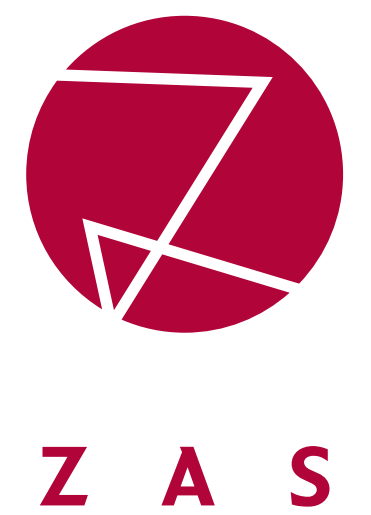


AN ALTERNATIVE ACCOUNT OF IMPRECISION

Stephanie Solt (solt@zas.gwz-berlin.de) // Centre for General Linguistics, Berlin // SALT 24, May 30-June 1, 2014



1. Basic Facts

Round numbers allow approximate interpretations:

- (1) a. Mabel owns one hundred sheep.
b. The path is fifty meters long.
c. Sue arrived at three o'clock.
d. The meeting lasted forty-five minutes.
 - ‘Roughly 100’; ‘50 +/- a couple meters’; ‘about 3:00’; etc.

Non-round numbers are interpreted precisely:

- (2) a. Mabel owns ninety-nine sheep.
b. The path is fifty-one meters long.
c. Sue arrived at three-oh-one.
d. The meeting lasted forty-four minutes.

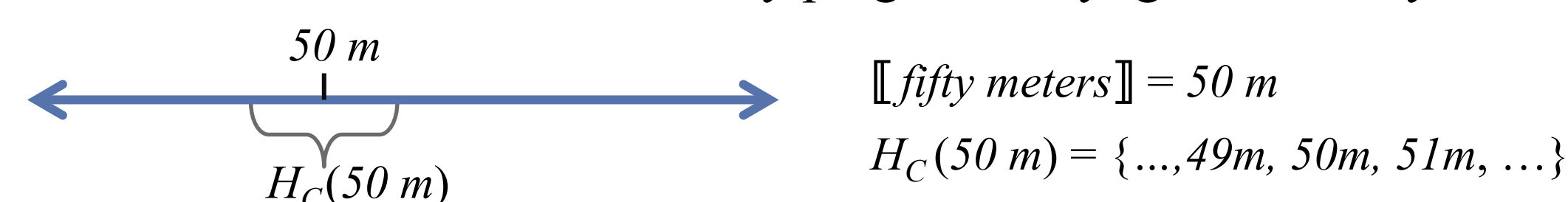
(Im)precision may be regulated overtly via approximators:

- (3) a. Mabel owns about one hundred sheep.
b. The path is roughly fifty meters long.
c. Sue arrived at approximately three o'clock.
d. The meeting lasted exactly forty-five minutes.

2. Theories of Imprecision

Pragmatic Halos (PH) – Lasersohn 1999

In addition to its denotation, each expression is associated with a contextually-determined set – its pragmatic halo – containing values that differ from the denotation in only pragmatically ignorable ways:

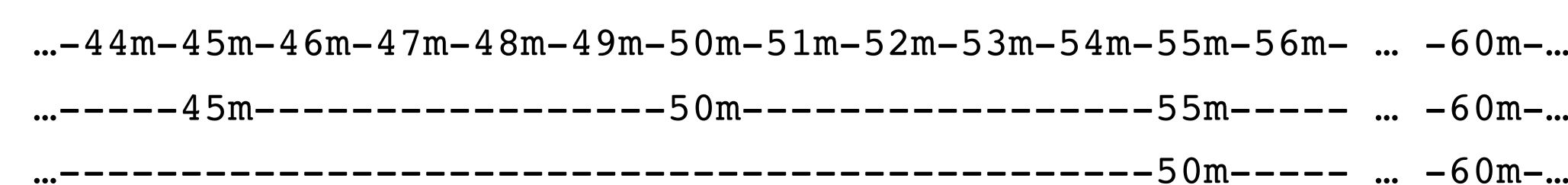


- Imprecision as pragmatic loose talk (not true but ‘close enough’)
 - No immediate account of round/non-round distinction: if 3:01 in halo of 3:00, shouldn't 3:00 likewise be in halo of 3:01? **Possibility:** Asymmetry in similarity judgments (Tversky 1977).

Approximators operate on halos: *exactly* shrinks halo, while hedges such as *roughly* expand expression's denotation to include halo.

Scale Granularity (SG) – Krifka 2007

Results of measurement may be reported w.r.t. scales that differ in their level of granularity, conceptualized as density of representation points:



- Imprecision = interpretation w.r.t. coarse-grained scale; round numbers occur on coarser scales.

Approximators determine scale choice (Sauerland & Stateva 2007): *exactly* specifies finest contextually available granularity level; *about/roughly*/etc. specify coarsest level.

REFERENCES: Cummins, C., U. Sauerland, & S. Solt. 2012. Granularity and scalar implicature in numerical expressions. *Linguistics and Philosophy* 35:135–169. Davies, M. 2008-. The Corpus of Contemporary American English (COCA): 450 million words, 1990-present. Katzir, R. 2007. Structurally-defined alternatives. *Linguistics and Philosophy* 30: 669–690. Krifka, M. 2007. Approximate interpretations of number words: A case for strategic communication. In G. Bouma et al. (eds.), *Cognitive foundations of interpretation*, 111–126. Koninklijke Nederlandse Akademie van Wetenschappen. Lasersohn, P. 1999. Pragmatic halos. *Language* 75:522–551. Sauerland, U. & P. Stateva. 2007. Scalar vs. epistemic vagueness: evidence from approximators. *Proceedings of SALT 17*, 228–245. Tversky, A. 1977. Features of similarity. *Psychological Review* 84:327–352.

3. Approximation and Comparison

Measure expressions in comparatives are interpreted precisely.

- (4) Mabel owns more than one hundred sheep.
 - No reading where true/felicitous if 99 obtains (though 99 > 98 ~ 100_{approx}).
 - No reading where false/infelicitous if 101 obtains (though 101 ~ 100_{approx}).
- (5) The path is more than fifty meters long.
 - No reading where true/felicitous if actual length is 49 meters.
 - No (?) reading where false/infelicitous if actual length is 51 meters.

Comparatives license granularity-based implicatures.

- (6) a. *more than 100* Typical inferences: 101 to 150 / 125 / 120 / 200
b. *more than 110* Typical inferences: 111 to 120 / 150 (Cummins et al. 2012)

Approximators in comparatives are NPis.

Disallowed in positive sentences:

- (7) *Mabel owns more than about/roughly/approximately/exactly one hundred sheep.
Exception: A: Mabel owns about 100 sheep B: No, she owns more than about 100.

But felicitous in negative sentences/downward-entailing contexts:

- (8) a. Mabel doesn't own more than about one hundred sheep.
 - no more than the **maximum** describable as *about one hundred*
 - b. Mabel owns no more than about one hundred sheep.
 - c. John doubts that Mabel owns more than about one hundred sheep.
 - d. If Mabel owns more than about one hundred sheep, we'll run out of vaccine.
 - e. Every farmer who owns more than about one hundred sheep...
- (9) This station can accommodate no more than exactly eight trains per hour.

Supported via corpus data (COCA; Davies 2008-); exceptions mainly negative comparatives (*less than*) and specific domains (e.g. astronomy)

4. Issues for Existing Theories

For PH, precise interpretation of comparative is problematic for view that halos are compositionally derived:

- (10) a. $[[one\ hundred]] = 100$ b. $H_C(100) = \{..., 98, 99, 100, 101, 102, \dots\}$
- (11) a. $[[more\ than\ one\ hundred]] = \lambda D.max_n(D(n)) > 100$
b. $H_C(\lambda D.max_n(D(n)) > 100) = \{..., \lambda D.max_n(D(n)) > 98, \dots\}$
 - Incorrectly predicts (4) is assertable if 99 obtains; requires stipulation that comparative (like *exactly*) shrinks halo.

Comparatives raise further issue for analysis of approximators via PH:

- (12) $[[about\ one\ hundred]] = H_C(100) = \{..., 98, 99, 100, 101, 102, \dots\}$
 - Type mismatch (not discussed by Lasersohn); potentially resolved via choice function.
Mabel owns about one hundred sheep. $\exists f[Mabel\ owns\ f(H_C(100))\ sheep].$
 - But to yield correct interpretation, must stipulate maximally wide scope for \exists .
(8a,b): $\neg \exists f[max_n(Mabel\ owns\ n\ sheep) > f(H_C(100))] \times$
 $\exists f[\neg (max_n(Mabel\ owns\ n\ sheep) > f(H_C(100)))] \checkmark$
 - (8c): $\exists f[John\ doubts\ (max_n(Mabel\ owns\ n\ sheep) > f(H_C(100)))] ?$

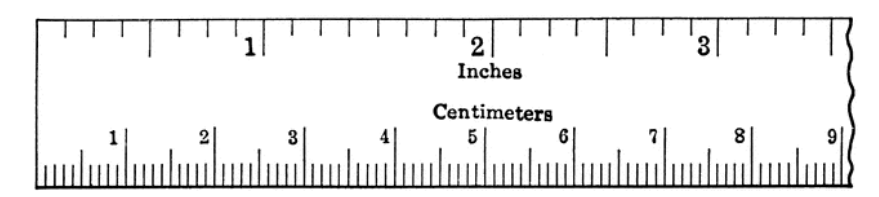
SG avoids generating incorrect low readings; (*about*) *one hundred* denotes scalar region as a **single unit**.

- But existing SG theories do not account for: i) selection of fine scale granularity by comparative; ii) restricted distribution of approximators in comparatives; iii) implicatures with comparatives (2 granularities active at once).

5. Proposal - Part I: Granularity as Alternatives

a) Granularity as sets of alternatives

Ruler metaphor: continuous scale on which discrete hierarchical structure is imposed, allowing expression of measurements at various precision levels



$$ALT_{1m}(50m) = \{..., 48m, 49m, 50m, 51m, \dots\} \quad ALT_{10m}(50m) = \{..., 30m, 40m, 50m, 60m, \dots\}$$

Per Krifka (2007), typical granularity levels based on:

- Powers of 10 and result of halving/doubling these
- Conventional measurement systems e.g. $ALT_{15min}(45min) = \{..., 30min, 45min, 60min, \dots\}$

b) Truth relative to granularity level

Granularity level *gran* contextually determined via assignment function *g*.

Measure expressions have underlying precise denotation.

Truth relative to granularity assignment defined as:

For a proposition ϕ containing a measure expression *M* and a degree *n* such that $[[M]]^g = n$, $[[\phi]]^g = 1$ iff

$$\forall n' \in ALT_{gran}(n) \text{ and } M' \text{ such that } [[M']]^g = n',$$

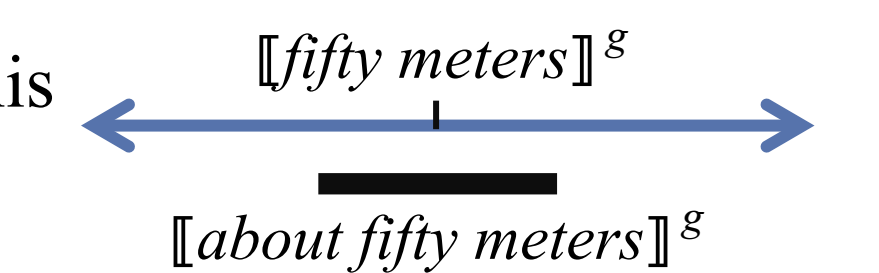
$[[\phi]]^{g[gran=0]} = 1$ requires a smaller displacement of the actual measure than $[[\phi[M/M]]]^{g[gran=0]} = 1$;

$[[\phi]]^g = 0$ otherwise.

- Roughly: *M* is the best choice at granularity *gran*

c) Approximators introduce granularity functions

Truth definition in (b) associates measure expression with scalar segment. This is lexicalized by approximators, which map points to segments that have semantic status of (coarse-grained) degrees.



$$[[approximator\ M]]^g = (n - gran'/2, n + gran'/2) \text{ for some } gran'$$

- *exactly*: *gran'* is finest contextually possible choice for *gran*.
- *about, roughly*, etc.: *gran'* is coarsest contextually possible choice for *gran*.

cf. **about 0 people* but *about 0 deg C*

6. Proposal - Part II: Approximators and Inferences

Mabel owns more than 100 sheep.

Alternative: *M. owns more than 150 sheep*
informativity +

- **Scalar implicature:** speaker not in position to assert *more than 150*.

Mabel owns more than about 100 sheep.

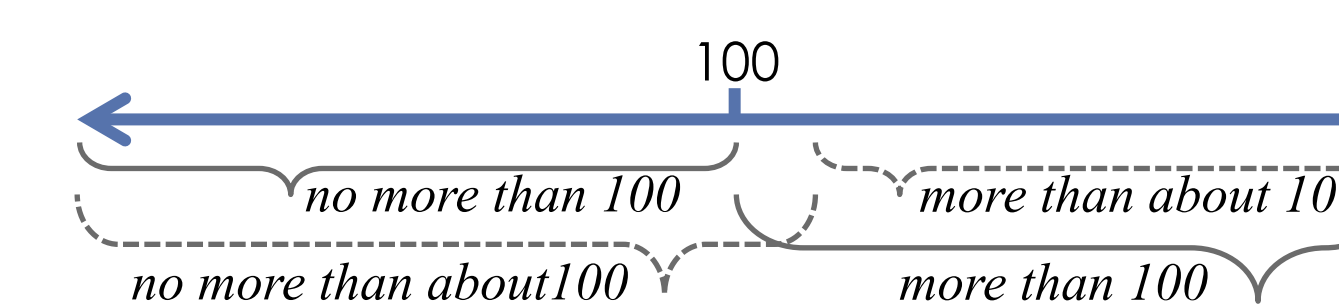
Alternative: *M. owns more than 100 sheep*
informativity = simplicity +
assertable \checkmark

- **Blocked:** better alternative always assertable.

Mabel owns no more than about 100 sheep.

Alternative: *M. owns no more than 100 sheep*.
informativity = simplicity +
assertable ?

- **Ignorance implicature:** speaker not in position to assert *no more than 100*.



Starting point: Alternatives defined structurally via deletion and substitution (Katzir 2007).

- Measure expressions: substitution constrained by *gran*; gives rise to granularity-based scalar implicatures

Communicative principle: Do not assert ϕ if there is an alternative ϕ' such that:

- ϕ' is ‘better than’ ϕ
- ϕ' is weakly assertable

‘Better than’ defined in terms of **simplicity** and **informativity**. For Katzir, informativity equated with entailment. I extend this to also take into consideration (lack of) vagueness.

Crucial case: *more than about 100* vs. *more than 100*

- *More than about 100* unidirectionally entails *more than 100*.
- *More than 100* less vague; has sharp lower bound.

Proposal: these two factors cancel; neither of these alternatives ranked above the other in informativity.

- Simplicity + entailment reversal in DE contexts \rightarrow NPI status of *more than about 100*