Scalarity and additivity in natural language: (IV) English *even*

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Recapitulation

- **Day 2 and Day 3: Comparatives and *-er*/*more***
  - How an additivity-based perspective improve our understanding of scalarity-related phenomena?
  - What is additivity?
- Yesterday
  - Formal analysis of gradable adjectives, including
    - ★ antonyms
    - ★ *-er*/*more*
    - ★ *less*
    - ★ various uses of gradable adjectives
    - ★ *than*-clause internal quantifiers
    - ★ numerical differentials
  - Cross-linguistic phenomena: languages without morphemes like *-er*/*more*
  - etc.

Today

- Day 1: Basics of scales and degrees; how they are relevant to natural language
  - ‣ What are scales? What are their formal properties? What operators do they support?
- Day 2 and Day 3: Comparatives and *-er*/*more*
  - ‣ How an additivity-based perspective improve our understanding of scalarity-related phenomena?
  - ‣ What is additivity?
- Day 4 and Day 5: *Even* and its cross-linguistic siblings
  - ‣ How a scalarity-based perspective improve our understanding of additivity-related phenomena?

Outline

Basic observations

(1) a. Even $[\text{Mary}]_F$ came.
     b. It's not the case that even $[\text{Mary}]_F$ came.

(2) a. **Presupposition of entity-based additivity**:
         (1) $\rightsquigarrow$ Someone other than Mary came.
     b. **Presupposition of likelihood-based scalarity**:
         (1) $\rightsquigarrow$ Compared to others, Mary was unlikely to come.

- The alternative set of Mary is considered ordered along a scale of likelihood.
  - i.e., how likely it is for x, a member in the alternative set of Mary, to make 'come(x)' true

(See e.g., Karttunen and Peters 1979)

A challenge with regard to the presupposition of additivity

- Szabolcsi (2017): Imagine Pooh and friends coming upon a bush of thistles. Eeyore (known to favor thistles) takes a bite but spits it out.

(3)   Those thistles must be really prickly! Even Eeyore spit them out!

- The use of *even* is felicitous in the given scenario, **but the presuppositional requirement of additivity is not met**, because Eeyore was the only one who took a bite of thistles and spit them out.

Challenges with regard to the presupposition of likelihood

- A low likelihood is not a necessary condition for felicitous uses of *even*.

(4)   John is a political non-conformist. He even read [*Manufacturing Consent*]$_F$ although it has been banned by the censorship committee.

(Rullmann 1997)

(5)   Seller to client: Both tools are strong. The one on the right is made of strong aluminum, and the one of the left is even made of [steel]$_F$.

(Greenberg 2016)

- A low likelihood is not a sufficient condition for felicitous uses of *even*.

(6)   The red box has fruits. The blue one (#even) has [apples]$_F$ in it.

(Greenberg 2016)

A new challenge with regard to QUD in using *even*

(7)   a.   Who spit out thistles?

       b.   Only [Eeyore]$_F$ spit thistles out.   A felicitous answer
           ⤳ Eeyore spit thistles out, and no one other than Eeyore did so.

(8)   a.   Who spit out thistles?

       b.   [Eeyore]$_F$ also spit thistles out.   A felicitous answer
           ⤳ Eeyore spit thistles out, and someone else did so.

(9)   a.   Who spit out thistles?

       b.   ??Even [Eeyore]$_F$ spit thistles out.   Not a felicitous answer!

(10)   a.   Who was (the most) unlikely to spit out thistles?

       b.   ??Even [Eeyore]$_F$ spit thistles out.   Not a felicitous answer!

- These data on question/answer congruence show that *even* is different from *only* or *also* with regard to the pattern of focus/QUD congruence.

(Zhang 2022)

A new challenge with regard to QUD in using *even*

- How do we use *even* felicitously then?
- Scenario: Imagine Pooh and friends coming upon a bush of thistles. Eeyore (known to favor thistles) takes a bite but spits it out.

(11)   a.   How are those thistles?   A degree question

           b.   ✓ Even Eeyore$_F$ spit them out!   A felicitous answer

(12)   a.   Are those thistles prickly?

                     (about whether a positive threshold of being prickly is reached)

           b.   ✓ Even Eeyore$_F$ spit them out!   A felicitous answer

- Even though *Eeyore* bears focus, a good QUD for using *even* felicitously is not about *Eeyore*, but about degrees.

(Zhang 2022)

A new challenge with regard to QUD in using *even*

- Another example: only boys as tall as 5 feet 8 inches are eligible to join the tennis team.

(13) a. How tall is Bill?
      b. ??Bill is even 6_F feet tall.   Not a felicitous answer!

(14) a. How tall is Bill unlikely to be?
      b. ??Bill is even 6_F feet tall.   Not a felicitous answer!

(15) a. How is Bill's eligibility to join the tennis team?
      b. ✓ Bill is even 6_F feet tall.   A felicitous answer

(16) a. Is Bill tall enough to join the tennis team?
         ✓ Bill is even 6_F feet tall.   A felicitous answer

- A good QUD for using *even* felicitously is not about *6 feet* (i.e., how tall Bill is), but about an underlying concern (e.g., the degree of eligibility).

(Zhang 2022)

Intuition behind *even*

(17)   Even Mary$_F$ came.
    a. $\rightsquigarrow$ The party was really successful, to the extent that Mary came.
    b. $\rightsquigarrow$ The meeting was really urgent, to the extent that Mary came.

(18)   It's not the case that even Mary$_F$ came.
    a. $\rightsquigarrow$ The party wasn't so successful that Mary came.
    b. $\rightsquigarrow$ The meeting wasn't so urgent that Mary came.

- The prejacent of *even* indicates a benchmark for the degree of success, urgency, etc.

(Zhang 2022)

Interim summary

- The use of *even* addresses a degree QUD.

(19) Even $[\text{Eeyore}]_F$ spit them out!
   ≈ Those thistles are so prickly that $[\text{Eeyore}]_F$ spit them out.

   $\underbrace{\hspace{8cm}}_{\text{wrt a degree QUD}}$ $\underbrace{\hspace{6cm}}_{\text{the prejacent of }even}$

(20) (It's not the case that) even $[\text{Mary}]_F$ came.   (Prejacent: *Mary came.*)

$\left.\begin{array}{l}\text{The exhibition was (not) so successful}\\\text{People were (not) so enthusiastic}\\\text{The matter was (not) so urgent}\end{array}\right\}$ to the degree that $\underbrace{[\text{Mary}]_F \text{ came.}}_{\text{the prejacent of }even}$

(Zhang 2022)

Outline

The use of *even* is based on scalarity

(21) a. Even [Eeyore]$_F$ spit thistles out.
      b. Even [Mary]$_F$ came.
      c. Bill is even [6 feet]$_F$ tall.

- The use of *even* express an intensified degree of eligibility, success, enthusiasm, urgency, etc.
- Thus, the semantics of *even* involves **scalarity**, i.e., **scale-based additivity**, **not entity-based additivity**
  - ‣ cf. entity-based focus particles like *also* (maybe *only* as well)
- The use of *even* makes its prejacent contribute information to resolve a contextually salient degree QUD, leading to an increase from a usual contextual threshold to a higher value, and thus resolving the degree QUD with an increasingly positive answer.

(Greenberg 2018, Zhang 2022)

The meaning of *even*

(22)   *even*(p)

   a.   asserts p.
   b.   presupposes
      (i) p provides information to resolve a degree QUD
      (ii) p is maximally informative, as informative as any of its
            alternatives in resolving this degree QUD
            (like a superlative meaning;
            see discussions on additive particles that encode / suggest an end point,
            e.g., works by Osamu Sawada, Guillaume Thomas, Carla Umbach)

- What an analysis needs to include
  ‣ Associating p with the resolution of a degree QUD
  ‣ How to represent maximal informativeness

(Zhang 2022)

Associating prejacent with the resolution of a degree QUD

- A necessity modal (see Kratzer 1981, 1991) is assumed to relate the prejacent of '*even(p)*' and the degree information for resolving a degree QUD.

(23)   Associating the prejacent p with the resolution of a degree QUD
        how G_{qud} is x_{qud}:
        $$\forall w' \in \mathrm{Acc}(w)[p(w') \rightarrow \underbrace{G_{\mathrm{qud}}(x_{\mathrm{qud}})(w')}_{\text{e.g., the prickliness degree of thistles in } w'} \geq d_{\mathrm{threshold}}]$$

        (to be revisited and changed into interval semantics that addresses informativeness)
        i.e., Every p-world is a world where the measurement of x_{qud} along the scale G_{qud} reaches the threshold degree $d_{\mathrm{threshold}}$.

(Zhang 2022); see also the analysis of *enough* and *so ...that* in Meier (2003), Hacquard (2005, 2006), Nadathur (2019)

Representing informativeness

- In a domain of scalar values (i.e., degrees or intervals), there is not necessarily entailment between a lower and a higher value along a scale.
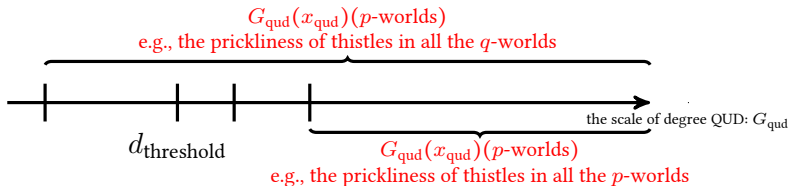
(24) a. Mary has exactly 3 kids $\not\models$ Mary has exactly 2 kids
      b. Mary has exactly 2 kids $\not\models$ Mary has exactly 3 kids

- However, if an underlying QUD addresses the degree of family burden, then having exactly 3 kids is at a higher level than having exactly 2 kids. The former burden level should entail (be more informative than) the latter burden level.
  (i.e., informativeness increases along with the increase of kid numbers.)

(25) degree QUD: how heavy is the family burden? $I_p >_{\text{info}} I_q$
      a. p = Mary has exactly 3 kids. I_p = the burden level of '$|kids| = 3$'
      b. q = Mary has exactly 2 kids. I_q = the burden level of '$|kids| = 2$'

The presupposition of *even*

(26)   The degree-QUD-based presupposition of *even*

$$G_{\text{qud}}(x_{\text{qud}})(p\text{-worlds})$$
e.g., the prickliness of thistles in all the q-worlds

$d_{\text{threshold}}$

the scale of degree QUD: G_{qud}

$$G_{\text{qud}}(x_{\text{qud}})(p\text{-worlds})$$
e.g., the prickliness of thistles in all the p-worlds

- In all the p-worlds (e.g., worlds where Eeyore spit thistles out), the resolution to the QUD (e.g., how prickly are thistles) exceeds the threshold for the positive use, $d_{\text{threshold}}$
- Among all the alternatives to the prejacent p, p solves the QUD in the most informative way.

The presupposition of *even*

(27) The presupposition of $[\![\text{even}]\!]^w$ in *even Eeyore$_F$ spit thistles out*:

(prejacent p = Eeyore spit thistles out)

$\forall w' \in \text{Acc}(w) \cap \underbrace{\lambda w.\text{Eeyore spit thistles out in } w}_{p}$

$[\underbrace{\text{Max}_{\text{info}}[\lambda I.G_{\text{qud}}(x_{\text{qud}})(w') \subseteq I]}_{} \subset [d_{\text{threshold}}, +\infty)] \wedge$

e.g., the most informative answer to the question
how prickly the thistles are in w'

$\forall q \in C[\underbrace{\text{Max}_{\text{info}}[\lambda I.[\forall w' \in \text{Acc}(w) \cap p[G_{\text{qud}}(x_{\text{qud}})(w') \subseteq I]]]}_{} \subseteq$

e.g., I_p=the most informative interval that answers the question
how prickly the thistles are in the p-worlds

$\underbrace{\text{Max}_{\text{info}}[\lambda I.[\forall w'' \in \text{Acc}(w) \cap q[G_{\text{qud}}(x_{\text{qud}})(w'') \subseteq I]]]]}_{}$

e.g., I_q=the most informative interval that answers the question
how prickly the thistles are in the q-worlds

Consequence 1: Entity-based additivity is not necessary

- Szabolcsi (2017): Imagine Pooh and friends coming upon a bush of thistles. Eeyore (known to favor thistles) takes a bite but spits it out.

(3)   Those thistles must be really prickly! Even Eeyore spit them out!

- Compared to alternatives, 'Eeyore' is maximally informative in addressing how prickly those thistles are.
- Here it is not true that others spit thistles out.

Concequence 2: Likelihood inference is an implicature

- It's not unlikely for John, a non-conformist, to read *Manufacturing Consent.*
- Likelihood might be due to a normal distribution assumption wrt a scale of being non-conformist: people that are highly non-conformist are rare.

(4)   John is a political non-conformist. He even read [*Manufacturing Consent*]$_F$ although it has been banned by the censorship committee.   (Rullmann 1997)

    a.   In all the worlds where the prejacent 'he read *Manufacturing Consent*' is true, John is above the threshold of being a non-conformist.

    b.   Compared to sentences alternative to the prejacent, the prejacent (i.e., he read *Manufacturing Consent*) is maximally informative in indicating how non-conformist John is.
            ⤳ e.g., A sentence 'he read both *Manufacturing Consent* and *The Decameron*' is not considered more informative than 'he read *Manufacturing Consent*' in indicating how non-conformist John is.
            (By saying ' 'he read *Manufacturing Consent*', John's degree of being non-conformist is already unquestionable)

Concequence 2: Likelihood inference is an implicature

(5)   Seller to client: Both tools are strong. The one on the right is made of
       strong aluminum, and the one of the left is even made of $[\text{steel}]_F$.

<div align="right">(Greenberg 2016)</div>

    a.   In all the worlds where 'the tool of the left is made of steel' is
       true, our tools are above the threshold of being strong.

    b.   Compared to sentences alternative to the prejacent, saying this
       prejacent is maximally informative in indicating how strong our
       tools are.

Concequence 2: Likelihood inference is an implicature

(28)   Ed has two children and Fred even has $[\text{three}]_F$.   (Rullmann 1997)

    a.   In all the worlds where 'Fred has 3 children' is true, his degree of burden / enthusiasm for raising kid is above the threshold.

    b.   Compared to alternative sentences, saying 'Fred has 3 children' is maximally informative in indicating how heavy the burden is / how enthusiastic people (including Ed and Fred) are for raising kids.

        ↝ 'Fred has 4 children' is not considered resolving the degree QUD with a higher value (i.e., indicating a higher level of burden / enthusiasm).

Outline

Two kinds of scales
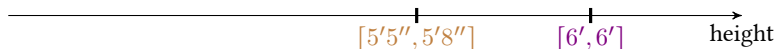
- In a domain of scalar values (i.e., degrees or intervals), there is not necessarily entailment between a lower and a higher value along a scale.

(29)   a.   Lucy is exactly 6 feet tall $\not\vDash$ Lucy is between $5'5''$ and $5'8''$ tall
          b.   Lucy is between $5'5''$ and $5'8''$ tall $\not\vDash$ Lucy is exactly 6 feet tall

- However, a higher value reaches higher thresholds (i.e., is more informative) than a lower value in addressing a relevant degree QUD.
- Two kinds of scales involved here:
  - ‣ One that addresses the height measurements   no evaluativity
  - ‣ The other one that addresses degree-QUD-based informativeness measurements: e.g., to what extent Lucy is (positively) tall, short, eligible for the tennis team?   with evaluativity

Two kinds of scales

- Another example: only boys as tall as 5 feet 8 inches are eligible to join the tennis team.

(13) a. How tall is Bill? (asking about the height measurement, not a positive use)
     b. ??Bill is even 6_F feet tall. Not a felicitous answer!
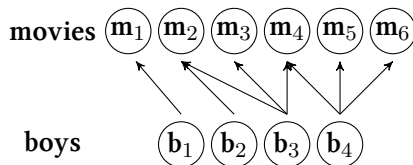
(15) a. How is Bill's eligibility to join the tennis team?
     b. ✓ Bill is even 6_F feet tall.   A felicitous answer
         (i) the truth of 'Bill is 6 feet tall' makes his eligibility above the threshold.
         (ii) Compared to alternatives to the prejacent, the prejacent is maximally informative in addressing the eligibility.

            (e.g., saying 'he is 7 feet tall' would not enhance the degree of eligibility.)

- Measurement sentence: context-independent
- Positive use: context-dependent
- Are there other phenomena in natural language that require the notion of a contextually relevant degree QUD?

Cumulative-reading sentence

movies $(m_1)(m_2)(m_3)(m_4)(m_5)(m_6)$

boys $(b_1)(b_2)(b_3)(b_4)$
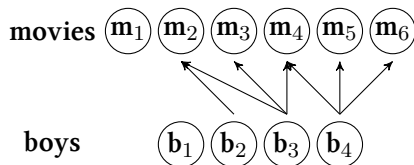
The genuine **cumulative** reading of is **true** in this context.

movies $(m_1)(m_2)(m_3)(m_4)(m_5)(m_6)$

boys $(b_1)(b_2)(b_3)(b_4)$

The genuine **cumulative** reading is **false** in this context.

(30) <u>Exactly three^u boys</u> saw <u>exactly five$^\nu$ movies</u>.

- **Cumulative reading**:

(31) $\underbrace{\sigma x \sigma y [\text{BOY}(x) \wedge \text{MOVIE}(y) \wedge \text{SEE}(x, y)]}_{\text{the mereologically maximal } x \text{ and } y \text{ satisfying these restrictions}} \quad \underbrace{\wedge |y| = 5 \wedge |x| = 3}_{\text{cardinality tests}}$

(Brasoveanu 2013)

About modified numerals

- Modified numerals contribute maximality (see e.g., Szabolcsi 1997, Krifka 1999, de Swart 1999, Umbach 2005).

(32) a. Mary fed two dogs. They are cute. Perhaps she fed more.
      b. Mary fed at least two dogs. They are nice. #Perhaps she fed more.

- *at least two dogs* denotes and counts the totality of dogs fed by Mary.

(30) Exactly three^u boys saw exactly five^v movies.

- Brasoveanu (2013): the semantic contribution of modified numerals:
  - The introduction of discourse referents (drefs)
  - After adding restrictions like BOY(x), MOVIE(y), and SEE(x, y) on drefs, the application of maximality operators and cardinality tests
    - ★ Maximality is mereology-based

Another cumulative-reading sentence

(33)   In Guatemala, at most 3% of the population own at least 70% of the land.

- Krifka (1999): the simultaneous mereology-based maximization strategy

    '*would lead as to select the alternative **In Guatemala, 100 percent of the population own 100 percent of the land**, which clearly is not the most informative one among the alternatives – as a matter of fact, it is pretty uninformative.*'

Another cumulative-reading sentence

(33) In Guatemala, at most 3% of the population own at least 70% of the land.

- Krifka (1999):

    '*What is peculiar with sentences like (33) is that they want to give information about the bias of a statistical distribution. One conventionalized way of expressing particularly biased distributions is to select a small set among one dimension that is related to a large set of the other dimension.*'
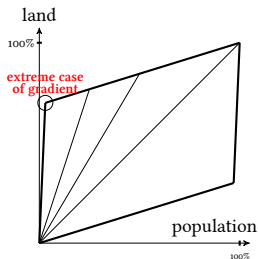
Degree-QUD-based maximal informativeness:
The case of the movie-seeing scenario
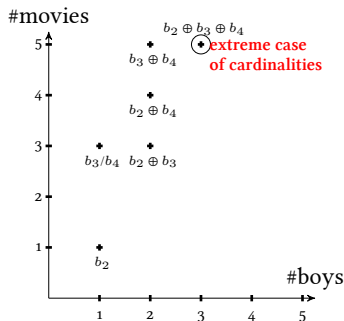
(30) Exactly three boys saw exactly five movies.
      QUD: How much is the overall film consumption among boys?
      ⤳ The maximally informative true answer corresponds to the
      cardinalities of the mereologically maximal drefs.

Degree-QUD-based maximal informativeness:
The case of the land-owning scenario

(33) In Guatemala, at most 3% of the population own at least 70% of the land.

QUD: How skewed is wealth distribution in Guatemala?

⤳ The maximally informative true answer corresponds to the case with the maximal ratio between the amount of land and the population of its owner.

(Zhang 2023)

The interpretation of cumulative-reading depends on a degree QUD

- The interpretation of cumulative-reading sentences involves
  - measurements represented by numbers along multiple dimensions
  - how numbers contribute to address an underlying degree QUD

(30) Exactly three boys saw exactly five movies.
      QUD: How much is the overall film consumption among boys?
      $\rightsquigarrow$ Maximal informativeness is achieved with the mereologically maximal boy-sum and movie-sum.

(33) In Guatemala, at most 3% of the population own at least 70% of the land.
      QUD: How skewed is wealth distribution in Guatemala?
      $\rightsquigarrow$ Maximally informativeness is achieved with the case where the ratio between the amount of land and its owner population is maximal.

Discussion on informativeness

- Language phenomena relevant to a degree QUD:
  - The use of *even*
  - Cumulative-reading sentences that involve multi-dimensional measurements
- Compared to a direct, entailment-based informativeness (see Schlenker 2012, Fintel et al. 2014), a degree-QUD-based informativeness is looser
  - Oftentimes, direct entailment doesn't hold.

(34)   a.   Lucy is exactly 6 feet tall $\not\models$ Lucy is between $5'5''$ and $5'8''$ tall
           b.   Lucy is between $5'5''$ and $5'8''$ tall $\not\models$ Lucy is exactly 6 feet tall

(30)   Exactly three boys saw exactly five movies.

(30')   Exactly one boy saw exactly four movies.

Take-home messages:

- Day 4 and Day 5: *Even* and its cross-linguistic siblings
  - How a scalarity-based perspective improve our understanding of additivity-related phenomena?
- The case study of English *even*:
  - scalarity and scale-based additivity of *even*
  - degree QUD and maximal informativeness

Tomorrow

- Day 4 and Day 5: *Even* and its cross-linguistic siblings
  - How a scalarity-based perspective improve our understanding of additivity-related phenomena?
- Tomorrow: cross-linguistic siblings of *even*
  - Chinese *gèng*
  - Chinese *hái*
  - Chinese *dōu*
  - and their use in comparatives

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