Cardinals of Approximation in Spanish (and beyond)

Jon Ander Mendia
jmendiaaldam@linguist.umass.edu
UMASS AMHERST

Going Romance XXIX *December 11, 2015*

Complex Cardinals of Approximation

Syncatically complex numbers that (i) contain some quantificational expression and (ii) convey some kind of uncertainty or vagueness.

- The English indefinite *some* may convey uncertainty or ignorance.

(1) Bill: Some professor is dancing on the table
$\rightsquigarrow$ *Bill doesn't know who the professor is*

- The English indefinite *some* may convey uncertainty or ignorance.

(1) Bill: Some professor is dancing on the table
$\rightsquigarrow$ *Bill doesn't know who the professor is*

- Today I discuss cases where *some* is used to modify numbers.

(2) a. Sixty-some people arrived
$\rightsquigarrow$ *Somewhere between 60 and 69 people arrived*

b. I have won over thirty-some thousand dollars at the local bingo
$\rightsquigarrow$ *I have won more than $30K but less than $40K*

Roadmap

1. I discuss data from Spanish, and draw some connections with other languages like Basque and Japanese to illustrate the main properties of CCAs.
2. Provide a description of their syntactic, semantic and pragmatic properties.
3. Introduce an initial analysis, general enough to cover all the cases.
4. Discussion of problems and loose ends.

Types of quantifiers

- In Spanish, a variety of vague/indefinite determiners akin to *some* can combine with numbers as well.

(3) *sesenta y { pico / tantos / algún(os) } euros*
60 and "some" euros
$^{\checkmark}$€ $\approx$ [61,69]; *€ $\leq$ 60; *€ $\geq$ 70

(4) *ciento y { pico / tantos / algún(os) } euros*
100 and "some" euros
$^{\checkmark}$€ $\approx$ [101,199]; *€ $<$ 101; *€ $>$ 199

Types of quantifiers

- In Spanish, quantifiers other than *some* can appear in CCAs.

(5) *sesenta y muchos euros*
60 and many euros
$^{\checkmark}$€ ≈ [66,69]; *€ ≤ 65; *€ ≥ 70

(6) *sesenta y pocos euros*
hundred and few euros
$^{\checkmark}$€ ≈ [61,64]; *€ ≤ 60; *€ ≥ 65

- I will use "#Q" to refer generically to those quantifiers that can combine with numerical expressions: *muchos, pocos, picos, tantos, alg-o/-ún.*

A point of variation

- In the general case, #Qs that participate in CCAs cannot precede the number.

(7) *diez* - *i* - #Q
10 and #Q
⇝ diecialgo, diecimuchos, diecipocos

(8) * #Q - *i* - *seis*
#Q and 6
Intended: *algo-i-seis, *poco-i-seis

A point of variation

- But in some dialects (Venezuela, Mexico?) a similar strategy can be used by using what it looks like a null #Q.[1,2]

(9) *t - i - cuatro*
∅ and 4
⇝ 24, 34, 44, 54, 64, 74, 84, 94

(10) *t - i - cinco*
∅ and 5
⇝ 25, 35, 45, 55, 65, 75, 85, 95

[1] http://cvc.cervantes.es/foros/leer_asunto1.asp?vCodigo=40848

[2] http://www.portalcol.com/columnas/entredos/01.htm.

Japanese

- In Japanese CCAs are formed with the indeterminate pronoun *nan* ("what").

(11) *juu* - *nan* - *nin* - *ka* - *ga*
10 what CL-HUMAN PART
'ten-some people'
⇝ 11, 12, 13, 14, 15, 16, 17, 18, 19

Japanese

- In Japanese CCAs are formed with the indeterminate pronoun *nan* ("what").

(11) *juu - nan - nin - ka - ga*
10 what CL-HUMAN PART
'ten-some people'
⇝ 11, 12, 13, 14, 15, 16, 17, 18, 19

- *Nan* can also precede the numeral. [Anderson 2015]

(12) *nan - juu - nin - ka - ga*
what 10 CL-HUMAN PART
'some ten people'
⇝ 10, 20, 30, 40, 50, 60, 70, 80, 90

Syntax

- #Q can only combine with numerals that can independently combine by addition with some other number.

(13) ✓ **Complex numbers**

a. *diez* - *i* - *seis*
   10 and 6

b. *diez* - *i* - #Q
   10 and #Q

   ⇝ diecialgo, diecimuchos, diecipocos

Syntax

- #Q can only combine with numerals that can independently combine by addition with some other number.

(13) ✓ **Complex numbers**

a. *diez - i - seis*
   10 and 6

b. *diez - i - #Q*
   10 and #Q

   ⇝ diecialgo, diecimuchos, diecipocos

(14) ✗ **Simplex numbers**

a. *quince* (“fifteen”) no addition

b. * *quince-i-dos* Intended: 15 + 2

c. * *quince - i - #Q*
   15 and #Q

Semantics

- CCAs denote upper and lower bounds –*at least* and *at most* readings.

(15) a. Twenty-some people came to the party
b. If 19 people came ⇒ FALSE
c. If 32 people came ⇒ FALSE
d. If [21,29] people came ⇒ TRUE

Semantics

- CCAs denote upper and lower bounds –*at least* and *at most* readings.

(15) a. Twenty-some people came to the party
b. If 19 people came ⇒ FALSE
c. If 32 people came ⇒ FALSE
d. If [21,29] people came ⇒ TRUE

⇒ CCAs are not just approximate numbers (Krifka 2009).

(16) twenty-some people ≠ { some twenty people / around twenty people / more or less twenty people / ?twenty-odd people }

Semantics

- The range of number that CCAs are compatible with is determined by the base.
- In Basque, unlike English or Spanish, the numeral system is predominantly of base 20.

(17) a. *hogei - ta - hamaika*
20 and 11
'thirty-one'

b. *ber - hogei - ta - hamaika*
2 20 and 11
'fifty-one'

Semantics

- Western Basque also has a CCA construction. The possible denotations are determined by the base.

(18) *hogei* - *ta* - *sak*
20 and #Q
'twenty-some'
✓ [21,39]; * ≤ 21; * ≥ 39

Pragmatics

- The uncertainty/ignorance component of CCAs is a conversational implicature, akin to that of *algún* (Alonso-Ovalle and Menéndez-Benito 2010) and *some* in English (Weir 2012).

(19) Bill: So, you paid again twenty-some bucks for a terrible show?

Pragmatics

- The uncertainty/ignorance component of CCAs is a conversational implicature, akin to that of *algún* (Alonso-Ovalle and Menéndez-Benito 2010) and *some* in English (Weir 2012).

(19) Bill: So, you paid again twenty-some bucks for a terrible show?

(20) **Cancellability**
Al: Yep, I did pay twenty-some bucks again, $27 to be sure.

Pragmatics

- The uncertainty/ignorance component of CCAs is a conversational implicature, akin to that of *algún* (Alonso-Ovalle and Menéndez-Benito 2010) and *some* in English (Weir 2012).

(19) Bill: So, you paid again twenty-some bucks for a terrible show?

(20) **Cancellability**
Al: Yep, I did pay twenty-some bucks again, $27 to be sure.

(21) **Reinforceabitliy**
Al: Well, I did pay twenty-some bucks for the show, but I can't remember how much exactly.

Pragmatics

- The uncertainty/ignorance component of CCAs is a conversational implicature, akin to that of *algún* (Alonso-Ovalle and Menéndez-Benito 2010) and *some* in English (Weir 2012).

(19) Bill: So, you paid again twenty-some bucks for a terrible show?

(20) **Cancellability**
Al: Yep, I did pay twenty-some bucks again, $27 to be sure.

(21) **Reinforceabitliy**
Al: Well, I did pay twenty-some bucks for the show, but I can't remember how much exactly.

(22) **Disappearence in DE contexts**
Al: No, that's false, I didn't paid twenty-some bucks for the show.
⇝ *no uncertainty about whether Al paid twenty-some bucks*

Interim summary

Syntax

- #Qs can only combine with complex numbers.
- Usually CCAs are post-numeral, but there's cross-linguistic variation as to whether CCAs can be pre-numeral.

Interim summary

Syntax

- #Qs can only combine with complex numbers.
- Usually CCAs are post-numeral, but there's cross-linguistic variation as to whether CCAs can be pre-numeral.

Semantics

- They denote lower and upper bounds.
- The range of values they can denote depends on the base.

Interim summary

Syntax

- #Qs can only combine with complex numbers.
- Usually CCAs are post-numeral, but there's cross-linguistic variation as to whether CCAs can be pre-numeral.

Semantics

- They denote lower and upper bounds.
- The range of values they can denote depends on the base.

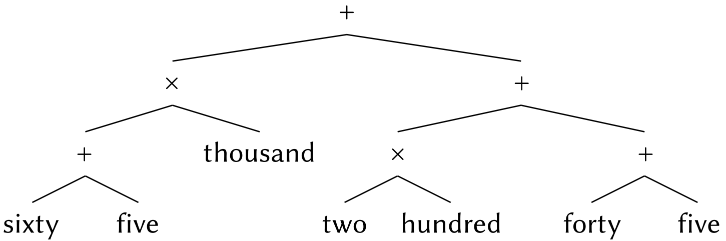
Pragmatics

- The uncertainty/ignorance component of that CCAs come with is a conversational implicature.

Background assumptions

- Complex numerals have a complex syntactic structure (Huford 1975)

(23) **Structure of 65245** [Anderson 2013]



- Two environments: multiplicative and additive.

Background assumptions

- Cardinal numbers (simple and complex) are properties of degrees.

(24) $[\![twenty]\!] = \lambda d.[d = 20]$ [Landman 2004]

Background assumptions

- Cardinal numbers (simple and complex) are properties of degrees.

(24) $[\![\textit{twenty}]\!] = \lambda d.[d = 20]$ [Landman 2004]

- Complex *additive* cardinals have a coordinate structure (Ionin and Matushansky 2006), headed by an additive head ADD (Anderson 2015).

(25) $[\![\text{ADD}]\!] = \lambda D' \lambda D'' \lambda d\,.\,\exists d' d''[d = d' + d'' \wedge D'(d') \wedge D''(d'')]$

Syntax/Semantics of Complex Cardinals

- *Multiplicative* cardinals are the product of some integer $n \in \{1, 2, ..., 9\}$ and a numerical *base* B^n, where $B^n = 10^n$ for some number n. This follows the positional notation for numbers.

Syntax/Semantics of Complex Cardinals

- *Multiplicative* cardinals are the product of some integer $n \in \{1, 2, ..., 9\}$ and a numerical *base* B^n, where $B^n = 10^n$ for some number n. This follows the positional notation for numbers.

- In the decimal system (Spanish, English), *base* is a power of 10.

(26) $[\![B^n]\!] = \lambda d.[d = 10^n]$

Syntax/Semantics of Complex Cardinals

- *Multiplicative* cardinals are the product of some integer $n \in \{1, 2, ..., 9\}$ and a numerical *base* B^n, where $B^n = 10^n$ for some number n. This follows the positional notation for numbers.

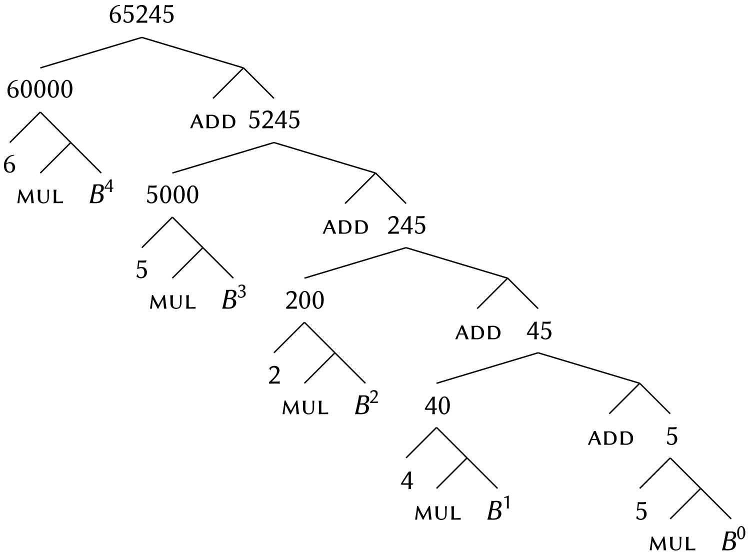
- In the decimal system (Spanish, English), *base* is a power of 10.

(26) $[\![B^n]\!] = \lambda d.[d = 10^n]$

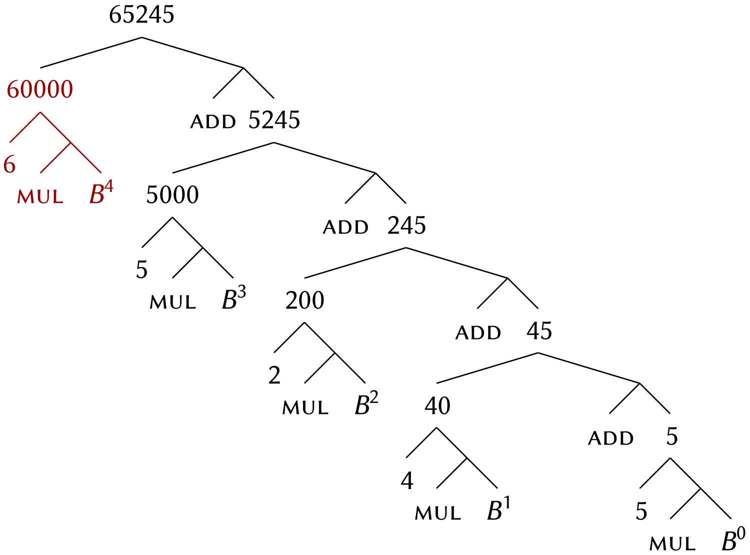
- The multiplication is carried out by the head MUL, parallel to ADD. The values of the *base B* are freely eligible by MUL.

(27) $[\![\text{MUL}]\!] = \lambda D' \lambda D'' \lambda d\,.\,\exists d' d'' [d = d' \times d'' \wedge D'(d') \wedge D''(d'')]$

Syntax/Semantics of Complex Cardinals



Syntax/Semantics of Complex Cardinals



Syntax/Semantics of Complex Cardinals

(28) a. $[\![6]\!] = \lambda d.[d = 6]$

b. $[\![B^4]\!] = [\![10000]\!] = \lambda d.[d = 10000]$

Syntax/Semantics of Complex Cardinals

(28) a. $[\![6]\!] = \lambda d.[d = 6]$

b. $[\![B^4]\!] = [\![10000]\!] = \lambda d.[d = 10000]$

(29) $[\![60000]\!] = [6\ [\text{MUL}\ B^4]] = [6\ [\text{MUL}\ 10000]] = [\![\text{MUL}]\!]([\![10000]\!])([\![6]\!])$

Syntax/Semantics of Complex Cardinals

(28) a. $[\![6]\!] = \lambda d.[d = 6]$

b. $[\![B^4]\!] = [\![10000]\!] = \lambda d.[d = 10000]$

(29) $[\![60000]\!] = [6\ [\textsc{mul}\ B^4]] = [6\ [\textsc{mul}\ 10000]] = [\![\textsc{mul}]\!]([\![10000]\!])([\![6]\!])$

$= \lambda D' \lambda D'' \lambda d\,.\,\exists d' d''[d = d' \times d'' \wedge D'(d') \wedge D''(d'')]([\![10000]\!])([\![6]\!])$

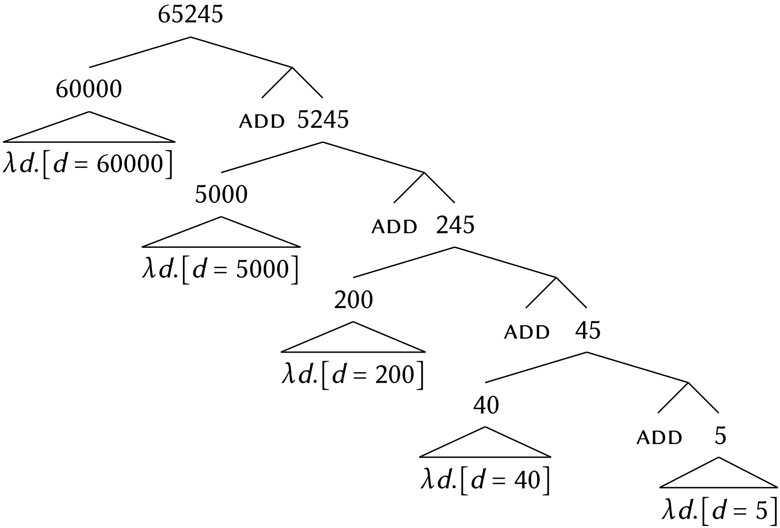
$= \lambda d\,.\,\exists d' d''[d = d' \times d'' \wedge [\![10000]\!](d') \wedge [\![6]\!](d'')]$

$= \lambda d\,.\,\exists d' d''[d = d' \times d'' \wedge \lambda d.[d = 10000](d') \wedge \lambda d.[d = 6](d'')]$

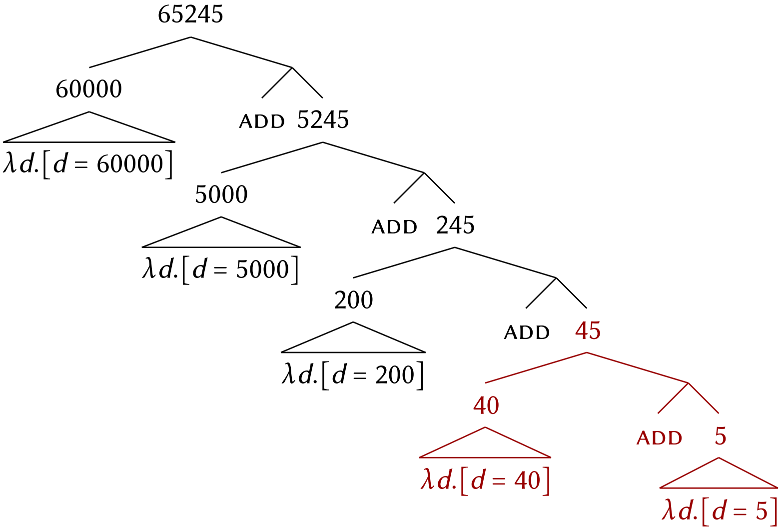
$= \lambda d\,.\,\exists d' d''[d = d' \times d'' \wedge d' = 10000 \wedge d'' = 6]$

$\rightsquigarrow \lambda d\,.[d = 10000 \times 6]$

Syntax/Semantics of Complex Cardinals



Syntax/Semantics of Complex Cardinals



Syntax/Semantics of Complex Cardinals

(30) a. $[\![40]\!] = \lambda d.[d = 40]$

b. $[\![5]\!] = \lambda d.[d = 5]$

Syntax/Semantics of Complex Cardinals

(30) a. $[\![40]\!] = \lambda d.[d = 40]$

b. $[\![5]\!] = \lambda d.[d = 5]$

(31) $[\![45]\!] = [40\ [\textsc{add}\ 5]] = [\![\textsc{add}]\!]([\![5]\!])([\![40]\!])$

Syntax/Semantics of Complex Cardinals

(30) a. $[\![40]\!] = \lambda d.[d = 40]$

b. $[\![5]\!] = \lambda d.[d = 5]$

(31) $[\![45]\!] = [40\ [\textsc{add}\ 5]] = [\![\textsc{add}]\!]([\![5]\!])([\![40]\!])$

$= \lambda D' \lambda D'' \lambda d\ .\ \exists d' d''[d = d' + d'' \wedge D'(d') \wedge D''(d'')]([\![5]\!])([\![40]\!])$

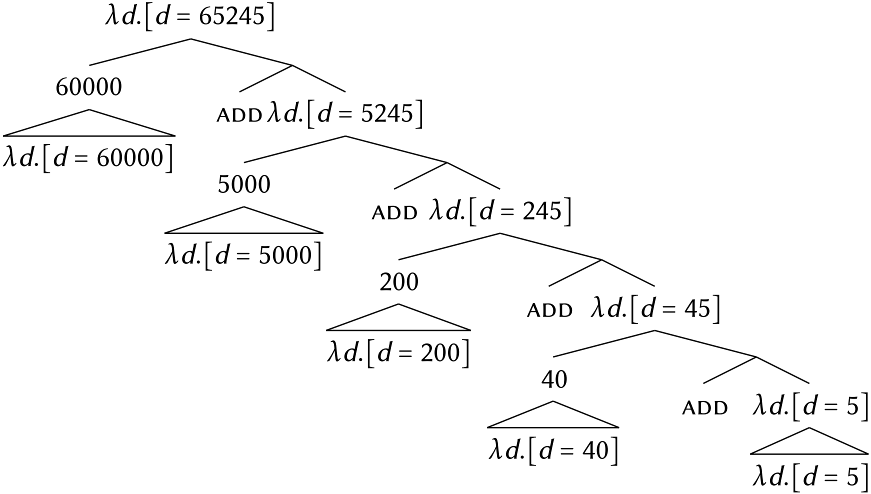
$= \lambda d\ .\ \exists d' d''[d = d' + d'' \wedge [\![5]\!](d') \wedge [\![40]\!](d'')]$

$= \lambda d\ .\ \exists d' d''[d = d' + d'' \wedge \lambda d.[d = 5](d') \wedge \lambda d.[d = 40](d'')]$

$= \lambda d\ .\ \exists d' d''[d = d' + d'' \wedge d' = 5 \wedge d'' = 40]$

$\rightsquigarrow \lambda d\ .[d = 5 + 40]$

Syntax/Semantics of Complex Cardinals



CCAs: Background assumptions

- *pocos* ("few"), *muchos* ("many") and indefinites *algo/tantos/pico* ("some") modify a silent noun NUMBER.

(32) a. few books = [[few NUMBER] books] [Kayne 2005; Zweig 2005]

b. two-some books = [[two [some NUMBER]] books] [Anderson 2015]

CCAs: Background assumptions

- *pocos* ("few"), *muchos* ("many") and indefinites *algo/tantos/pico* ("some") modify a silent noun NUMBER.

(32) a. few books = [[few NUMBER] books] [Kayne 2005; Zweig 2005]

b. two-some books = [[two [some NUMBER]] books] [Anderson 2015]

- The denotation of NUMBER is simply the set of "basic" numbers.

(33) $[\![\text{NUMBER}]\!] = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$ $\lambda d.[0 < d < 10]$

CCAs: Background assumptions

- *pocos* ("few"), *muchos* ("many") and indefinites *algo/tantos/pico* ("some") modify a silent noun NUMBER.

(32) a. few books = [[few NUMBER] books] [Kayne 2005; Zweig 2005]

b. two-some books = [[two [some NUMBER]] books] [Anderson 2015]

- The denotation of NUMBER is simply the set of "basic" numbers.

(33) $[\![\text{NUMBER}]\!] = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$ $\lambda d.[0 < d < 10]$

- The denotations of the indefinites *algo/tantos/pico* are modeled after the epistemic indefinite *algún* in Spanish (AO&MB 2013; Anderson 2015).

(34) $[\![\text{INDF}]\!] = \lambda f_{\langle dt,dt\rangle} \lambda D_{\langle dt\rangle} . \lambda d_d : \textbf{anti–singleton}(f).[f(D)(d)]$

⇒ $[\![\text{INDF}]\!]$ denotes a subset selection function over degrees f that selects some integer from the set of numbers denoted by NUMBER.

CCAs: Background assumptions

- Instead, *muchos* and *pocos* are defined following their usual definition (under the cardinal –not proportional– version): They determine the property of degrees that remain above/below certain threshold.

CCAs: Background assumptions

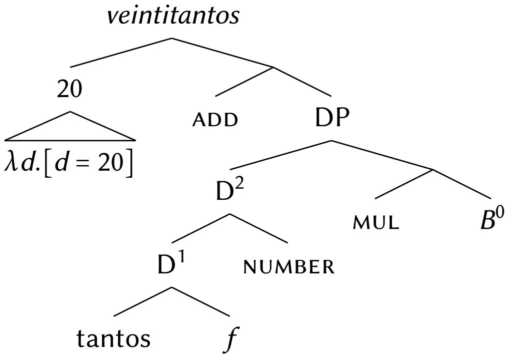
- Instead, *muchos* and *pocos* are defined following their usual definition (under the cardinal –not proportional– version): They determine the property of degrees that remain above/below certain threshold.
- That threshold is established by the *median* M of NUMBER, which corresponds to the n^{th} ordered value of some set of numbers A: $n = \frac{1}{2}(|A| + 1)$.
- In the decimal system, the median of NUMBER is always 5.

(35) $[\![\text{MUCHOS}]\!] = \lambda D \lambda d.[(D)(d) \wedge d > M(D)]$

(36) $[\![\text{POCOS}]\!] = \lambda D \lambda d.[(D)(d) \wedge d < M(D)]$

Derivation I

(37)



Derivation I

(38) $[\![\mathrm{D}^2]\!] = [\![\mathit{tantos}]\!]([\![f]\!])([\![\textsc{number}]\!])$
$= \lambda D \lambda d.[f(D)(d)](\lambda d'[0 < d' < 10])$
$= \lambda d.[f(\lambda d'[0 < d' < 10])(d)]$
$= \lambda d.[f(0 < d < 10)]$

Derivation I

(38) $[\![\mathrm{D}^2]\!] = [\![\textit{tantos}]\!]([\![f]\!])([\![\textsc{number}]\!])$
$= \lambda D \lambda d.[f(D)(d)](\lambda d'[0 < d' < 10])$
$= \lambda d.[f(\lambda d'[0 < d' < 10])(d)]$
$= \lambda d.[f(0 < d < 10)]$

(39) $[\![\mathrm{DP}]\!] = [\![\textsc{mul}]\!]([\![B^0]\!])([\![\mathrm{D}^2]\!])$
$= \lambda D' \lambda D'' \lambda d\,.\, \exists d' d''[d = d' \times d'' \wedge D'(d') \wedge D''(d'')]$
$(\lambda d.[d = 1])(\lambda d.[f(0 < d < 10)])$
$= \lambda d\,.\, \exists d' d''[d = d' \times d'' \wedge \lambda d.[d = 1](d') \wedge \lambda d.[f(0 < d < 10)](d'')]$
$= \lambda d\,.\, \exists d' d''[d = d' \times d'' \wedge d' = 1 \wedge f(0 < d'' < 10)]$
$\rightsquigarrow \lambda d.[f(0 < d < 10)]$

Derivation I

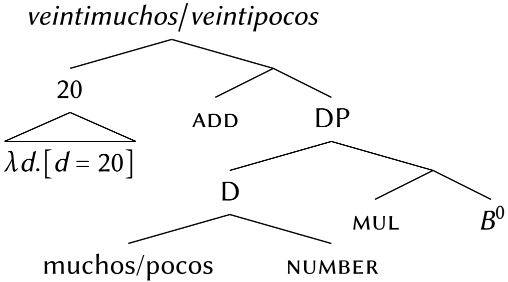
(38) $[\![\mathrm{D}^2]\!] = [\![\textit{tantos}]\!]([\![f]\!])([\![\textsc{number}]\!])$
$= \lambda D \lambda d.[f(D)(d)](\lambda d'[0 < d' < 10])$
$= \lambda d.[f(\lambda d'[0 < d' < 10])(d)]$
$= \lambda d.[f(0 < d < 10)]$

(39) $[\![\mathrm{DP}]\!] = [\![\textsc{mul}]\!]([\![B^0]\!])([\![\mathrm{D}^2]\!])$
$= \lambda D' \lambda D'' \lambda d\,.\,\exists d' d''[d = d' \times d'' \wedge D'(d') \wedge D''(d'')]$
$(\lambda d.[d = 1])(\lambda d.[f(0 < d < 10)])$
$= \lambda d\,.\,\exists d' d''[d = d' \times d'' \wedge \lambda d.[d = 1](d') \wedge \lambda d.[f(0 < d < 10)](d'')]$
$= \lambda d\,.\,\exists d' d''[d = d' \times d'' \wedge d' = 1 \wedge f(0 < d'' < 10)]$
$\rightsquigarrow \lambda d.[f(0 < d < 10)]$

(40) $[\![\textit{veintitantos}]\!] = [\![\textsc{add}]\!]([\![\mathrm{DP}]\!])([\![20]\!])$
$= \lambda d\,.\,\exists d' d''[d = d' + d'' \wedge f(0 < d'' < 10) \wedge d'' = 20]$
$\rightsquigarrow \lambda d.[f(20 < d < 30)]$

Derivation II

(41)



Derivation II

(42) $[\![\text{D}]\!] = [\![\textit{muchos}]\!]([\![\textsc{number}]\!])$
$= \lambda D \lambda d.[(D)(d) \wedge d > M(D)]$
$= \lambda d.[(\lambda d'[0 < d' < 10])(d) \wedge d > M(\lambda d'[0 < d' < 10])]$
$= \lambda d.[0 < d < 10 \wedge d > 5]$
$\rightsquigarrow$ True if $d \in \{6, 7, 8, 9\}$

Derivation II

(42) $[\![\text{D}]\!] = [\![\textit{muchos}]\!]([\![\textsc{number}]\!])$
$= \lambda D \lambda d.[(D)(d) \wedge d > M(D)]$
$= \lambda d.[(\lambda d'[0 < d' < 10])(d) \wedge d > M(\lambda d'[0 < d' < 10])]$
$= \lambda d.[0 < d < 10 \wedge d > 5]$
$\rightsquigarrow$ True if $d \in \{6, 7, 8, 9\}$

(43) $[\![\text{D}]\!] = [\![\textit{pocos}]\!]([\![\textsc{number}]\!])$
$= \lambda d.[0 < d < 10 \wedge d < 5]$
$\rightsquigarrow$ True if $d \in \{1, 2, 3, 4\}$

Derivation II

(44) $[\![\textit{veintimuchos}]\!] = [\![\text{ADD}]\!]([\![\text{DP}]\!])([\![20]\!])$
$= \lambda d\,.\,\exists d' d''[d = d' + d'' \wedge 0 < d' < 10 \wedge d' > 5 \wedge d'' = 20]$
$\rightsquigarrow \lambda d.[25 < d < 30]$

(45) $[\![\textit{veintipocos}]\!] = [\![\text{ADD}]\!]([\![\text{DP}]\!])([\![20]\!])$
$= \lambda d\,.\,\exists d' d''[d = d' + d'' \wedge 0 < d' < 10 \wedge d' < 5 \wedge d'' = 20]$
$\rightsquigarrow \lambda d.[20 < d < 25]$

Calculating inferences

- The uncertainty that CCAs convey is derived as an implicature.

Calculating inferences

- The uncertainty that CCAs convey is derived as an implicature.
- In a neo–Gricean framework, utterance of a sentence φ by a speaker S commits S to the knowledge of φ ($K_S\varphi$; Quality Inference).

Calculating inferences

- The uncertainty that CCAs convey is derived as an implicature.
- In a neo–Gricean framework, utterance of a sentence φ by a speaker S commits S to the knowledge of φ ($K_S\varphi$; Quality Inference).
- By the Maxim of Quantity, the fact that CCAs can verify more than one situation triggers the question as to why the speaker did not use an exact number.

Calculating inferences

- The uncertainty that CCAs convey is derived as an implicature.
- In a neo–Gricean framework, utterance of a sentence φ by a speaker S commits S to the knowledge of φ ($K_S\varphi$; Quality Inference).
- By the Maxim of Quantity, the fact that CCAs can verify more than one situation triggers the question as to why the speaker did not use an exact number.
- As a consequence, Stronger Alternatives $[n]$ to the assertion $[n, n+i]$ are negated, $\neg K_S[n]$.

Calculating inferences

- The uncertainty that CCAs convey is derived as an implicature.
- In a neo–Gricean framework, utterance of a sentence φ by a speaker S commits S to the knowledge of φ ($K_S\varphi$; Quality Inference).
- By the Maxim of Quantity, the fact that CCAs can verify more than one situation triggers the question as to why the speaker did not use an exact number.
- As a consequence, Stronger Alternatives $[n]$ to the assertion $[n, n+i]$ are negated, $\neg K_S[n]$.

(46) a. Assertion by S: $[20 < n < 30]$ *costó veintantos euros*

b. Quality inference: $K_S[20 < n < 30]$

c. Primary implicatures: *for all* $n \in \{20 < n < 30\}$, $\neg K_S[n]$

⇒ Together with the assertion conveys that for every SA $[n]$, it is not the case that the speaker knows $[n]$.

The good things

- Syntactic properties:
  - ✓ #Qs can only combine with complex numbers.
  - ✓ It is possible to combine #Qs in prenumeral position.

The good things

- Syntactic properties:
  - ✓ #Qs can only combine with complex numbers.
  - ✓ It is possible to combine #Qs in prenumeral position.
- Semantic properties:
  - ✓ Upper and lower bound readings.
  - ✓ Interpretation depending on the base.

The good things

- Syntactic properties:
  - ✓ #Qs can only combine with complex numbers.
  - ✓ It is possible to combine #Qs in prenumeral position.
- Semantic properties:
  - ✓ Upper and lower bound readings.
  - ✓ Interpretation depending on the base.
- Pragmatic properties:
  - ✓ The ignorance/uncertainty component derived as an implicature.

The not so good things (for Spanish)

Overgeneration

Unattested combinations are predicted to be OK:
NUM+#Q+#Q (e.g., *ciento y algo y algo; *ciento y muchos y pocos,...).

The not so good things (for Spanish)

Overgeneration

Unattested combinations are predicted to be OK:
NUM+#Q+#Q (e.g., *ciento y algo y algo; *ciento y muchos y pocos,...).

Undergeneration

The range of possible values for NUM+#Q when NUM is in the hundreds or higher is not just limited to tuples of #Q and any one base.
ciento y tantos ⇒ TRUE if 127.

The not so good things (for Spanish)

Overgeneration

Unattested combinations are predicted to be OK:
NUM+#Q+#Q (e.g., *ciento y algo y algo; *ciento y muchos y pocos,...).

Undergeneration

The range of possible values for NUM+#Q when NUM is in the hundreds or higher is not just limited to tuples of #Q and any one base.
ciento y tantos ⇒ TRUE if 127.

The Problem

Overgeneration should not be overgeneration.

Japanese again

(47)

nan	-	*zen*	*nan*	-	*byaky*	*nin*	-	*ka*	- *ga*
what		thousand	what		hundred	CL-human		PART	NOM

⇝ Some-thousand some-hundred people

⇒ True for [2001,9999][3]

[3]Thanks to Kiyomi Kusumoto for her help with the Japanese data.

Conclusion and further developments

- CCAs occur in a variety of languages.
- The analysis presented here is a first step at providing a general account of the syntax/semantics of complex cardinals of approximation (see Anderson 2015 for English).
- The account provides a very (too?) general framework to derive CCAs.
- Moving further:
  1. Get a better understanding of the limited distribution of #Qs within and across languages.
  2. Measure the syntactic plausibility of the structures adopted here.
  3. Assess how the analysis informs us about the meaning of those quantification expressions that participate in CCAs.

Thank you!

Feedback welcome:

jmendiaaldam@linguist.umass.edu

Bibliography I

Alonso-Ovalle, L. and Menéndez-Benito, P. (2010). Modal indefinites. *Natural Language Semantics*, 18:1–31.

Alonso-Ovalle, L. and Menéndez-Benito, P. (2013). Modal determiners and alternatives: Quantity and ignorance effects. In *Proceedings of SALT 23*, pages 570–586.

Anderson, C. (2013). Approximation of complex numerals using *some*. In *Proceedings of the Western Conference on Linguistics 2013*, pages 131–143.

Anderson, C. (2015). Numerical approximation using *some*. In Zeijlstra, H. and Csipak, E., editors, *Proceedings ofSinn und Bedeutung 19*, pages 54–69.

Huford, J. (1975). *The linguistic theory of numerals*. Cambridge University Press.

Ionin, T. and Matushansky, O. (2006). The composition of complex cardinals. *Journal of Semantics*, 23:315–360.

Kayne, R. S. (2005). On the syntax of quantity in english. In *Movement and silence*. Oxford University Press.

Krifka, M. (2009). Approximate interpretations of number words: A case for strategic communication. In Hinrichs, E. and Nerbonne, J., editors, *Theory and evidence in semantics*, pages 109–132. CSLI Publications.

Bibliography II

Landman, F. (2004). *Indefinites and the type of sets.* Landman, Fred. 2004.Indefinites and the type of sets. Oxford: Blackwell, Oxford.

Partee, B. (1987). Noun phrase interpretation and type-shifting principles. *Studies in Discourse Representation Theory and the theory of generalized quantifiers*, 8:115–143.

Solt, S. (2014). Q-adjectives and the semantics of quantity. *Journal of semantics*, 32(2):221–273.

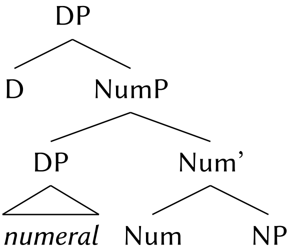
Weir, A. (2012). *Some*, speaker knowledge, and subkinds. In Rendsvig, R. and Katrenko, S., editors, *ESSLLI 2012 Student Session Proceedings*, pages 180–190.

Zweig, E. (2005). Nouns and adjectives in numeral nps. In Bateman, L. and Ussery, C., editors, *Proceedings of the thirty-fifth annual meeting of the North East Linguistic Society*, pages 663–676.

Appendix I

- Structure of DPs: Numerals come as Specifiers in NumP. [Solt 2014]

(48)



(49) $[\![Num]\!] = \lambda x_e \lambda n_d.[|x| = n]$

(50) **Degree Argument Introduction** If α is a branching node, $\{\beta, \gamma\}$ are the set of α's daughters, $[\![\beta]\!] = \lambda x_e.[P(x)]$, and $[\![\gamma]\!] = \lambda x_e \lambda n_d.[Q(d)(x)]$, then $[\![\alpha]\!] = \lambda n_d \lambda x_e.[P(x) \wedge Q(d)(x)]$.

Appendix II

(51) Iota Typeshift:
Shift $P_{\langle dt \rangle}$ to $\iota d[P(d)]$ [Partee 1987]

(52) Generalized Quantifier Typeshift:
Shift $P_{\langle dt \rangle}$ to $\lambda Q \exists d.[P(d) \wedge Q(d)]$.