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Distributivity and Additivity: The Case of the Romanian Distributive Marker *câte*

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1 Introduction

The aim of this paper is to single out the semantic contribution of Romanian *câte* in its guise as a marker of nominal distributivity, more precisely as an element which modifies a numeral, either as part of a referential DP, or as part of a measure phrase. The main claim to be defended is that the role of this marker is to exclude non-distributive interpretations of cardinal expressions. This predicts that whenever a nominal phrase containing *câte* is possible, a nominal phrase containing a plain cardinal is also possible on a distributive interpretation. The theoretical consequences are that the contribution of this marker is best represented as a licensing condition parallel to NPI licensing in the spirit of Oh's (2001, 2005) treatment of Korean distributive marker *-ssik*. A possible improvement on Oh's account is that a larger number of possible licensors than the distributive operator will be discussed. At every point of the discussion, it is important to keep in mind that even if no full-fledged analysis is reached, the lines of inquiry pursued here have a bearing on the general phenomenon of cardinal distributivity, and not on some particular semantic effect of some distributive marker.

The second part of the paper starts out from the observation that there are certain environments that seem to reject the hypothesis that the semantic role of *câte* is simply that of a disambiguator between a distributive and a collective or cumulative reading. These are cases in which the nominal expression targeted by *câte* would have been unambiguously interpreted as a distributive share even without the marker, and in which adding this marker is perfectly natural and non-redundant (maybe even preferred by speakers).

Conversely, there are distributive cardinals which can be degraded or even ungrammatical with *câte*. Firstly, *câte* is plainly ungrammatical with gradable cardinal expressions such as **câte mulți* ('_{DIST} many'), **câte puțini* ('_{DIST} few'), **câte mai mulți* ('_{DIST} more'), **câte mai puțin de trei* ('_{DIST} less than three'). Secondly, *câte* is degraded in certain sentences, including cases in which it is part of a measure phrase which does not keep track of the part-whole relations of its distributive key (i.e., a non-monotonic measure). These cases were the subject of an acceptability experiment. The result, in a nutshell, is that *câte* is sensitive to the monotonic vs. non-monotonic distinction, but that this contrast is not as steep as a contrast in grammaticality. This leads to the claim that *câte*, besides the licensing condition mentioned before, comes with an implicature which I will call additive.

The paper is organized as follows. Section 2 focuses on the properties of *câte* as a marker of nominal distributivity on the share. Section 2.1 is a brief cross-linguistic survey of the uses of these markers. Section 2.2 places the Romanian marker in the picture. Section 2.3 focuses on the limits of cardinal distributivity in general and supports the claim that the same limits apply to shares marked with *câte*. Section 2.4 explores the marker's dependency on and obligatory co-variation with some plurality (of entities or events) as a licensing condition. Section 3 is dedicated to a little studied property of share markers: It is not sufficient that the

values introduced by such nominal phrases co-vary with respect to some other variable, they must be interpreted as being additive. This hypothesis was tested in an experiment (presented in Section 3.1), in which two types of measures are shown to display a contrast in acceptability in the presence of *câte*. Section 3.2 introduces some of the technical ingredients which will be employed in the analysis proposed further. Section 3.3 offers support for the claim that the additivity condition is a conventional implicature. Section 3.4 spells out the additivity implicature. Section 4 concludes the paper.

2 The distributive licensing condition

2.1 Markers of nominal distributivity

I will assume throughout the paper that the Romanian distributive marker *câte* has three uses, a classification which is supported on syntactic and semantic grounds. The adverbial use is illustrated in (1). There are also two nominal uses, illustrated in (2a) and (2b) respectively. The first construction is an indefinite which has to be interpreted distributively, while the second is a cardinal expression, also obligatorily distributive.¹ The constructions in (2a) and (2b) have distinct distributions, with the former being wider than the latter.

- (1) *Copiii danseză (doi) câte doi.*
 children.DEF dance.3PL two DIST two
 ‘The children are dancing in twos/two by two.’
- (2) a. *S-a mai trezit câte un copil/câte cineva din când în când.*
 REFL-has ADV awoken DIST a child DIST somebody from when in when
 ‘From time to time, some child or other woke up.’
- b. *Copiii au mâncat câte două înghețate.*
 children.DEF have eaten DIST two ice-creams
 ‘The children ate two ice-creams each.’

The present discussion focuses only on cardinal expressions with *câte* (2b). A possible source of confusion is that the Romanian singular form *un_{MASC}/o_{FEM}* is ambiguous between cardinal *one* and the plain indefinite *a(n)*. All examples of cardinal *câte* will involve numerals from *two* upwards.

Secondly, the terms ‘sortal key’ and ‘distributive share’ (Choe, 1987) will be employed as a pretheoretical tool. For instance, in (2b), the sortal key is the plurality of children, while the share is the plurality of pairs of ice-creams. In this respect, *câte* may be called a share marker. Another possible source of confusion may stem from what we take to be the key.

In the cross-linguistic surveys of different distributivity markers, the main focus has been on the distributive interpretation of nominal phrases containing a cardinal and a sortal noun, such as English binominal *each* in (3) (Champollion, 2016a, 2017; Szabolcsi, 2011), German

¹ To illustrate distributive and cumulative readings of nominal phrases, take the English sentence *The children ate two ice-creams*, which is ambiguous between two readings: (a) distributive – each child ate two ice-creams; (b) cumulative – there were two ice-creams overall and each of the children ate a part. Taking the distributive reading, the children are, in Choe’s (1987) terms, the sortal key of the distributive relation, while the ice-creams represent the share. One could see them as related in the same way as the domain and the co-domain of a function. Different values of the sorting key correspond to different values of the share. For instance, if the children are Mary and Tom, the distributed share corresponding to Mary’s eaten ice-creams will be a set of two ice-creams, and the distributed share corresponding to Tom’s eaten ice-creams will be a different set of two ice-creams. Since there are two correlated pluralities involved in a distributive relation, the term co-variation has been used by some authors, and will be employed in this paper as well. It is therefore important to stress from the beginning that the term ‘distributive marker’ is used throughout the paper as ‘distributive marker on the share’.

jeweils in (4) and (5) (Zimmermann, 2002), Telugu numeral reduplication in (6) and (7) (Balusu, 2006), Hungarian reduplication in (8) (Farkas, 2015), Kaqchikel reduplication in (9) (Henderson, 2014, 2016):

- (3) a. *The boys saw two monkeys each.*
 b. %*Each boy had one apple each.*
 c. (?)*Every boy had one apple each.*
- (4) *Die Jungen haben jeweils zwei Affen gesehen.*
 the boys have DIST two monkeys seen
 a. ‘Each of the boys has seen two monkeys.’
 b. ‘The boys have seen two monkeys each time.’
- (5) *Jeweils zwei Jungen standed Wache.*
 DIST two boys stood watch
 ‘Each time, two boys kept watch.’
- (6) *ii pilla-lu renDu renDu kootu-lu-ni cuus-ee-ru.*
 these kid-PL two two monkey-PL-ACC see-PAST-3PL
 lit. ‘these kids saw two-two monkeys’
 a. ‘These kids each saw two monkeys.’ Participant key reading
 b. ‘These kids saw two monkeys in each time interval.’ Temporal key reading
 c. ‘These kids saw two monkeys in each location.’ Spatial key reading
- (7) *Prati pillavaaDu renDu renDu kootu-lu-ni cuus-ee-Du.*
 every kid two two monkey-PL-ACC see-PAST-3SG
 lit. ‘Every kid saw two two monkeys’
 a. ‘Every kid saw two monkeys.’ Participant key reading
 b. ‘Every kid saw two monkeys in each time interval.’ Temporal key reading
 c. ‘Every kids saw two monkeys in each location.’ Spatial key reading
- (8) Context: Nurses are talking about how the night went in a children’s ward:
 **Két-két gyerek fel-felébredt de más baj nem volt.*
 two-two child up-up woke but other trouble was not
 Intended: ‘From time to time there were pairs of children waking up, but there was no other trouble.’
- (9) *X-e'-in-tij-la' ox-ox wäy.*
 CP-A3P-E1S-eat-la' three-RED tortilla
 ‘I kept eating the tortillas in groups of three.’

Binominal *each* and *jeweils* have in common that they may be grouped under what Choe (1987) called “anti-quantifiers” (see Zimmermann, 2002: 37, for discussion of *jeweils*). This means they are truth-conditionally equivalent to a sentence in which the key is universally quantified. That is, (3a) is equivalent to *Each boy ate two sausages*, while (4a) is equivalent to *Jeder Junge hat zwei Affen gesehen* (‘Each boy saw two monkeys’). Szabolcsi (2011) reports that the possibility of a kind of concord between determiner and binominal *each* exists, at least for some speakers, cf.(3b), and that acceptability increases if one uses *every* instead of *each*, cf. (3b). As for German *jeweils*, since it is not limited to participant keys, co-occurring with a universal distributive subject naturally (cf. *Jeder Junge hat jeweils zwei Affen gesehen*) triggers the temporal or the spatial interpretation.

By contrast, Telugu, Hungarian and Kaqchikel reduplicated numerals are not merely marginally acceptable or interpretable within the scope of universal distributive quantifiers, rather, this kind of environment is reported in the literature (see references above) as a typical one. Even though for lack of space the counterpart of (7) on the participant key interpretation (a) is not given here, it can be found listed as a typical environment for reduplication in both Hungarian and Kaqchikel. Finally, one notices that there is some degree of cross-linguistic

variation across these reduplicated forms in terms of how easily temporal and spatial distributive readings are produced (if at all). For Telugu, the mechanism seems to be automatically available. For Kaqchikel, pluractional morphology on the verb is required, while for Hungarian not even this strategy works. See Henderson (2014) for an overview.

Despite these differences in distribution between these various markers, it appears at a first glance that their common semantic contribution is to disambiguate between a distributive and a non-distributive interpretation of the nominal phrase they attach to. Depending on the particular marker and the particular semantic account, this may mean that either the marker enforces distributivity over the nominal it is a part of (such accounts are, for instance, Zimmermann (2002) for *jewels*; Champollion (2017) for binominal *each* and *jewels*), or that it simply signals that the marked nominal phrase is within the scope of (or dependent on) some distributor.

2.2 Placing Romanian *câte* into the picture

The focus of the present paper is Romanian *câte* as a modifier of cardinal expression within nominal phrases. The following properties are taken to be central in the discussion that follows, therefore any other markers which display the same properties may be amenable to the same treatment.

Firstly, *câte* co-occurs with universal distributive subjects, in which case it seems to be a mere marker of distributive concord, cf. (10):

- (10) *Fiecare copil a văzut câte două maimuțe.*
 each child has seen DIST two monkeys
 ‘Each child saw two monkeys.’

The only detectable difference from a version without *câte* is that in (10) above, it cannot be that there is a specific pair of monkeys such that each child saw them. So far, the distributive marker seems to play the part of a disambiguator.

Nevertheless, the sentence below is unambiguously distributive to begin with (in the sense that the relevant nominal phrase is interpreted as a distributive share), cf. (11):

- (11) *Fiecare copil a vizitat (câte) cel mult două muzee.*
 each child has visited DIST the much two museums
 ‘Each child visited at most two museums.’

Modified numeral expressions such as *at most n* or *at least n* have been argued to resist specific interpretations, which seems to be correlated to the difficulty or impossibility with which these constructions display inverse scope (see Szabolcsi, 2010, for an overview). Even though *câte* is perfectly natural and non-redundant in the example below, there is no detectable difference in interpretation if it is left out.

Also, *câte* happily co-occurs with Romanian binominal *fiecare*, another case in which there is no disambiguation effect, cf. (12):

- (12) *Copiii au vizitat (câte) două muzee fiecare.*
 children.DEF has visited DIST two museums each
 ‘The children visited two museums each.’

Even though there is no detectable difference in meaning, speakers report that still they prefer adding *câte*. This is not a particularity of Romanian. Czech also possesses two distributive markers which seem to share some properties with *câte* and binominal *fiecare* respectively: preposition *po* and distributive quantifier *každý* ‘each’. In a self-paced reading experiment which targeted the interaction between *po* and *každý* in terms of effects on processing, Dotlačil (2015) tested, among others, the minimal pair seen in (13) (binominal *každý*, with and without *po*).

- (13) *Dva učitelé potrestali (po) jednom žákovi každý za pozdní příchod na vyučování.*
 two teachers punished DIST one student each for late arrival to class
 ‘Two teachers punished one student each for late arrival to class.’

The last word in the sentence showed a slowdown caused by late *každý* (without *po*), but this slowdown disappeared when the object was preceded by *po*. The result is interpreted in the following way: Late *každý* is costly, so *po* might be needed to reduce this cost.

I add one more example in which distributivity is overtly contributed by some expression: ratios. Again, there is no difference in meaning between the two versions (with or without *câte*), but one might resort to a similar explanation for the presence of *câte* as above, in terms of reducing processing costs, cf. (14).

- (14) a. *Compania a oferit (câte) două premii de participant.*
 company.DEF has offered DIST two prizes PREP participant
 ‘The company offered two prizes per participant.’
- b. *Săptămâna dinaintea examenului, Ion a citit (câte) două capitole pe zi și a reușit să treacă.*
 week.DEF before exam John has read DIST two chapters PREP day
 and has managed SUBJ pass
 ‘The week before the exam, John read two chapters per day and managed to pass.’

Finally, *câte* may modify measure phrases, see (15) and (16). In these constructions, the same sources of distributivity appear to be present as in the case of cardinal within referential DPs.

- (15) a. *Copiii au cumpărat câte două kilograme de mere fiecare.*
 children.DEF have bought DIST two kilos of apples each
 ‘The children bought two kilos of apples each.’
- b. *Fiecare copil a cumpărat câte două kilograme de mere.*
 each child has bought DIST two kilos of apples
 ‘Each child bought two kilos of apples.’
- (16) a. *Coșurile cântăresc câte trei kilograme fiecare.*
 baskets.DEF weigh DIST three kilos each
 ‘The baskets weigh three kilos each.’
- b. *Fiecare coș cântărește câte trei kilograme.*
 each basket weighs CÂTE three kilos
 ‘Each basket weighs three kilos.’

The conclusion arrived at so far is that *câte* cannot induce the interpretation as distributed share of the nominal phrase it is a part of, but depends on an independent source of distributivity. The semantic contribution of the distributive marker is neither disambiguation, nor reducing processing costs, since there are well-formed sentences in which neither of the two applies (for example, (16b) above, where, the processor already knows that the measure phrase is going to be interpreted distributively by the time it gets to *câte*).

In order to identify the possible sources of co-variation that license the Romanian marker, I will adopt the account of covert and overt distributivity sketched in Champollion (2017), leaving open the possibility of choosing a different implementation. This is because, given the ‘weak’ nature of the marker itself, the problem of how covert distribution and partitions function is much too general for the present discussion. In the case of sentences with a plurality serving as sortal key, such as (17) below, we can assume for the present purposes, following Champollion (2017), that these sentences are ambiguous depending on whether there is a covert distributive operator present (for the definition, see Champollion, 2016b, definition (45)).

- (17) a. *The boys* [D_{agent} [*saw a monkey*]].
 b. $\exists e$ [$*agent(e) = \oplus boy \ \& \ e \in * \lambda e' (*see(e')) \ \& \ monkey(theme(e')) \ \& \ Atom(agent(e'))$]

(17) says that there is an event e with the maximal sum of boys as agent, and this event is a sum of events e' that are seeing events, have a monkey as theme and an atomic agent.

In the case of the Romanian distributive marker, I assume that if the covert distributive operator is present (for instance in (2b)), then *câte* is licensed. But the same job can be fulfilled by binominal *fiecare* as in (16a), or by subject *fiecare* as in (16b), or by a ratio as in (14), in which case the covert distributive operator is absent and the source of distributivity is *fiecare*/the ratio expression itself.

2.3 *Câte* and spatio-temporal distributivity

All of the examples above were cases in which some plural participant was present beside the nominal phrase marked as distributive share by the distributive marker. Even though restricted, one can nevertheless find examples which are more easily analyzed as involving a covert partition rather than a covert distributivity operator. Unlike Telugu reduplication, the Romanian *câte* is not readily interpretable as being distributed over times or locations. Not even contextual support can help much in the cases in (18):

- (18) a. ??*Au plecat câte doi copii.*
 have left DIST two children
 Intended: ‘Two (different) children left each time/in each place.’
 b. ??*Grupul de copii a văzut câte două maimuțe.*
 group.DEF of children has seen DIST two monkeys
 ‘The group of children saw two (different) monkeys each time/in each place’

Yet, under very specific conditions, nominal phrases with *câte* show inverse scope and can be spatio-temporally distributed. These are contexts which involve a series of programmed events, such as in (19):

- (19) a. *Câte doi angajați au condus fiecare invitat la aeroport.*
 DIST two employees have led each guest to airport
 ‘Pairs of employees accompanied each guest to the airport.’
 b. *Vor sta de pază câte doi soldați până mâine.*
 will.3PL stay of guard DIST two soldiers until tomorrow
 ‘Pairs of soldiers will stand on guard until tomorrow.’

In (19a), the only available interpretation is the one in which different groups of two employees accompany different guests. Also, in (19b), different pairs of soldiers take shifts to stand on guard. If such an ‘organized event’ interpretation is not available, *câte* is excluded.

To preclude the discussion, I will assume that *câte* can rely for licensing on a covert partition operator, in contrast to *jeweils* which itself introduces such an operator (see Champollion, 2016b, 2017). As expected, *jeweils* will be more easily interpreted as having a spatio-temporal key, including in scenarios such as (18), as long as the context allows this. As for *câte*, it seems to be licensed as long as the cells of the partition are clearly identifiable (e.g., guest departures or shifts in (19) above).

Since these kinds of contexts are quite marginal, the following paragraphs will focus on a parallel with Hungarian reduplicated numerals (Farkas, 2015). The data on Hungarian are provided as evidence that Hungarian reduplicated numerals come with a constraint on the type of variable they may depend on for distributivity. As opposed to distributive indefinites, they require to be quantified over by a plurality of type entity. Distributive indefinites, on the other hand, are much more liberal, and are felicitous with habituals, frequency adverbs and pluractional operators. The data in (20) and (21) support this point:

- (20) *Olykor, mikor egy-egy/*két-két olyan könyvet olvasok, ami a szívemhez*
 sometimes when one-one/*two-two such book read.1SG that to my-heart
szól, jól érzem magam.
 speak.3SG well feel.1SG REFL

Only interpretation: ‘Sometimes, when I happen to read a book that speaks to my heart I feel well.’ – *book* co-varies with *times*

- (21) *A politikus néha/mindig megtapsolt egy-egy/*két-két ellenzéki hozzászólást.*
 the politician sometimes/always applauded a-a/*two-two opposition comment
 Only interpretation: ‘Sometimes/always, the politician applauded an opposition comment.’ – *comments* co-vary with *occasions*

- (22) Context: Nurses are talking about how the night went in a children’s ward:
*Egy-egy/*Két-két gyerek fel-felébredt de más baj nem volt.*
 a-a/*two-two child up-up woke, but other trouble was not
 Only interpretation: ‘From time to time some child or other woke up.’

Romanian *câte* with cardinals is marginal in such contexts, and so is a distributive reading of the plain cardinal. It is not ungrammatical as such, only it strongly suggests that the number of books is somehow relevant in making the statement true (as if reading a different number of books might produce a different result), hence the deviance of the example in (23).

- (23) ??*Uneori, când citesc (câte) două cărți ușoare mă simt bine.*
 sometimes when read.1SG DIST two books light me feel well
 ‘Sometimes, when I read two light books I feel good.’

The same applies to the other two sentences in (24) and (25), the Romanian translation of (21) and (22) with cardinals:

- (24) ??*Politicianul uneori/mereu a aplaudat (câte) două comentarii ale opoziției.*
 politician.DEF sometimes/always has applauded DIST two comments POSS opposition

- (25) Context: Nurses are talking about how the night went in a children’s ward:
 ??*S-au mai trezit (câte) doi copii, altfel n-au fost probleme.*
 REFL-have ADV awoken DIST two children other not-have been problems

On the other hand, there seems to be a correlation between the availability of a distributive interpretation for plain cardinals and the degree of acceptability of a cardinal modified by *câte*.

- (26) *Când citesc (câte) două cărți deodată mă ia cu amețeala.*
 when read.1SG DIST two books at-a-time me takes with dizziness
 ‘When I read two books at the same time, I get dizzy.’

In (26), the effect of adding *at a time* is that the distributive interpretation of the cardinal becomes the most salient and the distributive marking becomes perfectly acceptable.

- (27) I won’t let you into my room anymore!
Întotdeauna găsesc (câte) cel puțin trei obiecte aruncate pe jos.
 always find.1SG DIST the least three objects thrown on floor
 ‘I always find at least three objects scattered on the floor.’

Example (27) indicates that modified numerals also fare better in terms of being distributed shares. Again, the distributive reading of the plain cardinal is the most salient.

- (28) *To tîngițea (câte) trei pastile.*
 PLU swallowed DIST three pills
 ‘He kept swallowing three pills.’

The pluractional adverb *tot* does not easily allow for the co-variation of plain cardinals or for using distributive markers of the share, but in the case in (28) it allows for both, presumably due to the verb itself, which is non-iterative and favors a single event interpretation.

The conclusion we come to is that, in contrast to Henderson's (2014) observations regarding Kaqchikel reduplication which, unlike non-reduplicated cardinals, is easily acceptable with frequency adverbs and pluractional verbal markers, the Romanian marker correlates with the plain cardinal. The easier the latter is acceptable on a co-varying reading, the more acceptable the former is in the same context. Therefore, the question of what helps or impedes the distributive marker in these environments boils down to the question of what helps or impedes co-varying readings of plain cardinals.

The following is only a suggestion on how to tackle this problem, inspired by Filip's (2004) treatment of Russian verbal prefixes *na-* and *po-*. Very briefly, these prefixes are characterized as relating the event they modify to some measure phrase which has to be extensive and is interpreted as bounded, but not necessarily telic. This property of boundedness is captured as the requirement of being a 'maximal separated entity', which is based on Krifka's (1997) notion of adjacency. See Filip (2004), definition (34) for more details. The intuition behind this would be that *câte* (via its additivity condition – see Section 3) requires that the share be distributed over by a bounded and partitioned distributive key. Habituals, frequency adverbs and pluractionals do not supply partitions by default. Partitions can nevertheless be made available by the strategies listed above: adding *at a time*, modifying with *at least/at most*, and the choice of verb. Speaking in terms of granularity, these strategies ensure that there might be spatial or temporal cells for a partition to serve as key units for the distributive share.

2.4 The licensing condition for *câte*

Oh (2001, 2005) discusses Korean measure phrases with suffix *-ssik* by suggesting a parallel to polarity items. Like polarity items, phrases marked by *-ssik* must be in the scope of some distributivity (D) operator. Cable (2013) remarks that Oh needs to assume two separate D operators as possible licensors, one taking entities in the restriction, and the other events, which is not very elegant. It was already hinted at the fact that this problem may be circumvented by unifying all forms of distributivity as event distributivity, a move undertaken by Champollion (2017) for instance. Moreover, there are also accounts of partitions over events or over pairs of events and individuals (e.g., Beck & von Stechow, 2007). According to Champollion (2017) for instance, distributive operators introduce a plurality of events which come with a specification of granularity atom on some participant, while partitive operators also introduce a plurality of events, but rely on the context to set the granularity.

Another possible objection to Oh's account is mentioned by Hwang (2012): Korean has split and non-split measure phrase construction (*boy-CASE 3-CL-ssik* and *boy-3-CL-ssik-CASE* respectively). The non-split ones are the focus of Oh's account, but they seem to allow for collective readings, as in (29), while the split counterparts do not:

(29) *boy 3-CL-ssik-NOM made a chair.*

OK: In each subevent, a triplet of boys made a chair. (distributive)

OK: In one event, triplets of boys joined forces to make a chair. (collective)

The latter objection does not apply to Romanian, which displays collective readings of adverbial uses of *câte*, but never with adnominal ones.

Also, the fact that there exist various types of distributivity-inducing operators with different forces goes in the same lines as the classification of polarity operators in terms of strength, ranging from operators which induce merely decreasing contexts, to anti-additive and anti-morphic operators (see Zwarts, 1998). Similarly, the hypothesis put forth in (30) is that the possible licensors for distributive cardinals, ranging from strongest to weakest, are:

(30) Distributive operators:

- D operator
- Part over time or space intervals (frequency adverbs, pluractionals)
- Part operator over events, contextual support needed (planned, organized events)

To conclude this section, Romanian plain cardinals may display co-variation more easily, when they are under the scope of a D operator, or with difficulty, when they are distributed over by a Part operator. Distributive marking is possible to the extent to which the co-variation interpretation is available. Since it has been seen that not all contexts are ambiguous to begin with, the next question is what the semantic contribution of the distributive marker is. The next section is dedicated to addressing this problem.

3 *Câte* and additivity

Taking *câte* as a marker of distributivity for cardinal expressions, it becomes apparent that certain expressions are blatantly ungrammatical when modified by it, independently of the context of use. More precisely, *câte* is incompatible with gradable expressions: **câte mulți* ('DIST many'), **câte puțini* ('DIST few'), **câte mai mulți* ('DIST more'), **câte mai puțin de trei* ('DIST less than three'). This is surprising given that these constructions can be distributive. For instance, in the sentence *Each child read few books*, *few* is interpreted locally, with the possibility remaining that the number of books which were read overall is not few.

Another contrast with expressions of cardinality is that the former are perfectly acceptable and easily receive a distributive reading in certain contexts in which using *câte* produces a decrease in acceptability. The following pair of examples displays an interesting contrast, given in (31). This contrastive pair was mentioned for the first time by Zhang (2013) in relation to English binominal *each* (see (32)).

- (31) a. *Lichidele măsoară (câte) 20 de mililitri.*
 liquids.DEF measure DIST 20 of mililiters
 'The liquids measure 20 mililiters.'
- b. *Lichidele măsoară (??câte) 20 de grade Celsius.*
 liquids.DEF measure DIST 20 of degrees Celsius
 'The liquids measure 20 degrees Celsius each.'

- (32) a. *The hams weighed 20 pounds each.*
 b. **The hams read 350 degrees each. (cf. The hams each read 350 degrees.)*

The Romanian distributive marker is also degraded in type b. examples. According to Zhang, the contrast in (32) can be explained as a consequence of the sensitivity of binominal *each* to the contrast between two types of measures, monotonic vs. non-monotonic, represented here by weight and temperature respectively. The notion of monotonicity (Schwarzschild, 2002, 2006), as well as the more restrictive term extensive measure (Krifka, 1997) refers to the presence or absence of a correlation between a dimension of measure and the part-whole structure of what is being measured. Schwarzschild's point of departure in teasing apart non-monotonic from monotonic measures are two opposing nominal constructions, [Num Meas of N] and [Num Meas N]. To take an example, one can use temperature in the second configuration, but not the first: **20 degrees of water* vs. *20 degree water*. Conversely, when testing weight, the first construction is available, while the second is not: *2 pounds of coffee* vs. **2 pound coffee*. The reason for this contrast is that temperature is not monotonic on the domain of entities (it does not track the part-whole relations over this domain), while weight is monotonic. That is to say, adding more coffee to a given portion of coffee results in an increase in its weight. Zhang's analysis derives monotonicity out of the at-issue semantic import of each. Its formal representation involves a ratio expression.

Cardinality is by definition monotonic over the domain of individuals. This is why the contrast of the kind that was exhibited in (31) is absent in constructions containing *câte* and cardinals. There are, however, certain barely detectable semantic effects. The presence of the distributive marker in the sentence in (33) seems to indicate that adding up the weights of the suitcases is in some way relevant, for example, in a context in which the suitcases have to be loaded on some platform.

- (33) *Fiecare valiză cântărește câte cinci kilograme.*
 each suitcase weighs DIST five kilos
 ‘Each suitcase weighs five kilos.’

Since these effects are difficult to judge and require very fine linguistic intuitions, the main point of focus in the detection of the role of monotonicity will be sentences with non-monotonic measure phrases, such as temperature, speed, earthquake magnitude etc. The following section presents an experiment which targets the effect of monotonicity on the acceptability of measure phrases containing *câte*. The expectations were that the latter kind of sentences, containing *câte* with non-monotonic measures, will be degraded as opposed to all other combinations (without *câte* and non-monotonic or with/without *câte* and monotonic).

3.1 The experiment²

The following online acceptability experiment was run on Ilex and explores the effects of monotonicity on three types of distributive markers. The 74 participants were native speakers of Romanian. They were asked to evaluate the sentences on a scale of acceptability ranging from 1 to 10, depending on how natural they considered them to be. The fillers were chosen so as to range from completely acceptable to plainly ungrammatical.

- (34) a. *Acești copii cântăresc câte 30 de kilograme.*
 these kids weigh DIST 30 of kilos
 ‘These kids weigh 30 kilos each.’
 b. *Fiecare din acești copii cântărește 30 de kilograme..*
 each from these kids weighs 30 of kilos
 ‘Each of these children weighs 30 kilos.’
 c. *Acești copii cântăresc 30 de kilograme fiecare.*
 these kids weigh 30 of kilos each
 ‘These kids weigh 30 kilos each.’
- (35) a. *Aceste mașini de cursă ajung la câte 360 de kilometri pe oră.*
 these cars of race reach at DIST 360 of kilometers per hour
 ‘These race cars reach 360 km per hour each.’
 b. *Fiecare din aceste mașini de cursă ajunge la 360 de kilometri pe oră.*
 each from these cars of race reaches at 360 of kilometers per hour
 ‘Each of these race cars reaches 360 km per hour.’
 c. *Aceste mașini de cursă ajung la 360 de kilometri pe oră fiecare.*
 these cars of race reach at 360 of kilometers per hour each
 ‘These race cars reach 360 km per hour each.’

There are two distinct factors, yielding six conditions: type of distributive marker (*câte* – (a) / subject *fiecare* – (b) / binominal *fiecare* – (c)) and type of measure phrase (monotonic – (34) / non-monotonic – (35)). The type of measure phrase was classified as either monotonic

² This section has been substantially revised. I am greatly indebted to the editors for their support and contribution in organizing the report of the findings of this experiment into a much more thorough and scientifically appropriate form than in earlier drafts.

(weight, duration, volume etc. – (34)) or non-monotonic (temperature, speed etc. – (35)), following the characterization and tests in Schwarzschild (2002). Since it was impossible to construct sentences which were identical on everything except for the monotonic/non-monotonic condition (the verbs had to be different etc.), the type of measure phrase was manipulated between items.

The prediction was that *câte* (a) is compatible with monotonic measures, but degraded with non-monotonic ones, whereas subject *fiicare* (b), which serves as control condition, is equally compatible with monotonic and non-monotonic measures. Therefore, the comparison of *câte* with subject *fiicare* is predicted to interact with monotonicity. There was no prediction for the effect of monotonicity on judgments of binominal *fiicare* (c), since it may also be sensitive to monotonicity, as English binominal *each* was reported by Zhang (2013) to be. Evidence on this question will be obtained by whether the second comparison, the one between binominal *fiicare* and the control condition, subject *fiicare*, interacts with monotonicity or not.

Table 1. Testing the effects of monotonicity, marker type and monotonicity x marker type on acceptability. Legend: Monotonicity: monotonic1 = non-monotonic; monotonic2 = monotonic; Marker: (a) [*câte*]; (b) [subj *fiicare*]; (c) [binom *fiicare*]

	Estimate	Std. Error	<i>t</i> -value
(Intercept)	1.231e-16	7.640e-02	0.000
monotonic2-1	2.033e-01	6.186e-02	3.287
marker(b)-(a)	3.104e-02	6.434e-02	0.482
marker(c)-(b)	1.505e-01	6.852e-02	2.197
monotonic2-1:marker(b)-(a)	-3.692e-01	8.417e-02	-4.386
monotonic2-1:marker(c)-(b)	1.457e-01	8.417e-02	1.731

A linear mixed effects model analysis was conducted on the 3×2 factorial design with the factors *Distributive Marker* and *Measure Phrase*. Table 1 sums up the results. The condition means are plotted in Figure 1.

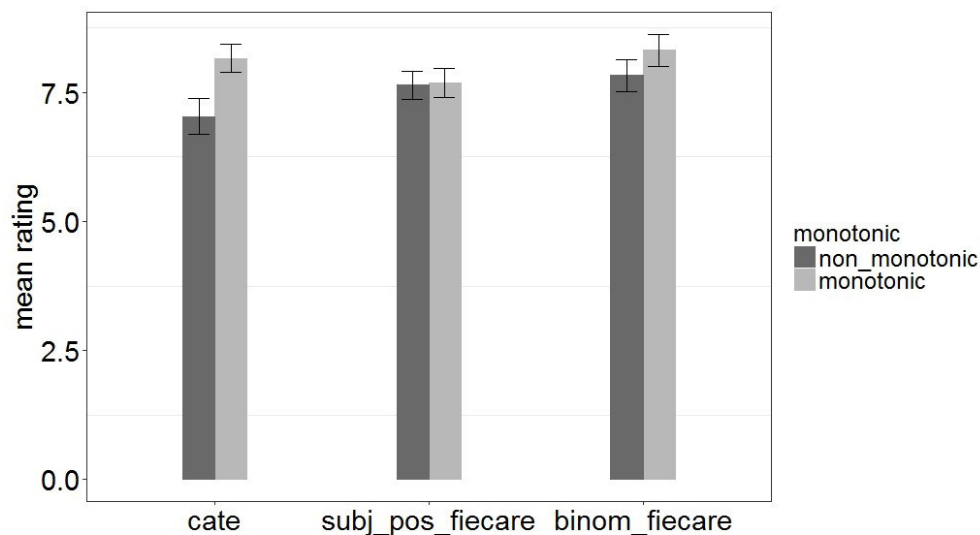


Figure 1. Means of acceptability by marker and monotonicity. Error bars represent a 97.5 confidence interval

The critical *t*-value was set to 2.0; *t*-values with an absolute value larger than the critical *t*-value are considered significant. The main prediction was corroborated by the significant interaction of the comparison between *câte* and subject *fiicare* with monotonicity (cf. monotonic2-1:marker(b)-(a) in Table 1). As can be seen in Figure 1, there is a monotonicity effect

in the case of *câte*, but not in the case of subject *fiecare*. However, the effect of monotonicity does not differ between binominal *fiecare* and subject *fiecare* (cf. monotonic2-1: marker(c)-(b)), supporting a lack of monotonicity effect for binominal *fiecare* as well. Furthermore, the analysis revealed a main effect of monotonicity with monotonic measures leading to overall higher judgments than non-monotonic measures (cf. monotonic2-1), no main effect for the comparison between *câte* and subject *fiecare* (cf. marker(b)-(a)) and a main effect for the comparison between binominal *fiecare* and subject *fiecare* (cf. marker(c)-(b)). This latter main effect means that binominal *fiecare* is judged on average higher than subject *fiecare*.

The main conclusions drawn from these results are that, as predicted, judgments for *câte* suffer if combined with non-monotonic measures unlike judgments for subject *fiecare* which remain unaffected by whether measures are monotonic or non-monotonic. There was no evidence that binominal *fiecare* responds differently to the monotonicity distinction than subject *fiecare*.

3.2 Monotonicity, additivity and event-relatedness

As can be seen in Figure 1, even though the decrease of acceptability with *câte* plus non-monotonic measures is statistically relevant, it cannot be considered a contrast in terms of (un)grammaticality. The acceptability of *câte* plus non-monotonic measures remains quite high. The grand mean is 7.77, while the mean for this particular construction is 7.03. As a result, I assume that, besides the licensing condition discussed in Section 2, *câte* is associated with an additivity implicature.

The notion of additivity is stricter than that of monotonicity (as defined in Lassiter, 2011). Additivity requires that, for any variables x and y , $m(x \oplus y) = m(x) + m(y)$, i.e., the measure of the sum of x and y is the sum of their measures. Monotonicity merely requires that $m(x \oplus y) > m(x)$ and $m(x \oplus y) > m(y)$. In what follows, I will discuss sentences in which the distributive marker introducing the share applies to a measure which is by definition monotonic on the domain of the key, but the implicature the marker is associated with induces strict additivity. To take an example, cost is by definition merely non-monotonic, in the sense that buying two objects together may sum up to a price that is higher than the individual prices (monotonicity) but which is lower than the sum of the two prices (non-additivity). Nevertheless, when *câte* applies to this measure, the stronger additivity constraint applies. In (36) below, the total price must be computed by adding the two prices together.

- (36) *Cele două cămăși costă câte 10 euro.*
 the two shirts cost CÂTE 10 euros
 ‘The two shirts cost 10 euros each.’

Additivity is not a property of the measure function itself, it is the particular interpretation that the sentence receives due to the distributive marker: Shares are not merely distributed, they must be added, which is in principle possible as long as the measure introduced in the share is monotonic over the domain introduced by the key. Therefore, strictly speaking, the type of measures *câte* is compatible with must be monotonic, but the interpretation that ensues is a stronger, additive one, which of course can be viewed as a consequence of distributivity.

A further complication arises with phrases of the form [*câte* Num NP], where the NP denotes entities. Example (10), repeated here as (37), is taken as an illustration.

- (37) *Fiecare copil a văzut câte două maimuțe.*
 each child has seen DIST two monkeys
 ‘Each child saw two monkeys.’

One can interpret the phrase *două maimuțe* ‘two monkeys’ (without *câte*) as being specific and as not interacting with the quantified subject (i.e., there are two monkeys such that each

child saw them). But such a reading is impossible if *côte* is added, due to the latter's licensing condition.

Focusing on the non-specific reading, it may be the case that different children happened to see the same monkeys such that the overall number of monkeys involved in these seeing events is lower than the number of children multiplied by two. First of all, the view endorsed here is that this is not a case of monotonicity as opposed to the stronger additivity condition, in the sense that cardinality might be merely monotonic on the domain of entities. The ignorance or indifference with respect to counting the same individual twice is a separate, unrelated issue. Measures which are monotonic and possibly non-additive are so due to their intrinsic properties, while the issue of counting individuals multiple times is a matter of ignorance or indifference with respect to value assignment on entity variables.

To take only one example of a formal implementation which takes a more fine-grained approach to how measures are applied to all domains, including times, spaces and individual, see the following definition of extensive measure functions in Krifka (1997) in (38):

- (38) m is an extensive measure function for a set U with respect to concatenation ' \wedge ' iff:
- a) m is a function from U to the set of positive real numbers.
 - b) $\forall x, y \in U [m(x \wedge y) = m(x) + m(y)]$ (additivity)
 - c) $\forall x, y \in U [m(x) > 0 \wedge \exists z \in U [x = y \wedge z] \rightarrow m(y) > 0]$ (comensurability)

For the present purposes, since we are concerned with variables which range over individuals, concatenation amounts to sum formation.³ But since sum formation is idempotent ($x \oplus x = x$) while concatenation is not, ($x \wedge x \neq x$), Krifka further proposes a constraint on the conditions under which the two can be equated: Concatenation as sum formation over the domain of entities is only defined in cases where the members of the sum do not overlap. The consequence of this caveat is that cardinality is an extensive measure over entities, disregarding idempotence.

If we adopt this view, then we could say that *côte* is restricted to extensive measures. But the notion of extensive measure is not sufficient to capture distributive readings because it would leave open the option that the same reality (the visit at the zoo) might be expressed in two different ways depending on the choice of focus – on the individuals or on the associated events. This is the case of the cumulative readings of cardinals reported in Krifka (1990). Taking a case in which during a whole year, 2000 individual ships passed through a lock twice, there are two ways of truthfully referring to this fact, cf. (39):

- (39) a. Object related (OR): *Last year, 2000 ships passed through the lock.*
 b. Event related (ER): *Last year, 4000 ships passed through the lock.*

Looking at the zoo scenario, imagine a situation in which John and Mary visited the zoo and John saw Henry the gibbon, Beth the baboon and Sue the orangutan, while Mary saw Pepe the howler monkey, Beth the baboon and Sue the orangutan. On an object related reading, John and Mary saw four monkeys in total, but this cannot be expressed with a distributive statement such as *John and Mary saw two monkeys each*. To put it differently, if there were an object-related reading for distributed shares, it would merely require that the total number of distributed individuals (in our case monkeys) should be the cardinality of the key (in this case of the subject) multiplied by the cardinality of the share (two), which in this case would yield four. In this respect, the claim that distributive markers exclusively target object-event pairs is in line with other accounts of nominal distributivity which take the mediation of an event variable to be crucial.

³ See Champollion & Krifka (2016) for an overview of the definitions of sum formation, as applied over the domain of individuals (entities or events) within a mereology.

On the event related reading they saw three monkeys each. Only the latter is a truth-conditionally appropriate linguistic representation of the situation. The natural initial reaction to this statement is that this is obviously so, since the reading is distributive and the semantic computation proceeds in parallel, under the scope of some distributive operator. This is indeed the reason behind the exclusion of an OR reading, but the observation still stands: The counting of two entities under different assignments is precluded only once. This fact will be taken as sufficient reason to assume that the mechanism behind deriving event related readings is obligatorily applied to distributed shares.⁴

3.3 The additivity condition is a conventional implicature

The purpose of the experiment presented in Section 3.1 was to test the hypothesis that *câte* is a marker of distributivity on the share with an additivity implicature. The additivity condition is not taken to be part of the at-issue content because it does not have any effect on the truth conditions of the sentence. My own intuitions as well as those of some of my informants (native speakers of Romanian) are that the sentence in (40), which was one of the items in the experiment involving non-monotonic measures with *câte*, is judged true if the respective cars can reach that speed, but the use of *câte* seems inappropriate.

- (40) ??*Aceste mașini de cursă ajung la câte 360 de kilometri pe oră.*
 these cars of race reach at DIST 360 of kilometers per hour
 ‘These race cars reach 360 km per hour each.’

More precisely, under the present account, the additivity condition is a conventional implicature (henceforth CI) which applies to the *câte* + Meas construction, and it is a context-independent, non-at-issue semantic condition. The notion of conventional implicature employed in (41) follows the definition in Potts (2005), building on a brief description found in Grice (1975).

- (41) a. CIs are part of the conventional meaning of words.
 b. CIs are commitments, and thus give rise to entailments.
 c. These commitments are made by the speaker of the utterance “by virtue of the meaning of” the words he chooses.
 d. CIs are logically and compositionally independent of what is “said (in the favored sense)”, i.e., independent of the at-issue entailments.

I follow the strategy in Potts (2005), that of removing the conditions one by one and testing whether the alleged CI still holds its ground. Conditions (a), (b) and (d) are more easy to defend, so they will be addressed first. Regarding the possibility that condition (a) is not enforced, Potts (2005: 211):

If we remove the conventional-meanings property, we find ourselves in a world of commitments (logical entailments) that inhere in no specific lexical item. In my dissertation (Potts, 2003), I suggested that this might not be a genuine class of meanings. At the time, it seemed to me that the only possible contenders for this classification were things like sarcasm, skepticism, and the like.

Condition (b) is met by virtue of the fact that additivity is not cancellable, calculable or detachable, and is therefore a semantic entailment. The fact that additivity is part of the conventional meaning of *câte* excludes it from the class of conversational implicatures. The latter are by definition calculable via pragmatic reasoning strategies, while conventional implicatures (CIs) are idiosyncratic properties of linguistic expressions. Conversational implicatures are

⁴ This hypothesis is of a larger magnitude than what is supposed to be the target of this paper, more specifically it should apply to unmarked non-specific cardinal expressions such as *They saw two monkeys*. This extension is left for further research.

cancellable via contextual priming, as well as detachable (one can express the same implied meaning by using a different linguistic structure).

The distributive marker discussed here is not context-dependent (it is not calculable via extra-linguistic, pragmatic processes). It is calculated semantically by means of the semantic composition of entities with non-monotonic measures. The semantic composition relating the entities and the measures is worked out by the main predicate. In (40) above, the predicate itself (successfully) combines cars and their respective speeds, but the additivity implicature is not observed, regardless of any pragmatic factors. Also, the additivity condition is **non-cancellable** and **non-detachable**. The only alternative to *câte 360 de km/h* in the example above is *360 de km/h*, which simply lacks the implicature.

If removing condition (d) were possible, the additivity condition would be a presupposition. But the high acceptability as well as intuitions of native speakers suggest that it is not a precondition for the felicitous use of *câte*. If the licensing condition is not observed (i.e., there is no plurality or quantifier to serve as distributive key), the sentence is uninterpretable, see (42):

- (42) #*Ion a mâncat câte două mere.*
 Ion has eaten CÂTE two apples
 #‘Ion has eaten two apples each.’

But (40) above is perfectly intelligible, though slightly deviant. Moreover, no interaction can be observed with the predicates taken as tests for presuppositionality in the literature (so-called ‘presupposition plugs’ and ‘holes’).

Regarding condition (c), the division between at-issue entailments and CIs (non-at-issues entailments) is generally teased apart by the fact that when the former are embedded under attitude predicates, they are interpreted locally, while the latter exclude such an interpretation. For instance, Bach (1999) employs the IQ (indirect quotation) test in order to argue that many (all) of the expressions which have been typically classified as CIs are actually at-issue entailments. The test is so convincing because it takes the term *at issue* in its strongest, most literal sense: *that which is asserted*, not necessarily by the speaker. For instance, the conjunction *but* is usually taken to carry the implicature that the second conjunct is unexpected given the first one, cf. (43):

- (43) Shaq is huge, but he is agile.
 CI: Being huge usually precludes being agile.

In a main clause, this entailment is attributed to the speaker and taken to be computed outside of the at-issue content. To paraphrase, (43) asserts that Shaq is huge and agile, and implies that this is an unexpected combination according to the speaker. Bach draws attention to the effect of embedding, cf. (44):

- (44) Marv said that Shaq is huge but that he is agile.

In this case, it is not only that it may not be the speaker’s, but Marv’s belief that size usually does not combine with agility, but, more importantly, if the speaker intends to convey that Marv believes and has uttered the sentence with *but*, he cannot leave the conjunction out and use *and* instead. That is, *Marv said that Shaq is huge and that he is agile* would not count as a faithful rendering of Marv’s statement.

Turning back to the additivity condition, we can see that it is enforced independently of any embedded attitude holder. The deviance of (40) is impervious to presupposition plugs and holes, as previously stated. The IQ test is not applicable either. The addition of an embedded attitude holder in (40) (*Marv said that these race cars reach CÂTE 200 km/h*) does not alter the degree of acceptability of the sentence in any way.

The notion of speaker commitment is indeed not obvious or at least diluted. It seems at a first blush as if the non-at-issue additivity entailment is impersonal, independent of the speaker or of other attitude holders alike. If there is any speaker commitment, it is that the shares introduced via *câte* + MeasP are not merely iteratively separated via distribution, but also incrementally related. But even if one does not accept such a broad and impressionistic view of speaker commitment, there are facts related to scope which preclude the additivity condition from being understood as a local at-issue semantic phenomenon. The iterativity of the share is part of the at-issue semantic import of *câte* + MeasP. The absence of a governing distributive operator leads to uninterpretability, as illustrated above (see (42)). By contrast, the additivity condition, besides the fact that it does not produce uninterpretability when not observed, must in general be computed over and beyond the distributive licenser. The representation in (45) is a very simplified representation of how the meaning of *câte* is computed.

(45) *Fiecare copil a văzut câte două maimuțe.*
 each child has seen DIST two monkeys
 ‘Each child saw two monkeys.’

- a. At issue: $\forall x. [[*child(x)] \rightarrow \exists y. [*monkey(y) \ \& \ |y|=2]]$ licensing condition satisfied
 b. CI: $\forall x,y. [[*monkey(x) \ \& \ *monkey(y)] \rightarrow |x| + |y| = |x+y|$

The values the entity variables ranging over monkeys are dependent on the value assignment function which ranges over children. Therefore, the additivity condition cannot be verified locally. There is an additional problem, also related to binding, which is discussed first in Karttunen and Peters (1979) and addressed in most accounts of conventional implicatures. As Potts (2005: 43) remarks, this is a general property of CIs – “there is usually a one-way dependency, in the sense that the CI functor is saturated by something from the at-issue realm”. The problem (or rather the difficulty) is to capture this dependence compositionally. In our case, it is the x and y variables in the additivity condition which need to be identified as the variables that are fed to the measure function at the assertion level. This is an overarching issue, which will be left for further research.

3.4 The additivity CI as a condition over event-entity pairs

The additivity implicature is, in more formal terms, given in (46).

(46) A proposition containing an expression of the form *câte d Meas* verifies the following additivity condition:

$$\forall x,y [\exists e,e'. e \neq e' \wedge \theta_1(e)=x \wedge \theta_2(e')=y \wedge \mu(x)=\mu(y)=d] \rightarrow [\mu(\langle e,x \rangle \oplus \langle e',y \rangle) = 2 * d]$$

In words, for any x and y of type entity such that there are two distinct eventualities e and e' in which x and y (respectively) are participants and they measure d degrees on the scale introduced by *Meas*, then the event-object pair that is the sum of these two events and participants measures d multiplied by 2.

The formula above basically says that the measures introduced by *câte* are necessarily event related in the sense of Krifka (1990) and Doetjes & Honcoop (1997). This amounts to saying that *câte* is the distributive counterpart of cumulative event-related cardinals. An example of a cumulative event-related interpretation of a cardinal is given in (47).

(47) *Last year, 4,000 ships passed through the lock.*

- a. Object-related (OR) reading: 4,000 ships are such that each of them passed through the lock last year.
 b. Event-related (ER) reading: there were 4,000 events in which a ship passed through the lock last year.

In order for the event related reading to be available, Doetjes & Honcoop (1997) assume that cardinals can optionally incorporate an event variable into their restrictor, yielding a determiner which ranges over event-object pairs. For instance, the cardinal in the example above is 4000_x on the object related reading, but $4000_{\langle e,x \rangle}$ on the event related one. The following two operations, defined as in (48) below, have to apply in order to yield the event-related reading, by specifying how to reduce measures of event-object pairs to measures of objects:

(48) a. Standardization⁵

$$[\neg \text{ITER}(e,x,R) \ \& \ N(x) \ \& \ R(e,x)] \rightarrow [\mu'(e,x) = n \leftrightarrow \mu(x) = n]$$

b. Generalization

$$[\neg \langle e,x \rangle \circ \langle e',x' \rangle \ \& \ \mu'(e,x) = n \ \& \ \mu'(e',x') = n'] \rightarrow [\mu'(\langle e,x \rangle \oplus \langle e',x' \rangle) = n+n']$$

If the verb is non-iterative, then the measures of the objects are simply added. Since *pass through the lock* is iterative (i.e., the same object may pass through a lock more than once), generalization applies. As long as there are two non-overlapping events e and e' such that some object passed through the lock. This allows for the recycling of individuals: If ship x passed through the lock twice, it will be counted as ‘two ships’. Importantly, the amount denoted by cardinal *4000* is the result of applying the two operations in (48) to the parts of the participants (the ships) and their corresponding subevents. This makes the reading cumulative. By contrast, the implicature associated with *câte* targets the numeral itself (d in (46) above) which the distributive marker modifies. Therefore, this version of Generalization applies bottom-up.

This excludes gradable measures from ever combining with *câte*, since, by definition, they cannot be additive. This means that, with gradable cardinality expressions, the satisfaction of the implicature is by definition impossible. This accounts for the complete ungrammaticality of **câte mulți* (‘DIST many’), **câte mai puțin de trei* (‘DIST less than three’) etc.

An apparent exception is the well-formed *câte cel puțin n* (‘DIST at least n’) and *câte cel mult n* (‘DIST at most n’).

These expressions are not actually gradable. The contribution of *most/least* modification is to introduce an ignorance implicature. To illustrate, a paraphrase for *at most three* which explicitly expresses the content of the implicature is ‘three, maybe less’.

Nowen (2010) provides a classification of modified cardinal into two classes, Class A and Class B, cf. (49). Class A modifiers include comparatives like *less/more than n*, the prepositional modifiers *over n*, *under n* and *between n and m*. Class B modifiers include, in addition to the superlatives in (3), the adverbs *minimally n*, *maximally n*, the prepositions *from n*, *up to n*, and complex expressions like *n or more/fewer*. *Câte* systematically combines with Class B cardinals and is ungrammatical with Class A cardinals (except for the counterpart of *from n*).

(49) a. CLASS A: **câte mulți* (‘DIST many’), **câte puțini* (‘DIST few’), **câte mai mulți* (‘DIST more’), **câte mai puțin de trei* (‘DIST less than three’), **câte peste trei* (‘DIST over three’), **câte sub trei* (‘DIST under three’), **câte între cinci și zece* (‘DIST between five and ten’).

b. CLASS B: *câte minim trei* (‘DIST minimum three’), *câte maxim trei* (‘DIST maximum three’), *câte până la trei* (‘DIST up to three’), *câte trei sau mai multe* (‘DIST three or more’).

⁵ In words, if an event e is non-iterative (i.e., there is no recurrence of the same individual as the theta role of two distinct subevents of e), then the measure of the event-object pair is equivalent to the measure of the object itself. Below, e is an event type variable, x is an entity type variable, R is an event property and N is a nominal property. Overlap is represented as \circ .

Kennedy (2015) offers a pragmatic account of the ignorance flavor that comes with Class B modifiers. The central idea is that modified cardinals such as *at least six* or *at most six* are in competition with two more informative options, either the plain cardinal, or Class B expressions such as *more than six* or *less than six*, cf. (50) and (51).

- (50) a. *This airplane has six emergency exits.*
 b. *This airplane has more than six emergency exits.*
 c. *This airplane has at least six emergency exits.*

- (51) a. $\llbracket \text{six} \rrbracket = \lambda P_{\langle d,t \rangle}. \max\{n \mid P(n)\} = 6$
 b. $\llbracket \text{more than six} \rrbracket = \lambda P_{\langle d,t \rangle}. \max\{n \mid P(n)\} > 6$
 c. $\llbracket \text{at least six} \rrbracket = \lambda P_{\langle d,t \rangle}. \max\{n \mid P(n)\} \geq 6$

If someone utters (50) instead of the two other stronger alternatives (50b) or (50c), it follows that the speaker is not in a position to say whether the number of exits is exactly six or whether it is strictly higher than six. A plausible explanation for why this might be the case is ignorance.

The view advocated here is that the information provided by *at most* and *at least* is indeed an implicature and amenable to a pragmatic account in the same lines as those sketched by Kennedy (2015), but, crucially, the condition \geq is not part of the semantics of *at least n*. The ‘and maybe more’ part of the meaning is not part of the assertion. At the level of assertion then, I assume that the modified cardinal *at least six* has the same denotation as the plain cardinal *six*. This also answers a puzzle regarding the fact that *at least n* seems to pass the cumulativity test, yet when placed in the role of theme, produces bounded events (cf. *John ate at least three apples in an hour/ *for an hour*). If this is correct, it becomes apparent that these modified cardinals do verify our additivity condition in (46). Strictly speaking, *at most six* plus *at most six* equals *at most twelve*, which basically means *twelve, maybe less*. Since additivity can in principle be observed, *câte* is grammatical as a modifier of these Class B cardinals.

The last issue to tackle is the question why sentences like (52) below are not completely ungrammatical, on a par with **20 degrees of water*.

- (52) *?Acele lichide sunt la câte 20 de grade Celsius.*
 these liquids are at DIST 20 degrees Celsius
 ‘These liquids are at 20 degrees Celsius each.’

A tentative answer is that in **20 degrees of water*, the measure head lexically encodes information about its two arguments. By contrast, in the example above, whether additivity is obeyed or not is a matter of contingency, since the two domains which have to be checked for co-extensiveness are introduced at a distance. In the case above, monotonicity is not verified, since the liquids range over entities and temperature does not keep track of part-whole relations in the domain of entities. But, if one looks at sentences like (53) expressing rates of growth of temperature, where the relevant domain is not that of entities but of times, *câte* becomes perfectly acceptable.

- (53) *La fiecare măsurare s-a observat că temperatura a crescut*
 at each measurement REFL-has observed that temperature.DEF has risen
cu câte 5 grade Celsius.
 with DIST 5 degrees Celsius

‘With each measurement it was observed that the temperature rose by 5 degrees Celsius.’

4 Conclusion

The starting point of the present account was the observation that the Romanian distributive marker *câte* seems to play a very modest role in the semantics of the sentences it occurs in. It cannot introduce distributivity itself and in certain cases cannot even be said to function as a disambiguator. Section 2 was dedicated to arguing that whatever mechanism is responsible for the co-varying (distributive) interpretation of unmarked cardinals is also responsible for the obligatorily co-varying (distributive) interpretations of cardinal expressions with *câte*. This observation raises issues that are relevant beyond the semantic effects of distributive markers, but are important in discovering the limits in the availability of distributive interpretations for cardinal expressions in general.

Even though the issue is too broad to be addressed here, certain possible lines of investigation were mentioned, mainly having to do with the (un)boundedness of the potential key, the idea behind this being that frequency adverbs and pluractional operators are imperfect keys for cardinal expressions because they do not define the units they introduce (temporal intervals or events, as the case may be). Another very interesting issue which is left for further research is the obligatory interpretation of the cardinal as being under focus in these environments, to the extent to which it can get a co-varying reading.

As for cardinals expressions marked with *câte*, the idea that distributivity must be supplied by some other source is expressed in the form of a licensing condition. Section 3 was dedicated to the differences between *câte* and cardinals that are unmarked for distributivity. Investigating these differences has led to the conclusion that nominal phrases containing *câte* are not merely distributive, but also additive. The additivity condition is not as strong as the licensing condition, therefore it was classified as an implicature. This implicature explains certain selectional restrictions that apply to this marker, namely it can only modify a particular subset of cardinal expressions: plain cardinals and Class B cardinals. It also explains the lower acceptability of *câte* plus non-monotonic measure combinations, which was confirmed by the experiment presented in Section 3.1.

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