Multidimensional adjectives, A corpus-based study

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**Adjectives: A respect argument**

It can be saturated:
1) Tweety is healthy *with respect to* blood pressure

It can be bound:
2) Tweety is healthy *in every / some / most* respect(s)

It can be implicitly saturated / bound:
3) Tweety is *healthy*

\[\Rightarrow\] Adjectival dimensions function as categorization criteria.
Adjectives: A respect argument

It can be saturated:
1) Tweety is healthy with respect to blood pressure
   #a bird with respect to size/ flying

It can be bound:
2) Tweety is healthy in every / some / most respect(s)
   #a bird in every / some / most respects / #generally a bird

It can be implicitly saturated / bound:
3) Tweety is healthy

⇒ Adjectival dimensions function as categorization criteria. Nominal ones don’t!
Nominal concepts are mean-based (1/2)

Murphy 2002; Hampton 1998; Cognitive linguists (Lakoff 1987):

An entity is classified as a bird iff (roughly) its mean degree in the dimensions of bird, small size, flying, perching, etc. (or of some bird exemplar) exceeds the standard.
Nominal concepts are mean-based (2/2)

The dimensions are not necessary conditions for membership. Only the mean in the dimension counts.
Are adjectives mean-based? (1/2)

Context:

Entities' degrees in the health dimensions

- **Health**: is measured by bp, pulse and sugar
- **Dan**: is maximally healthy wrt bp and pulse, but not in the norm wrt sugar
- **Sam**: 's degrees are all in the normative range, yet the lowest possible
- (Dan's **mean** is higher than Sam’s – 37 vs. 30).
Are adjectives mean based? (2/2)

Intuition: Sam is healthy and Dan is sick;
So Sam is healthier (although Dan’s mean is higher)

It is not the case that we compare Sam's mean in the dimensions to Dan's mean.
Had we done that, we would have judged Dan to be healthier than Sam.

NO!
Transformation operations

Context: We discover that birdhood depends on ten genes (categorization criteria):

Tan is a bird wrt to gene 1-6 but not a bird wrt genes 7-10

V
Conclusions

- The Adjectival / Nominal distinction is a cue for selecting processing type (dimension-set type)

- The cue can be ‘overridden’: Nouns can ‘turn’ into adjectives, and v.v.
Accommodation
Adjectives - as a case study

How can we tell how to interpret:

Dan is healthy
Mary is intelligent

∀ / ∈ ??
I. Conjunctive Adjectives

(normal, typical, healthy, familiar, conservative…)

Entities must reach the standard in all the dimensions.

Intuition: If one is healthy in every respect except she has the flu, strictly speaking, she is *not healthy*.
Conjunctive Adjectives

(normal, typical, healthy, familiar):

\[
[[\text{Dan is healthy}]]_c = 1 \quad \forall Q \in \text{PREDICATE}, \ Q \text{ is a respect of } \text{healthy} \text{ in } c, \quad [[\text{Dan is } Q]]_c = 1
\]

(Dan is healthy wrt all healthy’s dimensions in c: \(bp \text{ and pulse and sugar}\))

The default interpretation involves (implicit) universal quantification on dimensions.
My proposal (3/4)

II. Disjunctive Adjectives
(bad, sick, atypical, abnormal, different, innovative…)

Entities must reach the standard in but one dimension.

Intuition: Entities that violate some health dimension in a context are considered sick.
My proposal (4/4)

Disjunctive Adjectives
(bad, sick, atypical, abnormal)

\([\text{[[Dan is sick]]}_c = 1 \text{ iff } \exists Q \in \text{PREDICATE}, Q \text{ is a respect of } \text{sick} \text{ in } c, [\text{[[Dan is Q]]}_c = 1}\]

(Dan is sick wrt some dimension of sick in c: \text{bp} \text{ or pulse or sugar})
Exception phrases

Only universal quantification licenses exception phrases:

(1) *Everybody except for Dan is singing*
(2) *Nobody except for Dan is singing*
(3) *Somebody except for Dan is singing*
Prediction 1

*Except-phrases* can operate on the dimension-set of an adjective, as in *healthy except for bp*, but:

This is more likely to happen in *conjunctive adjectives* than in *disjunctive ones*.

In disjunctives this requires accommodating a non-default universal quantifier (as in *sick in every respect except bp*).
Fact 1

Dimension-set readings are felicitous only with conjunctive adjectives:

(1)  I am a 64-year-old man, healthy except for high bp
(2)#  … sick except for (normative) bp

[[Dan is healthy except wrt bp]]_c = 1 iff
  \forall Q \in \text{PREDICATE}, Q \neq \text{bp}, Q \text{ is a respect of } healthy \text{ in } c:
  [[Dan is Q]]_c = 1
(Dan is healthy wrt every dimension except bp in c)
Negation

On my proposal:

A negated conj. adjective (like not healthy) denotes the entities that fail to fall under some ‘healthy' dimension.

\[
[[\text{Dan is not healthy}]]_c = 1 \iff \\
\neg \forall Q \in \text{PREDICATE}, Q \text{ is a respect of healthy in } c, [[\text{Dan is } Q]]_c = 1 \iff \\
\exists Q \in \text{PREDICATE}, Q \text{ is a respect of healthy in } c, [[\text{Dan is } Q]]_c \neq 1
\]

(Dan is not healthy wrt some dimension in c)

A negated disj. adjective (like not sick) denotes the entities that fall under no 'sick' dimension.

\[
[[\text{Dan is not sick}]]_c = 1 \iff \\
\neg \exists Q \in \text{PREDICATE}, Q \text{ is a respect of sick in } c, [[\text{Dan is } Q]]_c = 1 \iff \\
\forall Q \in \text{PREDICATE}, Q \text{ is a respect of sick in } c, [[\text{Dan is } Q]]_c \neq 1
\]

(Dan is sick wrt no dimension in c)
Prediction 2

Under negation ‘except’ is likely to operate on the dimension -set of disjunctive, not conjunctive, adjectives:
Fact 2

Dimension-set readings are felicitous only with negated disjunctive adjectives:

(1) # They are not healthy, except for (normative) bp
(2) They are not sick, except for high bp

[[Dan is not sick except wrt bp]]_c = 1 iff

\[\forall Q \in \text{PREDICATE}, Q \neq \text{bp}, Q \text{ is a respect of } \text{sick} \text{ in } c,\]

[[Dan is Q]]_c \neq 1

(Dan is sick wrt no dimension except bp in c)
A corpus-based study (1/10)

Method:
1. Count the different uses of ‘except’ with conj. / disj. adjectives in the first ~70 Google results with each.
2. Exclude uses with explicit universal quantification:

1) *Everything normal except for high bp*
2) *Nothing abnormal except for high bp*
3) *Little abnormal except for high bp*
4) *The tests appeared normal except for high bp*
5) *Totally healthy except for failing eyesight*
6) *Completely healthy except for failing eyesight*
7) *Absolutely healthy except for failing eyesight*
8) *Otherwise healthy except for failing eyesight*
9) *All in all healthy, except for failing eyesight*
3. Ignore non dimension-set uses of ‘except’:

- **Quantification over entities, events, time points, etc.:**
  - *Everyone's been sick (except me--ha!) …*
  - *Never been sick (except a cold last year)*

- **Mitigation:**
  - *I was off sick, except I was only half sick; the rest was tiredness*

- **A different clause:**
  - *One would never know I was sick. Except for being bald, I look …*
A corpus-based study (4/10)

Predictions about the number of dimension-set uses:

   (Dan is healthy except for bp)
   Many
   (Dan is not healthy except for bp)
   Few

   (Dan is not sick except for bp)
   Many
   (Dan is sick except for bp)
   Few
A corpus-based study (9/10)

Predictions about the number of dimension set uses:

1. **Conj. Adj.**  
   (healthy except for bp)  
   **Many**  
   183  
   (+99%)  
   **Negated Conj.**  
   (not healthy except for bp)  
   **Few**  
   1  
   (~1%)  

2. **Negated Disj. Adj.**  
   (not sick except for bp)  
   **Many**  
   42  
   (75%)  
   **Disj. Adj.**  
   (sick except for bp)  
   **Few**  
   14  
   (25%)
A corpus-based study (10/10)

The results with 14 adjectives (7 disj., 7 conj.)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(~99%)</td>
<td></td>
<td>(~1%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(75%)</td>
<td></td>
<td>(25%)</td>
</tr>
</tbody>
</table>
However, negated forms are scarce in natural use!

Few negated ‘conjunctive’ adjectives

⇒

Few/no dimension-set readings with them
## Controlling for Frequency

<table>
<thead>
<tr>
<th>Conjunctives</th>
<th>Frequency</th>
<th>Dimension set uses</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ADJ</td>
<td>NEG-ADJ</td>
<td></td>
</tr>
<tr>
<td>healthy</td>
<td>230,000,000</td>
<td>2,360,000</td>
<td>48</td>
</tr>
<tr>
<td>typical</td>
<td>167,000,000</td>
<td>2,820,000</td>
<td>31</td>
</tr>
<tr>
<td>normal</td>
<td>895,000,000</td>
<td>4,820,000</td>
<td>46</td>
</tr>
<tr>
<td>identical</td>
<td>76,500,000</td>
<td>3,820,000</td>
<td>60</td>
</tr>
<tr>
<td>familiar</td>
<td>188,000,000</td>
<td>11,400,000</td>
<td>28</td>
</tr>
<tr>
<td>unfamiliar</td>
<td>17,100,000</td>
<td>161,000</td>
<td>20</td>
</tr>
<tr>
<td>healthier</td>
<td>24,900,000</td>
<td>19,000</td>
<td>14</td>
</tr>
<tr>
<td>sick</td>
<td>1,880,000</td>
<td>3,010</td>
<td>11</td>
</tr>
<tr>
<td>better</td>
<td>1,270,000,000</td>
<td>7,640,000</td>
<td>7</td>
</tr>
<tr>
<td>worse</td>
<td>160,000,000</td>
<td>1,100,000</td>
<td>48</td>
</tr>
<tr>
<td>similar</td>
<td>803,000,000</td>
<td>917,000</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Disjunctives</th>
<th>Frequency</th>
<th>Dimension set uses</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ADJ</td>
<td>NEG-ADJ</td>
<td></td>
</tr>
<tr>
<td>sick</td>
<td>170,000,000</td>
<td>1,420,000</td>
<td>1</td>
</tr>
<tr>
<td>atypical</td>
<td>7,900,000</td>
<td>108,000</td>
<td>8</td>
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<tr>
<td>abnormal</td>
<td>32,000,000</td>
<td>140,000</td>
<td>2</td>
</tr>
<tr>
<td>different</td>
<td>1,080,000,000</td>
<td>4,220,000</td>
<td>3</td>
</tr>
<tr>
<td>innovative</td>
<td>162,000,000</td>
<td>170,000</td>
<td>0</td>
</tr>
<tr>
<td>bad</td>
<td>1,010,000,000</td>
<td>58,000,000</td>
<td>19</td>
</tr>
<tr>
<td>dissimilar</td>
<td>5,090,000</td>
<td>531,000</td>
<td>31</td>
</tr>
</tbody>
</table>
Study II (1/8)

18 adjectives

~100 counts for each

Separately searching for negated forms, e.g.
not P except
hardly P except
doesn’t seem to be P except…

Comparing “the likelihood of a dimension-set reading” in non-negated uses versus negated uses
Study II (2/8)

Predictions about **Conjunctive adjectives**:

<table>
<thead>
<tr>
<th>Non-negated dimension - set uses</th>
<th>Non-negated uses</th>
<th>(2-3 times higher than)</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ ] Non-negated uses</td>
<td>&lt;br&gt; &lt;br&gt;</td>
<td>[ ] Negated uses</td>
</tr>
<tr>
<td>[ ] Negated dimension - set uses</td>
<td>[ ] Negated uses</td>
<td>[ ] Negated uses</td>
</tr>
</tbody>
</table>
Study II (3/8)

Predictions about Disjunctive adjectives:

| Non - negated dimension - set uses |
| Non - negated uses |
| (2-3 times Lower than) |

| Negated dimension - set uses |
| Negated uses |

‘P except for Dim’

‘not P except Dim’

‘not P except ’
The likelihood of dimension-set readings in exception phrases with disjunctive adjectives is ~3-16 times higher when they are **negated** than when they are non-negated.

<table>
<thead>
<tr>
<th>Disjunctive adjectives</th>
<th>Non-negated</th>
<th>Negated</th>
<th>Ratio</th>
<th>Both</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>P Except Dim P except</td>
<td>Neg P Except Dim Neg P except</td>
<td>Negated Non-negated</td>
<td>(Neg) P Except Dim (Neg) P except</td>
</tr>
<tr>
<td><strong>Bad</strong></td>
<td>0.03</td>
<td>0.55</td>
<td>16.5</td>
<td>0.33</td>
</tr>
<tr>
<td><strong>Sick</strong></td>
<td>0.02</td>
<td>0.26</td>
<td>10.8</td>
<td>0.10</td>
</tr>
<tr>
<td><strong>Atypical</strong></td>
<td>0.19</td>
<td>0.68</td>
<td>3.51</td>
<td>0.38</td>
</tr>
<tr>
<td><strong>Abnormal</strong></td>
<td>0.06</td>
<td>0.20</td>
<td>3.35</td>
<td>0.15</td>
</tr>
<tr>
<td><strong>Different</strong></td>
<td>0.13</td>
<td>0.40</td>
<td>3.04</td>
<td>0.28</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>0.09</strong></td>
<td><strong>0.42</strong></td>
<td><strong>7.44</strong></td>
<td><strong>0.25</strong></td>
</tr>
</tbody>
</table>
Study II (5/8)
The likelihood of dimension-set readings in exception phrases with conjunctive adjectives is ~4-7 times higher when they are non-negated than when they are negated.

<table>
<thead>
<tr>
<th>Conjunctive adjectives</th>
<th>Non-negated</th>
<th>Negated</th>
<th>Ratio</th>
<th>Both</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>P Except Dim</td>
<td>Neg P Except Dim</td>
<td>Non-negated Negated</td>
<td>(Neg) P Except Dim</td>
</tr>
<tr>
<td>Normal</td>
<td>0.69</td>
<td>0.10</td>
<td>6.87</td>
<td>0.51</td>
</tr>
<tr>
<td>Typical</td>
<td>0.54</td>
<td>0.09</td>
<td>6.12</td>
<td>0.41</td>
</tr>
<tr>
<td>Healthy</td>
<td>0.54</td>
<td>0.11</td>
<td>4.84</td>
<td>0.34</td>
</tr>
<tr>
<td>familiar</td>
<td>0.45</td>
<td>0.09</td>
<td>4.82</td>
<td>0.33</td>
</tr>
<tr>
<td>Healthier</td>
<td>0.35</td>
<td>0.09</td>
<td>3.85</td>
<td>0.31</td>
</tr>
<tr>
<td>Average</td>
<td><strong>0.51</strong></td>
<td><strong>0.10</strong></td>
<td><strong>5.30</strong></td>
<td><strong>0.38</strong></td>
</tr>
</tbody>
</table>
Study II (6/8)

The likelihood of dimension-set uses with **Conjunctives**:

- **Non-negated**: ~4-7 times higher than
  - `(healthy except for bp)`
- **Negated**:  
  - `(not healthy except for bp)`

The likelihood of dimension-set uses with **Disjunctives**:

- **Negated**: ~3-16 times higher than
  - `(not sick except for bp)`
- **Non-negated**:  
  - `(sick except for bp)`
**Study II (7/8) A third set?!**

The **likelihood of dimension-set readings** in exception phrases with **mixed adjectives** is **roughly the same** when they are negated and non-negated.

<table>
<thead>
<tr>
<th>Mixed adjectives</th>
<th>Non-negated</th>
<th>Negated</th>
<th>Ratio Non-negated</th>
<th>Ratio Negated</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>P Except Dim</td>
<td>Neg P Except Dim</td>
<td>Neg P except</td>
<td></td>
</tr>
<tr>
<td><strong>Unfamiliar</strong></td>
<td>0.15</td>
<td>0.27</td>
<td>1.81</td>
<td></td>
</tr>
<tr>
<td><strong>Worse</strong></td>
<td>0.20</td>
<td>0.32</td>
<td>1.62</td>
<td></td>
</tr>
<tr>
<td><strong>Dissimilar</strong></td>
<td>0.58</td>
<td>0.83</td>
<td>1.44</td>
<td></td>
</tr>
<tr>
<td><strong>Intelligent</strong></td>
<td>0.37</td>
<td>0.41</td>
<td>1.10</td>
<td></td>
</tr>
<tr>
<td><strong>Better</strong></td>
<td>0.25</td>
<td>0.25</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Good</strong></td>
<td>0.24</td>
<td>0.21</td>
<td>1.14</td>
<td></td>
</tr>
<tr>
<td><strong>Similar</strong></td>
<td>0.80</td>
<td>0.67</td>
<td>1.20</td>
<td></td>
</tr>
<tr>
<td><strong>identical</strong></td>
<td>0.86</td>
<td>0.49</td>
<td>1.75</td>
<td></td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td>0.09</td>
<td>0.42</td>
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**Study II** (7/8)  A third set?!

The **likelihood of dimension-set readings** in exception phrases with **mixed adjectives** is roughly the same when they are negated and non-negated.

<table>
<thead>
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<th>Negated</th>
<th>Both</th>
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<td>P Except Dim</td>
<td>Neg P Except Dim</td>
<td>Neg P Except Dim</td>
</tr>
<tr>
<td><strong>Unfamiliar</strong></td>
<td>0.15</td>
<td>1.81</td>
<td>1.10</td>
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<td>0.25</td>
<td>1.44</td>
<td>1.10</td>
</tr>
<tr>
<td><strong>Similar</strong></td>
<td>0.24</td>
<td>1.14</td>
<td>1.10</td>
</tr>
<tr>
<td><strong>Identical</strong></td>
<td>0.80</td>
<td>1.20</td>
<td>1.10</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td>0.86</td>
<td>1.75</td>
<td>1.10</td>
</tr>
</tbody>
</table>

**Many dimension set readings; Indeterminate quantifier force**
The likelihood of a dimension-set reading in exception phrases with non-negated versus negated forms (8/8)

- **Disjunctive**
  - Bad
  - Sick
  - Atypical
  - Abnormal
  - Different
  - Unfamiliar
  - Worse
  - Dissimilar
  - Intelligent
  - Better
  - Healthier
  - Familiar
  - Healthy
  - Typical
  - Normal

- **Mixed**
  - 0.00
  - 0.09
  - 0.20
  - 0.30
  - 0.33
  - 0.55
  - 0.62
  - 0.69
  - 0.91
  - 1.00
  - 1.14
  - 1.20

- **Conjunctive**
  - 4.82
  - 4.84
  - 3.85
  - 1.75
  - 6.12
  - 6.87
  - 6.00
  - 7.00
Predictive factors (1/10)

Which cues help speakers to distinguish between disjunctive and conjunctive adjectives ??
Polarity?? (2/10)

a. Conjunctive: normal, typical, healthy, familiar, healthier

b. Disjunctive: bad, sick, atypical, abnormal, different

c. Borderline

   conjunctive: identical, similar, good, (better)

   disjunctive: intelligent, dissimilar, worse, unfamiliar
Polarity (2/10)

a. Conjunctive: normal, typical, healthy, familiar, healthier
b. Disjunctive: bad, sick, atypical, abnormal, different
c. Borderline
   conjunctive: identical, similar, good, (better)
   disjunctive: intelligent, dissimilar, worse, unfamiliar

⇒ Polarity is a reliable predictor 🌸

The quantifier force systematically varies in antonym pairs
⇒

Negative adjectives are negations of their positive antonyms
Related results (3/10)

Healthy + healthier conjunctive;
good + better mixed;
bad + worse borderline disjunctive
Related results (3/10)

Healthy + healthier \textit{conjunctive};
good + better \textit{mixed};
bad + worse \textit{borderline} \textit{disjunctive}

\[\Rightarrow\]

The dimensions of derived comparatives integrate via the default operation of the adjectives they derive from
Kennedy and McNally (2005):

- **Wet** is ‘partial’: Even minimally wet entities are wet.
- **Dry** is ‘total’: Only maximally dry entities are dry.
- **Tall** is ‘relative’: Its standard is context dependent.

Conjunctive/Disjunctive ≠ Total/Partial

The Total/Partial distinction is per a dimension

The conj./disj. distinction is not

(it’s about the way judgments of membership in all the dimensions together determine membership in the adjective).
Can we derive the **quantifier force** from the *standard type*:

???

To be healthy one must be maximally healthy

⇒

One must be maximally healthy in all the dimensions;

&

To be sick one must be somewhat sick

⇒

One must be somewhat sick in but one dimension
Standard type?? (6/10)

<table>
<thead>
<tr>
<th>Conjunctive</th>
<th>Polarity + Standard type</th>
<th>Disjunctive</th>
<th>Polarity + Standard type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healthy</td>
<td>Positive + Relative or total</td>
<td>bad</td>
<td></td>
</tr>
<tr>
<td>Typical</td>
<td></td>
<td>Sick</td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td></td>
<td>Atypical</td>
<td></td>
</tr>
<tr>
<td>Healthier</td>
<td></td>
<td>Abnormal</td>
<td></td>
</tr>
<tr>
<td>familial</td>
<td></td>
<td>Different</td>
<td></td>
</tr>
</tbody>
</table>

⇒ Perhaps standard type is a cue, but not a reliable one…

😊
Tests for standard type

(Rotstein and Winter 2004; Kennedy and McNally 2004)

First, typically, in partial (minimum standard) predicates, any non-zero degree in P entails P-hood, but in relative predicates many non-zero degrees may be below the contextual standard. Thus, the interpretation of (a), but not of (b), is intuitively judged to be a contradiction.

a. # The door is not open, but it is still ajar [contradiction]
b. Sam is not tall but his height is normal for his age [No contradiction]

Second, the negation of a total predicate entails the assertion of its (partial) antonym, but in relative predicates entities may fall under neither P nor P’s antonym. For instance, not closed entails open (a), but not short does not entail tall (b).

a. The door is not closed ⇒ The door is open.
b. Sam is not short ¬⇒ Sam is tall.

Third, mid-point modifiers like half or partially entail P-hood in partial predicates and non-P-hood in total predicates (a-b). They entail membership under neither P nor not-P in relative predicates (c).

a. The door is half open ⇒ The door is open.
b. The door is half closed ⇒ The door is not closed.
c. The tree is half tall ¬⇒ The tree is (not) tall.

Forth, in minimum standard predicates x is more P than y entails x is P (a). In maximum standard predicates x is more P than y entails y is not P (b). Comparative phrases with a relative predicate P entail neither that x is P nor that y is not P (c), etc.

a. The door is more open than the window ⇒ The door is open.
b. The door is more closed than the window ⇒ The window is not closed.
b. Rod A is longer than Rod B ¬⇒ Rod A is long.
    ¬⇒ Rod B is not long.
Variance in interpretation correlates with quantifier type;

An exceptional (conjunctive) use of *atypical*:

*Patient 4 was atypical except for the high-pitched voice*

\[\Rightarrow\]

In scientific contexts *atypical* is used conjunctively.

*Atypical \cong \text{belongs / patterns with an atypical group}*

\[\Rightarrow\]
Explicit quantification? (8/10)

Do the Google results re. implicit quantification represent *natural use* at all

???

The most frequent force of explicit quantifiers over dimensions

= 

The ‘default’ force of implicit quantifiers over dimensions

???
Explicit quantification? (9/10)

The Google results represent *natural use*.

- Lapata and Keller (2005)
- Initial results from linguistic corpuses

The most frequent force of explicit quantifiers over dimensions = The ‘default’ force of implicit quantifiers over dimensions

- Initial results from linguistic corpuses
- Google counts with explicit quantification *have to be examined*.
Implicit and Explicit quantification

- CORPUS OF AMERICAN ENGLISH
  (400 MILLION WORDS, 1990-2009)
- BRITISH NATIONAL CORPUS
  (100 MILLION WORDS, UK, 1980-1993)
<table>
<thead>
<tr>
<th>Conjunctives</th>
<th>ADJ. except</th>
<th>Negated ADJ. except</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>the middle ear cavity was <strong>normal except</strong> for a small amount of blood in</td>
<td>0</td>
</tr>
<tr>
<td>Typical, healthier</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Healthy</td>
<td>2 (+2 cases of explicit quantification)</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>1) he is <strong>healthy except</strong> for failing eyesight ...</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>2) The brilliant young judge, <strong>healthy except</strong> for his heart</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>3) Susie is a ten-month-old baby, <strong>perfectly healthy except</strong> that she has a congenital abnormality of her foot</td>
<td>0</td>
</tr>
<tr>
<td>familiar</td>
<td>1 older woman, who appeared <strong>familiar except</strong> for the tattoos that covered her face and shoulders. &quot;Mother? &quot;</td>
<td>0</td>
</tr>
<tr>
<td>Identical</td>
<td>48 (+3 cases of explicit qua.)</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>all the world's children prove <strong>identical except</strong> for their color and clothes.</td>
<td>0</td>
</tr>
<tr>
<td>Similar</td>
<td>4 The groups were <strong>similar except</strong> for sex, the placebo group having more boys</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td><strong>63 + 10</strong></td>
<td>0</td>
</tr>
<tr>
<td>Disjunctives</td>
<td>ADJ. except</td>
<td>Negated ADJ. except</td>
</tr>
<tr>
<td>------------------------------</td>
<td>-------------</td>
<td>---------------------</td>
</tr>
<tr>
<td><strong>Bad</strong></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Sick</strong></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Atypical</strong></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Abnormal, unfamiliar</strong></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Different</strong></td>
<td>0</td>
<td>0 (+4 cases of explicit qua.)</td>
</tr>
<tr>
<td>The Friday night before Flynn had an abortion was <strong>no different except</strong> Margaret, who…, couldn't concentrate</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Dissimilar, worse, intelligent, better</strong></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Borderline Conj. good</strong></td>
<td>0</td>
<td>0 + 4</td>
</tr>
<tr>
<td>It's (=life is) <strong>pretty good except</strong> for, like, homework</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Borderline Conj.</strong></td>
<td>0</td>
<td>0 (+2 cases of explicit qua.)</td>
</tr>
</tbody>
</table>

---

52
A corpus based study

Results III. Nouns don’t combine with *except* at all (0 dimension-set uses in the first 100-34 Google results with each).

<table>
<thead>
<tr>
<th>Nouns</th>
<th>P Except Dim</th>
<th>(Neg) P except</th>
</tr>
</thead>
<tbody>
<tr>
<td>bird</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>table</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>mother</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>capital</td>
<td>0</td>
<td>34</td>
</tr>
<tr>
<td>carrot</td>
<td>0</td>
<td>34</td>
</tr>
</tbody>
</table>

Conclusion: The dimensions of nouns do not combine via quantifiers, but via mean operations.
General conclusions

Adjectival dimensions tend to combine via quantifiers, not via averaging.

The quantifiers’ force depends on the adjectives:

- Polarity;
- Standard type;
- Contextual interpretation;
- Default explicit quantifiers over dimensions;

...
To do

- Improve the methodology
- Study many more adjectives.
- Test with natural examples (linguistic corpora)
- Test the hypothesis with other methodologies
- Look for predictive factors …
Psycholinguistic correlates of categorization tasks that:

- involve averaging (“nominal dimensions”)

- don't involve averaging (“adjectival dimensions”)
Neural correlates (1/2)

Ashby and Maddox 2005:
Selective brain deficits

Conjunctive and disjunctive (rule-based) tasks:
Require more working memory, EF
Recruit mostly verbal, declarative systems (the prefrontal cortex).

Mean-based (prototype-resemblance) tasks recruit implicit or procedural learning systems (the inferotemporal cortex).

The basal ganglia selects the strategy in a given situation.
Neural correlates (2/2)

Consistent with considerable lesion and imaging data:

**Noun processing tasks:**
Processing semantic knowledge about nominal categories (animals, artifacts) recruits inferior (and middle) temporal lobe (Randi 2003: 66-67)

**Adjective processing tasks:**
Any studies?
Developmental correlates (1/2)

The late maturation of the prefrontal cortex affects children performance.


Keil 1979: Children (up to age 10) often base categorization on similarity.
Consistent with findings from noun /adjective acquisition.

Waxman and Lidz 2006, Berman 1988, Gozderv 1961:
Children (up to age 5 years) have selective control of word classes:
  Nouns (and verbs) >> Adjectives

Polinsky 2005:
Incomplete learners (whose acquisition was interrupted at age 5):
  Nouns (and verbs) >> Adjectives
Morpho-syntactic cues for predicting whether the interpretation:

- involves averaging (“nominal dimensions”)

- doesn't involve averaging (“adjectival dimensions”)

- Wrt phrases
- Dimensions’ descriptions
- More
Modifying a predicate $P$ with a \textit{wrt}-phrase makes sense \textit{iff}
Entities may be regarded as $P$ in one respect, and as 'not $P$' in another \textit{iff}
P's dimensions are categorization criteria \textit{iff} Either $P$ or $P$'s negation is conjunctive
WRT phrases (2/6)

Multidimensional adjectives:

*healthy wrt bp*

Modifying a predicate $P$ with a $wrt$-phrase makes sense iff
Entities may be regarded as $P$ in one respect, and as 'not $P$' in another iff $P$'s dimensions are categorization criteria iff Either $P$ or $P$'s negation is conjunctive
**WRT phrases (3/6)**

Multidimensional adjectives:
*healthy wrt bp*

One-dimensional adjectives:
#is tall wrt height

(we cannot find two respects)

Modifying a predicate $P$ with a *wrt*-phrase makes sense iff Entities may be regarded as $P$ in one respect, and as 'not $P$' in another iff $P$'s dimensions are categorization criteria iff Either $P$ or $P$'s negation is conjunctive
**WRT phrases** (4/6)

**Multidimensional adjectives:**

*healthy* wrt *bp*

**One-dimensional adjectives:**

*is tall* wrt *height*

(we cannot find two respects)

Modifying a predicate $P$ with a *wrt*-phrase makes sense iff

Entities may be regarded as $P$ in one respect, and as 'not $P$' in another iff $P$'s dimensions are categorization criteria iff

Either $P$ or $P$'s negation is conjunctive

**Nouns**

*is a bird* wrt *flying*

(nouns mean-based, not conjunctive)
**WRT phrases (5/6)**

**Multidimensional adjectives:**
*healthy wrt bp*

**One-dimensional adjectives:**
*#is tall wrt height*

(we cannot find two respects)

Modifying a predicate $P$ with a *wrt*-phrase makes sense iff
Entities may be regarded as $P$ in one respect, and as 'not $P$' in another iff $P$'s dimensions are categorization criteria iff
Either $P$ or $P$'s negation is conjunctive

**Nouns**
*#is a bird wrt flying*

(nouns mean-based, not conjunctive)

‘Exceptions’:
*health wrt bp; typicality wrt flying an Italian wrt food*
WRT phrases (6/6)

Multidimensional adjectives:

- **Healthy wrt bp**

One-dimensional adjectives:

- **#Is tall wrt height**
  (we cannot find two respects)

**Modifying a predicate** $P$ with a **wrt-phrase** makes sense iff
**Entities** may be regarded as $P$ in one respect, and as 'not $P$' in another iff $P$'s dimensions are categorization criteria iff Either $P$ or $P$'s negation is conjunctive

**Nouns**

- **#Is a bird wrt flying**
  (nouns mean-based, not conjunctive)

‘Exceptions’:

- **Health wrt bp**
- **Typicality wrt flying**
- **An Italian wrt food**

(Exceptions: Nouns that are morpho-semantically related to adjectives, i.e. Nominalizations and +Human nouns, which have adjectival entries)
‘Exceptions’

+Human nouns resemble adjectives wrt: agreement and copula:

<table>
<thead>
<tr>
<th>Adjectives</th>
<th>Nouns</th>
<th>+Human nouns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dan (hu) yarok</td>
<td>#Dan (hu) cipor</td>
<td>Dan (hu) idiot</td>
</tr>
<tr>
<td>‘Dan is green\textsuperscript{MASC}’</td>
<td>‘Dan is a bird’</td>
<td>‘Dan is an idiot\textsuperscript{MASC}’</td>
</tr>
<tr>
<td>Beth (hi) yeruka</td>
<td>#Beth (hi) cipor</td>
<td>Beth (hi) idiot\textsuperscript{FEM}</td>
</tr>
<tr>
<td>‘Beth is green\textsuperscript{FEM}’</td>
<td>‘Beth is a bird’</td>
<td>‘Beth is an idiot\textsuperscript{FEM}’</td>
</tr>
</tbody>
</table>

Nominalizations resemble adjectives wrt argument structure:

<table>
<thead>
<tr>
<th>Adjectives</th>
<th>Nouns</th>
<th>Nominalizations</th>
</tr>
</thead>
<tbody>
<tr>
<td>The conference was successful for a student conference</td>
<td># Tweety is a bird for a water-bird</td>
<td>The conference was a success for a student conference</td>
</tr>
</tbody>
</table>
Dimensions’ descriptions

The adjectival dimensions: ‘Respects’

Example: Dan is not healthy in three respects: bp, pulse …

The nominal dimensions: ‘typical’

Example: Flying, singing and perching is typical of birds
The comparative operation in comparisons of the form "x is more P than y (is P)" selects for one-dimensional predicates.
One-dimensional adjectives:

Dan is taller than Mary

The comparative operator in the construction "x is more P than y (is P)“ selects for one-dimensional predicates
One-dimensional adjectives:  
Dan is taller than Mary

Multidimensional adjectives:  
Dan is healthier than Mary wrt bp wrt bp and pulse in every respect  
(easily turn one-dimensional in virtue of the wrt argument)

The comparative operator in the construction "x is more P than y (is P)" selects for one-dimensional predicates
More (4/5)

One-dimensional adjectives:
Dan is taller than Mary

Multidimensional adjectives:
Dan is healthier than Mary
wrt bp
wrt bp and pulse
in every respect
(easily turn one-dimensional in virtue of the wrt argument)

The comparative operator in the construction "x is more P than y (is P)" selects for one-dimensional predicates

Nouns
#Tweety is more a bird than Tan
(Nouns do not license a 'wrt' argument, so they are inherently multi-dimensional)
More (5/5)

One-dimensional adjectives:

Dan is taller than Mary

Multidimensional adjectives:

Dan is healthier than Mary
wrt bp
wrt bp and pulse
in every respect
(easily turn one-dimensional
in virtue of the wrt argument)

The comparative operator in the construction "x is more P than y (is P)" selects for one-dimensional predicates

Nouns

#Tweety is more a bird than Tan
(Nouns do not license a 'wrt' argument, so they are inherently multi-dimensional)

‘Exceptions’: Not really

#Dan is more an Italian
than Mary is
#The first talk was more a success than the second
Why one-dimensional predicates?

_More_ (in "x is more P than y (is P)“) denotes the _difference operation_ (von Stechow 1984):

\[
[[\text{Dan is 2 cms taller than Sam}]]_c = 1 \quad \text{iff} \quad f_{\text{tall},c}( [[\text{Dan}]]_c ) - f_{\text{tall},c}( [[\text{Sam}]]_c ) = 2 \text{ cms}
\]

⇒ It cannot apply to two dimensions simultaneously
⇒ It cannot operate on ordinal (non-difference) scales
Why are nominal scales ordinal?

The nominal-dimensions’ weights are context dependent. The variance in weights preserves the ordering between entities’ degrees, but not the differences between them.

<table>
<thead>
<tr>
<th>Table 1: Predicate types</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ratio</strong></td>
</tr>
<tr>
<td>Knowledge about ratios:</td>
</tr>
<tr>
<td><em>Dan is twice as tall as Sam</em></td>
</tr>
<tr>
<td><em>Dan is twice as happy as Sam</em></td>
</tr>
<tr>
<td>Knowledge about intervals:</td>
</tr>
<tr>
<td><em>Dan is 2 inches taller than Sam</em></td>
</tr>
<tr>
<td>Knowledge about ordering:</td>
</tr>
<tr>
<td><em>Dan's degree (the extent it satisfies the property) 'tall' is bigger than Sam's</em></td>
</tr>
</tbody>
</table>
According to my proposal:

1. The natural interpretation of more P and Q is more P & more Q;
2. The natural interpretation of more P or Q is more P or more Q

More modifies each conjunct/disjunct separately, operating on one dimension at a time.
More selects one dimension (2/4)

Method
35 Hebrew speaking subjects read descriptions like the following:

Sam weighs 100kg   Dan weighs 70 kg   (i.e., Sam is fatter)
Sam is not bald   Dan is bald   (i.e., Dan is balder)

Followed by the questions:

1. Sam is more “fat and bald” than Dan   Yes/No
2. Dan is more “fat and bald” than Sam   Yes/No
3. Dan and Sam are equally “fat and bald”   Yes/No
More selects one dimension (3/4)

Sam weighs 100 kg    Dan weighs 70 kg    (i.e., Sam is fatter)
Sam is not bald      Dan is bald        (i.e., Dan is balder)

Prediction:
If more bald and tall = balder and taller
   equally bald and fat = equally fat and equally bald.

As Sam is fatter but Dan balder, subjects will say that:
1. Sam is not more “fat and bald”
2. Dan is not more “fat and bald”
3. They are not equally “fat and bald”
More selects one dimension

Results: 90% of the subjects answered as predicted.

Conclusion:

\[
\begin{align*}
\text{more bald and tall} & = \text{balder and taller} \\
\text{equally bald and fat} & = \text{equally fat and equally bald}
\end{align*}
\]

Similar patterns with: \text{Equally fat} characters, one balder.

\text{The conj. adj. Typical wrt flying and singing.}
More in comparisons between predicates (1/3)

Comparisons of values of two different functions ("x is more P than y is Q") make sense only provided that the functions’ ranges can be normalized (transformed into the same bound interval).

Example: Dan is better in mathematics than in literature if Dan's marks in these two fields are, say, 5 and 4, respectively, on a shared six-point scale.
More in comparisons between predicates (2/3)

Nouns

*Tweety is more a horse than a bird*

*This is more a table than a wall*

The range of nominal degree functions is readily normalized (They are based on averaging on values of different functions).

Comparisons of values of two different functions (“x is more P than y is Q”) make sense only provided that the functions’ ranges can be normalized (transformed into the same bound interval).
More in comparisons between predicates (3/3)

Nouns
Tweety is more a horse than a bird
This is more a table than a wall
The range of nominal degree functions is readily normalized
(They are based on averaging on values of different functions).

Adjectives
??Tweety is more happy than tall
Adjectives are not mean-based
(not readily normalized),
so they occur less freely in such comparisons

Comparisons of values of two different functions
(“x is more P than y is Q”)
make sense only provided that the functions’ ranges can be
normalized (transformed into the same bound interval).
To do

- Establish the magnitude of the conj/disj phenomena (study with corpus methods many more adjectives).
- Look for predictive factors
- Test (and establish or refute) the neural hypothesis
- Test (and establish or refute) the syntactic hypotheses
THANK YOU!

Any comments are most welcomed:

galitadar@gmail.com
Selected References

- Randi C. Martin 2003 *Annual rev. of psy*. 54: 55-89