

Time-counting expressions as aspectual complex numerals*

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Abstract

We compare the syntactic and semantic properties of time-counting expressions to those of better studied counting systems, such as complex cardinal numerals (Kayne 2005, 2016; Ionin & Matushansky 2006; Stavrou & Terzi 2008; Di Sciullo 2012, 2015, a.o.). From a typological point of view, we will focus on Romance languages. We argue that time-counting expressions, as opposed to complex numerical expressions, may have specific aspectual properties. We observe first that time-counting expressions involve a “salient” reference time, henceforth SRT, on the basis of Italian and Spanish. We argue that this salient reference hour-time may denote either a time-point or a time-interval. The time-point interpretation of the SRT gives rise to telic construals in some cases. The lack of SRT makes number phrases not interpretable as time denoting expressions. The telic construals usually involve locative or goal prepositions, such as *a* “to” in Italian, *para* “for” in Portuguese or *to* in English. On the other hand, time-interval interpretations of SRT are typical of time-counting expressions involving pseudo-partitives in languages like Catalan. In these cases, the reference-time is not viewed as the endpoint of a telic interval. We also discuss telic cases similar to the pseudo-partitive ones in that they involve [*quarter* + *minutes*] constituents, but involving aspectual prepositional projections. We analyze time-counting expressions in terms of extended prepositional projections including RelView categories, discussed in Cinque & Rizzi (2010) for the syntax-semantics of locative/directional prepositions, in order to formalize the spatial location of time. By doing so, we propose a unified account for the variety of Romance languages time-counting expressions.

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1. Purpose

We explore the formal and the aspectual properties of time-counting expressions in Romance languages. Considering expressions such as the ones in (1) and (2), we raise the following questions: What is the role of prepositions in these expressions and what do time-counting expressions tell us about the properties of the Language Faculty?

(1) un quarto alle cinque (It.)
a quarter to the five
“a quarter to five”

(2) dos quarts i cinc de nou (Ca.)
two quarters and five of nine
“eight thirty-five”

It is well known that prepositional structure (PP) may delimit events in the verbal projections (Tenny 1987, Di Sciullo & Tenny 1997, Di Sciullo 1997, 2005, Travis 2000, Ramchand 2008, Garcia-Padro 2015, a.o.) The delimiting properties of PPs in DPs is however open to further inquiry. We develop the hypothesis formulated in Di Sciullo (2016) according to which time-counting expressions are part of the extended nominal projection, including numeral cardinals (Numcard), see (3) from Cinque (2005). They provide a domain in which the operations of the Language Faculty relate number, time and space via prepositions.

(3) [Quniv . . . [Dem . . . [Numord . . . [RC . . . [Numcard . . . [Cl . . . [A . . . NP]]]]]]]
(Cinque 2005)

According to the Strong Minimalist Thesis (Chomsky 2001, *et seq.*), language is an optimal solution to interface conditions, in that language is an optimal way to link sound and meaning. There is a significant asymmetry between the conceptual intentional (C-I) interface, the system

of thought, and the sensorimotor (SM) interface externalizing the system of thought, with the first having primacy. Interface asymmetries arise with unpronounced constituents. The internal syntax of time-counting expressions analyzed in Kayne (2005, 2016) includes unpronounced nominal expressions, such as HOURS and YEARS. We focus on the derivation of time-counting expressions as cases of interface asymmetries including unpronounced prepositional constituents.

We assume that prepositions project additional functional structure (van Riemsdijk 1990; Jackendoff 1983; Koopman 2010; den Dikken 2010; Tortora 2008, Koopman 2000, Terzi 2010, Cinque 2010, Svenonius 2010). We provide arguments to the effect that, in some cases, the prepositional structure delimits time-counting expressions, whereas in other cases it does not support telic construals. The evidence comes from temporal boundaries, time span vs. durative modification, and point of view. We propose a unified derivation of time-counting expressions and variation between Romance languages. We draw consequences for the understanding of aspect in time-counting expressions, given the Conceptual-Intentional (CI) and Sensorimotor (SM) interface asymmetries.

Firstly, we discuss some properties of cardinal numerals and time-counting expressions the derivation of cardinal numbers, such as *vingt-et-un* (Fr.) (twenty and one) ‘twenty-one’ and time-counting expressions, such as *le due e mezzo* (It.) (the two and half) ‘two thirty’. We argue that cardinal numerals merge with additive and multiplicative morphology, e.g. *one hundred (and) one*. This morphology is silent in some cases, e.g. *venti due* (It.) ‘twenty-two’, *due cento* (It.) ‘two hundred’; however it is nevertheless legible at the CI interface. Secondly, we argue that sometimes silent conjunctions and prepositions are part of the derivation of cardinal number and time-counting expressions. These expressions include unpronounced nouns, such as HOUR and YEAR (Kane 2003, 2006, 2015), and sometimes silent prepositional structure parting, orienting, and delimiting time in abstract space (Di Sciullo 2016). Interestingly, the prepositional structure may in some cases have delimiting properties, e.g. *un quarto *(alle due)* (It.) ‘a quarter *(to two)’, as well as a Relative View property (Cinque & Rizzi 2010, *et seq.*), compare the preceding example to the following *le due meno un quarto* (It.) (the two minus one quarter) ‘a quarter to two’. However, pseudo-partitive morphology does not have a delimiting effect in cases such as the following from Catalan, e.g. *un quart i cinc de nou* (a quart five of nine) ‘twenty past eight’. Thirdly, we rely on Cinque & Rizzi’s (2010) extended projection of

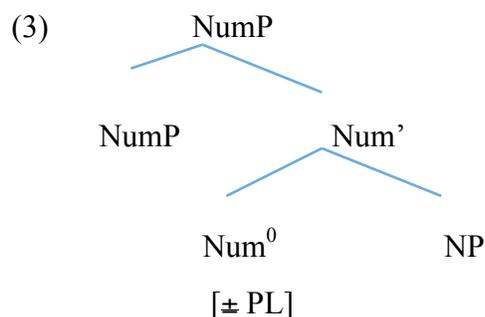
prepositions in order to identify the spatial location of time with time denoting expressions. We derive the differences between Romance languages regarding the variation in the form and interpretation of time denoting expressions. In the last section, we draw consequences of our analysis for the understanding of how the operations of the Language Faculty relate number, time and space.

2. Cardinal numerals

2.1 The structure of cardinal numerals

In this section, we present an overview of our assumptions on the structure of cardinal numerals as well as the aspects of their syntax-semantic properties they share with time-counting expressions.

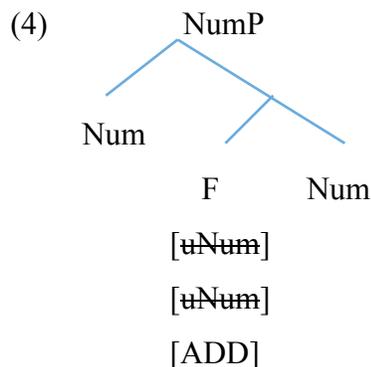
Cardinal numerals are generally assumed to occupy the Specifier of numeral phrase (NumP), (3). This is the case in Ionin & Matushansky (2006) analysis, based on X-bar structure and type theoretical semantics, as well as in Stavrou & Terzi (2008).¹



For Ionin & Matushansky (2006), additive structures, such as *twenty two*, are analyzed as conjunctions; whereas multiplicative structures, such as *two hundred*, are analyzed as complementation structures. Di Sciullo (2012) proposes that complex numerals include a

¹ Several other analyses have been proposed for the internal structure of complex cardinal numerals, including a flat structure (Zabbal 2005). We will assume that the internal structure of these expressions is asymmetrical, and thus not reduced to a sisterhood relation. See Di Sciullo (2015) for discussion.

functional head that can be pronounced in some cases, as in (4). The functional head has both valued and unvalued features. The unvalued (u) features [uNum] are checked and eliminated. In additive structures, the valued [ADD] feature is interpreted as a non-Boolean conjunction operator and thus has a group reading.



The operator feature [ADD] is spelled out as the coordination conjunct *e* “and” in Italian cardinal numerals, as in *cento e uno* “hundred and one”, as well as in time-counting expression, as in Italian *le due e cinque* (the two and five) “five past two”. In cardinal numerals, the non-Boolean interpretation (group reading) of [ADD] is part of their semantic interpretation whether it is pronounced or remains silent.² Thus, following Di Sciullo (2012, 2015), we assume that unpronounced functional heads are part of the structure of cardinal numerals.

Furthermore, we assume that the subtractive operator [SUB] is also an operator feature in time counting expressions and it is spelled out as a preposition *de* “from” in Latin cardinal numeral numerals, as in *duo de viginti* (two from twenty) “eighteen”, and *meno* “minus” in Italian, as in *le due meno cinque* (the two minus five) “five to two”.

² While Languages vary according to the pronunciation or silence of [ADD], e.g. *ventuno* (It.) vs. *vingt-et-un* (Fr.) “twenty one”, the group reading for additive cardinal numerals is preserved when the coordinating conjunction is not pronounced:

- i. Il y a vingt-et-un livres en tout sur cette étagère. (Fr.)
It there have twenty and one books in all on this shelf
“There are twenty one books in all on this shelf.”
- ii. #Il y a vingt livres en tout et un livre en tout sur cette étagère.
It there have twenty books in all and one book in all on this shelf
“There are twenty books in all and one book in all on this shelf.”
- iii. John read twenty-one books altogether.
- iv. #John read twenty books altogether and one book altogether.

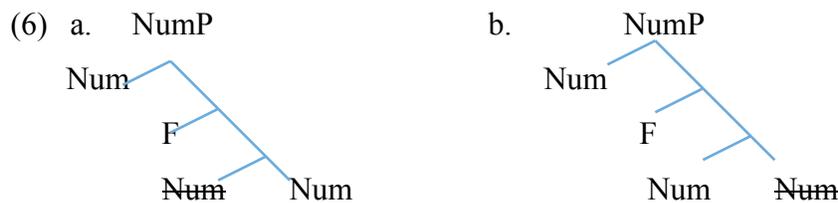
We thus take [ADD] and [SUB] to be independently motivated and to be part of the set of interpretable operator features in cardinal numerals.

2.2 The position of the digit with respect to the base

There is variation in the position of the digit with respect to the base in cardinal numeral numbers. For example in Latin, inverse ordering of the base with respect to the digit is observed in additive cardinal structures, as the examples in (5) illustrate.

- (5) a. viginti unus (Lat.)
 “twenty one”
 b. unus et viginti
 one and twenty
 “twenty one”

The derivations for the different orderings of the constituents of cardinal numerals can proceed as follows. Two numerals are first merged. A functional head is externally merged to the result. One or the other of the two numerals is internally merged to the functional head, (6).



The different linearizations of the parts of cardinal numerals follow from the computational procedure of the Language Faculty, where a single operation derives structure building (External Merge) and displacement (Internal Merge) (see Chomsky 2000 *et seq.*). See Di Sciullo (2015) for further discussion.

2.3 Perspectives

The fact that two structures may be used to refer to the same cardinal number suggests that cardinal numerals can be expressed in different perspectives. This is the case in Latin for example, as we illustrate in (7). These examples show that there is variation in the order of the digit with respect to the base near the tenths. They show further that the preposition *de* “from” must be pronounced in cases where the digit precedes the base.

- (7) a. octo decim (Lat.)
eight ten
“eighteen”
- b. duo de viginti (Lat.)
two (down) from twenty
“eighteen”
- c. novem decim (Lat.)
nine ten
“nineteen”
- d. un de viginti (Lat.)
one (down) from twenty
“nineteen”

The directional preposition brings about a spatial orientation in the interpretation of cardinal numerals. In (7a) and (7c) the individuation of a given number is relative to the lower base, ten, whereas in (7b) and (7d), it is relative to the higher base, twenty, as represented in (8).

- (8) a. 108.20 b. 10.....2.20
  

We provide evidence that this is also the case for time-counting expressions in section 3.

2.4 Relative View

We follow Di Sciullo (2016) and take that the derivation of cardinals includes projections of Relative View (RelView) in the extended functional projection for preposition, for example the one in (9) from Cinque & Rizzi (2010).

- (9) [Ppdir [PPstat AT [DPplace [DegP [ModeDirP [AbsViewP [RelViewP

those of counting systems, such as cardinal numerals. We present arguments that prepositional structure may have delimiting properties in time-counting expressions. The evidence comes from overt and silent temporal delimiters, as well as time span vs. durative adverbial modification. We argue further that time-counting expressions include aspectual categories, including salient reference point and relative view. We distinguish telic and atelic time counting expressions and suggest a unified analysis of the variants in terms of extended functional projections for prepositions.

3.1 Time-counting expressions and pronounced/silent constituents

Time-counting expressions and cardinal numbers share properties, including pronounced functional categories, such as conjunctions and prepositions, as illustrated with the examples in (1) and (2) above, repeated here in (11) and (12).

(11) un quarto alle cinque (It.)

a quarter at-the five

“a quarter to five”

(12) dos quarts i cinc de nou (Ca.)

two quarters and five of nine

“eight thirty-five”

Time-counting expressions also include silent constituents. Kayne (2005, 2006, 2016) propose to analyze time-counting expressions as including unpronounced nominals, including HOUR and O’CLOCK. In English, nouns, such as *years*, *hour* and *time*, can be silent, e.g. *it is six*: CLOCK TIME_i F^o [six HOUR] t_i (Kayne 2005). Agreement relations provide evidence that this is also the case in morphologically rich languages such as Italian, (13).

(13) a. È/*Sono l’una. (It)

is/are the one

“It is one o’clock.”

b. *È/Sono le due.

is/are the two

“It is two o’clock.”

Locative and directional prepositions, sometimes unpronounced adverbial PPs are also part of time-counting expressions. The adverbial PPs provide a broader areal boundary to time-counting expressions, as evidenced by the contrast between (14a, b) and (14c, d) below.

(14) a. È l’una e mezza (di mattina). (It.)

is the one and a half of morning

“It is one in the morning.”

b. Sono le due meno un quarto (di pomeriggio).

are the two minus a quarter of morning

“It is a quarter to two in the morning.”

c. #Sono le due meno un quarto (di sera).

are the two minus a quarter of evening

“It is a quarter to two in the evening.”

d. #Sono le sette e mezza (di notte).

are the seven and half of night

“It is seven thirty in the night.”

Furthermore, hours can be divided in parts, such as quarters. Quarters are intervals that cannot be interpreted without a temporal endpoint brought about by PPs, (15a). Time span vs. durative PP modification, (15b), provide further support to the aspectual properties of time-counting expressions.

(15) a. È un quarto *(alle due). (It.)

Is a quarter *(to two)

“It will be a quarter *(to two).”

b. Sarà un quarto alle due (tra pochi minuti/*per pochi minuti).

will be a quarter at two (in a few minutes/*for a few minutes)

“It will be a quarter to two (in a few minutes/*for a few minutes).”

Prepositional constituents, be they pronounced or silent, contribute to delimit time-counting expressions in abstract space.

3.2 Time-counting expressions and Salient Reference Time (STE)

Time-counting expressions of the sort we are considering here minimally involve a DP denoting the hour. In principle, given the availability of additive and subtractive operator features in a given language, see section 1.3 above, reference to a concrete time-point could be made either with respect to the preceding or to the following hour, as shown in the Italian examples in (16a) - (17a):

- (16) a. le tre e cinque (It.)
the three and five
“five past three”
b. ? le quattro meno cinquanta cinque
the four minus fifty five
“five past three”

- (17) a. le quattro meno cinque (It.)
the four minus five
“five to four”
b. ? le tre e cinquanta cinque
the three and fifty five
“five to four”

However, there is a clear contrast in acceptability between the (a) and (b) counterparts in (16)-(17). In both cases, the relevant time-point, i.e. 3:05 in (16) and 3:55 in (17), is expressed in relation to the closest hour-time. We claim that this effect is due to a saliency condition, according to which closest hour-times are more salient, and we will refer to these hour-times as

Salient Reference Times, henceforth SRTs. In the following sections, we will show that a subset of SRTs give rise to a variety of aspectual construals in time-counting expressions.

3.3 Time-counting expressions and relative view

Natural languages articulate time in time-counting expressions in a prospective or retrospective point of view, as shown in Romanian DPs in (18):

- (18) a. Este doi și jumătate. (Ro.)
is two and half
“It is two thirty.”
b. Este jumătate la trei.
is half to three
“It is two thirty.”

The examples in (18) show that the same time-point can be referred to either under a prospective view, see (18a), using an overt ADD operator *e și* “and”, or under a retrospective view, see (18b); that is, rendering the time-point as a function of the time lacking for the following time-hour. These two types of view construal behave notably differently in Romance, regarding their linguistic properties. Prospective view is generally instantiated through an ADD operator feature, whereas in retrospective view construals, we can distinguish at least three types of contexts: (a) those involving a SUB operator feature, see (17a) above with *meno* “minus” in Italian, (b) those showing a LOCATIVE/GOAL preposition, such as in (19) and (20):

- (19) un quarto alle cinque (It.)
a quarter to-the five
“a quarter to five”

(20) vinte para as cinco (Port.)
twenty for the five

“twenty to five”

The examples show that the same time-point can be referred to either under a prospective view, cf. (18a) and (18b) using an overt ADD operator *e* “and” in Italian and *și* “and” in Romanian, or under a retrospective view, see (19b) and (20b); that is, rendering the time-point as a function of the time lacking for the following time-hour. These two types of view construal behave notably differently in Romance, regarding their linguistic properties. Prospective view is generally instantiated through an ADD operator feature, whereas in retrospective view construals, we can distinguish at least three types of contexts: i) those involving a [SUB] operator feature, see (21) with *meno* “minus” in Italian, ii) those showing a LOCATIVE/GOAL preposition, such as in (22) and (23):

(21) *le due meno cinque* (It.)
the two minus five
“five to two”

(22) *un quarto alle cinque* (It.)
a quarter to-the five
“a quarter to five”

(23) *vinte para as cinco* (Port.)
twenty for the five
“twenty to five”

And finally iii) partitive-like constructions, such as the Catalan one in (24):

(24) *un quart i cinc de nou* (Cat.)
a quarter and five of nine
“twenty past eight”

Romance variety. According to Torres i Vilatarsana (2001), the time-counting expression in (27) is attested in a number of Valencian Catalan varieties:

(27) tres quarts per les cinc (Valencian Catalan)
 three quarters for the five
 “a quarter to five”

As in the Italian and Portuguese examples above denoting the same time-point, i.e. 4:45, (27), also features a definite STR, i.e. *les cinc* “five HOURS”, preceded by a GOAL preposition *per* “to”. However, the measure phrase is different, *un quarto* “a quarter” in Italian but *tres quarts* “three quarters” in Valencian Catalan. We claim that this difference in the measure phrase is the by-product of the polar head *DOWN* under RelView, as shown in the derivation in (28):

(28) three quarters [_{RelView} ~~three quarters~~ DOWN [_{RelView} ~~three quarters~~ to [_{Place/Goal}
 [the five HOURS] ~~three quarters~~]]].
 (Valencian Catalan)

As opposed to UP in (26), DOWN in (28) maps the measure phrase *tres quarts* “three quarters” onto a series of increasing numbers of quarters {*a quarter* > *two quarters* > *three quarters*}. This explains why the same time-point, i.e. 4:45, is denoted by different measure phrases, *one quarter* vs. *three quarters*, under apparently the same conditions in (25) and (27) above, i.e. similar GOAL/LOCATIVE prepositions and similar syntactic derivations.

3.5 Time-counting expressions and genitive prepositional contexts

In addition to time-counting expressions involving addition or subtraction operator features and those involving goal/locative prepositional projections, we distinguish a third type of time-counting expressions which lack the aspectual telic character of the later ones, but also involve a

prepositional configuration. The example in (29) illustrates a time-counting expression from standard Catalan:³

- (29) un quart i cinc de nou
 a quarter and five of nine
 “twenty past eight”

This type of time-counting expression involves a genitive preposition *de* “of” and a determinerless SRT, as shown by the ungrammaticality of (30a), as opposed to (30b):

- (30) a. És un quart i cinc de (*les) nou. (Ca.)
 is a quarter and five of (the) nine
 “It is twenty past eight.”
 b. Són *(les) nou i cinc.
 are the nine and five
 “It is five past nine.”

In addition, the SRT of the time-counting expression is not interpreted as a telic endpoint. Time-counting expressions involving addition or subtraction operators, as well as locative/goal prepositional projections, are contingent on the vicinity of an SRT, as shown in the examples (16)-(17). However, in the type of time-counting under consideration, the vicinity of an SRT does not play any role, as shown by the grammaticality of both (31) and (32):

- (31) tres quarts de nou (Ca.)
 three quarters of nine
 “eight forty five”

³ This type of time-counting expression is also found in Southern German, cf. (i)-(ii):

- (i) Es ist viertel neun (Uhr).
 it is quarter nine (hours)
 “It is a quarter past eight.”
 (ii) Es ist fünf (Minuten) vor drei viertel drei (Uhr).
 It is five (minutes) before three quarters three (hours)
 “it is twenty to three.”

- (32) un quart de nou (Ca.)
 a quarter of nine
 “a quarter past eight”

Where (32) denotes the closest quarter to the ninth hour and (31) denotes the farthest one.

3.6 Genitive time-counting expressions and partitives

Genitive time-counting expressions share with partitives, in particular with pseudo-partitives a strong restriction on which N can occur in the sequence Num1 N of Num2, cf. *dos quarts de nou* “eight thirty” Num1 (*dos* “two”) N (*quarts* “quarters”) of (*de*) Num2 (*nou* “nine”). As shown in (33), only quarters can appear as N in genitive time-counting expressions in Catalan:

- (33) a. un quart i cinc de nou (Ca.)
 a quarter and five of nine
 “twenty past eight”
 b. *vint (minuts) de nou
 twenty minutes of nine
 “twenty past eight”
 c. *mitja (hora) de nou
 half hour of nine
 “eight and a half”

(33a, b) show that times internal to the hour cannot be denoted by using minutes or halves in genitive time-counting expressions. This restriction does not apply to other types of time-counting expressions. For instance, (34) shows that both quarters and minutes are equally compatible with an [ADD] operator feature:

- (34) a. les nou i quart (Ca.)
 the nine and quarter
 “a quarter past nine”
- b. les nou i deu
 the nine and ten
 “ten past nine”

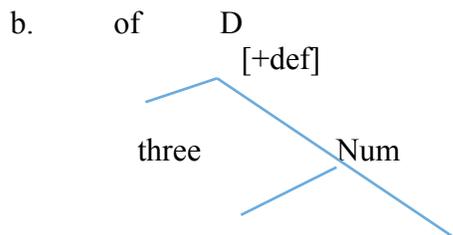
The restriction illustrated in (33) is similar to the one observed in pseudo-partitives, as shown in (35):

- (35) a. un pessic de sal/*arròs/*anys (Ca.)
 “a pinch of salt/rice/years”
- b. un grapat d’arròs/anys
 “a handful of rice/years”

In Catalan the atomizer noun *pessic* “pinch” is compatible with the mass noun *sal* “salt” but not with *arròs* “rice” or *anys* “years”. On the other hand, the noun *grapat* “handful” is compatible with both *arròs* “rice” and *anys* “years”. Thus, we claim that the N *quart* “quarter” in the relevant time-counting expressions is as an atomizer noun with respect to HOUR.

However, as opposed to pseudo-partitives, we claim that the nominal expression following the genitive preposition *de* “of” is not an indefinite DP but rather a definite one, with a silent head noun HOUR and a Num(eral) raising to D, as in (36a):

- (36) a. tres quarts de nou (=13) (Ca.)
 three quarters of nine
 “a quarter to nine”



~~three~~ N
 HOUR

Comparative considerations in Romance suggest that there is such a Num-to-D movement, see Longobardi (2001) *et seq.*:

- (37) a. Il est trois heures (Fr.)
 “It is three o’clock”
 b. Sono le tre HOURS (It.)
 “It is three o’clock”

The derivation of genitive time-denoting expressions such as *as tres quarts de cinc* “a quarter to five” could be derived on the basis of extended functional projections for prepositions including the higher measure phrase DegP, as in Cinque & Rizzi (2010), see (38). This would lead to the derivation of telic and atelic time-counting expressions in a unique abstract space. We leave the investigation of this hypothesis for further research.

- (38) [DegP three quarters [RelView ~~three quarters~~ OUT [RelView ~~three quarters~~ of [Place/Goal
 [five HOURS] ~~three quarters~~]]].

3.7 Section summary

Summarizing, time-counting expressions, like cardinal numerals, include functional heads that can be silent in some cases. We identified telic and atelic time construals, both mediated by prepositional structures. We provided a unified analysis of the variation between Romance languages in the expression of telic and atelic construals. The variation boils down to a minimal difference in the choice of a prepositional head in RelView. RelView, along with STR are both aspectual categories contributing to the individuation of time points by means of time-counting expressions.

4. Consequences

Our analysis has consequences for the understanding of Aspect in time at the syntax-semantic interface. Functional structure, including silent prepositions and PPs, provides further support to the phonetic-semantic interfaces asymmetry (Chomsky 2008, Di Sciullo 2008) and to the syntax-semantic transparency hypothesis (Chierchia 2013, Jacobson 2013). Time-counting expressions, like cardinal numerals, include directional prepositions that bring about the perspective in which numbers and time are identified in abstract space. Delimiting prepositions and PP structures are legible at the CI interface but not at the SM interface. The derivation of cardinal numerals and time-counting expressions in terms of Merge and Principles of efficient computation, minimizing externalization at the SM interface, and maximizing asymmetry at the CI interface (Di Sciullo 2015), brings further support to the Strong Minimalist **Thesis**, according to which language is an optimal way to link sound and meaning.

5. Summary

We compared the syntactic and the semantic properties of cardinal numerals and time-counting expressions in order to identify their commonalities and their differences. Focusing on Romance languages, we argued that their structure is derived by the same combinatorial operation, which may also generate unpronounced elements. We developed the hypothesis that they both include aspectual RelView categories, whereas only time-counting expressions include SRT. We analyzed time-counting expressions in terms of an extended prepositional projection for the syntax-semantics of prepositions, in order to formalize the spatial location of time. We provided derivations for additive and subtractive cardinal numerals as well as upward and downward oriented time-counting expressions. We derived the differences between closely related languages with respect to the prospective or the retrospective point of view from a minimal difference in the extended prepositional projection. By doing so, we proposed a unified account for the variety of Romance languages time-counting expressions. Finally, we identified consequences of our analysis for the Strong Minimalist Thesis, interface asymmetries and syntax-semantic transparency.

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