

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]_F came.
b. It's not the case that even [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
 \leadsto 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
 \leadsto 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**.

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*

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

(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.

Interim summary

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

(19) **Even** [Eeyore]_F spit them out!
≈ Those thistles are **so prickly that** [Eeyore]_F spit them out.

$\underbrace{\hspace{15em}}_{\text{wrt a degree QUD}} \qquad \underbrace{\hspace{15em}}_{\text{the prejacent of } \textit{even}}$

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

The exhibition was (not) **so successful**
People were (not) **so enthusiastic**
The matter was (not) **so urgent**

} **to the degree that** [Mary]_F came.
 $\underbrace{\hspace{10em}}_{\text{the prejacent of } \textit{even}}$

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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)

- 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} :

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

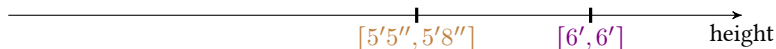
e.g., the prickliness degree of thistles in w'

(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. Lucy is exactly 6 feet tall $\not\equiv$ Lucy is between 5'5'' and 5'8'' tall
 - b. Lucy is between 5'5'' and 5'8'' tall $\not\equiv$ Lucy is exactly 6 feet tall

- However, if an underlying QUD addresses how Lucy is tall (with the positive use of *tall*), then a higher value reaches higher thresholds (i.e., is more informative) than a lower value in addressing this degree QUD. (i.e., informativeness increases along with the increase of high values.)

- (25) degree QUD: to what extent is Lucy tall? (the positive use of *tall*)
 \rightsquigarrow how high a threshold is achieved?

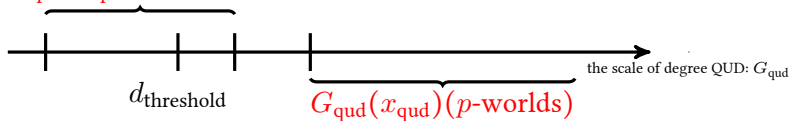
Thus $G_{\text{qud}}(\text{Lucy})(p\text{-worlds}) \geq_{\text{info}} G_{\text{qud}}(\text{Lucy})(q\text{-worlds})$

- a. p = Lucy is exactly 6 feet tall.
- b. q = Lucy is between 5'5'' and 5'8'' tall.

The presupposition of *even*

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

$G_{\text{qud}}(x_{\text{qud}})(q\text{-worlds})$



- In all the p -worlds, the resolution to the QUD 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 Mary_F came*:
 (prejacent $p = \text{Mary came}$)

$\forall w' \in \text{Acc}(w) \cap \underbrace{\lambda w. \text{Mary came in } w}$

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

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

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

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

$\text{Max}_{\text{info}}[\lambda I. [\forall w'' \in \text{Acc}(w) \cap q[G_{\text{qud}}(x_{\text{qud}})(w'') \subseteq I]]] \subseteq (0, +\infty)]$

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

- (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)
- (28) Ed has two children and Fred even has [three]_F. (Rullmann 1997)

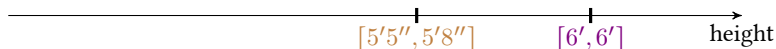
- What the above last example tells us:

- ▶ Fred has three children.
- ▶ There is an implicit degree QUD associated with the number of children (e.g., how people are nervous / enthusiastic about having children)
 - ★ ‘Fred has 3 children’ indicates a degree of nervousness / enthusiasm above the threshold
 - ★ ‘Fred has 3 children’ is maximally informative, i.e., ‘Fred has 4 children’ is not considered more informative

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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.
- (24)
- 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_F feet tall. **Not a felicitous answer!**

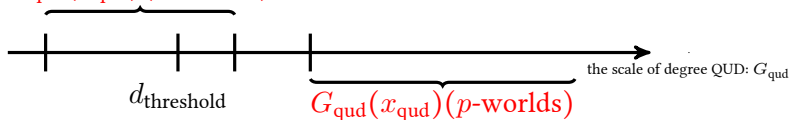
(15) a. How is Bill's eligibility to join the tennis team?
b. ✓ Bill is **even** 6_F feet tall. **A felicitous answer**

- Measurement sentence: context-independent
- Positive use: context-dependent

Two parts in the presupposition of *even*

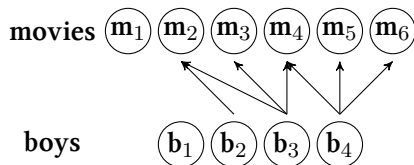
(25) The degree-QUD-based presupposition of *even*

$G_{\text{qud}}(x_{\text{qud}})(q\text{-worlds})$

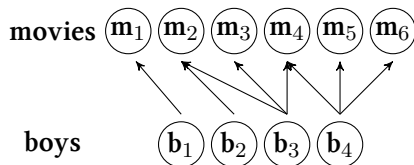


- Along the scale of G_{qud} :
 - Comparison between I_p and $[d_{\text{threshold}}, +\infty)$: evaluativity wrt G_{qud}
 - Comparison between I_p and alternatives I_q : maximal informativeness
- Are there similar phenomena in natural language that require the notion of a contextually relevant degree QUD?

Cumulative-reading sentence



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



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

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

- **Cumulative reading:**

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

(Brasoveanu 2013)

About modified numerals

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

- (31) 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.

- (29) 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 $\text{BOY}(x)$, $\text{MOVIE}(y)$, and $\text{SEE}(x, y)$ on drefs, the application of maximality operators and cardinality tests
 - ★ Maximality is mereology-based

Another cumulative-reading sentence

(32) 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.'*

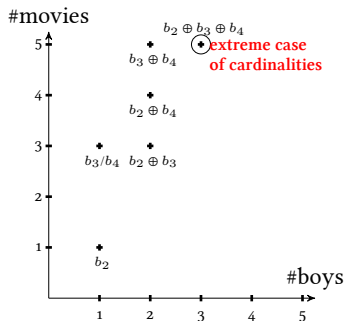
Another cumulative-reading sentence

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

- Krifka (1999):

‘What is peculiar with sentences like (32) 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



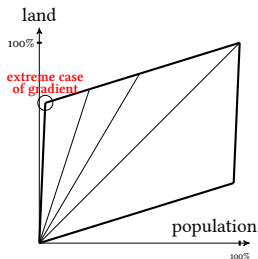
(29) Exactly three boys saw exactly five movies.

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



(32) 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

(29) 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.

(32) 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.

- (24) 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

(29) Exactly three boys saw exactly five movies.

(29') 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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