# The Vague Expression of Quantity

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# Introduction

- Typical focus:
  - Vague adjectives: *tall*, *expensive*, *thin*, *red*, *old*, *bald*
  - Vague nouns: heap
    - Dimensions: height, cost, age, hue, etc.

# Introduction

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  - Vague adjectives: *tall*, *expensive*, *thin*, *red*, *old*, *bald*
  - Vague nouns: heap
    - Dimensions: size, cost, age, hue, etc.
- Today's focus:
  - Vagueness in the expression of quantity and amount
    - Dimensions: cardinality (number); volume/mass (additive dimensions)

# Game Plan

1. Inherently vague quantity expressions:
   - Adjectives of quantity: *many*, *few*, *much*, *little*
2. Imprecise interpretations of precise quantity expressions
   - Round number effect (Krifka 2007)
3. Case study in vagueness in quantity
   - *Most* vs. *more than half*

# 1. Adjectives of Quantity

(1) a. **Many** people I know like jazz

b. **Few** students came to the lecture

c. I don't have **much** money

d. There is **little** water in the bucket

# 1. Adjectives of Quantity: Parallels to Vague Gradable Adjectives

- Gradability

(2) a. Fred drank **more/less** wine than Barney
b. Betty read **the most/the fewest** books

(3) a. Fred drank **too much** wine
b. Barney drank **very little** wine
c. Betty read **as many** books **as** Wilma
d. I'm surprised Wilma read **that few** books

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- Gap between positive and negative

(4) a. Many runners finished the race — Both can be false
b. Few runners finished the race

(5) a. Fred is tall — b. Fred is short — Same

# 1. Adjectives of Quantity: Parallels to Vague Gradable Adjectives

- Context sensitivity

  (6) Many students came to the lecture

  - Situation 1: In-class lecture in advanced Semantics class
  - Situation 2: University-wide lecture by Bill Clinton

- Borderline cases
  - 1000 students coming to Clinton's lecture is many
  - 3 is not many
  - But what about 50? 100?

# 1. Adjectives of Quantity: Parallels to Vague Gradable Adjectives

- Sorities Paradox
  - **a.** If 1000 students attend Clinton's lecture, that is many
  - **b.** If *n* students attending Clinton's lecture is many, then *n* - 1 students attending Clinton's lecture is many
  - **c.** 3 students attending Clinton's lecture is many

# 1. Adjectives of Quantity: Parallels to Vague Gradable Adjectives

- Compositional regulation of vagueness
  - *For* phrases

    (7) a. Barney owns few books for a professor
        b. Barney is tall for a jockey

  - *Compared to* phrases

    (8) a. Fred owns few books compared to Barney
        b. Fred is tall compared to Barney

# 1. Adjectives of Quantity
# Distinctions from 'Ordinary' Adjectives

- Predicative use

(9) a. Fred is tall b. The fans were many

(10) a. I consider Fred tall b. *I consider the fans many

(11) a. Every boy is tall b. *Every fan is few

- Differential use

(12) a. Fred drank much/little more than Barney
b. *Fred is tall taller than Barney

# 1. Adjectives of Quantity
# Lexical Semantics

- Gradability modeled via scales *S* consisting of set of degrees *d* ordered by ordering relationship >
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- 'Ordinary' gradable adjectives: gradable predicates over **individuals**

(13) a. $[\![\text{tall}]\!] = \lambda d \lambda x.\text{HEIGHT}(x) \geq d$

b. $[\![\text{short}]\!] = \lambda d \lambda x.\text{HEIGHT}(x) \leq d$

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- Adjectives of quantity: gradable predicates over **scalar intervals**

(14) a. $[\![\text{many}]\!] = \lambda d \lambda I.d \in I$

b. $[\![\text{few}]\!] = \lambda d \lambda I.d \in \text{INVERSE}(I)$

# Comparison Classes

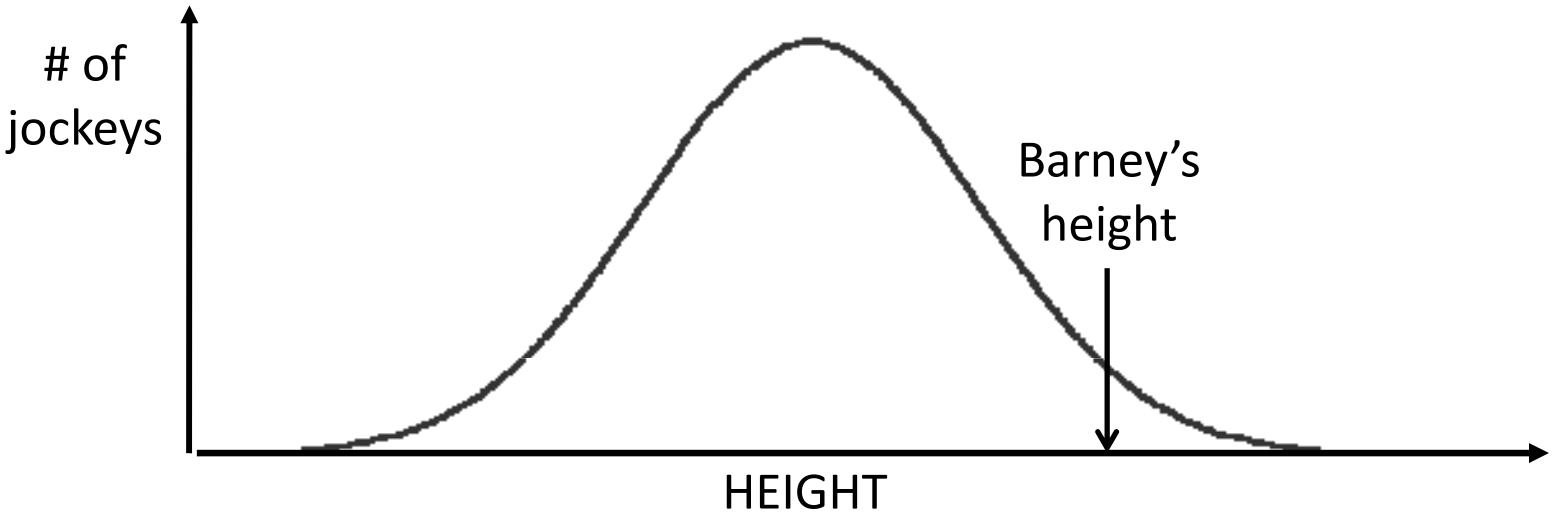
- Vague expressions interpreted with reference to comparison class (Klein 1980)

(15) Barney is tall for a jockey

'Barney's height exceeds the standard for jockeys'

'Barney is (considerably) taller than the average jockey'

'Barney is taller than most jockeys'



# Comparison Classes

(16) [[Barney is tall for a jockey]] = 1 iff HEIGHT(Barney) > $N_S$,

where $N_S$ = median$_{x:jockey(x)}$(d:HEIGHT(x)=d) $\pm$

n•MAD$_{x:jockey(x)}$ (d:HEIGHT(x)=d)

(17) [[POS tall]]= $\lambda$x.HEIGHT(x) > $N_S$,

where $N_S$ = median$_{x \in CC}$(d:HEIGHT(x)=d) $\pm$

n• MAD$_{x \in CC}$(d:HEIGHT(x)=d)

(18) [[POS]]= $\lambda$I.$N_S \subset$ I

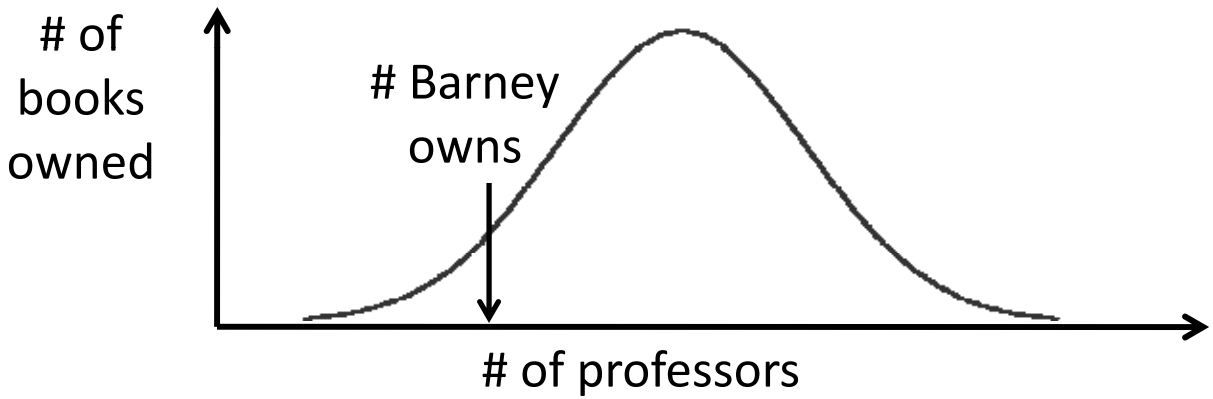
where $N_S$ = meadian$_{x \in CC}$(d:HEIGHT(x)=d) $\pm$

n• MAD$_{x \in CC}$(d:HEIGHT(x)=d)

# Comparison Classes

(19) Barney owns few books for a professor

'Barney owns fewer books than most professors'




(20) [[(19)]] = 1 iff # of books owned by Barney < $N_S$,

where $N_S$ = median$_{x:professor(x)}$(d:x owns d-many books) $\pm$ MAD$_{x:professor\ (x)}$ (d:x owns d-many books)

# Comparison Classes

A broader view of comparison classes:

(21) a. Barney is tall for a jockey

- CC = jockeys (subject of gradable expression $\in$ CC)

b. Barney owns few books for a professor

- CC = professors (subject of gradable expression $\notin$ CC)

c. For a Sunday, there are many cars in the lot

- CC = Sundays (times *t*)

d. Few students came to the lecture

- Compared to what I expected
- CC = situations consistent with my expectations (worlds *w*) (cf. Fernando & Kamp 1996)

# 1. Adjectives of Quantity
# A Complication

- Cardinal vs. proportional readings (Partee 1989):
  - (22) Few Linguistics students are registered for Psychology of Language
    - **Cardinal:** a small <u>number</u> of Linguistics students
    - **Proportional:** a small <u>proportion</u> of the Ling. students

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# A Complication

- Cardinal vs. proportional readings (Partee 1989):

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  - **Cardinal:** a small <u>number</u> of Linguistics students
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- Distinct:

  …because there **are** few Linguistics students — Cardinal

- Grammatically determined:

  (23) a. There are few Linguistics students — Cardinal

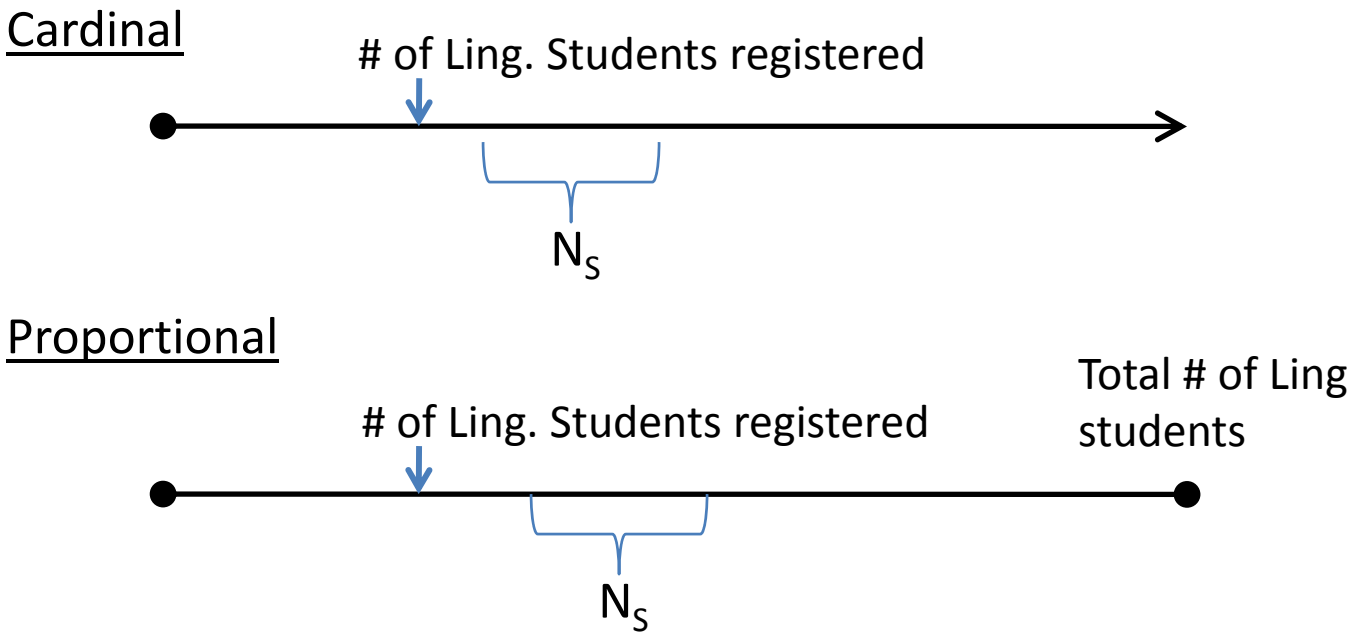
  b. Few of the Linguistics students are here — Proportional

  c. Few students I know like jazz — Proportional

# 1. Adjectives of Quantity Cardinal vs. Proportional

- Proportional reading of Q-adjectives arises when domain of quantification is a topic/presupposed
- Consequence for scale structure: upper bound

  Few Linguistics students are registered for Psychology of Language



# 1. Adjectives of Quantity
## Vagueness and the Proportional Reading

- Borderline cases remain:

  (24) Many of the people in this room have blue eyes

  - How many out of 50?

- But context sensitivity reduced:

  (25) a. Many of the dots on the screen are black
  b. Few of the dots on the screen are black

  (26) Few of the people in this room are right handed

  - Cf. Kennedy (2007): maximize contribution of conventional elements
    - Relative gradable adjective: *tall* (standard context dependent)
    - Absolute gradable adjective: *full* (standard = endpoint)

# 2. Round Number Effect

- RNRI Principle (Krifka 2007): Round number words in measuring contexts tend to have round interpretations:

(27) a. Forty students came to the party
b. Thirty-nine students came to the party

(28) a. We bought one hundred kilos of rice
b. We bought one hundred and three kilos of rice

(29) a. Mary waited for forty-five minutes
b. Mary waited for forty minutes

(30) a. The wheel turned on hundred and eight degrees
b. The wheel turned two hundred degrees

# 2. Round Number Effect

- Krifka (2007): The result of measuring can be reported with respect to various levels of granularity that differ in density of representation points

**Number:**

```
--------------------40------------------------------50-------
----35--------------40--------------45--------------50-------
-34-35-36-37-38-39-40-41-42-43-44-45-46-47-48-49-50-51-52-
```

**Time (minutes):**

```
0-------------------------------60-----------------------
0---------------30----------------60----------------90----
0------15-------30-------45-------60-------75-------90----
0-5-10-15-20-25-30-35-40-45-50-55-60-65-70-75-80-85-90-95-
```

# 2. Round Number Effect

**The Coarsest Scale Principle:**

If a measure expression $\alpha$ occurs on scales that differ in granularity, then uttering $\alpha$ implicates that the most coarse-grained scale on which $\alpha$ occurs is used

- Derived via principles of strategic communication (Parikh 2001): if $\alpha$ is ambiguous between 2 meanings M and M', where M is much more likely than M', then speaker can use $\alpha$ to convey M

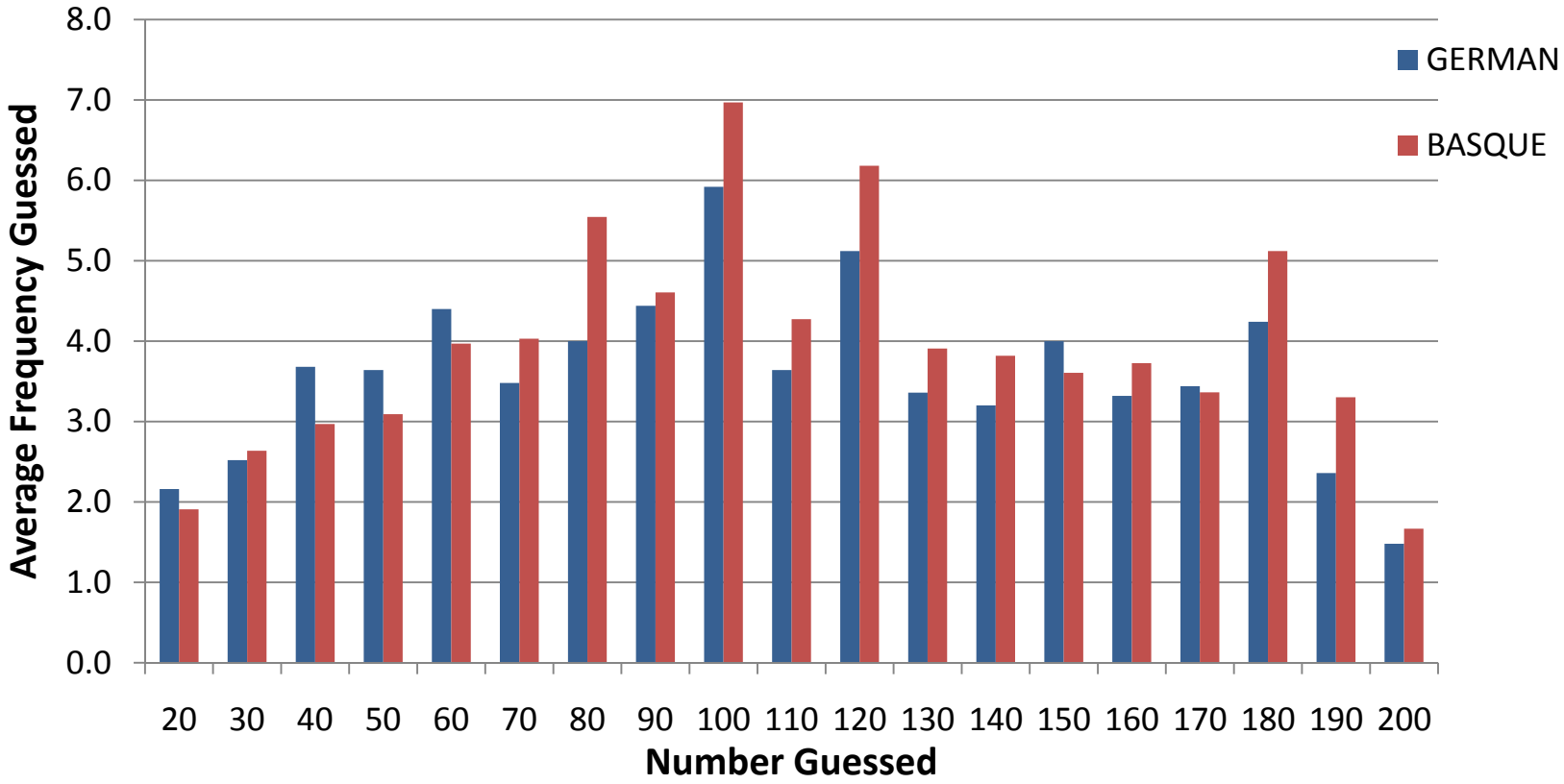
(31) a. $\text{forty}_{10}$ = [35,36,….40,… 43,44]

b. $\text{forty}_{1}$ = [40]

p([35,36, ….50,… 43,44]) > p([40])

# 2. Round Number Effect Language Effects?

- Decimal (e.g. English, German) vs. vigesimal (e.g. Basque) languages?



# 3. *Most* vs. *More than Half*

- Two proportional quantifiers with (superficially) equivalent semantics

(32) a. **Most** Americans support Obama's economic program

b. **More than half of** Americans support Obama's economic program

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(33) $[\![\text{most}]\!] = [\![\text{more than half}]\!] = \lambda X \lambda Y.|X \cap Y| > ½ |X|$

- (32a,b) true iff # of Americans who support Obama's program > ½ total # Americans

# 3. *Most* vs. *More than Half*
# Distinct Interpretation

- *Most* > *more than half*

  (34) Unfortunately, the long term maintenance of the reduced weight is poor, and **more than half, if not most**, of the persons eventually return to their former obese state

- *More than half* has sharp lower bound; *most* does not

  (35) a. **More than half** of the U.S. population is female ✓

  b. **Most** of the U.S. population is female **??**

  – The facts: female 50.7% vs. male 49.3% (U.S. Census Bureau 2008)

# 3. *Most* vs. *More than Half* Corpus Analysis

- Corpus of Contemporary American English (COCA)
  - 400+ million words (20 million/year for 1990-2009)
    - Spoken language
    - Fiction
    - Popular magazines
    - Newspapers
    - Academic texts

# 3. *Most* vs. *More than Half* Corpus Analysis

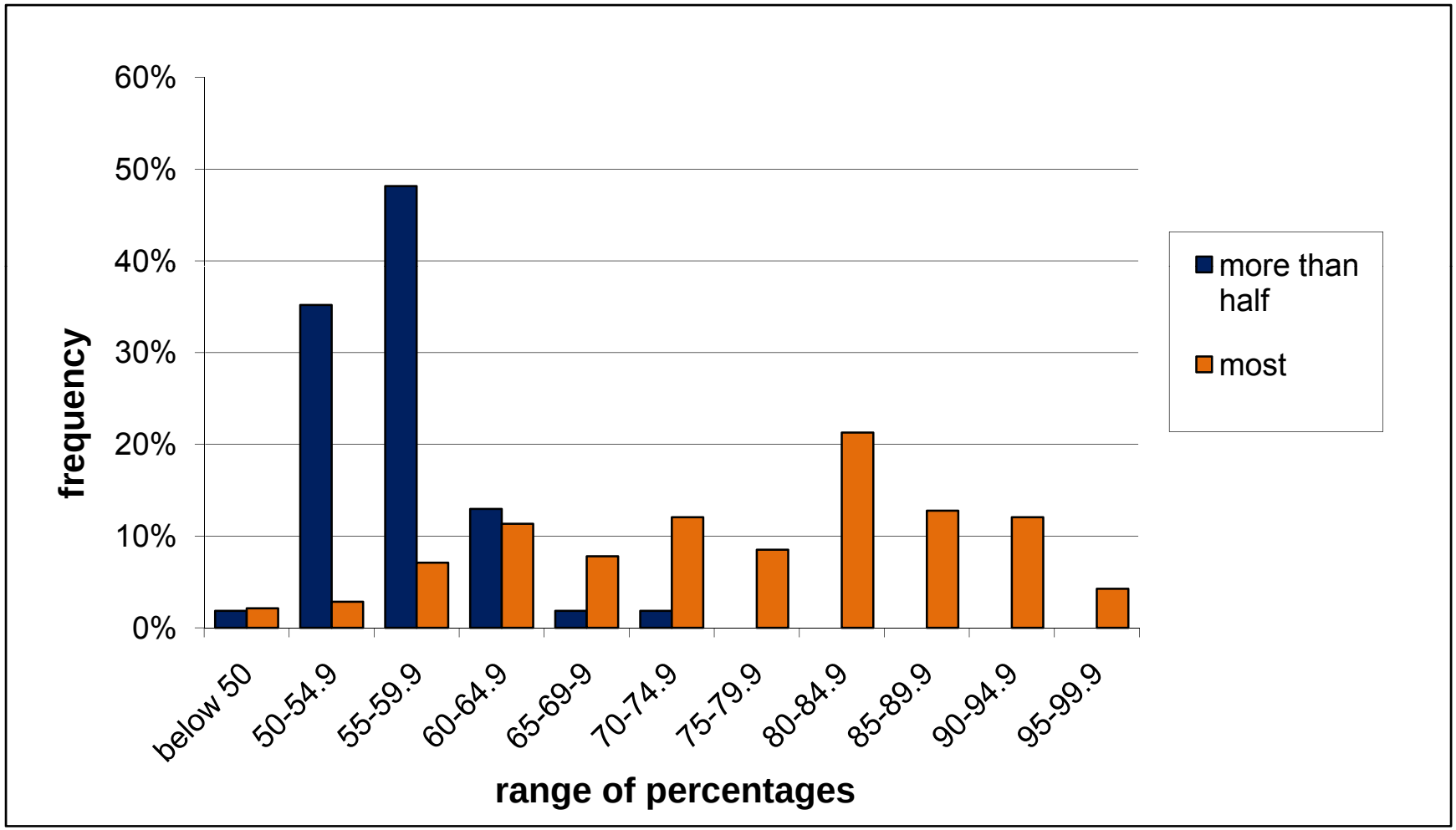
- *Most* > *more than half*

(36) a. The survey showed that **most students (81.5%)** do not use websites for math-related assignments

(*Education*, 129(1), pp. 56-79, 2008)

b. **More than half of respondents (55%)** say that making money is more important now than it was five years ago (*Money*, 21(3), p. 72, 1992)

# 3. *Most* vs. *More than Half*
# Corpus Analysis



# 3. Most vs. More than Half Corpus Analysis

- *Most* + plural generic; *more than half* awkward in similar contexts

(37) a. **Most teens** want to fit in with their peers (*CNN YourHealth*, 31/8/2002)

b. ??**More than half of teens** want to fit in with their peers

- *More than half* + plural relatively rare:

(38) a. **More than half of the doctoral degrees in engineering** awarded by American universities each year go to foreigners. (*Associated Press*, 6/1/2007)

b. **More than half of all farmworkers** earn less than $12,500 annually (*Ms*, 15(2), p. 40, 2005)

# 3. Most vs. More than Half Corpus Analysis

- More than half requires domain that can be individuated/counted

(39) a. But like **most things**, obesity is not spread equally across social classes (*Mens Health*, 23(7), p. 164, 2008)

b. ??But like **more than half of things**, obesity is not spread equally across social classes

- Most combines with vague predicates

(40) a. **Most of our employees** are, like me, ordinarily talented (Fortune, 157(13), p. 129, 2008)

b. ??**More than half of our employees** are, like me, ordinarily talented

# Summary of Corpus Data

- *Most* and *more than half* are used to express distinct ranges of proportions
- *Most* yields a generic interpretation in contexts where *more than half* is infelicitous or has a 'survey results' interpretation
- *More than half* (but not *most*) requires an enumerable domain and a precisely defined predicate
  - ➢ The semantics of *more than half* explicitly references counting/measurement; the semantics of *most* does not

# Proposal

- The distributional and interpretative differences between *most* and *more than half* result from fundamentally different logical forms (cf. Hackl to appear)
- *More than half* expresses a comparison between **numbers or proportions**

(41) $[\![\text{more than half}]\!](F)(G) = 1$ iff $|F \cap G| / |F| > ½$

- *Most* expresses a comparison between **sets**

(42) $[\![\text{most}]\!](F)(G) = 1$ iff $F \cap G$ is larger than $F - G$

# *More than half*

$$[\![\text{more than half}]\!](F)(G) = 1 \text{ iff } |F \cap G| / |F| > ½$$

- Explicitly based on counting → sets must be countable
- The choice of *more than half* implies a scale with higher alternatives to *half*; *more than half* is restricted (by implicature) to values close to half

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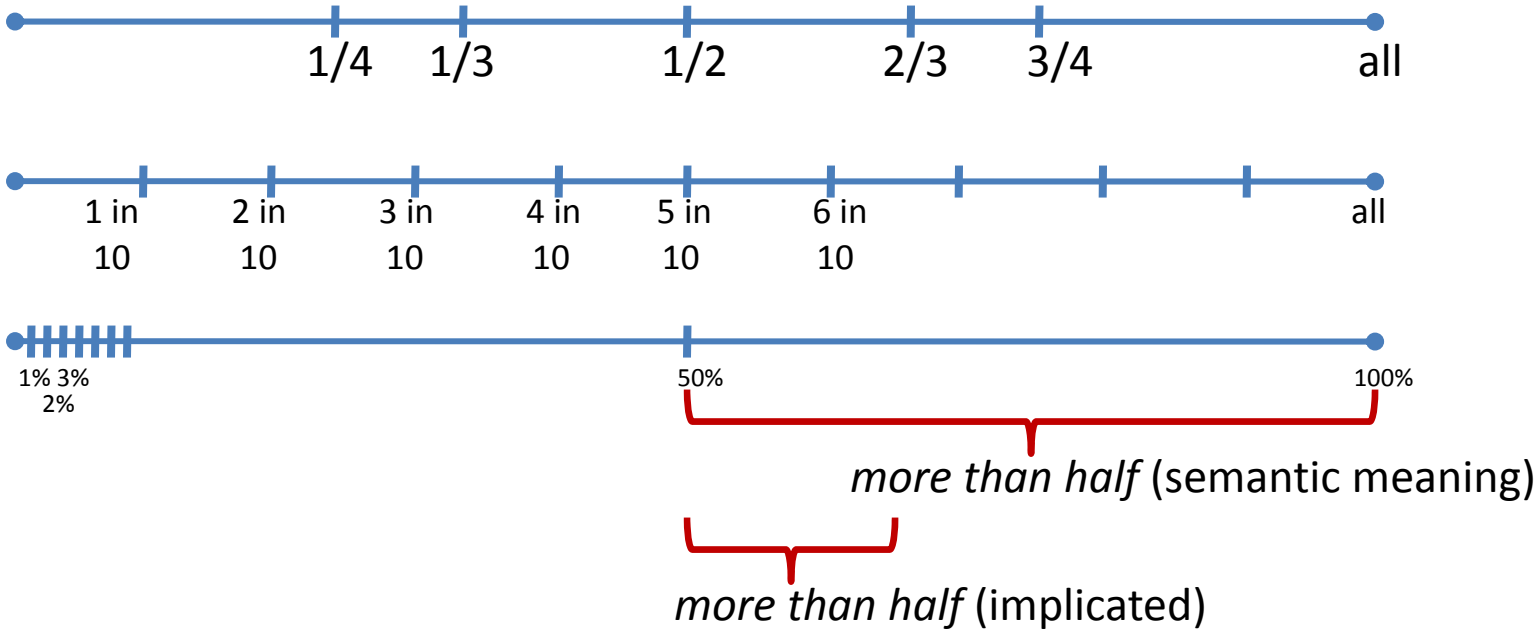

# *Most*

$[\![\text{most}]\!](F)(G) = 1$ iff $F \cap G$ is larger than $F - G$

- Does not explicitly encode degrees/proportions → 'larger' may be assessed via counting or a more approximate mode of comparison
  - Dehaene (1992): in addition to the capacity to represent precise numerosities, humans (and animals) possess a separate system for processing approximate quantities:
    - Involved in estimating and comparing quantities
    - Sensitive to differences in magnitude

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    - Involved in estimating and comparing quantities
    - Sensitive to differences in magnitude
- Does not participate on a scale of proportion, but rather competes with expressions denoting relationships between sets

(43) ***Some…many….most….all***

- Inherently coarse-grained ; *all* as salient alternative

# Degrees and Proportion

- Most → comparison of proportion without encoding degrees
- Parallel to vagueness more broadly?

(44) a. **More than half** of the students are female >50%

b. **Most** of the students are female >>50%

(45) a. Barney is **taller** than the average jockey Height(B) > Avg

b. Barney is **tall** for a jockey Height(B) >> Avg

# Vagueness and Quantity
# Conclusions

- Role of comparison classes (broadly considered)
- Interpretive effect of scale structure
- Imprecision as granularity
- Vagueness without degrees?