NEGATIVE PREDICATES:
THE QUANTITY METAPHOR AND TRANSFORMATION VALUES

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1. DIFFERENCES BETWEEN POSITIVE AND NEGATIVE PREDICATES

1.1 Cross polar comparisons

(1) **Dan is taller than Sam is short*

1.2 Numerical degree modification of 'positive' (non-comparative) forms of predicates:

(2) a. *Dan is two meters tall*
b. **Dan is two meters short*

1.3 Numerical degree modification of comparative predicates:

(3) a. *Dan is two meters taller*
b. *Dan is two meters shorter*

1.4 Exceptional positive predicates:

(4) a. *#Dan is two degrees warm* (Kennedy 2001; Moltmann 2006)
b. *#Dan is two degrees cold*

1.5 Ratio modifiers:

(5) a. *Dan is twice as tall as Sam*
b. ?*Dan is twice as short as Sam*
(6) a. *The table is twice as long as the sofa*
b. ?*The table is twice as short as the sofa*
(7) a. *The table is twice as big as the chair*
b. ?*The table is twice as small as the chair*
(8) a. *Dan is twice as fast as Sam*
b. ?*Dan is twice as slow as Sam*

Table 1 presents the number of entries of the form "*twice as ADJ as"* with positive and negative antonyms found in a google search, and the ratio between these numbers.

In 78% of the cases (14 of 18 adjective pairs), the use of ratio modifiers like *twice* is more frequent in positive adjectives than in their negative antonyms.

TABLE 1: THE USE OF *TWICE* WITH ADJECTIVES AND THEIR ANTONYMS

More uses in the positive adjective, compared to the negative antonym:

		twice as ADJ as	ratios
1	similar	2,740	
	dissimilar	0	0.0%
2	likely	591,000	
	unlikely	1,660	0.3%
3	similar	2,740	
	different	9	0.3%
4	long	1,210,000	
	short	14,400	1.2%
5	true	170	
	false	2	1.2%
6	fast	1,300,000	
	slow	35,200	2.7%
7	happy	13,800	
	unhappy	632	4.6%
8	beautiful	15,200	
	ugly	792	5.2%
9	big	307,000	
	small	18,300	6.0%
10	tall	63,400	
	short	14,400	22.7%
11	good	184,000	
	bad	45,200	24.6%
12	healthy	7,810	
	sick	2,550	32.7%
13	safe	712	
	unsafe	241	33.8%
14	Hot	18,500	
	cold	6,390	34.5%

Less uses in the positive adjective, compared to the negative antonym:

		twice as ADJ as	ratios
1	right	10	
	wrong	656	1.5%
2	warm	1,010	
	cold	6,390	15.8%
3	intelligent	1,880	
	stupid	10,800	17.4%
4	safe	712	
	dangerous	3,310	21.5%

2. THE QUANTITY METAPHOR: ADDITIVE FUNCTIONS

(9)	a. *More boys than girls smile*	[the quantity reading]
	b. *Dan is happier than Sam*	[the extent reading]

2.1 The quantity metaphor (cf. Moltmann 2006):
The extent to which entities satisfy an adjective, for instance *happy*, reflects the quantity that they possess of the thing denoted by the adjective's nominalization, *happiness* (where one’s happiness is an element of the domain D, just like one’s legs or hair).

2.2 Quantity functions are ***additive*** (Klein 1991):
The number of apples in two baskets together equals the sum of numbers of the apples in each basket separately.

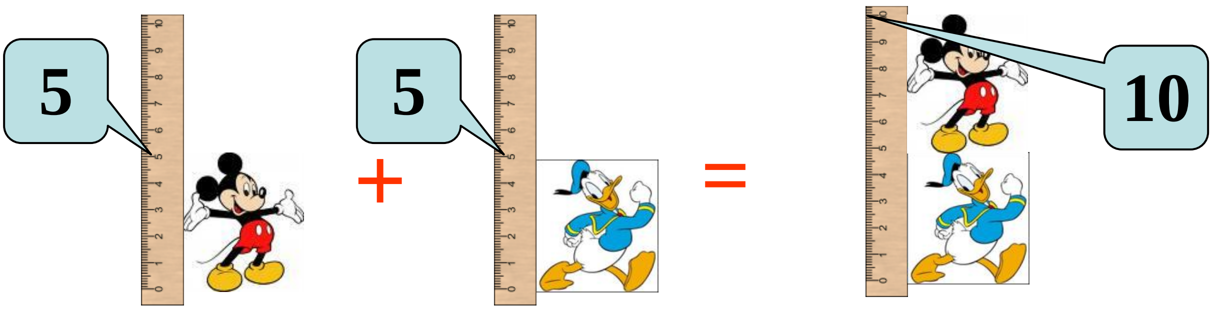
Because of the quantity metaphor, semantic theories postulate additivity:
The degree function of *long*, f_{long}, is additive in the sense that it adequately represents the fact that the length of the concatenation (placing end to end) of two entities ($d_1 \oplus_{length} d_2$) equals the sum of lengths of the two separate entities (d_1 and d_2):

Differences between degrees adequately represent differences between "quantities of length" in entities:

(10) a. $f_{long}(d_1 \oplus_{length} d_2) = f_{long}(d_1) + f_{long}(d_2)$

Ratios between degrees adequately represent ratios between "quantities of length" in entities:

b. $f_{long}(d_1) = f_{long}(d_2)$ iff
$f_{long}(d_1 \oplus_{length} d_2) = 2 \times f_{long}(d_1)$



3. NEGATIVE PREDICATES: NON-ADDITIVE FUNCTIONS

I submit that the mapping of entities to degrees in negative predicates like *short* is not known to be additive wrt quantities of height that entities possess (or do not possess).

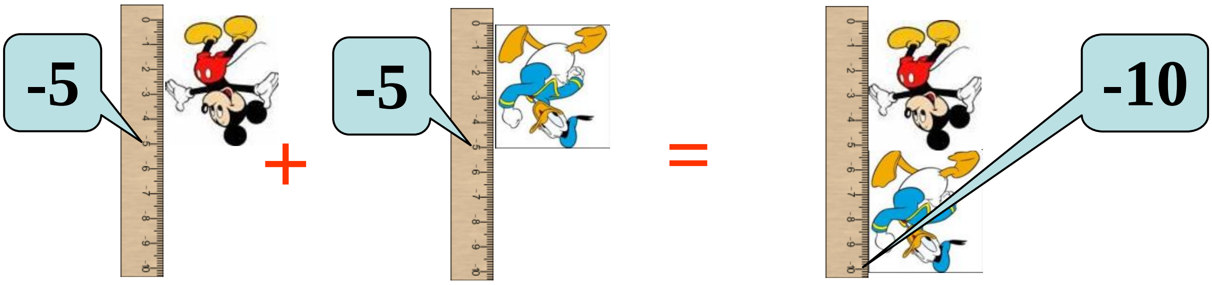
Partial information:
Let $\mathbf{W_c}$ be the set of worlds consistent with the information in **an *actual context*** (the linguistic and world knowledge of a given community of speakers out of the blue; Stalnaker 1975).

What do we know about the degree function of *short* in actual contexts?

3.1 **Linearly reversed functions**

(11) a. *Dan is taller than Sam* iff *Sam is shorter than Dan*
[The degree functions are reversed]
b. *Dan is 2cm taller than Sam* iff *Sam is 2cm shorter than Dan*
[The intervals between degrees are preserved]

For example, $\mathbf{f_{0\text{-tall}}}$ (= λd. 0–f_{tall}(d)) is linearly reversed compared to f_{tall}



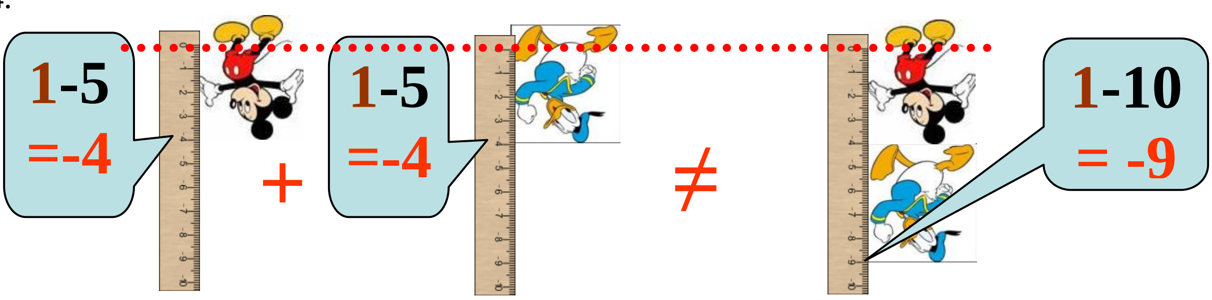
3.2 **Linearly transformed functions**

Other examples of linearly reversed functions (transformed by a constant):

$\mathbf{f_{1\text{-tall}}} = \lambda d.\ 1 - f_{tall}(d)$
$\mathbf{f_{2\text{-tall}}} = \lambda d.\ 2 - f_{tall}(d)$
$\mathbf{f_{3.75\text{-tall}}} = \lambda d.\ 3.75 - f_{tall}(d)$
$\mathbf{f_{-4\text{-tall}}} = \lambda d.\ -4 - f_{tall}(d)$
…
$\forall Tran \in \Re$, $f_{Tran\text{-tall}} = \lambda d.\ Tran - f_{tall,w}(d)$ properly reverse the degrees.

Transformed height functions are not additive wrt height:
If, for instance, $f_{tall}(d_1) = f_{tall}(d_2) = 5$,
Then, by additivity: $f_{tall}(d_1 \oplus d_2) = 10$.
But by the definition of f_{1-f}: $f_{1\text{-}f}(d_1) = f_{1\text{-}f}(d_2) = -4$ and
$f_{1-f}(d_1 \oplus d_2) = 1 - f_{tall}(d_1 \oplus d_2) = -9 \neq (2 \times -4)$.

The ratio between the degrees of $d_1 \oplus d_2$ and d_1 is 9/4 and the ratio between their heights is 8/4.



3.3 The 'zero' test

(12) Question:
Does *short* map entities with zero height (surfaces; points) to zero?

Answer 1 (von Stechow 1984; Kennedy 1999):
No. Entities with no height are mapped to a degree that approximates infinity.

Answer 2 (Me, my informants):
Bohhh??

Conclusion: $\neg\forall w \in W_c$: $f_{short,w} \neq \lambda d.\ 0 - f_{tall,w}(d)$
(f_{short} is transformed by an unknown constant)

3.4 Summary of my proposal:

$\forall w \in W, \forall d \in D$: $f_{short,w}(d) = Tran_{short,w} - f_{tall}(d))$

We know nothing about the constant $Tran_{short}$; it varies across worlds in W_c.

	Degrees in *tall* (= $f_{tall,w}(d)$)				**Transformation value**	**Degree in *short* (= $f_{short,w}(d)$)**			
									
W1	200cm	50cm	20cm	10cm	$Tran_{short,w1} = 10$	-190cm	-40cm	-10cm	0cm
W2	200cm	50cm	20cm	10cm	$Tran_{short,w2} = 0$	-200cm	-50cm	-20cm	-10cm
W3	200cm	50cm	20cm	10cm	$Tran_{short,w3} = -10$	-210cm	-60cm	-30cm	-20cm

f_{tall} is based on a measuring convention f_{short} is based on function-reversal

3.5 Direct results of my proposal

Interestingly, by representing this constant we can derive the polarity effects. If in c, e.g., *tall* maps an entity d to n cms ($\forall w \in W_c$, $f_{tall,w}(d) = n$), *short* maps d to $Tran_{short} - n$ cms ($\forall w \in W_c$, $f_{short,w}(d) = Tran_{short,w} - n$), where the value $Tran_{short}$ is unknown (varies in W_c).

3.5.1 Indeterminacy concerning the numerical degrees short assigns:

Lacking knowledge about $Tran_{short}$, we cannot say which entities are *n meters short* in c ($\neg\exists d \in D$: $\forall w \in W_c$, $f_{short,w}(d) = n$),

f_{short}(ostrich) = ?? **-190cm?**
-200cm?
-210cm?

So numerical-degree phrases like *two meters* can’t be used with *short*.

3.5.2 Comparatives

When degree-differences are computed, the transformation values of the two degrees cancel one another:

$$\forall w \in W_c: \quad \mathbf{f_{tall,w}(ostrich) - f_{tall,w}(chicken) = 200cm - 50cm = 150cm = f_{short,w}(chicken) - f_{short,w}(ostrich) = (\cancel{Tran}_{short,w} - 50cm) - (\cancel{Tran}_{short,w} - 200cm) = 150cm}$$

So numerical degree predicates are felicitous in comparatives.

*3.5.3 Cross-polar comparisons (*Dan is taller than Sam is short):*

Only the degree assigned by *short* has a transformation value, so this value does not get canceled out. Lacking knowledge about $Tran_{short}$, such statements can never be verified, and are considered anomalies.

$$\forall w \in Wc: \quad \mathbf{f_{tall}(ostrich,w) - f_{short}(chicken,w) = 200cm - (Tran_{short,w} - 50cm) = 150cm - Tran_{short,w} = ??}$$

3.5.4 Ratio modifiers

The penguin has a double length compared to the robin in a context c iff
in any w in W_c, *tall* maps the robin to some number n (e.g., 10cm), and
the chicken to 2n (e.g., 20cm), iff
in any w in W_c, *short* maps the robin to $Tran_{short,w}$ – n (e.g., $Tran_{short,w}$ – 10cm), and
the chicken to $Tran_{short,w}$ – 2n (e.g., $Tran_{short,w}$ – 20cm).
But none of the degrees $Tran_{short,w}$–n and $Tran_{short,w}$–2n is two times the other (unless $Tran_{short,w}$=0).

So *twice as short* is less acceptable than *twice as tall*.

3.5.5 Exceptional positive predicates (like warm)

The degrees of positive predicates are not reversed, but they may well be transformed. This explains the infelicity of *2 degrees warm* and our unclear intuitions concerning the zero point of *warm* (as a temperature predicate).

3.5.6 Cross linguistic variations

Languages may vary as to whether predicates like *heavy* or *warm* measure inner states (i.e., they are additive) or external states (they are non-additive) or both, and thereby differ as to whether numerical degree predicates and ratio modifiers are licensed or not.

CONCLUSIONS

- Predicates with transformed functions are incompatible with ratio modifiers and numerical degree modifiers (except in the comparative).
- Many positive predicates (though not all) are based on conventional measuring systems, who are additive (i.e. their degree functions are not transformed).
- The degree function of negative predicates are linearly reversed compared to their positive antonyms. If and to what extent the reversal transforms them, we cannot tell.
- For these reasons, negative predicates are not (or are much less) acceptable with ratio modifiers and numerical degree modifiers (except in the comparative), than most of the positive predicates are.

  In other words, degrees of negative predicates only represent intervals between degrees, while those of positive predicates also represent ratios.

4. PROBLEMS WITH PREVIOUS THEORIES

4.1 Too small domains

In Kennedy (2007), domains of measure functions are too much restricted:

- We do have clearer intuitions about zero points in predicates like *tall* than in predicates like *short* or *warm*, which is not captured if all have the zero point excluded from the domain.
- Kennedy's (2007) also fails to capture the fact that If Dan's age is unknown or if Dan is extremely tall / short for his age, we can felicitously say that: *Dan is tall for a fourth grader but he is short for a fifth grader.*

4.2 Extra complexity

Theories of negative predicates such as Seuren (1978, 1984), von Stechow (1984) and Kennedy (1999, 2001) represent degrees as **intervals**, not numbers (which is counter-intuitive and complex).

(13) *Sam is as tall as Dan is, and, in fact, taller*
[We may truthfully assign to Dan any degree above zero up to its maximal height]
$\lambda\delta.\ f_{tall}([[Dan]]) \geq \delta$.

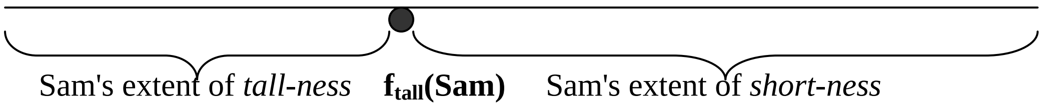
For example, Von Stechow (1984) uses this in analyzing comparatives:
[[*as tall as Dan*]] = $max(\lambda\delta.f_{tall}([[Dan]]) \geq \delta)$
**Dan is taller than Sam is not* is anomalous because the set $\lambda\delta.\ f_{tall}([[Sam]]) < \delta$ has no maximum (Sam does not have infinitely many heights).

The current proposal predicts these facts while maintaining that degrees are numbers. As such, it is more than expected that degree denoting expressions (like *two meters tall* or *as tall as Dan is*) will behave like numerals, i.e. will allow for 'at least' 'at most' and 'exactly' readings, depending on context (as in (13)).

4.3 (In)commensurability: Problems with the account for **cross polar anomalies**

Kennedy (1999) assumes that predicates with different ordering dimensions have different (non-commensurable) degree types.
Kennedy (1999, 2001) predicts that cross polar comparisons are anomalies by stipulating that positive and negative predicates are linked with different (non-commensurable) extent-types:

Positive predicates like *tall* map entities d into *positive extents* –
the set of degrees that can be truthfully applied to them, $\lambda\delta.|\ f_{tall}(d) \geq \delta$
Negative predicates like *short* map entities d into *negative extents* –
the set of degrees that can't be truthfully applied to them, $\lambda\delta.f_{short}(d) \leq \delta$



But the assumption that different degree types are non-commensurable is inadequate.
Often different scales *are* comparable:

(14) a. *My 14 year old son is also an Aug 24 Virgo. I find that he is more typical of* ***a Leo*** *in the sense that he is outgoing and easy to get along with. Don't get me wrong, he also has* ***Virgo*** *type behavior*

[Different typicality scales are not "the same": they are ordered by different dimensions]

According to Kennedy, examples like (14b) can receive a metalinguistic interpretation. That is, they can be used ironically to convey the information that Ram is not intelligent. According to Klein (1991), in this use, (b) is an answer to the question *is Ram intelligent* rather than to a question like *how tall is Dan* or *how clever is Ram*.

b. *Dan is more tall than Ram is intelligent*

However, I submit that many similar comparisons may not be meta-linguistic.

c. *This Thai dish is more* ***sour*** *than* ***sweet*** *(or* ***anything else****)*
d. *This rod is more* ***red*** *than it is* ***blue***

These examples need to be interpreted neither as comparisons of deviation nor meta-linguistically in the above sense. (2e) can answer the question *how much is the piano part (of) a showcase for a virtuoso soloist*?).

e. *The program began with Debussy's rarely heard Fantasies. In this three-movement, artfully integrated piece –* ***a "concerted" work*** *rather than* ***a completely developed concerto -*** *the extensive piano part is more of* ***a first among equals*** *than* ***a showcase for a virtuoso soloist***

f. *When Dan comes home from school and I come home from work, we are always hungry and tired. But usually, Dan is more* ***hungry*** *than* ***tired****, while I am more* ***tired*** *than* ***hungry****.*

g. *Dan is tired and Mira is hungry. Take care of them. Dan is more* ***tired*** *than Mira is* ***hungry****, so take care of him first.*

Finally, surprisingly, nouns freely occur in between-predicate comparisons:

h. *Bling Bling says "tweet" (I'm convinced he's more* ***a bird*** *than* ***a cat).***
i. *... giving me three bits of furniture which she didn't want anymore (a coat rack, chair, and stool thing which is really more* ***a table*** *than* ***anything else***
j. *The "wall" was rolling backward until it come to a horizontal position, now being more* ***a table*** *than* ***a wall***
k. *Chevy is more* ***a car*** *than* ***a truck***
l. *The ostrich is more* ***a bird*** *than the platypus is* ***a mammal***

Finally, according to Kennedy (1999: 100), *long* and *wide* share the dimension, *linear extent*, differing only in 'the perpendicular aspect'. So what is a *'dimension'*?
My proposal predicts cross-polar anomalies to occur regardless of the account for incommensurability (and give a new account of (in)commensurability in Sassoon 2008).

4.4 Stipulative notions

In the current proposal no ordering relation for degrees needs to be stipulated (degrees are always ordered by the relation 'bigger or equal' of the reals, ≥), unlike in many previous theories (Rullmann 1995; Landman 2005, etc.)
This allow me to simplify the meaning of comparative morphemes like *more* and *less*.

4.5 **Wrong predictions regarding the licensing of numerical degree predicates**

Previous theories (von Stechow 1984; Kennedy 1999, 2001) assume the degrees of positive predicates, including *warm*, to be initial segments, while only predicates whose degrees are final segments (negative ones) are predicted not to combine with numerical degree predicates.

[[*Dan is two meters tall*]]$_c$ = 1 iff $\{\delta\in S_{tall}: \delta \leq 2\} \subseteq \{\delta\in S_{tall} \mid \delta \leq f_{tall}([[Dan]])\}$

No entity d can be *two meters short*, because a proper initial segment of a scale (a positive extent) can never be a subset of a proper complement of an initial interval (a negative extent):

* [[*Dan is two meters short*]]$_c$ = 1 iff $\{\delta\in S_{tall}: \delta \leq 2\} \subseteq \{\delta\in S_{tall}: f_{tall}([[Dan]]) \leq \delta\}$

- But *warm* is positive while not allowing numerical degree predicates!
- *Dan is two meters short* is analyzed as equivalent to *Dan is shorter than two meters*, but the latter is a fine sentence (Landman 2005).
  [The same problems apply to von Stechow's 1984 version].

My proposal allows for 4 group of predicates' functions: +/- reversed (determines polarity) and +/- transformed (determines felicity of numerical degree predicates).
I analyze *Dan is shorter than 2 meters* as "shorter than [anything that's] 2meters".

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