the measure term is the syntactic head and the non-measure term is either a complement or a modifier, as shown in (13).[11] In contrast, measure readings are proposed to have a syntactic structure in which the noun denoting the thing being measured is the head, as shown in (14). The numeral and measure term form a constituent, here MP, that restricts the head noun.

(13)　Partition reading

```
              DP
           ┌──┴──┐
           D    numP
           │   ┌──┴───┐
          the num    nP₁
              │    ┌──┴───┐
             two  nP₁    nP₂
                  △       △
                items  [of] furniture
```

(14)　Measure reading

```
              DP
           ┌──┴────┐
           D      nP
           △    ┌──┴────┐
          the  MP      nP
             ┌─┴─┐      △
            num  M   [of] furniture
             │   │
            two tonnes
```

As noted by Rothstein (2009; 2011), the structures in (13) and (14) make different syntactic predictions. First, it is expected that the count-mass status of the DP will depend on which noun (the measure term or the non-measure term) is the head. In (13), the head noun is the measure term, which is count. In (14), however, the head noun is the non-measure term, which happens to be mass. Evidence from the distribution of *much* and *many* largely confirms this prediction. DPs that are typically used in contexts that support a partitioned meaning sound awkward when they follow *much of* but sound natural following *many of*, whereas the opposite holds for DPs that are typically used in contexts that support a measured reading. For example, in a context where the speaker is talking about a large amount of furniture stored in a single warehouse, the sentences in (15a) and (16b) are coherent whereas the ones in (15b) and (16a) sound distinctly odd.

---

[11] There is variation in the literature as to whether the numeral is represented as a specifier of the phrase headed by the measure term, or as the head of its own projection, as shown here. The choice is not critical to our discussion below. There is also some variation in the literature as to whether the *of* term is a head of a prepositional phrase with a denotation equal to its complement *n*P or whether *of* is inserted for case reasons but is not a true P⁰ head. Once again, the choice of analysis does not affect the discussion here.

(15)    PARTITION TERMS
      a.   Many of the 300 items of furniture will be exported to India.
      b. #Much of the 300 items of furniture will be exported to India.

(16)    MEASURE TERMS
      a. #Many of the 300 tonnes of furniture will be exported to India.
      b.   Much of the 300 tonnes of furniture will be exported to India.

The structures in (13) and (14) also make different predictions with respect to number agreement. It is well known that the number status of the subject DP is at least partly determined by number marking on the head noun. Considering this fact, the general structure in (13) predicts that number marking on the measure term should influence the form of the verb/auxiliary. In contrast, the general structure in (14) predicts that it should be the non-measure term that plays a role in agreement. The examples in (17) and (18) suggest that these predictions are on the right track.

(17)    MEASURE TERMS
      a.   The five minutes of silence we observed {was / ?were} appropriate.
      b.   The 500 grams of sugar we added to the sauce {gives / ?give} it a sweet aftertaste.

(18)    PARTITION TERMS
      a.   The five boxes of equipment we loaded into the truck {were / # was} going to be shipped to Toronto.
      b.   The 500 items of furniture that we bought at the flea-market {were / # was} in good condition.

In both (17) and (18), the non-measure term is singular and the measure term is plural. In contexts that support a measured reading—e.g., where the time-span of silence is contiguous (rather than 5 separate 1-minute intervals) and the sugar is measured in one big lump (rather than 500 separate 1-gram packets)—the sentences in (17) sound more natural with singular agreement. In contrast, in contexts that support a partitioned reading—e.g. where there are 5 separate boxes of equipment and 500 separate items of furniture—the sentences in (18) sound more natural with plural agreement. The syntactic structures in (13) and (14) can explain these preferences.[12]

   Given the behaviour of measure terms in English, a question arises about how classifiers are syntactically represented in languages like Mandarin and Ch'ol. Do DPs in such languages have a similar syntactic contrast between measured and partitioned readings? Li (2011) suggests that this is the case for Mandarin. He argues that sortal classifiers, which almost always convey a partitioned reading, are typically embedded in a partitioned syntax similar to (13).[13] In contrast, non-sortal classifiers, which are often used to convey a measured reading, are typically embedded in a measured syntax, similar to (14). For example, the phrase in (19) would have the syntactic structure in (21) when used to talk about five spatially separate eggs, whereas the phrase in (20) would have the

---

[12] It remains an open question why plural agreement in (17) is more acceptable than singular agreement in (18). It could be that coercion of *minutes* and *grams* into a partitioned reading is easier than the coercion of *items* and *boxes* into a measured reading. The contrast between (17) and (18) nonetheless lend support to the idea that the measure term is the head of the partitioned reading whereas the non-measure term is the head of the measured reading.
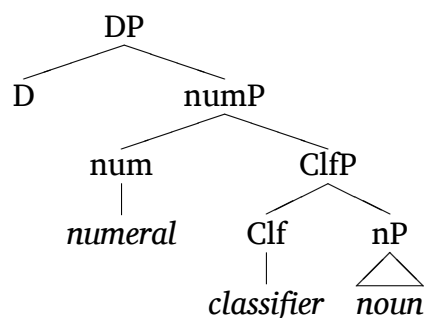
[13] A notable exception is when sortal classifiers are used to convey an estimation involving large round numbers. In such cases, Li (2011) argues that sortal classifiers convey a measured reading and are typically embedded in a measure syntax.

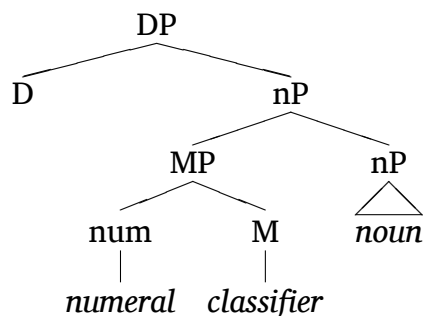syntactic structure in (22) when used to talk about one quantity of oil that measures three cups-worth.

(19)  wǔ  ge  jī-dàn
      five  CLF  egg
      'five eggs'

(20)  sān  bēi  yóu
      three  CLF  oil
      'three cups of oil'

(21)  PARTITION READING

```
                    DP
                  /    \
                 D      numP
                       /    \
                    num      ClfP
                     |      /    \
                  numeral  Clf     nP
                            |     /\
                        classifier  noun
```

(22)  MEASURE READING

```
                 DP
               /    \
              D      nP
                   /    \
                  MP      nP
                /   \     /\
             num     M   noun
              |      |
          numeral  classifier
```

As with English, there is some flexibility in terms of which type of reading the classifiers are used to convey—e.g., the phrase in (20) could be used to talk about three separate cups containing oil, in which case it would have the syntactic structure in (21)—however there is still a one-to-one correspondence between the reading that is conveyed and the syntactic structure that is employed, or so Li (2011) claims. The evidence in support of this analysis is based on the effect the subordinating particle *de* has on the readings when it appears between the classifier and noun (namely it forces a measured reading) and the effect that certain adjectival modifiers have on the readings when they appear between the numeral and classifier (namely they force a partitioned reading).[14]

Contrary to Li's (2011) analysis of Mandarin, we argue below that all numeral classifier constructions in Ch'ol have the same syntactic structure, namely the measure structure in (22). We cannot assess classifier constructions in Ch'ol using the same type of syntactic

---

[14] Mathieu & Zareikar (2015) also discuss the differences between measured and partitioned readings in a variety of languages, however they concentrate on languages where classifiers seem to be derived from nouns (and thus interact with plural marking). As discussed in section 3, in Ch'ol classifiers are derived from verbal or positional roots, and thus it is difficult to compare the analysis and diagnostics used in Mathieu & Zareikar (2015) to the ones offered here. Critically, under Mathieu & Zareikar's analysis, no measure term forms a constituent with the numeral independent of the noun, regardless of the type of reading (partitioned or measured). As will be made clear in section 4, such an analysis is incompatible with the Ch'ol data.

diagnostics used in English or Mandarin. Unlike English measure terms, classifiers in Ch'ol are (with few exceptions, discussed in §4.2 below) not nouns and thus do not have any status in terms of nominal subcategorization (i.e., they cannot be singular/plural nor mass/count—in fact, at least on the surface, there does not appear to be a syntactic mass-count distinction in Ch'ol). Unlike Mandarin, Ch'ol does not have a subordinating particle comparable to *de* nor does it allow adjectives to appear between numerals and classifiers. Nonetheless, other tests provide evidence that all classifiers in Ch'ol are embedded in a structure like the one in (22), which is more akin to the syntactic structure that underlies measured readings in English. However, Ch'ol allows for both measured and partitioned readings despite only having this type of structure.

## 3  Numerals and classifiers in Ch'ol

This section provides relevant background details about numerals and classifiers in Ch'ol, a Mayan language spoken by around 200,000 people in the state of Chiapas in southern Mexico. Unless otherwise noted, Ch'ol data presented here come from the third author, a speaker of the Tumbalá variety, as well as speakers consulted in the municipalities of Salto de Agua and Tila, Chiapas. Data appear from the two main dialects, Tila and Tumbalá; the dialects behave the same with respect to the core facts described here, with differences noted below. For overviews of Ch'ol grammar, see Vázquez Álvarez (2011) and Coon (2017a). We examine numerals in section 3.1 and then the origins of classifiers and productivity of the classifier system in section 3.2. Note that the grammatical overview in this section is intended to be broad in that it covers some relevant points about all types of classifier expressions in Ch'ol. In subsequent sections, we limit our focus to sortal classifiers, although we do discuss some historical and grammatical limitations on the types of readings that are available for other Ch'ol classifiers in section 5.

### 3.1  Ch'ol numerals

Numerals in counting expressions in Ch'ol obligatorily occur with a numeral classifier. As in other Mayan languages, the Ch'ol numerical system is vigesimal (base 20). Numerals 1–20 are shown in (23). As numerals never appear alone, numerals 1–19 are presented with the generic classifier *-p'ej*.[15]

(23)　Cʜ'ᴏʟ ɴᴜᴍᴇʀᴀʟꜱ (Arcos López 2009: 24)

| | | | |
|---|---|---|---|
| 1 | *jum-p'ej* | 11 | *juñlujum-p'ej* |
| 2 | *cha'-p'ej* | 12 | *lajchäm̃-p'ej* |
| 3 | *ux-p'ej* | 13 | *uxlujum-p'ej* |
| 4 | *chäm-p'ej* | 14 | *chäñlujum-p'ej* |
| 5 | *jo'-p'ej* | 15 | *jo'lujum-p'ej* |
| 6 | *wäk-p'ej* | 16 | *wäklujum-p'ej* |
| 7 | *wuk-p'ej* | 17 | *wuklujum-p'ej* |
| 8 | *waxäk-p'ej* | 18 | *waxäklujum-p'ej* |
| 9 | *bolom-p'ej* | 19 | *bolujum-p'ej* |
| 10 | *lujum-p'ej* | 20 | *juñ-k'al* |

The numerals 20 and above involve roots in classifier position which refer to powers of 20 (i.e., measure classifiers), shown in the table in (24). We return to the formation of complex numerals in section 4; see also the appendix in Warkentin & Scott (1980).

---

[15] Final nasals undergo place assimilation to the following consonant, represented in the orthography (INALI 2011). Relevant for our purposes here, the numeral 'one' alternates between *juñ* and *jum*, depending on the following classifier.

(24)    CLASSIFIERS FOR MULTIPLES OF 20

| 20 | -k'al |
|---|---|
| 400 (20$^2$) | -bajk' |
| 8,000 (20$^3$) | -pijk |

The base-20 roots in (24) fill the classifier position in the DP, as shown by the contrast in (25). In (25a), the numeral *ux* appears with the classifier *-kojty* for animals; in (25b), the numeral appears with the classifier *-k'al* for groups of twenty. That these occupy the same slot is shown by their inability to cooccur in (25c); the opposite ordering is ungrammatical as well. We return to this fact below.

(25)    a.    ux-**kojty**  wakax
              three-CLF  cow
              'three cows'

        b.    ux-**k'al**    wakax
              three-CLF  cow
              'sixty cows'

        c.    *ux-**k'al**-**kojty**  wakax
              three-CLF-CLF  cow

Today most speakers, including many monolingual speakers, use Ch'ol numerals only up to six, as well as ten, twenty, forty, sixty, eighty, one hundred and four hundred (Vázquez Álvarez 2011).[16] Numerals that were historically borrowed from Spanish are used for higher numbers. While Ch'ol-based numerals obligatorily appear with a classifier in counting constructions, classifiers are impossible with numerals of Spanish origin (Bale & Coon 2014), as shown in (26).

(26)    a.    cha'-*(**p'ej**) tyumuty
              two-CLF        egg
              'two eggs'

        b.    syete(*-**p'ej**)   tyumuty
              seven(SP)-CLF egg
              'seven eggs'

We will not discuss the important differences between Spanish-based numerals and traditional Ch'ol numerals further in this paper. See Bale & Coon (2014) for a more thorough discussion.

   The other element which appears with a classifier is the "interrogative numeral" *jay* 'how many' (27a). Other quantifiers like *kabäl* 'many' and *ts'itya'* 'few' do not appear with a classifier (27b). Numerals may be reduplicated for a distributive reading and still require a classifier, as in (27c) (examples are from Martínez Cruz 2007: 88).

(27)    a.    Jay-* (p'ej)     alaxax  ya'-añ?
              how.many-CLF orange  there-EXT
              'How many oranges are there?

        b.    Ya-añ      kabäl(*-p'ej) alaxax.
              there-EXT many-CLF     orange
              'There are many oranges.'

---

[16] Vázquez Álvarez (2011: 160) notes that four hundred is still in use because it is used to count corn during harvest times.

    c.    Ju-jum-p'ej   mi   la-k-xip-tyep'-e'.
           RED-one-CLF  IPFV  PL-A1-wrapped-wrap-SUF
           'We wrap them up one by one.'

### 3.2 Ch'ol classifiers

Numeral classifiers are found in a number of different Mayan languages, but the most robust systems are found in the Greater Tseltalan branch of the family, which includes Tseltal, Tsotsil, Chontal, Ch'orti', and Ch'ol (see e.g. Keller 1955; Berlin & Romney 1964; Berlin 1968; Fleck 1981). Arcos López (2009) identifies at least 180 classifiers in Ch'ol, though this is not an exhaustive list.

In closely-related Tseltal, Berlin & Romney (1964) identify 557 possible numeral classifiers. The table in (28), taken directly from Berlin & Romney (1964), provides an illustrative example of the richness of the system.

(28)    CLASSIFIERS IN DOMAIN OF 'AGGRETATION OF GLOBULAR OBJECTS'

| Category | Numeral Classifiers | Criterial Attributes |
|---|---|---|
| 'aggregations of globular-shaped objects, as corn kernals, coffee beans, peanuts, chili peppers, stones, pieces of corn dough, eggs, etc.' | /b'uhs/ | aggregated in a manner such that maximal horizontal extension of items is achieved with minimal spacing between items |
| | /t'ol/ | aggregated in a manner such that maximal vertical piling is achieved |

The large number of what are often highly specific classifiers like those in (28) raises questions about how speakers can acquire and use such systems. We discuss the formation of Ch'ol classifiers here, which will be relevant to their syntactic structures below.

A small number of Ch'ol numeral classifiers have an unknown origin (Arcos López 2009). These include some of the more frequently used numeral classifiers, shown in (29).

(29)

| classifier | used to count… |
|---|---|
| *-tyikil* | people |
| *-p'ej* | spherical things; generic classifier |
| *-k'ej* | round and flat things |
| *-ts'ijty* | long and skinny things |

While classifiers like those in (29) must simply be learned, the vast majority of numeral classifiers are formed from two main classes of roots: transitive roots and positional roots, discussed in turn below.[17] Richness in the verbal and positional domain thus translates directly to richness in the system of classifiers.

---

[17] A smaller number of classifiers are formed from nominal stem forms, not discussed in detail here. These include certain containers, like *p'ejty* 'pot' and *chikib* 'basket' (see §4.2), as well as certain nominal forms of intransitive roots, such as *-ñumel,* used to count repetitions (from the intransitive root *ñum* 'to pass').

### 3.2.1 Classifiers from transitive roots

As in other Mayan languages, transitive and positional roots are CVC in form. Coon (2017b)—drawing on work in Yucatec Maya (Lois 2011)—argues that Ch'ol roots show templatic effects, comparable to the more well-studied "root-and-pattern" morphology in Semitic languages (e.g. McCarthy 1981). Both consonants of the CVC roots are fully specified, but suprasegmental vowel qualities are specified during the course of the derivation (see e.g. Arad 2003 on Hebrew). The forms in (30) and (31) illustrate this pattern for transitive roots.

(30)    a.    Ta' i-**kuch**-u    si'        jiñi wiñik.
              PFV A3-carry-TV firewood DET man
              'The man carried firewood (on his back).'

        b.    Ta' **kujch**-i          si'.
              PFV carry.PASS-ITV  firewood
              'Firewood was carried (on back).'

(31)    a.    Ta' i-**jop**-o        kajpe jiñi x'ixik.
              PFV A3-gather-TV coffee DET woman
              'The woman gathered together coffee (beans).'

        b.    Ta' **jojp**-i          kajpe.
              PFV gather.PASS-ITV coffee
              'Coffee beans were gathered.'

Transitive roots can be identified by their ability to appear underived in verbal constructions with two arguments (see e.g. Haviland 1994 for a discussion of root classes in Tsotsil). The roots above appear in transitive stem forms in (30a) and (31a) with a plain root vowel: *kuch* and *jop*. The transitive stem requires a harmonic vowel "status suffix" and appears with two arguments. In the passive forms in (30b) and (31b), the root appears with a lengthened and devoiced root vowel, represented in the orthography as CVjC (orthographic *j* = IPA [h]).[18] The stem requires the intransitive status suffix, *-i*, and now takes only a single internal argument.

   Numeral classifiers may also be formed from these roots using the same CVjC form found in the intransitive (b) forms above. Examples of classifiers derived from transitive roots are shown in (32). Note that the internal argument of the transitive and unaccusative forms in (30) and (31) corresponds to the object being counted in the classifier constructions in (32).

(32)    a.    cha'-**kujch** si'
              two-CLF      firewood
              'two loads of firewood' (carried on back)

        b.    ux-**jojp**    kajpe
              three-CLF coffee
              'three handfuls of coffee (beans)'

Examples of other classifiers formed from transitive roots are shown in (33); see Aulie & Aulie (1978) and Arcos López (2009) for more.

---

[18] Other works on Ch'ol have described the CVjC forms as involving a [j] "infix" (e.g. Vázquez Álvarez 2011). The ultimate analysis is not central to our main point here, but see discussion in Coon (2017b).

(33)   CLASSIFIERS FROM TRANSITIVE ROOTS

| classifier | used to count… | root | |
|---|---|---|---|
| *-jajts'* | beats (of music) | *jats'* | 'hit' |
| *-jojp* | handfuls (of dry things) | *jop* | 'gather (dry things)' |
| *-kejp* | hanging bunches (i.e. bananas) | *kep* | 'hang' |
| *-kujch* | bulks, loads | *kuch* | 'carry' |
| *-läjts* | piles (i.e. of corn, firewood) | *läts* | 'pile up (solid things)' |
| *-lejb* | pieces | *leb* | 'take apart' |
| *-lejch* | spoonfuls (of food) | *lech* | 'scoop up food' |
| *-lujch* | spoonfuls (of liquid or fine grains) | *luch* | 'ladle, scoop liquid' |
| *-mejk'* | armfuls (both arms around) | *mek'* | 'hug' |
| *-p'ijch* | tacos | *p'ich* | 'make tacos' |
| *-p'ijs* | cupfuls | *p'is* | 'measure' |
| *-sejl* | round things (i.e. wheels) | *sel* | 'roll' |
| *-sujl* | plunges | *sul* | 'plunge' (into water) |

Importantly, note that just as verb choice may co-vary with the nature of the internal argument, so too do the corresponding numeral classifiers co-vary with the substance of the element counted. This is not unlike English, in which *coffee* is most naturally understood as a brewed beverage in a sentence like *she ladled the coffee*, but as a bean in a sentence like *she spread out the coffee to dry in the sun*. Similarly, in the classifier forms corresponding to transitive roots, a noun with a broad meaning may receive a different interpretation depending on the choice of classifier, as shown by the different readings of the noun *bu'ul* 'bean' in (34).[19]

(34)  a.  ux-**jojp**   bu'ul
          three-CLF  bean
          'three scoops of beans (seeds)'            (*jop* – 'to scoop dry things')

      b.  ux-**tsojl**  bu'ul
          three-CLF  bean
          'three rows of beans (plants)'             (*tsol* – 'to arrange in a line')

      c.  ux-**läjts**  bu'ul
          three-CLF  bean
          'three piles of beans (pods)'              (*läts* – 'to pile up solid things')

---

[19] The examples in (34) involve non-sortal classifiers. However, this influence of the classifier on the denotation of the noun extends to sortal classifiers as well. For example, the sortal classifiers *-p'ej*, *-tyejk*, and *-ts'ijty* can all combine with the noun *bu'ul*, yielding different effects on the truth conditions of the sentences, as reflected in the translations in (i).

(i)  a.  Ta'  k-mäñ-ä    cha'-p'ej   bu'ul.
         PFV  A1-buy-TV  two-CLF     bean
         'I bought two beans (i.e. bean seeds).'

     b.  Ta'  k-mäñ-ä    cha'-tyejk  bu'ul.
         PFV  A1-buy-TV  two-CLF     bean
         'I bought two bean plants.'

     c.  Ta'  k-mäñ-ä    cha'-ts'ijty bu'ul.
         PFV  A1-buy-TV  two-CLF      bean
         'I bought two bean-pods.'

For arguments that these classifiers are indeed sortal, and for further details about the semantic contribution of these classifiers, see sections 5 and 6 of Bale et al. (2016).

    d.   ux-**lujch**  bu'ul
          three-CLF  bean
          'three spoonfuls of (cooked) beans'          (*luch* – 'to spoon liquid')

### 3.2.2 Classifiers from positional roots

Numeral classifiers in Ch'ol are also derived from *positional* roots (discussed in detail in Arcos López 2009; see also Haviland 1981 on Tsotsil). Positional roots in Mayan languages form a distinct class, distinguishable in part by their semantic content (position, shape, surface quality, or physical state), but also by the special morphology used to form stems (England 1983; 2001; Haviland 1994; Henderson 2016; 2019; Coon 2019).

In Ch'ol, for example, positional roots form intransitive stative predicates with the suffix -*Vl* (the vowel is harmonic with the root vowel). As with transitive roots, the formation of numeral classifiers from positional roots is quite productive (though we have not systematically tested all roots): something that can be described as CVC-Vl can generally be counted with the classifier -CVjC. Examples with the positional roots *pal* 'clustered' and *koty* 'standing on four legs' are shown in (35) and (36).

(35)    a.   **Koty**-ol              jiñi  me'.
              standing.on.4.legs-STAT  DET  deer
              'The deer is standing on four legs.'

        b.   chäñ-**kojty**  me'
              four-CLF     deer
              'four deer'

(36)    a.   **Pal**-al          jiñi  ja'as   tyi    tye'.
              clustered-STAT  DET  banana  PREP  tree
              'The bananas are clustered in the tree.'

        b.   cha'-**pajl**  ja'as
              two-CLF   banana
              'two bunches of bananas'

Additional examples are shown in (37).

(37)    CLASSIFIERS FROM POSITIONAL ROOTS

| classifier | used to count… | root | |
|---|---|---|---|
| -*kojty* | four-legged things | *koty* | 'standing on four legs' |
| -*lijk* | pieces of cloth | *lik* | 'hanging' (e.g. cloth on a stick) |
| -*bojx* | shoes | *box* | 'hollowed out (round)' |
| -*pajl* | clusters | *pal* | 'clustered, bunched' |
| -*p'ujl* | piles | *p'ul* | 'piled up' |
| -*tyojk* | cracks | *tyok* | 'open' |
| -*wejl* | sides (e.g. of a board) | *wel* | 'flat' |
| -*wojl* | bottles | *wol* | 'spherical (solid)' |
| -*wojx* | soft spherical things | *wox* | 'spherical (flexible, soft)' |
| -*xejty* | convex objects | *xety* | 'in a convex form' (e.g. bowl on table) |
| -*xojty* | rings | *xoty* | 'ring shaped' |

Though this process appears to be productive, some CVjC classifiers also have extended uses, not predictable from the meaning of the corresponding CVC root alone. For example, the classifier -*kojty* is derived from the positional root *koty* 'standing on four legs'. It can

be predictably used to count four-legged animals such as cows, pigs, deer, and jaguars (38a). Beds, tables, and cars can also be counted with *-kojty* (38b). However, having four limbs is not necessary to be counted with *-kojty*, which is also used to count all animals regardless of the number of limbs: butterflies, snakes, chickens, birds, fish, or a dog with a missing leg (38c). The classifier *-kojty* is also used to count all chili peppers, regardless of shape (38d).

(38)    a.    cha'-kojty   chityam
              two-CLF     pig
              'two pigs'

        b.    cha'-kojty   wäyib
              two-CLF     bed
              'two beds'

        c.    cha'-kojty   p'ejpem
              two-CLF     butterfly
              'two butterflies'

        d.    cha'-kojty   ich
              two-CLF     pepper
              'two peppers'

In a similar vein, the classifier *-tyejk* is derived from the positional root *tyek*; roughly it is used to describe a configuration of organic things growing out of a sparsely-populated surface. Predictably, *-tyejk* may be used to count plants which are growing spaced apart, hairs sprouting out of an otherwise bald head, or several spaced-apart teeth (e.g. in a baby or an elderly person's mouth). For most elements, this configuration is important: *-tyejk* cannot be used to count teeth in a mouth full of teeth. However, *-tyejk* is also used to count all trees, regardless of their spacing.
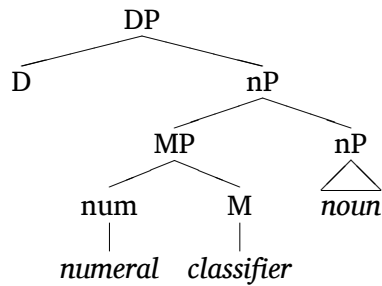
   The relevance of position, shape, and configuration means that—just as in (34) above—a single noun may be counted with more than one classifier. Snakes are particularly good candidates for this type of productivity, as shown in (39).

(39)    a.    juñ-**kojty**   lukum
              one-CLF     snake
              'one snake (any form)'

        b.    juñ-**xojty**   lukum
              one-CLF     snake
              'one snake (coiled up)'

        c.    juñ-**jäjl**   lukum
              one-CLF   snake
              'one snake (stretched out)'

        d.    juñ-**jijch'**   lukum
              one-CLF     snake
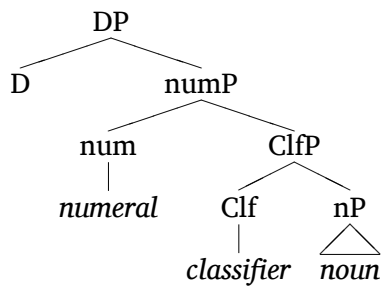              'one snake (hanging face-down)'

## 4 Classifiers and Measured Structures

In this section, we provide syntactic and semantic evidence that all numeral classifier constructions in Ch'ol have the structure repeated in (40), corresponding to the *measure* structure, rather than the one repeated in (41), corresponding to the *partition structure*.
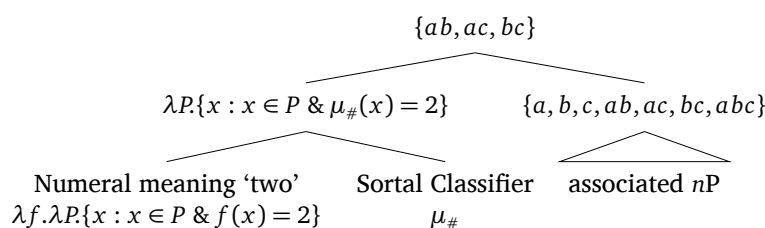
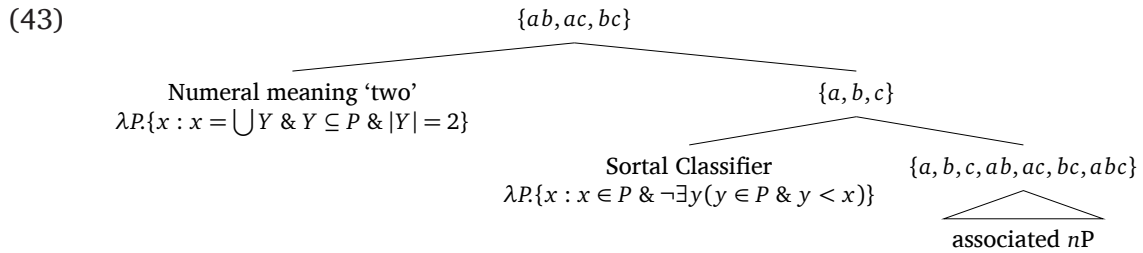(40)    MEASURE STRUCTURE

```
                    DP
              ┌──────┴──────┐
              D            nP
                      ┌──────┴──────┐
                     MP            nP
                  ┌───┴───┐        △
                 num      M       noun
                  │       │
               numeral  classifier
```

(41)    PARTITION STRUCTURE

```
                    DP
              ┌──────┴──────┐
              D           numP
                      ┌──────┴──────┐
                     num          ClfP
                      │        ┌────┴────┐
                   numeral    Clf        nP
                              │          △
                          classifier   noun
```

As reviewed in section 2, Li (2011) hypothesizes that classifier languages have both types of structures, similar to English. Furthermore, the difference between the partition and measure structures generally corresponds with different semantic interpretations of sortal and non-sortal classifiers. In this section, we will mainly focus on sortal classifiers, since it is their status with respect to this type of hypothesis that we aim to challenge. Such classifiers include many of the underived classifiers mentioned at the beginning of section 3.2, namely *-tyikil* (for people), *-p'ej* (for spherical things and the generic classifier) and *-ts'ijty* (for long and skinny things). Also included are some of the classifiers derived from positional roots that have extended meanings that lie beyond the expected meaning related to such roots: for example, the classifier *-kojty*, which is derived from the root meaning 'standing on four legs' but used for non-four legged entities such as chili peppers, as well as the classifier *-tyejk*, which is derived from the root meaning 'growing out of sparsely populated surfaces' but which is used to pick out trees and larger tree-like plants no matter what arrangement they are in. Li (2011) argues that these kinds of classifiers are biased towards a partitioned meaning since they are not associated with a specific measure—the only exception being expressions of estimation.

As mentioned in the introduction, the fact that sortal and non-sortal classifiers are used in the same types of structures regardless of whether they convey a measured or partitioned meaning (i.e., they are all used in measure structures) suggests that these structures should be associated with the same type of semantic entity (e.g., measure functions). Furthermore, such a structure implies that there does not exist a phrase—consisting only of the classifier and noun—that denotes a partition of the supremum of the nominal denotation. In other word, the syntactic structure is more in line with the compositional interpretation (42) rather than the one in (43).

(42)

$$\{ab, ac, bc\}$$

```
                        ┌──────────────┴──────────────┐
        λP.{x : x ∈ P & μ_#(x) = 2}          {a, b, c, ab, ac, bc, abc}
         ┌──────────┴──────────┐                  ┌──────┴──────┐
    Numeral meaning 'two'   Sortal Classifier   associated nP
   λf.λP.{x : x ∈ P & f(x) = 2}      μ_#
```

(43)

$$\{ab, ac, bc\}$$

Numeral meaning 'two'
$\lambda P.\{x : x = \bigcup Y \ \& \ Y \subseteq P \ \& \ |Y| = 2\}$

$$\{a, b, c\}$$

Sortal Classifier
$\lambda P.\{x : x \in P \ \& \ \neg \exists y(y \in P \ \& \ y < x)\}$

$$\{a, b, c, ab, ac, bc, abc\}$$
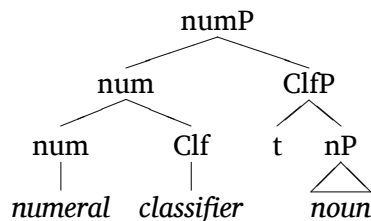
associated $n$P

Critically, the semantics in (42) can be used in contexts that support a partitioned meaning despite appearing in a syntactic structure that is isomorphic to the kinds of structures that convey a measured reading in languages like English and Mandarin. The measure function $\mu_{\#}$ maps groups to the number of objects/atoms in that group. Thus, it achieves the same result as counting the cardinality of a partition as shown by equivalencies of the topmost node in (42) and (43). In the rest of this section, we review some syntactic evidence that favours measured structures for all classifiers in Ch'ol and hence the type of semantic meaning for sortal classifiers represented in (42). In section 4.1 we argue that the [NUM + CLF] behaves as a maximal projection. In section 4.2 we present evidence that the noun functions as the head of the phrase.

### 4.1 The numeral and classifier form a constituent

The first piece of evidence for the structure in (40) above is that the numeral and classifier form a single phonological word in Ch'ol. This fact can be easily accounted for under the measure structure in (40), in which the numeral and classifier are both inside the MP constituent. Previous work has accounted for this fact under the partition structure in (44) by proposing that the classifier head undergoes head movement to adjoin to the numeral (see Borer 2005).

(44)    PARTITION STRUCTURE AFTER HEAD MOVEMENT

```
                numP
              /      \
           num       ClfP
          /    \      /  \
        num    Clf   t    nP
         |      |          △
     numeral  classifier  noun
```

These two possibilities make different predictions: under the measure structure, the [NUM + CLF] should behave as a maximal projection (possibly containing complex heads), while under the partition structure, the [NUM + CLF] should behave as a complex head.

Some initial evidence in favour of the measure-structure approach—in which the [NUM + CLF] is contained in a maximal projection excluding the nominal—comes from the formation of complex numerals. Recall from 3.1 above that Ch'ol's numerical system is base 20. To form numbers which are multiples of twenty, special classifiers denoting powers of twenty fill the classifier slot of the [NUM + CLF] expression, as in (45).

(45)    a.    cha'-k'al
              two-CLF.20
              'forty' (lit. two-20s)

        b.    cha'-bajk'
              two-CLF.400
              'eight hundred' (lit. two-400s)

These *veintenas*, or multiples of twenty, are important to the formation of more complex numerals, like those in (46). Numerals of each multiple of twenty belong to the next highest *veintena*, the bolded portion in the expressions below. For example, all numerals between 21 and 40 will contain *cha'-k'al* 'forty', as in (46a); numerals between 81 and 100 will contain *jo'-k'al* 'one hundred' in (46b), and so on.

(46)    COMPLEX NUMERALS (Warkentin & Scott 1980: 108)
    a.    cha'-p'ej  **i-cha'-k'al**
          two-CLF   A3-two-CLF.20
          'twenty-two' (lit. two of the group of two-20s)

    b.    lujum-p'ej  **i-jo'-k'al**
          ten-CLF       A3-five-CLF.20
          'ninety' (lit. ten of the group of five-20s)

    c.    jo'lujuñ-k'al    **i-cha'-bajk'**
          fifteen-CLF.20  A3-two-CLF.400
          'seven hundred' (lit. fifteen-20s of the group of two-400s)

Relevant for our purposes is that these forms clearly have an internal structure. In these complex expressions, the bolded *veintena* appears with 3rd person agreement ("Set A" in Mayanist terminology), normally found on possessed or relational nouns.[20] Though this system is not in current use by most Ch'ol speakers we have consulted, similar structures are reported in work on other languages in the family as well (e.g. Fleck 1981; Haviland 1981). While we do not elaborate on the structure of complex numeral expressions in Ch'ol, the important point is that the [NUM + CLF] component can contain more material than a single word. We claim that this fact is best accounted for under a structure in which numerals and classifiers form an XP, rather than a single complex head.

Evidence from juxtaposition corroborates the XP status of the [NUM + CLF]. As discussed in Vázquez Álvarez (2011), there are no specific morphemes that indicate conjunction or disjunction in Ch'ol. Coordinate XPs are frequently juxtaposed, a possibility shown for [NUM + CLF] phrases to express indefinite quantities in (47) (examples are from Martínez Cruz 2007: 32 and Vázquez Álvarez 2011: 255).

(47)    a.    wajali      am-bi      li    [ juñ-tyikil cha'-tyikil ] la-k-pi'äl.
              back.then  EXT-REP DET   one-CLF    two-CLF      PL-A1-friend
              'It is said that back then we had some friends.'

    b.    [ cha'-tyikil ux-tyikil ] kixtyañu
            two-CLF    three-CLF  person
          'few people'

Again, under an analysis where the [NUM + CLF] is a complex head, these constructions would be difficult to account for.

Finally, evidence for the XP status of the [NUM + CLF] unit comes from A′-movement (see Gil 1994 for similar arguments regarding Japanese). Basic word order in Ch'ol is described as VOS/VS (Coon 2010; Vázquez Álvarez 2011), but as in other Mayan

---

[20] Ordinal numbers also appear obligatorily with 3rd person Set A possessive morphology, as in (i)

(i) Tsa' chäm-i **i**-cha'-kojty-lel    wakax.
    PFV  die-IV  A3-two-CLF-NML  cow
    'The second cow died.'

Here and above, one might think of these "possessed" numeral stem forms as "belonging" to an abstract set of numbers, though we do not elaborate further on this here.

languages, arguments may front to preverbal position for topic, focus, relativization, and *wh*-questions (see e.g. England 1991; Aissen 1992; Clemens & Coon 2018). An intransitive verb with a postverbal subject is shown in (48a); in (48b) the subject has fronted and a focus interpretation arises (indicated by italics in the translation). For example, the VS sentence in (48a) is an appropriate out-of-the-blue statement, while the subject-focus sentence in (48b) is an appropriate response to a question asking who arrived.

(48)   a.   Ta'  jul-i-y-ob         ux-tyikil  x'ixik.
              PFV  arrive-ITV-EP-PL  three-CLF  woman
              'Three women arrived.'

        b.   [ Ux-tyikil  x'ixik  ]$_i$       ta'  jul-i-y-ob        ___$_i$.
              three-CLF  woman         PFV  arrive-ITV-EP-PL
              '*Three women* arrived.'

As shown in (49), the numeral and classifier can be displaced as a unit independent of the noun (49a), but the numeral cannot be displaced without the classifier (49b). As might be expected, fronting the [NUM + CLF] alone focuses the quantity; (49a) is an appropriate response to a question about how many women arrived, or to correct someone who erroneously claimed that only one woman arrived.

(49)    FOCUS
        a.   Ux-tyikil$_i$  ta'  jul-i-y-ob      [ ___$_i$ x'ixik    ].
            three-CLF  PFV  arrive-ITV-EP-PL       woman
            '*Three* women arrived.'

        b.  *Ux$_i$    ta'  jul-i-y-ob      [ ___$_i$ tyikil x'ixik   ].
            three  PFV  arrive-ITV-EP-PL      CLF    woman
            '*Three* women arrived.'

A similar example involving a *wh*-question is shown in (50) and (51). A transitive sentence with postverbal object is shown in (50a). In (50b) the entire DP has fronted to preverbal position.

(50)    WH-QUESTION
        a.   Ta'  a-mäñ-ä    cha'-p'ej alaxax.
            PFV  A2-buy-TV  two-CLF  orange
            'You bought two oranges.'

        b.   [ Jay-p'ej       alaxax  ]$_i$ ta'  a-mäñ-ä    ___$_i$?
            how.many-CLF  orange    PFV  A2-buy-TV
            'How many oranges did you buy?'

The example in (51a) illustrates that *jay-p'ej* 'how many' can front independently of the noun; fronting *jay* without the classifier is ungrammatical, as in (51b).

(51)    a.   Jay-p'ej$_i$     ta'  a-mäñ-ä   [ ___$_i$ alaxax ]?
            how.many-CLF PFV  A2-buy-TV     orange
            'How many oranges did you buy?'

        b.  *Jay$_i$      ta'  a-mäñ-ä   [ ___$_i$ p'ej alaxax ]?
            how.many  PFV  A2-buy-TV     CLF orange
            'How many oranges did you buy?'

Bale et al: Classifiers, partitions, and measurements

The important point of these examples it not that it is impossible to separate the numeral and the classifier; given that the two form a phonological word and never appear as stand-alone morphemes, this fact is unsurprising. What is important is that the [NUM + CLF] undergoes A′-fronting *without the nP* to a preverbal position occupied by other fronted XPs. The fact that [NUM + CLF] is eligible for A′-movement provides strong support for its phrasal status.

Furthermore, this pattern shares properties with clear cases of extraction out of DPs elsewhere in Ch'ol. For example, as discussed in Coon (2009) (see also Aissen 1996 on Tsotsil) possessor DPs may extract independently of the possessum in certain contexts. A full possessive phrase is shown fronted in (52a); in (52b) the *wh*-possessor has fronted, leaving the possessum in its postverbal base position (examples are from Coon 2009: 166).

(52)    a.    [ Maxki i-plato   ] tyi  yajl-i   ___$_i$?
              who   A3-plate  PFV  fall-ITV
              'Whose plate fell?'

        b.    **Maxki**$_i$ tyi  yajl-i   [ i-plato   ___$_i$ ]?
              who    PFV fall-ITV   A3-plate
              'Whose plate fell?'

Subextraction of both the possessor and of the [NUM + CLF] are subject to the same restriction: subextraction is only possible out of DPs in internal argument position (unaccusative subjects in (49) and (52), and transitive objects as in (51); see the discussion in Aissen 1996 and Coon 2009). Subextracting both possessors and the [NUM + CLF] MP out of a transitive subject, as in (53b) and (54b), is ungrammatical.

(53)    a.    [ Majki i-chich   ]$_i$ ta'  y-il-ä-y-ety        ___$_i$?
              who   A3-sister   PFV  A3-see-TV-EP-B2
              'Whose sister saw you.'

        b.    *Majki$_i$ ta'  y-il-ä-y-ety        [ i-chich  ___$_i$ ]?
              who   PFV  A3-see-TV-EP-B2   A3-sister
              intended: 'Whose sister saw you?'

(54)    a.    [ Ux-tyikil xk'aläl-ob ]$_i$ ta'  y-il-ä-y-ety        ___$_i$.
              three-CLF girl-PL     PFV  A3-see-TV-EP-B2
              '*Three girls* saw you.'

        b.    *Ux-tyikil$_i$ ta'  y-il-ä-y-ety      [ ___$_i$ xk'aläl-ob ].
             three-CLF PFV  A3-see-TV-EP-B2     girl-PL
             intended: '*Three* girls saw you.'

Taken together, the fact that (i) the [NUM + CLF] may undergo A′-movement, and (ii) this A′-movement is subject to the same restrictions as other clear cases of A′-movement (i.e. subextraction of possessors), suggests that the [NUM + CLF] forms an XP constituent independent of the noun.[21] Although we illustrated the movement restrictions and

---

[21] Carol-Rose Little (p.c.) has observed some variation in positions from which subextraction is available. We do not have an independent proposal for what governs the possibility of subextraction out of the DP, but simply note that its availability for some [NUM + CLF] strings provides support for treating this string as an XP constituent.

juxtaposition facts using sortal classifiers (since these are the more controversial classifiers with respect to the *measure* structure), it is important to note that these patterns hold for non-sortal classifiers as well.[22] For the sake of brevity, we forego the relevant examples (which can be obtained by direct substitution).

### 4.2 Evidence that the noun is a head and the MP is an adjunct

Having established that the [NUM + CLF] forms an XP constituent—labeled MP in (40) above—we now turn to evidence that in the [MP noun] construction, the noun is the head and the MP is an adjunct. There are two sources of evidence. First, in constructions without numerals, it is clear that adjuncts modify the head noun in a DP. With respect to DPs with numerals and classifiers, only the noun can be modified by such adjuncts and not the classifier, even when the same root is used to form the classifier and noun. Second, there is a parallelism between adjectives and MPs, suggesting that they serve the same kind of syntactic and semantic function within a DP.

#### 4.2.1 Modifying adjuncts and head nouns

Modification in Ch'ol provides evidence that the noun is the head in DPs that contain a measure phrase. In this section, we review some of the syntactic and semantic properties of Ch'ol modifiers discussed in Martínez Cruz (2007), before turning our attention to the relationship between nouns and measure phrases.

In Ch'ol, modifying adjuncts often appear with the relativizing clitic =*bä*, a borrowing from neighboring Zoquean languages (Zavala Maldonado 2007). Also, as in Zoque, Ch'ol modifiers with =*bä* may either precede or follow the head noun. We assume that the DP in (55a) has the structure in (55b), in which the modifier adjoins to the *n*P.

(55)  a.  jiñi  { buch-ul = bä        } x'ixik    { buch-ul = bä        }
          DET   seated-STAT = REL    woman    seated-STAT = REL
          'the seated woman'

  b.
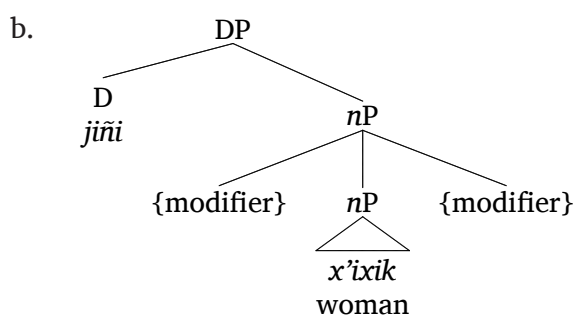


As Martínez Cruz notes, modification is a useful way to diagnose the head of the DP. Under our proposal, the [NUM + CLF] in a classifier construction is an MP which adjoins to the *n*P. While most classifiers are derived from verbal or positional roots (§3), a small number of nouns which denote measures—like *p'ejty* 'pot' and *chikib* 'basket'—may function either

---

[22] In a theory such as the one outlined in Svenonius (2008), it is possible to account for the fronting of the [NUM + CLF] independent of the noun even in a partition-like structure—first the *n*P would need to raise out of the DP and then the DP (with the trace of the nP remnant) would move to the front of the sentence. However, it is not clear how such a theory could account for the parallels between the movement of [NUM + CLF] and other types of subextraction discussed in this section, and we are unaware of independent motivation for this type of movement.

as nouns or as classifiers.[23] While both sentences in (56) below can be translated as 'one pot of eggs', *p'ejty* serves a different function in each.

(56)  a.  jum-**p'ejty** [$_{NP}$ tyumuty ]
          one-CLF        egg
          'one pot of eggs'

      b.  jum-p'ej [$_{NP}$ i-**p'ejty**-al    tyumuty ]
          one-CLF      A3-pot-NML egg
          'one pot of eggs'

In (56a), *-p'ejty* is acting as a numeral classifier; under our proposed structure in (40) above, *jump'ejty* is an MP which adjoins to the *n*P *tyumuty*. In (56b), on the other hand, *p'ejty* is the head noun; the numeral appears with the default classifier *-p'ej*. Internal to the bracketed *n*P, *tyumuty* behaves like a possessor in following the possessee and triggering Set A possessive agreement ('egg's pot'/'pot of eggs').

  As discussed in Martínez Cruz (2007), evidence that the bracketed strings in (56) indeed contain the nominal heads comes from modification. When a phrase-final modifier is added, it must be interpreted as modifying the head: in (57a) the eggs are broken, while in (57b), the pot itself is broken and nothing is asserted about the eggs (examples are from Martínez Cruz 2007: 29–30).

(57)  a.  jum-p'ejty   [ tyumuty ] **tyojp'em=bä**
          one-CLF.pot   egg        broken=REL
          'one pot of broken eggs'
          not: 'one broken pot of eggs'

      b.  jum-p'ej [ i-p'ejty-al    tyumuty ] **tyojp'em=bä**
          one-CLF   A3-pot-NML egg        broken=REL
          'one broken pot of eggs'
          not: 'one pot of broken eggs'

The modifier can also precede the modified constituents in (58), resulting in the same interpretations as above. As predicted under our analysis, it cannot intervene between *ip'ejtyal* and *tyumuty*, as shown in (58c).
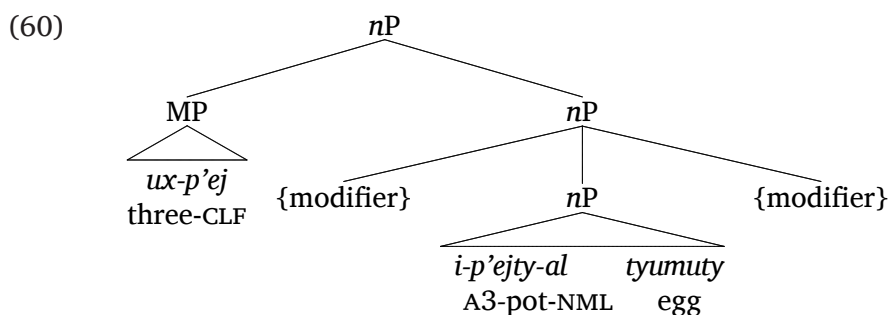
(58)  a.  jum-p'ejty    **tyojp'em=bä** [ tyumuty ]
          one-CLF.pot  broken=REL     egg
          'one pot of broken eggs'
          not: 'one broken pot of eggs'

      b.  jum-p'ej **tyojp'em=bä** [ i-p'ejty-al    tyumuty ]
          one-CLF  broken=REL      A3-pot-NML egg
          'one broken pot of eggs'
          not: 'one pot of broken eggs'

      c.  *jum-p'ej i-p'ejty-al    **tyojp'em=bä** tyumuty
          one-CLF  A3-pot-NML broken=REL     egg

The structures for (56a) and (56b) are given in (59) and (60). The modifier may appear on either side of the *n*P head (just as in modification without classifiers in (55)), and is interpreted as modifying the head. The [NUM + CLF] adjoins higher up.

---

[23] The possibility of using these nouns as classifiers appears to be subject to dialectal and possibly intra-speaker variation. We report the facts below described in Martínez Cruz (2007), though Arcos López (2009) notes that these are only possible as nouns—not as classifiers—for speakers he has consulted.

(59)

```
                              nP
                    ┌─────────┴─────────┐
                   MP                   nP
                  /  \          ┌───────┼───────┐
              ux-p'ejty     {modifier}  nP    {modifier}
            three-CLF.pot              /  \
                                   tyumuty
                                     egg
```
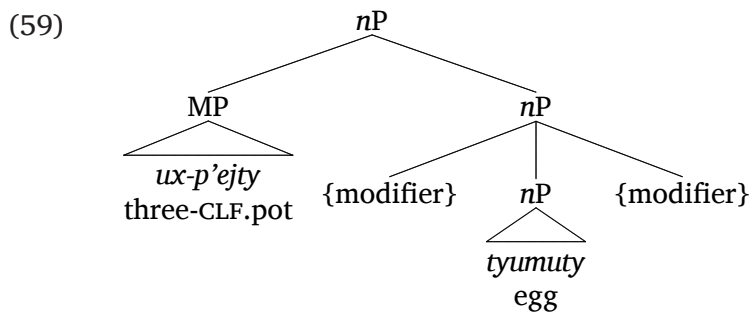
In (60), the measure term is the head of the *n*P and the modifier may again occur on either side of this *n*P.

(60)

```
                                nP
                       ┌────────┴────────┐
                      MP                 nP
                     /  \        ┌────────┼─────────┐
                 ux-p'ej    {modifier}   nP      {modifier}
                three-CLF               /  \
                                   i-p'ejty-al   tyumuty
                                   A3-pot-NML      egg
```

### 4.2.2 Modifying adjuncts and MPs

We claim that the MP is adjoined to the *n*P much like other modifiers, and we correctly predict the MP to share other behaviours with Ch'ol modifiers. First, given that nearly any lexical item in Ch'ol can serve as a stative predicate in what Mayanists call "non-verbal predicate" constructions, it is unsurprising that the [NUM + CLF] may appear in initial predicate position as well. Examples of stative predicates involving the adjective *kolem* 'big', the derived modifier *buchul* 'seated', and the [NUM + CLF] *uxtyikil* 'three (people)' are shown in (61).

(61)  a.  **Kolem** jiñi xiñich'.
          big     DET ant
          'The ant is big.'

      b.  **Buch-ul**    jiñi x'ixik.
          seated-STAT DET woman
          'The woman is seated.'

      c.  **Ux-tyikil** jiñi x'ixik-ob.
          Three-CLF DET woman-PL
          'The women are (in a group of) three.'

As with other modifiers, [NUM + CLF] sequences may also appear with the relativizing clitic =*bä* (see Vázquez Álvarez 2011 for details). Bare adjectives in Ch'ol must appear in prenominal position in attributive constructions, as in (62a), unless they are suffixed with the relative clause clitic =*bä*, as in (62b), in which case they may either precede or follow the noun (see also the examples in (55) and (57)–(58) above).[24]

---

[24] Ch'ol, like many other Mayan languages (England 2004; Henderson 2016), has a relatively small set of true adjectives, discussed in detail in Martínez Cruz (2007). True adjectives can be distinguished from other modifiers by their ability to appear directly in attributive position preceding the noun, as shown with the

(62)   a.   Ta' k-il-ä     jiñi **kolem** xiñich'.
               PVF A1-see-TV DET big     ant
               'I saw the big ant.'

        b.   Ta' k-il-ä     jiñi { **kolem** = **bä** } xiñich' { **kolem** = **bä** }.
               PVF A1-see-TV DET   big-REL       ant      big-REL
               'I saw the big ant.' (lit. 'I saw the ant that is big.')

The [NUM + CLF] sequences show the same distribution, as shown in (63).

(63)   a.   Ta' k-il-ä     **ux-tyikil** x'ixik-ob.
               PVF A1-see-TV three-CLF woman-PL
               'I saw three women.'

        b.   Ta' k-il-ä     { **ux-tyikil** = **bä** } x'ixik   { **ux-tyikil** = **bä** }.
               PVF A1-see-TV three-CLF-REL   woman   three-CLF-REL
               'I saw three women.' (lit. 'I saw women that were three.')

Again, given that [NUM + CLF] sequences may serve as predicates, as in (61) above, these facts are unsurprising. Also as expected, the meaning of the MP construction is slightly different when it appears as a predicate within a =*bä*-marked relative clause as in (63b). For example, the sentence without the relative clitic in (63a) suitably describes a situation in which the speaker saw three woman either one at a time, or collectively. However, the sentence in (63b) best describes a context in which the women were grouped as three, such as in a situation in which a parade of people are walking by in groups of two, but then exceptionally a group of three women walk by.

   Despite the slight difference in meaning (which is predicted given the contrast between numerals in predicate position versus modifying position even in English), numerals in combination with classifiers parallel adjectival modifiers like *kolem* 'big'. As demonstrated in (61), (62) and (63), both types of terms can appear as predicates, can directly modify a noun, and can modify a noun by serving as a predicate in a relative clause.

### 4.3 Summary

To summarize, in this section we defended the proposal that the [NUM + CLF] sequence in Ch'ol classifier constructions forms a syntactic constituent (MP), which may undergo A′-movement and juxtaposition independently of the noun it modifies. The MP may also be complex, with its own internal syntax, as in the complex constructions for numerals above twenty. Furthermore, the classifier is not the head of the DP, as shown by the modification facts in the previous section. The type of classifier—sortal versus non-sortal—does not influence the type of syntactic construction it appears in. Furthermore, the syntactic similarity between the two types of classifiers suggests that compositionally, they should receive the same type of semantic treatment, namely that of being a measure function.

   It is important to note that unlike English, there is no evidence that different readings (partitioned versus measured) are correlated with different syntactic structures. Except in exceptional circumstances involving estimation (see Li 2011), DPs with sortal classifiers cannot have a measured reading—for example, members of the denotation of the noun are necessarily contextually separated into concrete or abstract countable objects. DPs with non-sortal classifiers are generally associated with a measured reading. Thus, the correlation between partitioned readings and partition structures is not universal. In the next section, we discuss in more detail the availability of partitioned and measured

---

adjective *kolem* 'big' in (62a). Derived modifiers, like *buchul* in (61b) and (55) above, as well as *tyojp'em* 'broken' in (57)–(58) above, always require the use of =*bä*.

readings in Ch'ol, specifically focusing on some of the empirical limitations to making fine-grained distinctions.

## 5 Limits on assessing different types of classifier readings in Ch'ol

As described in section 3, there are only a small number of classifiers that are not derived from positional or transitive CVC roots. This puts certain limits on our ability to test for the range of different readings discussed in Rothstein (2011) and in Partee & Borschev (2012). There are three important limitations on classifier readings in Ch'ol: (i) classifiers in Ch'ol are generally not associated with "standard measures" in the sense described in Partee & Borschev (2012); (ii) measure terms associated with containers are generally not used as classifiers in Ch'ol; and (iii) because of the lack of container classifiers, it is difficult to assess whether some classifiers permit a partitioned reading or not.

The first limitation relates to how words for standard measurements became a part of Ch'ol. Current terms relating to standard measures—such as those associated with the English nouns *litres*, *grams*, *cups* and *kilos*—have been mainly borrowed from Spanish and function in Ch'ol as nouns, not as classifiers. In order to use such terms in counting expressions, they must appear in nominal position with the default classifier *-p'ej* attached to the numeral.

(64)     Ta'  k-jap-ä          cha'-*(p'ej) litro ja'.
         PFV A1-drink-TV two-CLF     litre  water
         'I drank two litres of water.'

Another limitation of classifier readings in Ch'ol is that *container* readings are generally not associated with classifiers. This is not an inherent grammatical limitation but may be related to the way classifiers are derived from certain types of roots. As discussed in section 3.2 above, most of the classifiers in Ch'ol are derived from roots associated with either actions (transitive roots) or physical configurations (the positional roots). These roots in general do not denote concrete containers. As a representative example, consider the classifier *-lujch* which we glossed as *ladle* in the table in (33) above. This classifier is derived from the root *luch* which means 'to scoop up (liquid)'. It is important to highlight that the classifier is not derived from a noun that denotes or names a ladle. In fact, it might be more accurate to gloss the classifier as *ladle-fuls* or *ladlings*, as in *two ladle-fuls of soup* or *two ladlings of soup*. Such a gloss would more accurately reflect that the noun is being measured by the potential action rather than by the physical presence of a ladle.

Indeed, phrases like *cha'-lujch ja'* ('two ladles of water') can only be used to denoted and refer to the stuff being measured and cannot be used to refer to a physical object used to carry out the measurement. For example, *cha'-lujch ja'* is perfectly coherent when appearing in the object position of the verb meaning 'to drink', but sounds incoherent when appearing in the object position of the verb meaning 'to break', even when two physical ladles are present and the speaker broke both ladles.

(65)  a.  Ta'  k-jap-ä          cha'-lujch ja'.
          PFV A1-drink-TV two-CLF    water
          'I drank two ladles of water.'

      b.  #Ta'  k-tyop'-o       cha'-lujch ja'.
          PFV A1-break-TV two-CLF    water
          INTENDED: 'I broke two ladles of water'

To communicate the intended reading in (65b), the nominalized form *lujch-ib* 'ladle' would be required.

The lack of container classifiers makes is difficult to test for some of the more subtle differences among partitioned, measured and concrete-container readings. This is the third limitation of assessing classifier readings in Ch'ol. Recall that a key aspect of diagnosing such readings was to take advantage of verbs that are sensitive to the subtle differences between a container and its contents. This is not possible if there is no container to distinguish from its contents.

For very similar reasons, it is also difficult to assess whether non-sortal classifiers permit a partitioned reading. To understand why, consider two different contexts that would render the sentence in (65a) above true. This sentence is true in a context where the speaker measures out two ladles worth of water into a bowl and drinks it. It is also true where there are two separate ladles with water in them and the speaker drinks all the water from both ladles (as long as the ladles are basically the same size). However, a measured reading could account for the truth of the sentence in both situations; in both contexts, the speaker is drinking two ladles worth of water. The truth conditions that account for measured readings are often broad enough to still be true in situations that typically support a partitioned reading.

To establish that there is a partitioned-reading with separate truth conditions, one either needs to take advantage of verbs that are sensitive to the differences between containers and contents (such as *break* versus *drink*, see Partee & Borschev 2012), take advantage of contrasts in number and nominal subcategorization (see Rothstein 2011), or use highly atypical contexts with very subtle judgment differences (see Rothstein's 2011 discussion of the English and Dutch measure term *litre*). The first strategy is generally not possible in Ch'ol since there is usually no contrast between a container named by a classifier and its contents—classifiers simply do not usually name containers. The second option is also not possible since Ch'ol does not mark contrasts in number nor in nominal subcategories in the same way that English does. The third is hard to implement in this case due to the difficulties of doing large-scale experimental tasks or tasks involving very subtle judgements in a non-university setting.

There is another option to detect partitioned readings with non-sortal classifiers, and this would be to test whether a sentence like (65a) is both true and false in a context where two ladles-worth of water were drunk from a bowl—true under a measured interpretation but false under a partitioned interpretation. (Note, speakers only report judging the sentence as true in such situations.) However, since the partitioned interpretation is so improbable with such constructions, not being able to detect an ambiguity might be due to the improbable nature of the reading rather than its impossibility.

Recall from the discussion in section 4.2 that for some speakers there are two non-sortal classifiers in Ch'ol that refer to containers and that are associated with nominal counterparts, namely *-p'ejty* ('pot') and *-chikib* ('basket'). However, the majority of Ch'ol speakers we consulted, including the third author, only permit these forms to function as nouns. Other work that reports on these classifiers (e.g., Martínez Cruz 2007) does not discuss them with respect to the availability of different types of readings. The two speakers we identified who accepted these forms as classifiers found it difficult to get a partitioned reading. For example, although the sentence in (66a) sounded natural, the one in (66b) was deemed questionable, although not completely unacceptable.

(66)  a.  Ta' k-jap-ä      cha'-p'ejty ja'.
          PFV A1-drink-TV two-CLF    water
          'I drank two pots of water.'

    b.  ?Ta'  k-tyop'-o      cha'-p'ejty ja'.
             PFV  A1-break-TV two-CLF    water
             'I broke two pots of water.'

To describe a situation where two pots were broken, the speakers preferred the sentences in (67), where *p'ejty* is part of a nominal expression and the default classifiers is affixed to the numeral.

(67)    a.   Ta'  k-tyop'-o     cha'-p'ej i-p'ejty-al    ja'.
             PFV A1-break-TV two-CLF  A3-pot-NML water
             'I broke two water-pots.'
    b.   Ta'  k-tyop'-o     cha'-p'ej p'ejty ja'.
             PFV A1-break-TV two-CLF  pot    water
             'I broke two pots of water.'

However, since so few speakers have been consulted and the judgments are rather subtle, more research needs to be done before making any firm conclusions about the availability of partitioned readings with non-sortal classifiers.

## 6 Conclusion

In this paper we explored the syntactic and semantic representation of classifiers in Ch'ol. We demonstrated that classifiers and numerals form a constituent that modifies the noun phrase. This same structure is used for both sortal and non-sortal classifiers, and furthermore seems to hold independent of different types of readings (measure versus partition readings). The syntactic similarities between these two types of classifiers suggest that they should also receive the same kind of semantic treatment, namely that of being a measure function (see Krifka 1995; Bale & Coon 2014).

    Although our entire discussion has been limited to Ch'ol, there are consequences for the analysis of other languages. First, we have demonstrated that the correlation between partition readings and partitioned structures is not universal. Second, we have developed a framework of arguments that can be readily applied to other classifier languages. In particular, this paper provided a variety of syntactic diagnostics to help determine (i) whether classifiers and numerals form a constituent independent of the nouns they modify and (ii) whether the modified noun serves as the head of the nominal constituent.

    In Ch'ol, sortal and non-sortal classifiers patterned in the exact same way: the classifier and numeral always formed a constituent that modified the noun and the noun was always the head of the larger nominal constituent. Future research should focus on whether classifier languages might differ in this respect. It is possible that, with these diagnostics, one could discover different classes of classifier languages in terms of how different types of readings and different types of classifiers correlate with different types of syntactic structures. Indeed, perhaps classifier languages form at least two distinct groups in this respect: those having both a partition and measure structure like Mandarin and those only having a measure structure like Ch'ol.

## Abbreviations

A = "Set A" person marking (ergative, possessive), B = "Set B" person marking (absolutive), CLF = numeral classifier, DET = determiner, DTV = derived transitive verb suffix, EP = epenthetic insertion, EXT = existential particle, IPFV = imperfective, ITV = intransitive verb suffix, NML = nominal suffix, PASS = passive, PFV = perfective, PREP = preposition, REL = relative, SP = Spanish origin, STAT = stative, TV = transitive verb suffix.

## Acknowledgements

## Funding Information

## Competing Interests

The authors have no competing interests to declare.

## References

Aissen, Judith. 1992. Topic and focus in Mayan. *Language* 68(1). 43–80. DOI: https://doi.org/10.1353/lan.1992.0017

Aissen, Judith. 1996. Pied-piping, abstract agreement, and functional projections in Tzotzil. *Natural Language and Linguistic Theory* 14(3). 447–491. DOI: https://doi.org/10.1007/BF00133596

Arad, Maya. 2003. Locality constraints on the interpretation of roots: The case of Hebrew denominal verbs. *Natural Language and Linguistic Theory* 21(4). 737–778. DOI: https://doi.org/10.1023/A:1025533719905

Arcos López, Nicolás. 2009. *Los clasificadores numerales y las clases nominales en ch'ol.* Mexico City: CIESAS MA thesis.

Aulie, Wilbur & Evelin Aulie. 1978. *Diccionario Ch'ol-Español, Español-Ch'ol.* Mexico City: Summer Institute of Linguistics.

Bale, Alan & Jessica Coon. 2014. Classifiers are for numerals, not nouns: Evidence from Mi'gmaq and Chol. *Linguistic Inquiry* 45(4). 695–707. DOI: https://doi.org/10.1162/LING_a_00170

Bale, Alan, Jessica Coon & Nicolás Arcos. 2016. Counting banana trees in Ch'ol: Exploring the syntax and semantics of sortal classifiers. *Manuscript.* http://ling.auf.net/lingbuzz/003057.

Berlin, Brent. 1968. *Tzeltal numeral classifiers: A study in ethnographic semantics.* The Hague: Mouton. DOI: https://doi.org/10.1515/9783111584232

Berlin, Brent & Kimball Romney. 1964. Descriptive semantics of Tzeltal numeral classifiers. *American Anthropologist* 66(3). 79–98. DOI: https://doi.org/10.1525/aa.1964.66.3.02a00840

Borer, Hagit. 2005. *Structuring sense.* Oxford: Oxford University Press. DOI: https://doi.org/10.1093/acprof:oso/9780199263905.001.0001

Cheng, Lisa Lai-Shen & Rint Sybesma. 1999. Bare and not-so-bare nouns and the structure of NP. *Linguistic Inquiry* 30(4). 509–542. DOI: https://doi.org/10.1162/002438999554192

Chierchia, Gennaro. 2010. Mass nouns, vagueness and semantic variation. *Synthese* 174. 99–149. DOI: https://doi.org/10.1007/s11229-009-9686-6

Clemens, Lauren Eby & Jessica Coon. 2018. Deriving verb initial order in Mayan. *Language* 94(2). 237–280. DOI: https://doi.org/10.1353/lan.2018.0017

Coon, Jessica. 2009. Interrogative possessors and the problem with piedpiping in Chol. *Linguistic Inquiry* 40(1). 165–175. DOI: https://doi.org/10.1162/ling.2009.40.1.165

Coon, Jessica. 2010. VOS as Predicate Fronting in Chol. *Lingua* 120(2). 354–378. DOI: https://doi.org/10.1016/j.lingua.2008.07.006

Coon, Jessica. 2017a. Ch'ol. In Judith Aissen, Nora England & Roberto Zavala (eds.), *The Mayan languages*, 648–684. New York: Routledge. DOI: https://doi.org/10.4324/9781315192345-23

Coon, Jessica. 2017b. Little-v agreement and templatic morphology in Ch'ol. *Syntax* 20(2). 101–137. DOI: https://doi.org/10.1111/synt.12135

Coon, Jessica. 2019. Building verbs in Chuj: Consequences for the nature of roots. *Journal of Linguistics* 55(1). 35–81. DOI: https://doi.org/10.1017/S0022226718000087

Doetjes, Jenny. 1996. Mass and count: Syntax or semantics? In *Proceedings of meaning on the HIL* (HIL Occasional Papers in Linguistics) 1. 34–52. Leiden: HIL/University of Leiden.

England, Nora. 1983. *A grammar of Mam, a Mayan language*. Austin, TX: University of Texas Press.

England, Nora. 1991. Changes in basic word order in Mayan languages. *International Journal of American Linguistics* 57. 446–86. DOI: https://doi.org/10.1086/ijal.57.4.3519735

England, Nora. 2001. *Introducción a la gramática de los idiomas Mayas*. Guatemala City: Cholsamaj.

England, Nora C. 2004. Adjectives in Mam. In R. M. W. Dixon & Alexandra Y. Aikhenvald (eds.), *Adjective classes: A cross-linguistic typology*, 125–146. Oxford: Oxford University Press.

Fleck, Margaret M. 1981. Tzotzil numeral root morphology. *Journal of Mayan Linguistics* 3. 5–24.

Gil, David. 1994. Summary: numeral classifiers. *Linguistic List* 5. 466.

Gillon, Brendan. 2004. Ambiguity, indeterminacy, deixis and vagueness: Evidence and theory. In Brendan Gillon & Steven Davis (eds.), *Semantics: A reader*, 157–187. Oxford: Oxford University Press.

Greenberg, Joseph H. 1972. Numeral classifiers and substantival number: Problems in the genesis of a linguistic type. *Working Papers on Language Universals* (9). 1–39.

Haviland, John B. 1994. "Te xa setel xulem" [The buzzards were circling] – categories of verbal roots in (Zinacantec) Tzotzil. *Linguistics* 32(4–5). 691–741. DOI: https://doi.org/10.1515/ling.1994.32.4-5.691

Haviland, John Beard. 1981. *Sk'op sotz'leb: El Tzotzil de San Lorenzo Zinacantán*. Mexico City: UNAM.

Henderson, Robert. 2016. Mayan semantics. *Language and Linguistic Compass* 10(10). 551–588. DOI: https://doi.org/10.1111/lnc3.12187

Henderson, Robert. 2019. The roots of measurement. *Glossa: a journal of general linguistics* 4(1). 1–31. Art. 32. DOI: https://doi.org/10.5334/gjgl.515

Instituto Nacional de Lenguas Indígenas. 2011. *Norma de escritura de la langua ch'ol*. Mexico City: INALI.

Keller, Kathryn C. 1955. The Chontal (Mayan) numeral system. *International Journal of American Linguistics* 21. 258–275. DOI: https://doi.org/10.1086/464339

Krifka, Manfred. 1995. Common nouns: A contrastive analysis of English and Chinese. In Gregory N. Carlson & Francis Jeffry Pelletier (eds.), *The generic book*, 398–411. Chicago, IL: Chicago University Press.

Landman, Fred. 2004. *Indefinites and the type of sets*. Oxford: Blackwell. DOI: https://doi.org/10.1002/9780470759318

Li, Xu-Ping. 2011. *On the semantics of classifiers in Chinese*. Amherst, MA: Bar-Ilan University Doctoral dissertation.

Li, Xu-Ping & Susan Rothstein. 2012. Measure readings of Mandarin classifier phrases and the particle *de*. *Language and Linguistics* 13(4). 693–741.

Lois, Ximena. 2011. Roots and patterns in Yucatecan languages. In Kirill Shklovsky, Pedro Mateo Pedro & Jessica Coon (eds.), *Proceedings of FAMLi: Formal approaches to Mayan linguistics*. Cambidge, MA: MIT Working Papers in Linguistics. *Paper presented at Formal Approaches to Mayan Linguistics*, MIT, Cambridge, MA.

Martínez Cruz, Victoriano. 2007. *Los adjetivos y conceptos de propiedad en Chol*. Mexico City: CIESAS MA thesis.

Mathieu, Eric & Gita Zareikar. 2015. Measure words, plurality, and crosslinguistic variation. *Linguistic Variation* 15(2). 169–200. DOI: https://doi.org/10.1075/lv.15.2.02mat

McCarthy, John J. 1981. A prosodic theory of noncaoncatenative morphology. *Linguistic Inquiry* 12(3). 373–418.

Partee, Barbara H. & Vladimir Borschev. 2012. Sortal, relational, and functional interpretations of nouns and Russian container constructions. *Journal of Semantics* 29(4). 445–486. DOI: https://doi.org/10.1093/jos/ffs009

Rothstein, Susan. 2009. Individuating and measure readings of classifier constructions: Evidence from Modern Hebrew. *Brill's Annual of Afroasiatic Languages and Linguistics* 1. 106–146. DOI: https://doi.org/10.1163/187666309X12491131130783

Rothstein, Susan. 2011. Counting, measuring and the semantics of classifiers. *The Baltic International Yearbook of Cognition, Logic and Communication* 6. 1–42. DOI: https://doi.org/10.4148/biyclc.v6i0.1582

Svenonius, Peter. 2008. The position of adjectives and other phrasal modifiers in the decomposition of DP. In Louise McNally & Chris Kennedy (eds.), *Adjectives and adverbs: Syntax, semantics, and discourse*, 16–42. Oxford: Oxford University Press.

Vázquez Álvarez, Juan J. 2011. *A grammar of Chol, a Mayan language*. Austin, TX: University of Texas Austin dissertation.

Warkentin, Viola & Ruby Scott. 1980. *Gramática Ch'ol*. Mexico City: Summer Institute of Linguistics.

Zavala Maldonado, Roberto. 2007. Las oraciones de relativo en lenguas cholanas, un calque zoqueano. *Paper presented at Conference on Indigenous Languages of Latin America-III*.