

The taming of uncertainty: How we make sense of it by words and numbers

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Two ways of expressing information about uncertain quantities

I. Verbal expressions of probability

- «It is likely (it is uncertain) that global temperatures will increase with 3 degrees»

II. Uncertainty intervals (ranges)

- «Global temperatures will increase with 2-5 degrees)
- Both give **factual, neutral information** about what to expect
- But also additional, **pragmatic information** about what to think and to decide.
- This talk reports findings about the pragmatic information

I. Verbal expressions of uncertainty: Probabilistic information

- Prescriptive: Recommended translations
 - IPCC and EFSA Guidance documents
- Descriptive: Empirical translations
- These translations do not always match
- People's translations diverge widely from each other
- Verbal phrases are VAGUE

Probability term	Subjective probability range
Almost certain	99-100%
Extremely likely	95-99%
Very likely	90-95%
Likely	66-90%
About as likely as not	33-66%
Unlikely	10-33%
Very unlikely	5-10%
Extremely unlikely	1-5%
Almost impossible	0-1%

Pragmatic function I: Hedging



- Michel de Montaigne (1588)
- “I love those words or phrases which mollifie and moderate the boldness of our propositions: *‘It may be: Perhaps: In some sort: Some: It is said: I think,’* and such like”

Pragmatic function II: Directionality

Positive / affirmative phrases

Pointing to occurrence of target outcome

- Certain
- Will happen
- Very likely
- Probable
- Entirely possible
- **Can** happen
- A possibility
- A chance
- **A risk**
- Cannot be ruled out
- A hope

Negations

Pointing to non-occurrence of target outcome

- Not quite certain
- Not safe
- Somewhat uncertain
- Quite uncertain
- Somewhat doubtful
- Doubtful
- Unlikely
- Improbable
- Very unlikely
- will not happen
- impossible

Directionality is not vague

- Directionality is revealed by giving pro or con reasons

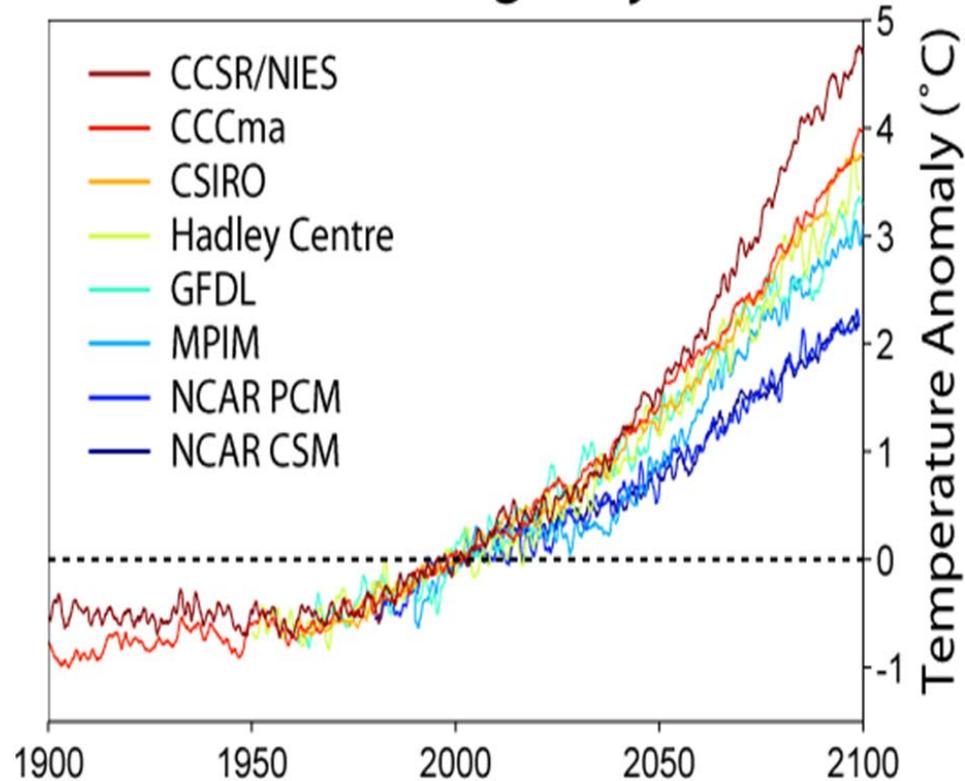
When are they used?

- Positive for high probabilities, negative for low probabilities (but not always)
- Positive for probabilities above reference point, negative for probabilities below reference point
- Reference point can vary according to *expectations*, *prior probabilities* and statements made by *others*, indicating *revisions* and *disagreements*
- Choice of term reveals the speaker's *attitudes* and *preferences*
- They influence the recipients' recommendations and decisions
- A 30-40% probability of success → quite possible or quite uncertain?

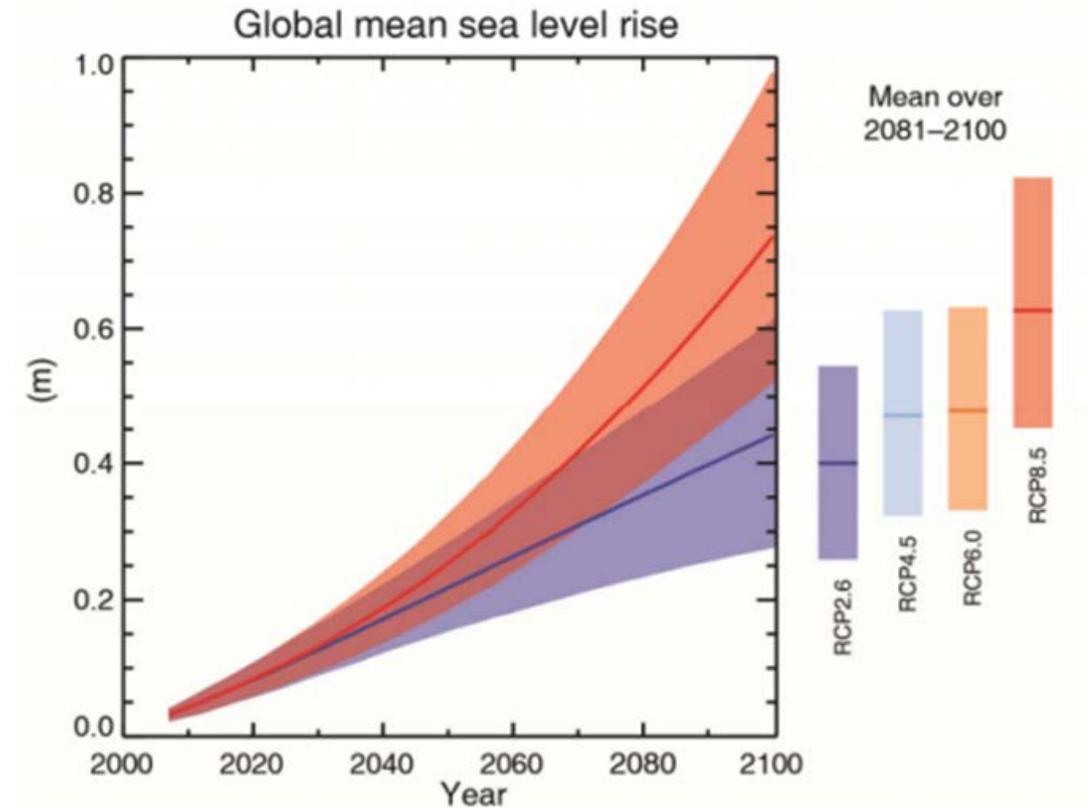
What can happen?

(Teigen, Brun & Frydenlund, 1999; Teigen, Filkukova & Hohle, 2018)

Global Warming Projections



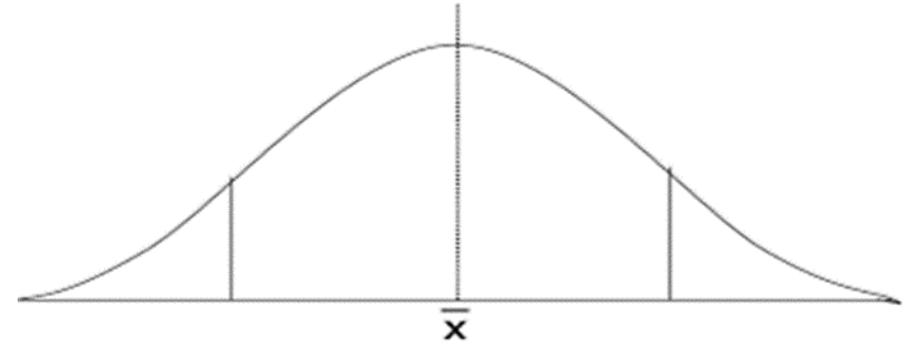
«It can be degrees warmer»



«The sea level may / could / can be m higher than today»

Uncertainty intervals (ranges)

- «A 2-5 degrees increase»
- Ranges are probabilistic (95% certain)
- Width of interval depends on confidence level
- High certainty requires wide intervals
- But this is not evident to everyone, since a narrow interval suggests certainty and expertise
- Students suggested wider intervals to be associated with lower rather than higher confidence level (Løhre & Teigen, 2017)
- They held conflicting opinions about which was wider, a 90% or a 60% interval



Two kinds of interval boundaries

Lower bound:

Positive

- Minimum
- At least
- Over
- More than

«It will be at least 2 degrees warmer»

Higher bound:

Negative

- Maximum
- At most
- Under
- Less than

«It will be at most 5 degrees warmer»

Pragmatic implications of single-bound statements

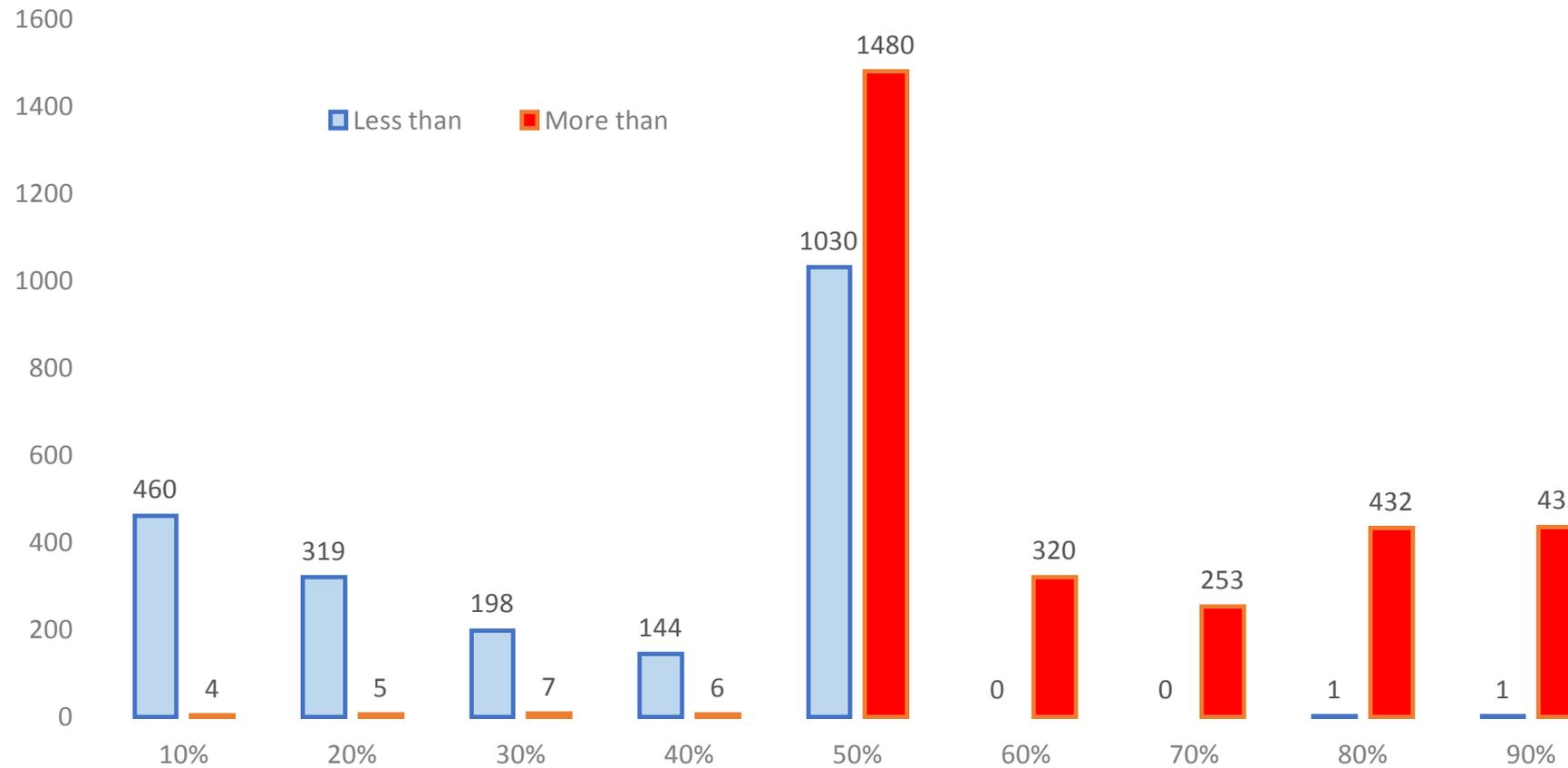
- Lower bound (more than) indicates largeness, relative to reference point (Teigen, 2008)
- Upper bound (less than) indicates smallness

Asymmetry:

- Lower bound statements more common (Hoorens & Bruckmüller, 2015 ; Halberg & Teigen 2009).
- Lower bound statements more neutral
- Choice of bound reveals *attitudes and concerns, recommendations and warnings*, (Hohle & Teigen, 2018)
- Choice of bound indicates direction of change (*trends*), *agreements and disagreements*

Occurrence frequencies of «**Less than x percent chance**» and «**More than x percent chance**» in Google News

(Hohle & Teigen, 2018)



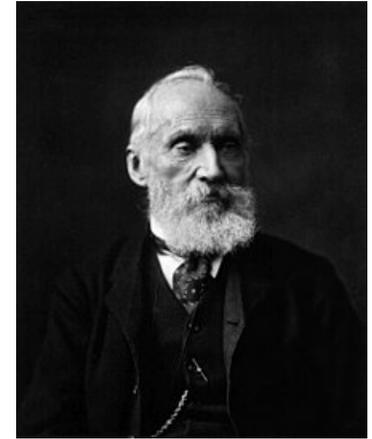
Conclusions

- Verbal probabilities and interval bounds have similar pragmatic implications
- They are not neutral, but have a positive or negative directionality
- They direct the recipients' attention
- They «leak» information about trends
- They reveal the speaker's beliefs and concerns
- and function as warnings and recommendations
- They are not completely symmetric (negativity effect)
- We have to know the context: Are they chosen freely by the speaker, or do they simply come in response to a question or a suggested value?
- Science communicators (and the public) should know the interplay between words and numbers, and the power of apparently innocent terms

The strength and weakness of numbers

When you cannot measure it, when you cannot express it in numbers, your knowledge is of a meagre and unsatisfactory kind.

Lord Kelvin



When you can measure it, when you can express it in numbers, your knowledge is still of a meagre and unsatisfactory kind

Jacob Viner



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