

# Linguistic Conditions on Theories of Vagueness

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# Round Numbers and Vagueness

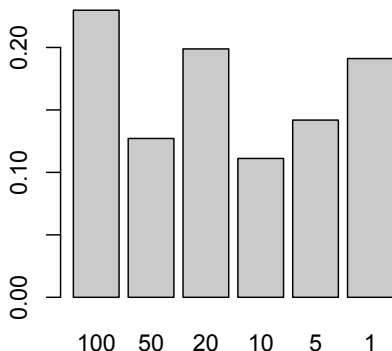
- Sorites, borderline cases
- S. Dehaene: two quantity systems



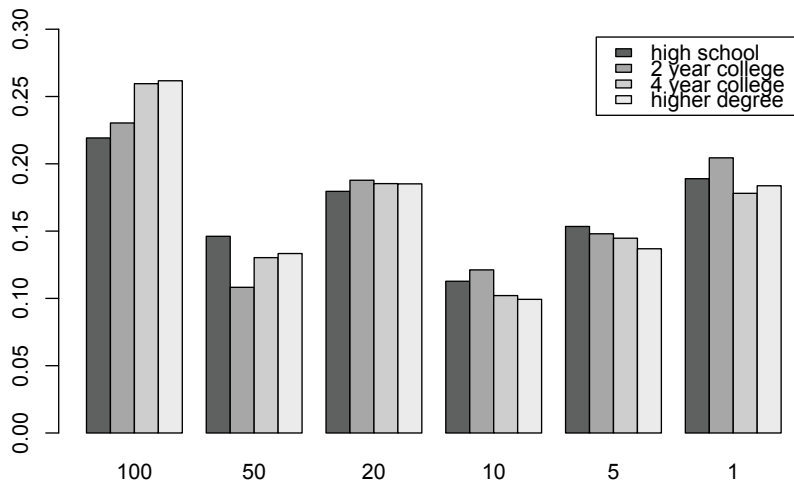
# Use of Round Numbers

- 60 questions about number trivia
- 200 anonymous respondents, some demographic data
- responses consisted just of integer numbers
- window of interest 20-1000
- calculate frequency of greatest divisor

## Frequency of Greatest Divisors

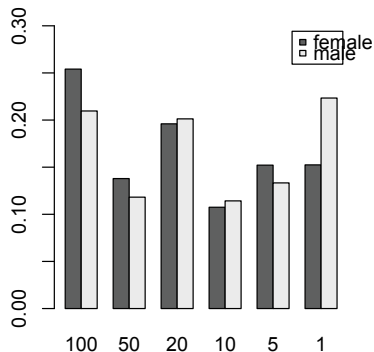


# Comparison by Education Level



# Initial Gender Comparison

- 85 females, 115 males
- median/mean male estimate:  
60/128
- median/mean female estimate:  
70/141
- $p = 0.001037$



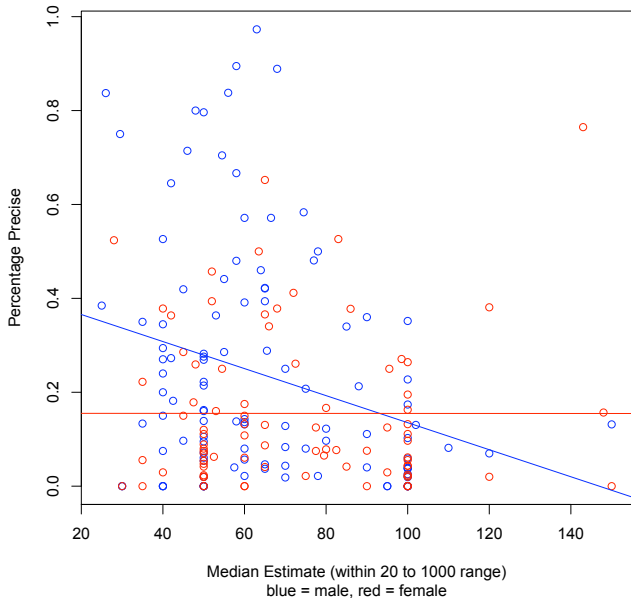
# Questions yielding larger numbers from females

<b>Question</b>	<b>female median</b>	<b>male median</b>	<b>diff.</b>
How many coins in total do you currently	189	81	108
How many times do you cook in a year?	300	200	100
How many times last month did you turn on a faucet or tap?	150	85.5	64.5
How many times have you taken medication?	160	100	60
How many books do you own?	120	62.5	57.5
How many pairs of shoes have you owned in your life?	102.5	50	52.5
How many times do you do laundry in a year?	98	55.5	42.5
How many nights did you sleep badly last	100	58	42
How many times do you do shopping in a year?	91.5	52	39.5
How many trees are there in your neighborhood?	82.5	56	26.5
How many days with sunshine did you have last year?	240	216	24

## Question yielding larger numbers from males

<b>Question</b>	<b>female median</b>	<b>male median</b>	<b>diff.</b>
How many times have you ever gotten a hair cut?	80	200	-120
How many banknotes have you touched this month?	50	100	-50
How many phone numbers have you stored somewhere?	56	100	-44
How many eggs did you eat last year?	71	97	-26
How many times in an average week do you look at a clock or	70	95	-25

## Connection between Subjects' Estimate Size and Precision



### Statistics

median:

$p=0.99785$

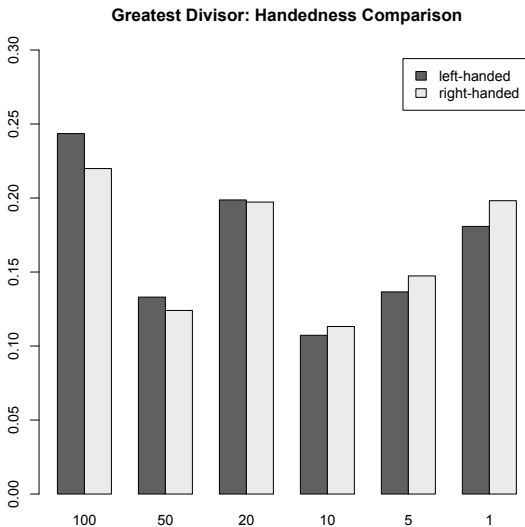
gender:

$p=0.00269$

median  $\times$  gender:

$p=0.01745$

- 114 familially right-handed, 82 familially left-handed, 4 NA
- chi-sq test of greatest divisor  $\geq 20$  vs.  $\leq 10$ :  $p=0.002938$



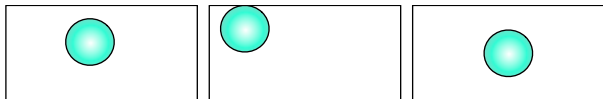
# Compositionality/Truth Functionality

- (1)  $\llbracket \text{Joe is tall.} \rrbracket = 0.5, \llbracket \text{Jane is smart} \rrbracket = 0.5$
- (2) a.  $\llbracket \text{Joe is tall and he isn't tall} \rrbracket \neq \llbracket \text{Joe is tall and Jane is smart} \rrbracket$   
 b.  $\llbracket \text{Jane is smart or she isn't smart} \rrbracket \neq \llbracket \text{Joe is tall or Jane is smart} \rrbracket$

- multivalued logic doesn't work (Kamp 1975)
- vagueness must come after composition, e.g. supervaluations

# Regulating Approximation Compositionally: Sauerland & Stateva 2006, t.a.

- (3) The ball is in the middle of the yard.



Less vague versions:

- (4) a. The ball is exactly in the middle of the yard only in picture C.  
 b. The ball is definitely in the middle of the yard only in picture C.

More vague versions:

- (5) a. The ball is approximately in the middle of the yard.  
 b. The ball is roughly speaking in the middle of the yard.

# Distribution of Sharpeners

- (6)
- a. What John cooked were definitely fifty tapas.
  - b. What John cooked was definitely Beef Stroganoff.
  - c. What John cooked was definitely healthy.
  - d. ??What John cooked was not definitely healthy.
- (7)
- a. What John cooked were exactly fifty tapas.
  - b. #What John cooked was exactly Beef Stroganoff.
  - c. #What John cooked was exactly healthy.
  - d. What John cooked wasn't exactly healthy.

# Distribution of Softeners

- (8)
- a. What John cooked were roughly speaking fifty tapas.
  - b. What John cooked was roughly speaking Beef Stroganoff.
  - c. What John cooked was roughly speaking healthy.
  - d. What John cooked wasn't even roughly speaking healthy.
- (9)
- a. What John cooked were approximately fifty tapas.
  - b. #What John cooked was approximately Beef Stroganoff.
  - c. #What John cooked was approximately healthy.
  - d. What John cooked wasn't even approximately healthy.

# Vagueness vs. Imprecision: Intuition of Pinkal and Kennedy

Imprecision arises with underlyingly precise concepts:

(10) Paris has *10 million* inhabitants.

Vague expressions lack underlying precise concepts:

(11) Paris is a *city*.

Sometimes this is hard to pin down:

- (12)
- a. The shutters are *closed*.
  - b. Sarkozy is *bald*.
  - c. Jonah is *poor*

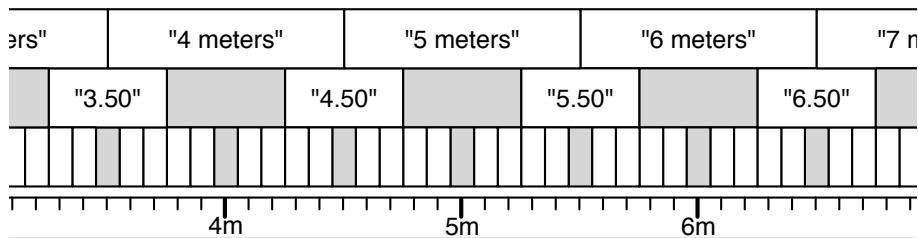
# A Test for Vagueness vs. Imprecision

Claim: *Exactly/absolutely/approximately/...* require imprecision.

- (13)
- a. Paris has exactly 10 million inhabitants.
  - b. #Paris is exactly a city.
  - c. The ball is exactly in the middle of the yard.
  - d. The room is absolutely empty.
  - e. Sarkozy is absolutely bald.
  - f. #Sarkozy is absolutely tall.

# Term-Interval Alignment and Granularity Regulation

Krifka (2007): shortest terms are recursively aligned with biggest intervals not yet named:



- *exactly, absolutely* remove coarse granularities from consideration
- *approximately* removes fine granularities from consideration

## Mid- vs. Endpoint Approximators

A second distinction exists between mid- and endpoint selecting expressions (cf. Kennedy & McNally):

- (14) a. (i) Sharpening granularity, midpoint: *exactly, precisely*  
 (ii) Sharpening granularity, endpoint: *absolutely, completely, perfectly*
- b. (i) Softening granularity, midpoint: *approximately, about*  
 (ii) Softening granularity, endpoint: *partially, sufficiently, roughly*

# Coercion between Approximators

In many cases an endpoint can be coerced into a midpoint:

(15) (Tancredi, p.c.)

- a. The sake cup is completely full.
- b. The sake cup is exactly full.

(16) a. The bottle is roughly empty.  
 b. The bottle is approximately empty.

How to get reliable data?

# Corpus Study on Mid-/Endpoints

Relative frequencies of approximator-adjective strings in the British National Corpus (100 million words)

Values reported are:

$$q = \frac{100\text{mill.} * \text{Freq}(\text{approximator-adjective-digram})}{\text{Freq}(\text{approximator}) * \text{Freq}(\text{adjective})}$$

E.g. *exactly*: 10307 occurrences, *half*: 29003 occurrences, *exactly half*: 27 occurrences

Value in the table:  $q = 9.0$

Interpretation (for small overall frequencies):  $q < 1$  below chance,  $q > 1$  above chance

Regulator	<i>approx.</i>	<i>exac.</i>	<i>preci.ly</i>	<i>compl.ly</i>	<i>absol.ly</i>	<i>parti.ly</i>
Adjective						
<i>true</i>	15.9	2.2	3.3	5.4	42.7	48.2
<i>false</i>	0	0	0	46.8	9.8	0
<i>right</i>	0.8	9.3	2.1	1.7	53.2	1.8
<i>wrong</i>	0	1.9	1.9	48.7	15.9	0
<i>clean</i>	0	0	0	13.4	8.4	0
<i>dirty</i>	0	0	0	0	0	0
<i>wet</i>	0	0	0	9.4	0	0
<i>dry</i>	0	0	0	46.5	0	12.1
<i>complete</i>	0	0	0	0	0	6.2
<i>incomplete</i>	0	0	0	0	0	0
<i>open</i>	0	0	0	8.6	1.8	26.6
<i>closed</i>	0	0	0	11.5	1.9	24.8
<i>satisfac.</i>	0	4.5	0	66.6	16.3	0
<i>unsatisf.</i>	0	0	0	0	0	0
<i>ten</i>	37.8	8.4	1.5	0	0.9	0
<i>half</i>	85.4	9.0	3.0	0	0.6	0

# 'True' Vagueness Regulation

Use of *maybe* and *definitely* without uncertainty about relevant aspects of the world:

- (17) This cone-shaped pile of 17 sand-grains on the table in front of us is maybe/definitely a heap.
- (18) At 210cm, Peter is definitely tall for a soccer player.
- (19) At 190cm, Lionel is maybe tall for a soccer player.

# Vagueness Regulating 'Approximators'

Vagueness regulating approximators can be just epistemic quantifiers, though some are more specialized:

- (20) a. Sharpeners: *definitely, positively, for sure, certainly, ...*  
b. Softeners: *maybe, more or less, -ish, like, ...*

Support for Epistemic Approaches to Vagueness

## Modals as Approximators

Epistemic *must* is not such a good shapener:

- (21) #This cone-shaped pile of 17 sand-grains on the table in front of us  
must be a heap.

The evidential component of *must* – the evidence cannot be direct:

- (22) a. These letters are black.  
b. #These letters must be black.  
c. These letters are definitely black.

When hearers interpretation alone is at stake, (21) improves:

- (23) This cone-shaped pile of 17 sand-grains on the table in front of us  
must be a heap to you.

# Pragmatic Restrictions

Vagueness of an expression can vary:

- (24) a. We need stones, not pebbles, for our catapult.  
 b. I have a stone in my shoe.

Like vagueness, precision is affected by the interests of speaker and hearer.

- (25) Q: When did you get up this morning?  
 A: At 5.  
 A' #At 5:01'32".

- (26) Q: When will the 1 minute lunar eclipse be visible?  
 A: #At midnight.  
 A': At 5:01'32".

# Conclusions

- different concepts of vagueness are needed: imprecision vs. real vagueness
- imprecision always involves real vagueness, too
- composition is problematic for multi-valued approaches to vagueness
- compositional regulation of vagueness further constrains the account of vagueness