Expensive, not expensive or cheap?

An experimental investigation of vague predicates

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Characteristics of vague predicates

- **Borderline cases**

These jeans are **expensive**

- TRUE
- ??
- FALSE

- 120€
- 60€
- 20€
Characteristics of vague predicates

- **Sorites paradox**

  Jeans that cost 100€ are expensive
  Jeans that cost 0,10€ less than an expensive pair of jeans are expensive

  Jeans that cost 5€ are expensive
Theories of vagueness

- Truth value gap/3-valued logic (Tye 1994)
- Truth value glut (Hyde 1997)
- Fuzzy logic (Goguen 1969)
- Supervaluationism (Fine 1975; Kamp 1975)
- Epistemicism (Williamson 1994)
- Contextualism (Raffman 1996, ms.; Fara 2000)
Theories of vagueness

*These jeans are expensive*

<table>
<thead>
<tr>
<th>Theory</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Truth value gap:</td>
<td>Neither true nor false</td>
</tr>
<tr>
<td>Truth value glut:</td>
<td>Both true and false</td>
</tr>
<tr>
<td>Fuzzy logic:</td>
<td>Partially true</td>
</tr>
<tr>
<td></td>
<td>- true to degree $n$ for $0 &lt; n &lt; 1$</td>
</tr>
<tr>
<td>Supervaluationist:</td>
<td>Neither true nor false</td>
</tr>
<tr>
<td></td>
<td>- true in some completions of the model, false in others</td>
</tr>
<tr>
<td>Epistemic:</td>
<td>Either true or false, but we don’t (can’t) know which</td>
</tr>
<tr>
<td>Contextualist:</td>
<td>It depends on which definition of <em>tall</em> we use</td>
</tr>
</tbody>
</table>
Experimental Approaches
Bonini et al. (1999)

Method
• Questionnaire based:

  When is it true to say a man is tall? ...

  ...Please indicate smallest height that in your opinion makes it true to say that a man is ‘tall’

  ... Please indicate the greatest height that in your opinion makes it false to say that a man is ‘tall’.

Findings
• Gap between positive & negative extensions of gradable terms
• Parallel to gap around definite but unknown value
  ➢ Taken to support epistemic view
Experimental Approaches
Raffman (ms.)

Method
• Judging of dynamic Sorites series of color chips
  – Blue, green or ??
• Multiple orders: blue $\rightarrow$ green, green $\rightarrow$ blue, random, 'reversal'

Findings
• Location of boundaries varied with order of exposure
• Hysteresis effects in 'reversal' condition
  ➢ Taken to support contextualist position
Experimental Approaches

Issues

**Methodological limitations**
- Questionnaire-based approach
  - ‘Dangerous’ city [annual #violent crimes/‘000 inhabitants]
- Narrow focus: color words
  - Perceptual
  - P / Q versus P / ¬P

**Missing link**
- Relation of gradable adjective (*tall*) to antonym (*short*)
  - Typically regarded as contraries (Cruse 1986)
  - But some theories of vague predicates (e.g. Klein 1980) equate negation of positive adjective (*not tall*) to antonym (*short*)
Research Objectives

The objective of the present research is to strengthen the empirical base against which theories of vagueness can be assessed, by profiling speakers’ interpretations of vague gradable adjectives.

Specifically:

- Do speakers allow **gap** between positive and negative extensions of vague gradable adjectives?
  - e.g. between *large* and *not large*
- Do they do so consciously?
- What is the relationship between the negation of a term and its antonym?
  - e.g. *not large* vs. *small*
Experiment 1 - Method

• Stimuli based on gradable adjectives (in German):
  3 adjectives:
  • groß, teuer and weit (large, expensive, far)
  their negations
  their antonyms

• Adjectives were presented in a sentence context
• Sentence were paired with set of pictures (Sorites series)
• **Task:** Which pictures can be described by the sentence?
• Two conditions:
  **Condition 1:** adjective vs. negation (e.g. teuer vs. nicht teuer)
  **Condition 2:** adjective vs. antonym (e.g. teuer vs. billig)
# Stimuli

<table>
<thead>
<tr>
<th>Adjective</th>
<th>Sentence</th>
<th>Pictures</th>
</tr>
</thead>
<tbody>
<tr>
<td>groß (large)</td>
<td>Der Koffer ist groß ...nicht groß ...klein</td>
<td>Series of 27 pictures (small to large suitcase)</td>
</tr>
<tr>
<td>teuer (expensive)</td>
<td>Die Jeans ist teuer ...nicht teuer ...billig</td>
<td>Series of 41 pictures (20 - 100€; 2€ increments)</td>
</tr>
<tr>
<td>weit (far)</td>
<td>Das Haus von Susis Mutter ist weit weg von Berlin ...nicht weit weg von Berlin ...nahe Berlin</td>
<td>Series of 27 pictures (varied distance house to Berlin)</td>
</tr>
</tbody>
</table>
Der Koffer ist groß
Participants

**Condition 1**
14 Humboldt University students
All female
Studies: French/Spanish/Italian
21 years old on average

**Condition 2**
17 Humboldt University students
14 female, 3 male
Studies: French/Spanish/Italian
26 years old on average
Procedure

- Paper and pencil task, administered in groups
  Sentence projected on screen
  Respondent checks pictures on worksheet
- **8 trials (sentence + picture series):**
  6 experimental items
  - 3 adjectives
  - 2 trials/adjective (adjective vs. antonym/negation)
  1 warm-up/1 distractor
Results - Condition 1:
# of pictures classified as adjective, not adjective and neither (gap)

Group 1

<table>
<thead>
<tr>
<th>Word</th>
<th>adjective</th>
<th>gap</th>
<th>not adjective</th>
</tr>
</thead>
<tbody>
<tr>
<td>expensive</td>
<td>20</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>far</td>
<td>15</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>large</td>
<td>10</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>
Frequency Distribution

# of participants who left a gap

Frequency Distribution

<table>
<thead>
<tr>
<th>Number of Participants</th>
<th>Gap</th>
<th>No Gap</th>
<th>Overlap</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>18</td>
<td>14</td>
<td>18</td>
</tr>
</tbody>
</table>

Legend:
- große
- teuer
- weit
Results - Condition 2

# of pictures classified as adjective, antonym and neither (gap)

**Group 2**

<table>
<thead>
<tr>
<th>Word</th>
<th>adjective</th>
<th>gap</th>
<th>antonym</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>expensive</td>
<td>20</td>
<td>10</td>
<td>5</td>
<td>35</td>
</tr>
<tr>
<td>far</td>
<td>15</td>
<td>5</td>
<td>5</td>
<td>25</td>
</tr>
<tr>
<td>large</td>
<td>10</td>
<td>10</td>
<td>5</td>
<td>25</td>
</tr>
</tbody>
</table>

Values: 40, 35, 40
Comparison of Conditions

<table>
<thead>
<tr>
<th>Size of Gap (on average)</th>
</tr>
</thead>
<tbody>
<tr>
<td>group 1 (adj/neg)</td>
</tr>
<tr>
<td>group 2 (adj/antonym)</td>
</tr>
</tbody>
</table>
Individual Comparison

Size of Gap (on average)

<table>
<thead>
<tr>
<th></th>
<th>expensive</th>
<th>far</th>
<th>large</th>
</tr>
</thead>
<tbody>
<tr>
<td>group 1 (adj/neg)</td>
<td>9,1</td>
<td>3,0</td>
<td>5,9</td>
</tr>
<tr>
<td>group 2 (adj/ant)</td>
<td>12,6</td>
<td>6,6</td>
<td>8,2</td>
</tr>
</tbody>
</table>
Statistical Testing

One-way ANOVA: 2 conditions (3 stimuli)
• Difference between conditions (means): $F(1,85)=7.62$, $p<0.01^*$

Post-hoc Analysis (pairwise t-Tests)
• Large: $p=0.18$
• Expensive: $p=0.16$
• Far: $p=0.03^*$
Experiment 2 (preliminary)

- Do speakers acknowledge a gap...
  - when asked to judge positive and negative extensions at once?
Method

• Revised version of the first experiment
  4 adjectives:
    teuer, groß, weit, heiß
  their negations
  • Participants judged positive and negative sentences on one set of pictures

Participants
6 Participants
3 female, 3 male
32 years old on average
Procedure

- Paper and pencil task, conducted in person
- 6 trials (sentences + picture series):
  4 experimental items
  4 adjectives
  1 trial/adjective (adjective vs. negation)

Order

- warmup
- 2 test items
- distractor
- 2 test items
Results - Experiment 2

Experiment 2

<table>
<thead>
<tr>
<th>Stimulus (Adjective)</th>
<th>Items (pictures)</th>
</tr>
</thead>
<tbody>
<tr>
<td>expensive</td>
<td>adjective: 30</td>
</tr>
<tr>
<td></td>
<td>gap: 5</td>
</tr>
<tr>
<td></td>
<td>not adjective: 10</td>
</tr>
<tr>
<td>large</td>
<td>adjective: 25</td>
</tr>
<tr>
<td></td>
<td>gap: 5</td>
</tr>
<tr>
<td></td>
<td>not adjective: 10</td>
</tr>
<tr>
<td>far</td>
<td>adjective: 25</td>
</tr>
<tr>
<td></td>
<td>gap: 5</td>
</tr>
<tr>
<td></td>
<td>not adjective: 10</td>
</tr>
<tr>
<td>hot</td>
<td>adjective: 40</td>
</tr>
<tr>
<td></td>
<td>gap: 5</td>
</tr>
<tr>
<td></td>
<td>not adjective: 15</td>
</tr>
</tbody>
</table>

Legend:
- adjective
- gap
- not adjective
Summary of Findings

• Respondents leave a gap: neither adjective nor its negation are applied to borderline individuals
  • Participants acknowledge gap when judging adjective and its negation at once

• Gap between adjective and its antonym is significantly larger than that between adjective and its negation
## Discussion

• Relative to theories of vagueness

<table>
<thead>
<tr>
<th>For a vague predicate P...</th>
<th>TV Gap</th>
<th>TV Glut</th>
<th>Fuzzy Logic</th>
<th>Supervaluation</th>
<th>Epistemic</th>
<th>Contextualist</th>
</tr>
</thead>
<tbody>
<tr>
<td>...speakers judge some entities as neither P nor ¬P</td>
<td>✓</td>
<td>✗</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>...speakers do so consciously (no evidence of commitment to bivalence/excluded middle)</td>
<td>✓</td>
<td>✗</td>
<td>✓?</td>
<td>✓?</td>
<td>✓??</td>
<td>✓?</td>
</tr>
</tbody>
</table>

- What does task measure? Judgments of truth value? Or something else?
## Discussion

- **Differential predictions?**

<table>
<thead>
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<th>Supervaluation</th>
<th>Epistemic</th>
<th>Contextualist</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compex sentences:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>for individual in ‘gap’,</td>
<td></td>
<td></td>
<td><img src="%E2%9C%93" alt="Checkmark" /></td>
<td><img src="%E2%9C%93" alt="Checkmark" /></td>
<td><img src="?" alt="Question" /></td>
</tr>
<tr>
<td>$P \lor \neg P$ accepted</td>
<td><img src="?" alt="Question" /></td>
<td><img src="?" alt="Question" /></td>
<td><img src="%E2%9C%93" alt="Checkmark" /></td>
<td><img src="%E2%9C%93" alt="Checkmark" /></td>
<td><img src="?" alt="Question" /></td>
</tr>
<tr>
<td>Reaction time:</td>
<td></td>
<td></td>
<td><img src="%E2%9C%93" alt="Checkmark" /></td>
<td><img src="%E2%9C%93" alt="Checkmark" /></td>
<td><img src="%E2%9C%93" alt="Checkmark" /></td>
</tr>
<tr>
<td>borderline individuals</td>
<td></td>
<td><img src="%E2%9C%93" alt="Checkmark" /></td>
<td><img src="%E2%9C%93" alt="Checkmark" /></td>
<td><img src="%E2%9C%93" alt="Checkmark" /></td>
<td><img src="%E2%9C%93" alt="Checkmark" /></td>
</tr>
<tr>
<td>take longer to judge</td>
<td><img src="?" alt="Question" /></td>
<td><img src="%E2%9C%93" alt="Checkmark" /></td>
<td><img src="%E2%9C%93" alt="Checkmark" /></td>
<td><img src="%E2%9C%93" alt="Checkmark" /></td>
<td><img src="%E2%9C%93" alt="Checkmark" /></td>
</tr>
<tr>
<td>Dynamic approach:</td>
<td><img src="??" alt="Question" /></td>
<td><img src="?" alt="Question" /></td>
<td><img src="??" alt="Question" /></td>
<td><img src="?" alt="Question" /></td>
<td><img src="%E2%9C%93" alt="Checkmark" /></td>
</tr>
<tr>
<td>boundaries for $P$ and $\neg P$ vary with order of exposure, etc.</td>
<td><img src="??" alt="Question" /></td>
<td><img src="?" alt="Question" /></td>
<td><img src="??" alt="Question" /></td>
<td><img src="?" alt="Question" /></td>
<td><img src="%E2%9C%93" alt="Checkmark" /></td>
</tr>
</tbody>
</table>

**Other??**
Discussion

- Relationship of negation of adjective to antonym?
  - Not treated as equivalent by speakers
  - But difference smaller than might be expected
    - Most of ‘gap’ between adjective and antonym is already present between adjective and its negation
  - How to characterize formally?
Thank You!
Acknowledgment

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