Approximation and the epistemic indefinite *some*

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1 Introduction

Epistemic indefinites such as *algún* and *some* convey ignorance about the witness of an existential claim.

(1)   Some professor is dancing on the table!

(2)   María se casó   con algún   estudiante del   departmento de
       María SE married with ALGUN student   of the department   of
       lingüística
       linguistics

       'María married a linguistics student.'

In English, *some* can also be used to convey ignorance about the exact number, creating a sense of approximation.

(3)   Twenty-some people were at the party.

(4)   Forty-some thousand students attend Michigan State University.

Goal: Give a compositional account of *#-some* and show how it fits into the picture with other epistemic indefinites.

Big picture:

- Show how an epistemic determiner can be involved in approximation.

- Shed light on *#-some* and see what it tells us about how the English determiner *some* works.

Roadmap:

- Basic data on *#-some* in §2.

- Draw comparisons between *#-some* and other epistemic indefinites in §3.

- Show in §4 how uncertainty about numbers can be done with epistemic indefinites in other languages, specifically Japanese and Spanish.

- Discuss Alonso-Ovalle and Menéndez-Benito (2010)'s analysis of *algún* in §5.

- Quick sketch of my analysis of *#-some*, based on Alonso-Ovalle and Menéndez-Benito's analysis of *algún*, is presented in §6.

- Present some assumptions about the syntax and semantics of cardinal numbers in §7, before analyzing *#-some* in §8 and §9

- Some lingering questions are discussed in §10

2 Approximation in *#-some*

Some can be used with numerals in order to form approximate interpretations.

Interpretation for these sorts of structures has both an "at least" component (start at the modified numeral) and an "at most" component.

(5)   Twenty-some people arrived.
       "At least 20 and not more than 29 people arrived."

(6)   I could have it entirely full of small icons and fit a hundred some icons on one screen if I really wanted to.
       "Fit at least a hundred and not more than 199 icons."

(7)   More than half of the expenditure of eighty-some thousand dollars is for soft costs.
       "At least eighty thousand dollars and not more than 89 thousand dollars."

A range of numbers:

- Range of numbers starting at the modified numeral

- Minimum bound demonstrated by using situations where the speaker learns new information after their utterance.

(8)   I saw twenty-some dogs during my walk today.

(9)   a. *Speaker learns he saw only 19 dogs:*
           (8) is judged to have been false.

       b. *Speaker learns he saw 23 dogs:*
           (8) is judged to have been true.

#-*some* isn't unrestricted:

- Numeral plays a role in whether #-*some* is licit.

- For instance, *five* and *ten* cannot be used.

- Explanation for this rooted in the fact that *five* and *ten* do not combine additively with numerals that follow them, whereas in (5–7), *twenty*, *hundred*, and *eighty* do.

(10) a. * ten-some
      b. * five-some

(11) a. * ten-five (expected: 15)
      b. * five-one (expected: 6)

Finally, #-*some* is only available with numerals that would've combined additively.

(12) some thousand people ($\neq 1000 \times$ a number in $[1, 9]$)

General picture: #-*some* can be used only with additive numeral constructions.

3 Epistemic indefinites and #-*some*

Epistemic indefinites and ignorance:

- Cross-linguistically there exist epistemic indefinites, indefinites which enforce knowledge requirements on the speaker.

- A few examples include Spanish *algún*(Alonso-Ovalle & Menéndez-Benito, 2010), Japanese *wh- ka* (Alonso-Ovalle & Shimoyama, 2014), German *irgendein* (Kratzer & Shimoyama, 2002; Aloni & Port, 2012), Romanian *vreun* (Farkas, 2002; Falaus, 2009), English singular *some* (Becker, 1999; Farkas, 2002), and others (see Alonso-Ovalle and Menendez-Benito (2013) for an overview).

- These indefinites all convey some ignorance on the part of the speaker as to the particular referent of an NP.

Ignorance and #-*some*:

- #-*some* conveys ignorance: ignorance about the particular number that satisfies the assertion.

- For instance, *twenty-some* expresses ignorance about which number in the sequence 20–29 is true.

- Demonstrated by trying to deny that ignorance exists.

(13) # Twenty-some people came to the party. In fact, it was exactly twenty-three people.

Comparison to *some* and *algún*: Like the epistemic indefinite *algún* and the determiner *some*, #-*some* requires that the speaker not be knowledge about the particular witness.

(14) # María se casó   con algún estudiante del   departamento de
      María SE married with ALGUN student   of the department of
      lingüística: en concreto con Pedro
      linguistics: namely   with Pedro

      'María married a linguistics student, namely Pedro.'

(15) Some professor is dancing on the table. #Namely, Jones.

(16) Twenty-some people showed up to the party. #Namely, twenty-five people.

Status of the ignorance component? As noted by Alonso-Ovalle and Menéndez-Benito (2010), the ignorance component of *algún* does not behave like an entailment or presupposition, but behaves like a conversational implicature.

Two tests are useful here:

1. Conversational implicatures disappear in downward entailing contexts.

2. Conversational implicatures can be reinforced.

In DE environment:

- Under negation or a verb such as *dudar* "to doubt," the implication of ignorance with *algún* disappears (17).

- #-*some* under a verb such as *doubt* or under negation, the ignorance about the number disappears as well.

(17) a. No es verdad que Juan salga con   alguna chica   del
         it is not   true that Juan date:subj3s with   ALGUNA girl
         departamento de   lingüística
         from the   department of   linguistics
         'Juan is not dating any girl in the linguistics department.'
      b. Pedro duda que Juan salga   con alguna chica del
         Pedro doubts that Juan date:subj3s with ALGUNA girl   from the
         departamento de lingüística
         department   of linguistics
         'Pedro doubts that Juan is dating any girl in the linguistics department.'

(18) a. It's not true that twenty-some people were at the party.

 b. I doubt that 20-some people came to the party.

Reinforcing ignorance:

- Presuppositions and semantic entailments cannot be reinforced, but the ignorance component of *#-some* can be reinforced.
- Ignorance component of *algún* and *some* can be reinforced as well.

(19) a. # The king of France is bald, and there is a king of France.

 b. # Jim kissed Kim passionately, and Kim was kissed.

 c. Mary cooked twenty-some pies, but I don't know exactly how many.

(20) María sale   con algún estudiante del   departamento de
 María goes out with ALGUN student   of the department   of
 lingüística, pero no sé   con quién
 linguistics, but not I know with whom.

 'María is dating some student in the linguistics department, but I don't know who.'

(21) Maria is dating some student in the linguistics department, but I don't know who.

4 Approximation with epistemic indefinites in Japanese and Spanish

Epistemic indefinites in other languages used for ignorance about number

- Japanese *wh-ka*
- Spanish (*algún que otro*)

Japanese: Uses structure of numeral to generate range for approximation.

Numerals in Japanese are formed compositionally.

- A base-10 numeral will be composed additively with a numeral following it (22a).
- A base-10 numeral will be composed multiplicatively with a preceding numeral (22b).

(22) a. juu -ichi
     ten one
     'eleven'

 b. ni -juu
     two ten
     'twenty'

Japanese has a mode of approximation making use of (i) an indeterminate pronoun *-nan* "what" and (ii) an existential-like operator *-ka*.

Indeterminate pronoun is merged in the location in the numeral being approximated.

- Approximate some number in the interval $[10, 19]$: the indeterminate pronoun is merged in the position following *juu* "ten" (as in (23)).
- Multiplicative numerals can be approximated. *-Nan* merged preceding a base-10 numeral, approximating the number that is being multiplied (24).

(23) Juu -nan -nin   -ka -ga kita.
 ten -what -CL(people) -ka -NOM came

 '10 plus x people came.'

(24) Nan -juu -nin   -ka -ga kita.
 what -ten -CL(people) -ka -NOM came.

 'x multiple 10 people came.'

Another modal determiner: *algún que otro*:

- A modal determiner that signals ignorance about a number, Spanish *algún que otro* (Alonso-Ovalle & Menendez-Benito, 2013).
- (25) implies that Juan bought some number of books, but that the speaker cannot identify the exact number, except that it is two or more.
- Like *algún*, its ignorance component can be reinforced.
- Signals ignorance about a number like *#-some*.

(25) Juan compró algún   que otro   libro
 Juan bought ALGUN QUE OTRO book

 'Juan bought books.'

(26) Juan compró algún   que otro   libro, pero no sé   cuántos
 Juan bought ALGUN QUE OTRO book but   not I know how many

 'Juan bought books but I don't know how many.'

5 About *algún*

- *algún* s used when the speaker cannot identify the witness of an existential claim.
- Ignorance component: Alonso-Ovalle and Menéndez-Benito make *algún* use of a subset selection function.
- *Algún* carries a presupposition that the selection function selects a non-singleton subset of *algún*'s restrictor.

(27) $[\![algún]\!] = \lambda f_{\langle et,et \rangle} \lambda P \lambda Q : \textbf{anti-singleton}(f).\exists x \left[f(P)(x) \wedge Q(x) \right]$

- *algún* competes pragmatically with the determiner *un*, which does not encode such a presupposition.
- Hearer forced to consider singleton alternatives, as the speaker ruled them out.
- Hearer draws an inference that the speaker could not have shrunk the domain to a singleton (either to avoid a false claim, or avoid a false exhaustivity inference).

Avoiding a false claim: (28) has the assertion in (28a) and the presupposition in (28b).

(28) Juan tiene que estar en alguna habitación de la   casa.
      Juan has   to   be   in ALGUN room   of the house

  a. Assertion: $\Box \left[\exists x \left[x \in f(\textbf{room}) \wedge \textbf{Juan is in } x \right] \right]$
  b. Anti-singleton constraint: $|f(\textbf{room})| > 1$

For clarity, assume the set of actual rooms in (29).

(29) {the bedroom, the living room, the bathroom}

The hearer must consider why the speaker didn't say any of the stronger things in (30).

(30) a. $\Box \left[\exists x \left[x \in f(\textbf{the-bedroom} \wedge \textbf{Juan is in } x) \right] \right]$
       $\Box \left[\textbf{Juan is in the bedroom} \right]$
  b. $\Box \left[\exists x \left[x \in f(\textbf{the-living-room} \wedge \textbf{Juan is in } x) \right] \right]$
       $\Box \left[\textbf{Juan is in the living room} \right]$
  c. $\Box \left[\exists x \left[x \in f(\textbf{the-bathroom} \wedge \textbf{Juan is in } x) \right] \right]$
       $\Box \left[\textbf{Juan is in the bathroom} \right]$

The hearer is forced to assume that the speaker couldn't utter the stronger claims (30), and hence generate the implicature they are false.

Avoiding an exhaustivity inference: the reasoning works similarly in order to avoid an exhaustivity inference.

(31) Juan puede estar en alguna habitación de la   casa.
      Juan may   be   in ALGUN room   of the house

  a. Assertion: $\Diamond \left[\exists x \left[x \in f(\textbf{room}) \wedge \textbf{Juan is in } x \right] \right]$
  b. Anti-singleton constraint: $|f(\textbf{room})| > 1$

This makes the competitors as in (32).

(32) a. $\Diamond \left[\textbf{Juan is in the bedroom} \right]$
  b. $\Diamond \left[\textbf{Juan is in the living room} \right]$
  c. $\Diamond \left[\textbf{Juan is in the bathroom} \right]$

Suppose the speaker had uttered (32a) instead. Then, the hearer could have made the inference in (33).

(33) $\Diamond(\textbf{Juan is in the bedroom})$ $\wedge$ $\neg\Diamond(\textbf{Juan is in the living room})$ $\wedge$ $\neg\Diamond(\textbf{Juan is in the bathroom})$

The hearer can then conclude that (33) is false, and that the speaker used *algún* to avoid the exhaustivity inference.

6 A sketch of the analysis for *#-some*

#-some is like *algún*:

- The similarities between properties of *#-some* and *algún* suggest they should get similar treatment.
- Build on Alonso-Ovalle and Menéndez-Benito (2010)'s analysis of *algún*, and Alonso-Ovalle and Menendez-Benito (2013)'s analysis of the approximator *algún que otro*.
- Weir (2012) also adapts this analysis to the determiner *some* with a subkind-denoting NP.

Adapting to *#-some*: Intuition will be that *some* signals that the speaker cannot identify the particular number that satisfies an existential claim.

Issue: If *#-some* makes use of alternatives, how are the correct alternatives generated?

- Why can a numeral such as *twenty-some* not mean 33 (for instance)?

- Use the syntactic structure of numerals to build the correct alternatives.

- Numerals do not freely combine (e.g, *twenty-thirteen* (=33), *ninety-twenty* (=110)). Use this fact about numerals to only generate alternatives that would be able to combine with the numeral.

- Japanese shows that its possible to use the structure of numerals to constrain the range of approximation.

7 Representing cardinal numbers

Degrees and numerals:

- Degree-semantics for cardinal numbers (cf. (Solt, 2014) for a similar move with quantity-words such as *few, many*).

- A simple cardinal number is a property of degrees ($\langle d, t \rangle$).

(34) $[\![twenty]\!] = \lambda d\, [d = 20]$

- Additive numerals (*twenty-three*) have a coordinate structure (Ionin & Matushansky, 2006; Zweig, 2005).

- Place addition function ADD in the head of a coordination phrase.

(35) Structure of an additive numeral (*twenty-three*)
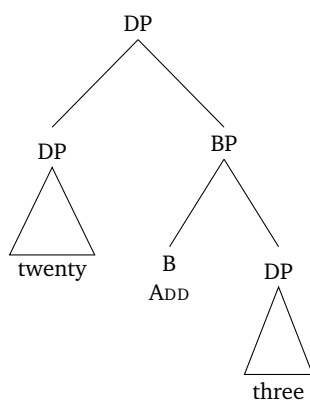
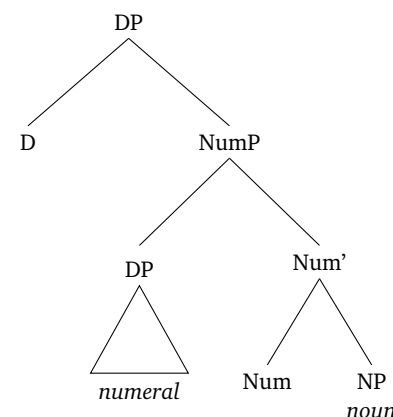- Function of ADD is to existentially quantify over degrees and sum them.

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

(37) $[\![twenty\ \text{ADD}\ three]\!] = \lambda d \exists d', d'' [d = d' + d'' \wedge [\![three]\!]\, (d') \wedge [\![twenty]\!]\, (d'')]$

Position of numerals within the DP:

- Put numerals in specifier of functional projection NumP dominating NP (see also Solt (2014) for *few* and *many*).

(38) Structure of the DP

- Num head measures cardinality of an individual.

(39) $[\![\text{Num}]\!] = \lambda e \lambda d\, [|x| = d]$

Building up the structure:

- Wrinkle: Num and NP are the wrong type to combine ($\langle e, dt \rangle$ and $\langle e, t \rangle$, respectively).

- Solt makes use of a rule of Degree Argument Introduction to compose the two.

(40) Degree Argument Introduction (DAI):   (Solt, 2014)
If α is a branching node, $\{\beta, \gamma\}$ are the set of α's daughters, and $[\![\beta]\!] = \lambda x_e . P(x)$, $[\![\gamma]\!] = \lambda x_e \lambda d_d . Q(d)(x)$, then $[\![\alpha]\!] = \lambda d_d \lambda x_e . P(x) \wedge Q(d)(x)$.

- DAI puts Num and NP together so that they are now $\langle d, et \rangle$.

(41)

Num'
⟨d, et⟩

Num ⟨e, dt⟩   NP ⟨e, t⟩
                people
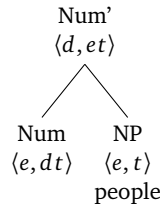
- Another wrinkle: the numeral is the wrong type to combine with Num+NP, as the numeral is ⟨d, t⟩ and Num+NP is ⟨d, et⟩.

- The iota typeshift can apply to lower the type of the numeral to d (Partee, 1987).

(42)   *twenty people*

DP

D   NumP ⟨e, t⟩

d Num' ⟨d, et⟩

ι   DP ⟨d, t⟩   Num ⟨e, dt⟩   NP ⟨e, t⟩
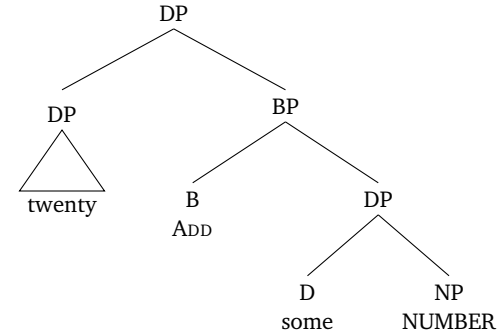   people

twenty
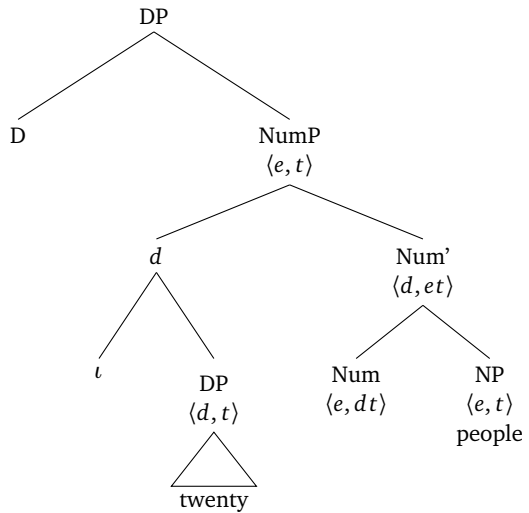
8   Syntax and semantics of *#-some*

#-some is also additive:

- As demonstrated earlier, *#-some* is only possible with additive numeral constructions.

- Use a coordinate structure.

- Analyze *some* as a determiner.

- Combines with a silent noun NUMBER (Kayne, 2005; Zweig, 2005).

- I assume NUMBER simply denotes the D_d.

(43)   *twenty-some*

DP

DP   BP

twenty   B   DP
           ADD
                 D   NP
                 some   NUMBER

How to treat *some*:

- Based on similarities with *algún*, analyze *some* in a related way.

- Weir (2012) directly ports the analysis of *algún* to *some*, using the denotation in (44).
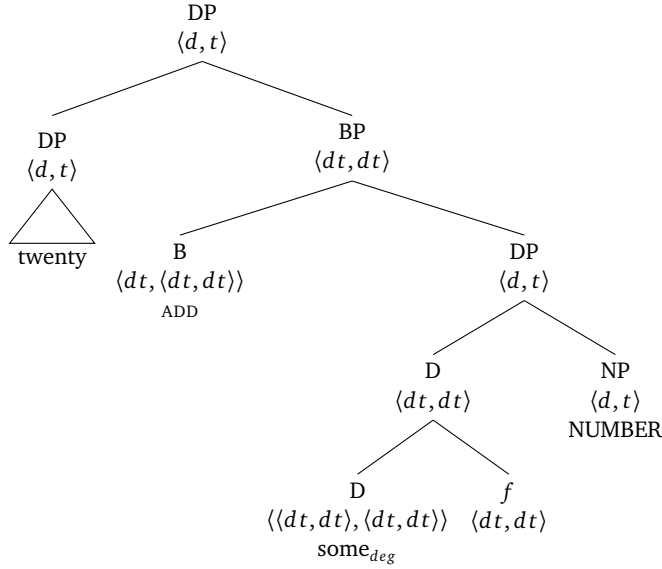
(44) $[\![some]\!] = \lambda f_{\langle et,et\rangle} \lambda P \lambda Q : \mathbf{anti\text{-}singleton}(f).\exists x \left[f(P)(x) \wedge Q(x)\right]$
       (Weir, 2012)

- This won't quite do for *#-some*.

- *some NUMBER* needs to be ⟨d, t⟩ to combine additively.

- Solution: *some* combines with properties of degrees, and has no existential force of its own.

- This makes *some* (now *some_{deg}*) type ⟨⟨dt, dt⟩, ⟨dt, dt⟩⟩.

- Use anti-singleton subset selection function.

(45) $[\![some_{deg}]\!] = \lambda f_{\langle dt,dt\rangle} \lambda D \lambda d : \mathbf{anti\text{-}singleton}(f) \left[f(D)(d)\right]$

Twenty-some, with types (f is represented syntactically):

(46)   *twenty-some*

DP
⟨d, t⟩
├── DP ⟨d, t⟩ — twenty
└── BP ⟨dt, dt⟩
    ├── B ⟨dt, ⟨dt, dt⟩⟩ — ADD
    └── DP ⟨d, t⟩
        ├── D ⟨dt, dt⟩
        │   ├── D ⟨⟨dt, dt⟩, ⟨dt, dt⟩⟩ — some$_{deg}$
        │   └── f ⟨dt, dt⟩
        └── NP ⟨d, t⟩ — NUMBER

With a bit of computation, *twenty-some* looks like this:

(47) $[\![\textit{twenty-some}]\!] = [\![\textit{twenty} [\text{ADD} [some_{deg} \textit{NUMBER}]]]\!]$
$= \lambda d \exists d', d'' \left[d = d' + d'' \wedge [\![\textit{twenty}]\!] (d') \wedge [\![some_{deg} \textit{NUMBER}]\!] (d'') \right]$

Namely, *twenty-some* is twenty and some indefinite number.

Merging in *#-some*:

- We run into the same type issue that happened with a more standard number like *twenty*: type clash between numeral and Num+NP.
- Lowering to type d using ι seems fundamentally incompatible with the pragmatics of *twenty-some*.
- ⟨d, t⟩ can be shifted to the type of a generalized quantifier (Partee, 1987).
- A type clash still results between Num' and the type ⟨dt, t⟩ numeral
- Resolved by having the numeral QR from the DP and adjoin to TP. Trace left behind will be interpreted as type d.

With QR:

(48)

TP
t
├── DP ⟨dt, t⟩ — twenty-some$_1$
└── TP ⟨d, t⟩
    ├── λ_1
    └── TP t
        └── t_1 people arrived
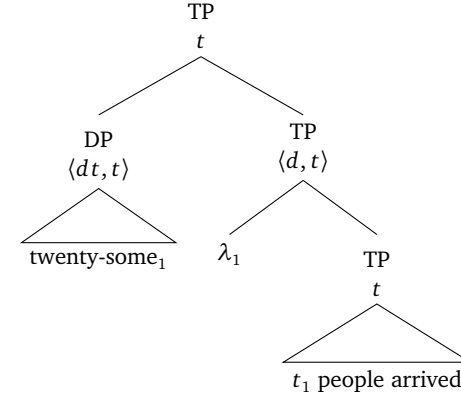
That the *#-some* numeral QRs sets up the possibility that its participate in scope ambiguities with other scope-taking operators, such as ∀. This prediction seems to be borne out:

(49)   Each dog licked twenty-some cats.

   a. ∃ > ∀: There is a number of cats that the speaker does not know precisely, and each dog licked that number of cats.

   b. ∀ > ∃: Each dog licked some number of cats, but not necessarily the same number of cats.

Logical form for *twenty-some people arrived*:

(50) $[\![\textit{twenty-some people arrived}]\!]$

$$= \exists d, d', d'' \left[\begin{array}{c} d = d' + d'' \wedge [\![\textit{twenty}]\!] (d'') \\ \wedge f(D)(d') \wedge \exists x \left[\begin{array}{c} |x| = d \wedge \\ \textbf{people}(x) \wedge \\ \textbf{arrived}(x) \end{array} \right] \end{array} \right]$$

$$= \exists d, d' \left[\begin{array}{c} d = d' + 20 \wedge f(D)(d') \\ \wedge \exists x \left[\begin{array}{c} |x| = d \wedge \\ \textbf{people}(x) \wedge \\ \textbf{arrived}(x) \end{array} \right] \end{array} \right]$$

9 Ignorance component of *#-some*

Anti-singleton subset selection function and ignorance: How does the anti-singleton subset selection function create the ignorance inference?

- Alonso-Ovalle and Menéndez-Benito (2010), following Kratzer and Shimoyama (2002), assumes that sentences are implicitly modalized with an assertion operator (abbreviated with □).

(51) $\llbracket \text{ASSERT} \rrbracket^{c} = \lambda p \lambda w. \forall w' \in \text{Epistemic}_{\text{speaker of c}}(w)\left[p(w')\right]$

- The anti-singleton domain function forces the hearer to consider why the speaker used *some*.

- The hearer considers the alternatives with singleton domains (which are stronger claims), but then draws the implicature that they must be false.

(52) Twenty-some people arrived.

$$\text{Assertion: } \Box \left[\exists d, d' \left[\begin{array}{c} d = d' + 20 \wedge f(D)(d') \\ \wedge \exists x \left[\begin{array}{c} |x| = d \wedge \\ \textbf{people}(x) \wedge \\ \textbf{arrived}(x) \end{array}\right]\end{array}\right]\right]$$

For concreteness, suppose that $D = \{1, 2, 3\}$. The hearer considers the alternatives in (53).

(53) Alternatives:

a. $\Box \left[\exists d, d' \left[\begin{array}{c} d = d' + 20 \wedge d' \in \{1\} \\ \wedge\, d\text{-people arrived} \end{array}\right]\right]$

b. $\Box \left[\exists d, d' \left[\begin{array}{c} d = d' + 20 \wedge d' \in \{2\} \\ \wedge\, d\text{-people arrived} \end{array}\right]\right]$

c. $\Box \left[\exists d, d' \left[\begin{array}{c} d = d' + 20 \wedge d' \in \{3\} \\ \wedge\, d\text{-people arrived} \end{array}\right]\right]$

However, the hearer then draws the inference that, since none of them were said, the speaker couldn't commit to any of them, generating the implicatures in (54).

(54) Implicatures:

a. $\neg\Box \left[\exists d, d' \left[\begin{array}{c} d = d' + 20 \wedge d' \in \{1\} \\ \wedge\, d\text{-people arrived} \end{array}\right]\right]$

b. $\neg\Box \left[\exists d, d' \left[\begin{array}{c} d = d' + 20 \wedge d' \in \{2\} \\ \wedge\, d\text{-people arrived} \end{array}\right]\right]$

c. $\neg\Box \left[\exists d, d' \left[\begin{array}{c} d = d' + 20 \wedge d' \in \{3\} \\ \wedge\, d\text{-people arrived} \end{array}\right]\right]$

Strengthened meaning of *#-some* is the conjunction of the implicatures and the assertation, creating the ignorance effect.

10 Lingering questions

Overgeneration of alternatives?

- NUMBER is simply D_d, and *some NUMBER* is very weak — it simply asserts that a number is in a non-singleton subset of D_d.

- But, the hope was to use the structure of the numeral itself to restrict what numbers would be possibilities in *#-some*.

- Other accounts of numbers have a similar issue
  - Difficult to rule out **twenty-thirteen*, for instance.
  - Ideally, the same restrictions that would ban *twenty-thirteen* would solve the overgeneration problem in this paper.

- Ionin and Matushansky (2006) follow Hurford (2003) in arguing for extra-linguistic factors constraining the possible combinations of numerals.

- Possibly, these constraints could be constructed syntactically as well, perhaps through feature checking.

#-some and #-something: How do these two related modifiers differ?

- They can be pulled apart in certain scenarios. In the situation below, Kate's response in (55b) is odd, but her response in (55c) is acceptable.

(55) *Situation: Anna wants to know Bill's football jersey number, and is asking Kate what the number is. Kate only has partial knowledge of the number, knowing that it is a number between 20 and 29.*

    a. Anna: What is Bill's jersey number?

    b. #Kate: I don't know, but it is twenty-some.

    c. Kate: I don't know, but it is twenty-something.

- Generalization seems to be that *#-some* is an approximate number, while *#-something* is the name of a numeral.

- Ideally, derive *#-something* from properties of *some* as well.

11 Conclusion

- Showed parallels between *#-some*, *some*, and *algún*.

- Analyzed *#-some* as building an indefinite number that combines additively with another number.

- *Some* in *#-some* used an anti-singleton subset selection function to generate an implicature of ignorance about a particular number.

- Shows how approximation within a range of numbers can be done with an epistemic indefinite.

- Suggests that *some* and *algún* are similar in their semantics and pragmatics.

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