

# 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

- 1 Canonical view on English *even* and challenges
- 2 A context-relevant scale in interpreting *even*
- 3 Degree QUD and maximizing informativeness

## Basic observations

- (1) a. Even [Mary]<sub>F</sub> came.  
b. It's not the case that even [Mary]<sub>F</sub> 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*]<sub>F</sub> 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*]<sub>F</sub>.  
(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*]<sub>F</sub> in it.  
(Greenberg 2016)

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

- (7) a. Who spit out thistles?  
b. **Only** [Eeyore]<sub>F</sub> spit thistles out. A felicitous answer  
     $\leadsto$  Eeyore spit thistles out, and no one other than Eeyore did so.
- (8) a. Who spit out thistles?  
b. [Eeyore]<sub>F</sub> **also** spit thistles out. A felicitous answer  
     $\leadsto$  Eeyore spit thistles out, and someone else did so.
- (9) a. Who spit out thistles?  
b. ??**Even** [Eeyore]<sub>F</sub> spit thistles out. **Not a felicitous answer!**
- (10) a. Who was (the most) unlikely to spit out thistles?  
b. ??**Even** [Eeyore]<sub>F</sub> 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<sub>F</sub> 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<sub>F</sub> 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**.

## 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<sub>F</sub> feet tall. **Not a felicitous answer!**
- (14) a. How tall is Bill unlikely to be?  
b. ??Bill is *even* 6<sub>F</sub> feet tall. **Not a felicitous answer!**
- (15) a. How is Bill's eligibility to join the tennis team?  
b. ✓ Bill is *even* 6<sub>F</sub> feet tall. A felicitous answer
- (16) a. Is Bill tall enough to join the tennis team?  
✓ Bill is *even* 6<sub>F</sub> 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*

(QUDs: how's the party? how urgent was the meeting? ...)

(17) Even  $\text{Mary}_F$  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  $\text{Mary}_F$  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.



# Outline

- 1 Canonical view on English *even* and challenges
- 2 A context-relevant scale in interpreting *even*
- 3 Degree QUD and maximizing informativeness

## The use of *even* is based on scalarity

- (21) a. **Even** [Eeyore]<sub>F</sub> spit thistles out.  
b. **Even** [Mary]<sub>F</sub> came.  
c. Bill is **even** [6 feet]<sub>F</sub> 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

# 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  $x_{qud}$ :

$$\forall w' \in \text{Acc}(w)[p(w') \rightarrow \underbrace{G_{qud}(x_{qud})(w')}_{\geq d_{\text{threshold}}}]$$

e.g., the prickliness degree of thistles in  $w'$

(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  $d_{\text{threshold}}$ .

([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.

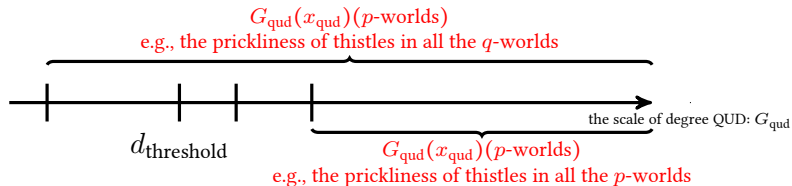
- (24)
- a. Mary has exactly 3 kids  $\not\equiv$  Mary has exactly 2 kids
  - b. Mary has exactly 2 kids  $\not\equiv$  Mary has exactly 3 kids

- 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*



- 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  $\llbracket \text{even} \rrbracket^w$  in *even Eeyore<sub>F</sub> spit thistles out*:  
 (prejacent  $p = \text{Eeyore spit thistles out}$ )

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

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

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

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

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

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

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.

## Consequence 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*]<sub>F</sub> although it has been banned by the censorship committee. (Rullmann 1997)
- a. In all the worlds where he read *Manufacturing Consent*, John is above the threshold of being a non-conformist.
  - b. Compared to alternative books, *Manufacturing Consent* is maximally informative in indicating how non-conformist John is.  
↪ e.g., The sum '*Manufacturing Consent* and *The Decameron*' is not more informative than *Manufacturing Consent* alone in indicating how non-conformist John is.

## 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 [steel]<sub>F</sub>.  
(Greenberg 2016)
- a. In all the worlds where the tool of the left is made of steel, our tools are above the threshold of being strong.
  - b. Compared to other materials, steel is maximally informative in indicating how strong our tools are.

## Concequence 2: Likelihood inference is an implicature

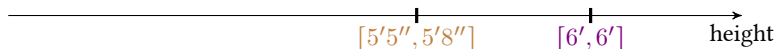
- (28) Ed has two children and Fred even has [three]<sub>F</sub>. (Rullmann 1997)
- a. In all the worlds where Fred has 3 children, his burden / enthusiasm for raising kid is above the threshold.
  - b. Compared to other numbers, 3 is maximally informative in indicating how heavy the burden is / how enthusiastic they (including Ed and Fred) are for raising kids.  
     $\rightsquigarrow$  ‘Fred has 4 children’ is not considered more informative in resolving the degree QUD.

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- 1 Canonical view on English *even* and challenges
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## 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)
- Lucy is exactly 6 feet tall  $\neq$  Lucy is between 5'5'' and 5'8'' tall
  - Lucy is between 5'5'' and 5'8'' tall  $\neq$  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.

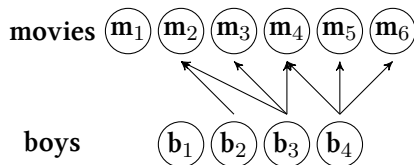
(13) a. How tall is Bill? (asking about the height measurement, not a positive use)  
b. ??Bill is **even** 6<sub>F</sub> feet tall. **Not a felicitous answer!**

(15) a. How is Bill's eligibility to join the tennis team?  
b. ✓ Bill is **even** 6<sub>F</sub> feet tall. A felicitous answer

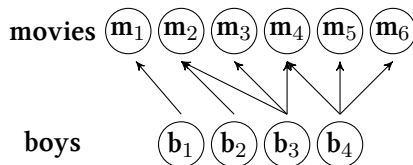
(i) Bill's being 6 feet tall makes his eligibility above the threshold.  
(ii) Compared to alternatives, the prejacent is maximally informative in addressing the eligibility.  
(e.g., being 7 feet tall would not make him more eligible.)

- 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



The genuine **cumulative** reading of  
is **true** in this context.



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

(30) Exactly three<sup>u</sup> boys saw exactly five<sup>v</sup> movies.

- **Cumulative reading:**

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

(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<sup>u</sup> boys saw exactly five<sup>v</sup> movies.

- Brasoveanu (2013): the semantic contribution of modified numerals:
  - The introduction of discourse referents (drefs)
  - After adding restrictions like  $\text{BOY}(x)$ ,  $\text{MOVIE}(y)$ , and  $\text{SEE}(x, y)$  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 us 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.'*

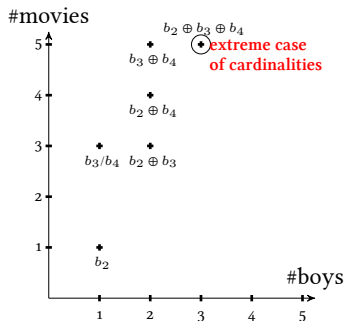
## Another cumulative-reading sentence

(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



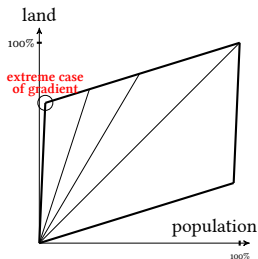
(30) Exactly three boys saw exactly five movies.

**QUD:** How much is the overall film consumption among boys?

↪ The maximally informative true answer corresponds to the cardinalities of the mereologically maximal drefs.

(Zhang 2023)

# 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.



# 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?**

↪ 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?**

↪ 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  $\neq$  Lucy is between 5'5" and 5'8" tall  
b. Lucy is between 5'5" and 5'8" tall  $\neq$  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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