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“Dimensions of uncertainty communication”

A review article from Prof Karl Halvor Teigen (University of Oslo)

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My Climate Risk
Interdisciplinary Learning Group, April 2024

Life is uncertain

- Only prophets can know for sure what will happen in the future (and they might not do that so well either!)
- This is especially relevant about climate change!
- The public needs to know what might/could happen
  - To foster informed decision
  - To maximise decision accuracy
- Scientists/communicators should be transparent about their uncertainty
  - To be honest
  - To foster trust

How can we communicate uncertainty effectively?

Words are more often used than numbers to express uncertainty

- As recipients, people report preferring numbers (e.g., a 20% chance) - but as speakers, they prefer words (e.g., it is unlikely, there is a chance; Erev & Cohen, 1990)
- Even experts (GPs) prefer words (Juanchich & Sirota, 2020)
- Possibly because most situations do not allow precise evaluation of uncertainty on a 0-100% scale.

Language (of uncertainty) as a toolbox

Current Psychology
https://doi.org/10.1007/s12144-022-03985-0

Dimensions of uncertainty communication: What is conveyed by verbal terms and numeric ranges

Karl Halvor Teigen[1]

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Regulating/standardising the use of probability words

➔ Need for a well thought through and evidence based approach ☺

Regulating/standardising the use of probability words

EFSA (2018)		IPCC (2010)		NATO (2016)	
Probability term	**Subjective probability range**	**Term**	**Likelihood of outcome**	**Verbal statement**	**Numerical assessments**
Almost certain	99–100%	Virtually certain	99–100%		
Extremely likely	95–99%				
Very likely	90–95%	Very likely	90–100%	Highly likely	More than 90%
Likely	66–90%	Likely	66–100%	Likely	60–90%
About as likely as not	33–66%	About as likely as not	33–66%	Even chance	40–60%
Unlikely	10–33%	Unlikely	0–33%	Unlikely	10–40%
Very unlikely	5–10%	Very unlikely	0–10%	Highly unlikely	Less than 10%
Extremely unlikely	1–5%				
Almost impossible	0–1%	Exceptionally unlikely	0–1%		

Standardising the use of probability words – yes, but… psychological interpretation ≠ guidelines

- People do not understand VP according to set guidelines
- E.g., very likely ➔ probability > 90% according to the IPCC….
- Only about 6% of the people got it (Budescu et al., 2009)

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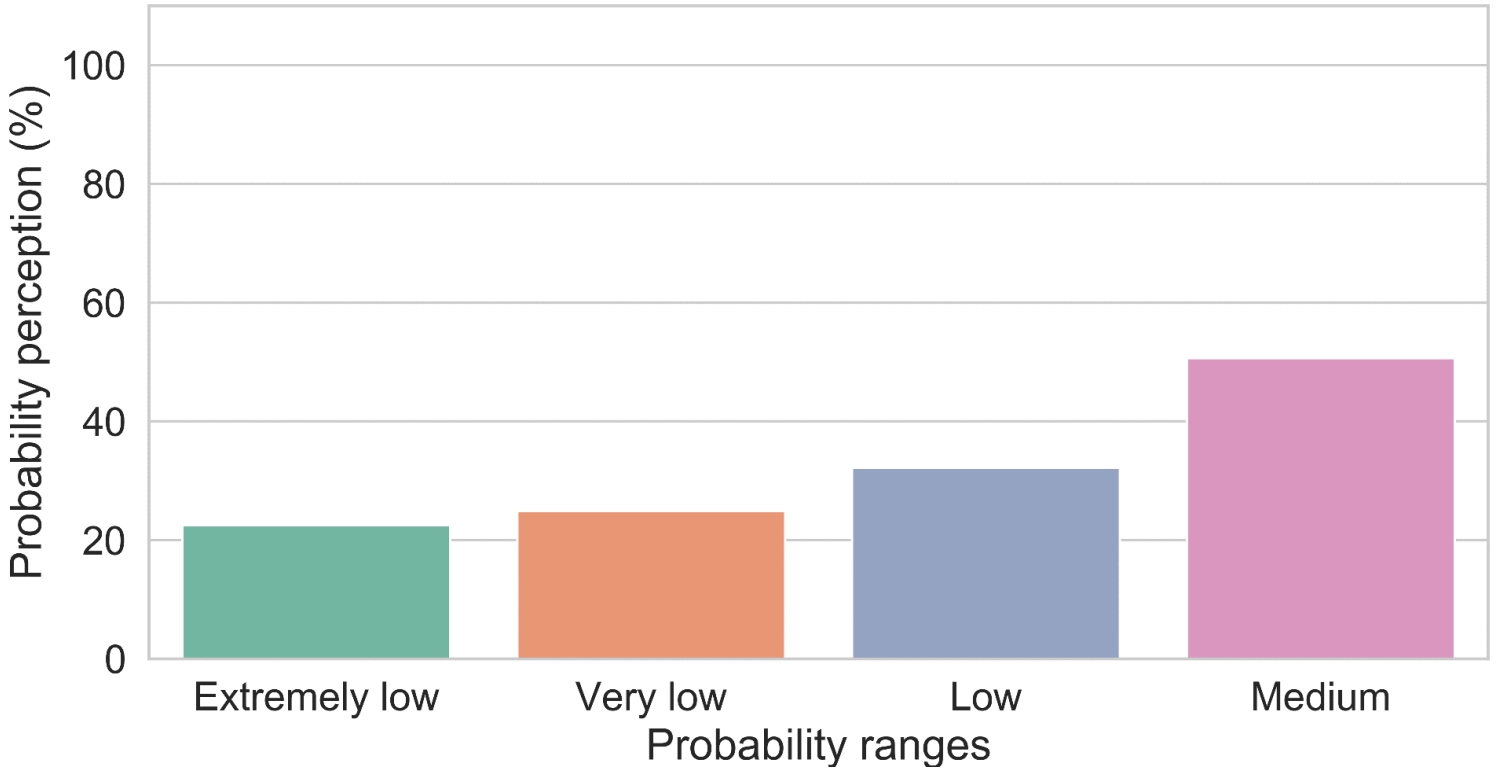
Standardising the use of probability words – yes, but… they are vague



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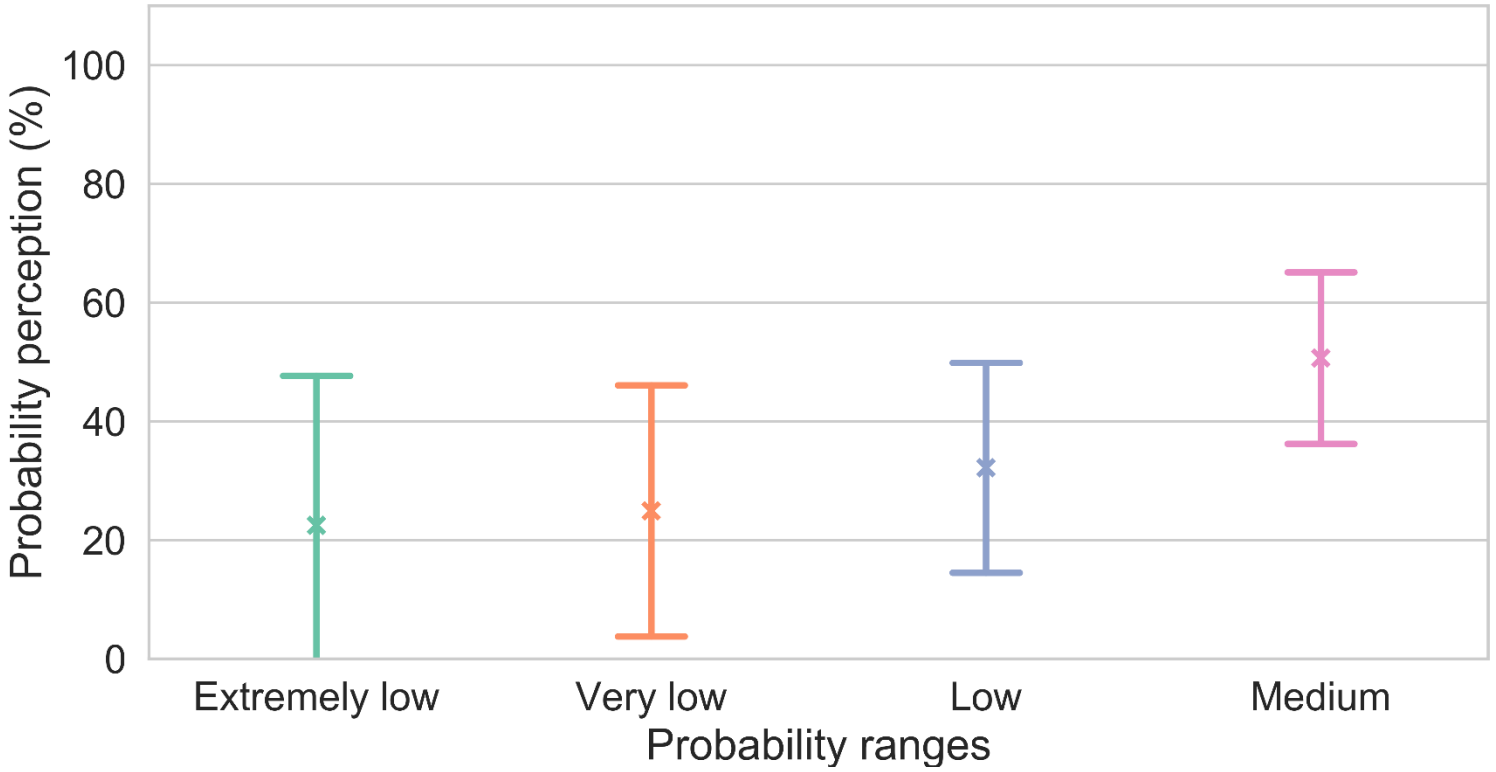

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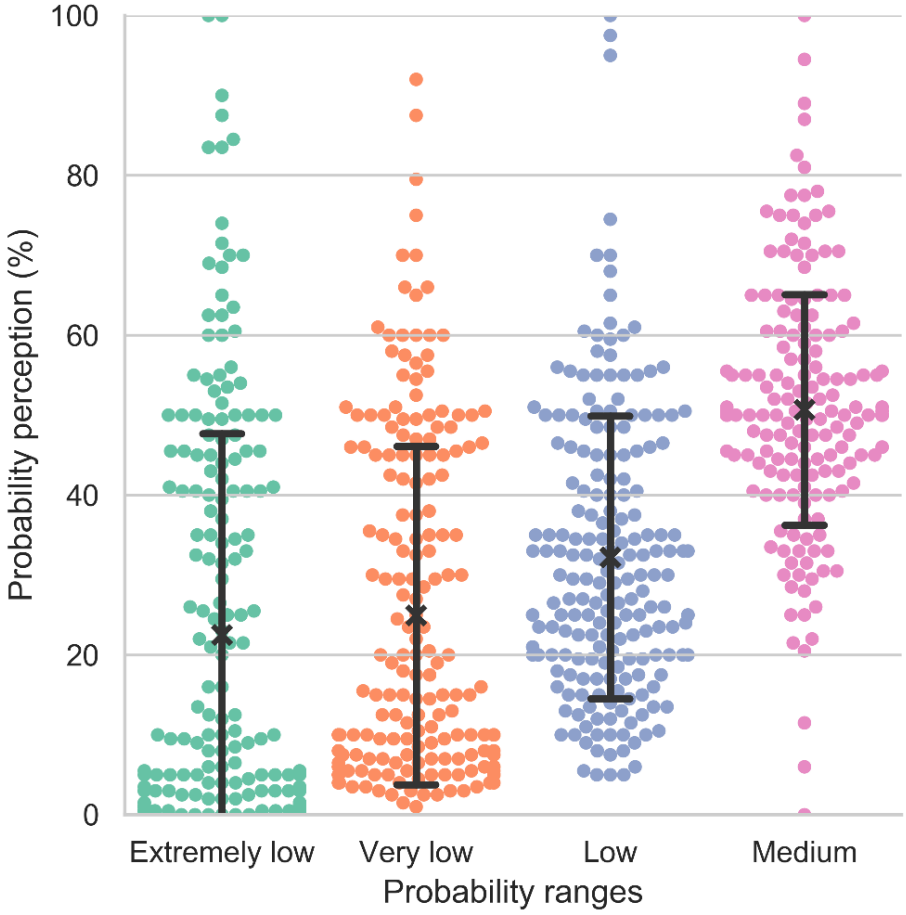

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Standardising the use of probability words – yes, but… context matters

- Context shapes our perception of the probability communicated.
- For ex: A severe likely event is on average perceived as more likely than a mildly negative event (a chance of becoming deaf vs. a chance of getting a cold)
- and also: an event that is usually frequent is perceived as more likely (e.g., a chance of rain in England > a chance of rain in Spain)

Probability words and intention perception

"*Maybe this is a mistake*"

- Question: Why is this person using the word "maybe"? (please answer in the chat)
  A. The person is uncertain
  B. The person is trying to be nice
- If you selected A: Maybe = 50% chance of mistake
- If you selected B: Maybe = 80-100% chance of mistake

Uncertainty communication and intention perception

- Challenge: Politeness considerations require speakers to downplay threats / use “mild” language.
- But, strong language may be needed to alert the public to hazards with potentially severe consequences

Juanchich, M., & Sirota, M. (2013). Do people really say it is "likely" when they believe it is only "possible"? Effect of politeness on risk communication *Quarterly Journal of Experimental Psychology, 66, 1268-1275.*
Sirota, M., & Juanchich, M. (2012). To what extent do politeness expectations shape risk perception? Even numerical probabilities are under the spell! *Acta Psychologica, 141, 391-399.*
Sirota, M., & Juanchich, M. (2015). A Direct and Comprehensive Test of Two Postulates of Politeness Theory Applied to Uncertainty Communication *Judgment and Decision Making, 10, 232–240-232–240.*

Sources of uncertainty

- Internal uncertainty = due to a lack of knowledge

➔ Communicated with phrases like “I am uncertain”, “I believe…”

- External uncertainty = due to the properties of the world

➔ Communicated with phrases like “It is likely” or “There is a chance”

- Most events are a mix of the two
- Words reflect different sources of uncertainty and have implications on judgment and decisions

Juanchich, M., Gourdon-Kanhukamwe, A., & Sirota, M. (2017). ‘I am uncertain’ or ‘It is uncertain’? How linguistic markers of the uncertainty source affect uncertainty communication. Judgment and Decision Making, 12, 445 - 465.

Sources of uncertainty leaks information about credibility

- Describing uncertainty in an external way (“it is very uncertain”) is trusted more than internal uncertainty (“I am very uncertain”)
- Except when an expert is talking

Løhre, E. Teigen K. H. (2023). When leaders disclose uncertainty: effects of expressing internal and external uncertainty about a decision Quarterly Journal of Experimental Psychology, 17470218231204350

Directionality

- Probability words are directional
- They nudge recipients' attention towards the possibility that the outcome will occur or the possibility that it won't – beyond the probability they convey
  - "There is a chance that this will be a success" [➔ attracts attention to possibility of success]
  - "It is unlikely that this will be a success" [➔ attracts attention to possibility of failure]

Effect of directionality on decision (Example of study, Teigen & Brun, 1999)

- Would you recommend a treatment that has **“a possibility”** to be effective?
- Would you recommend a treatment that is **“quite uncertain”** to be effective?
- Would you recommend a treatment that has **a 30-35% chance** to be effective?

Yes, absolutely 1 2 3 4 No, absolutely not

Taken as ‘Yes’ **Taken as ‘No’**

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Effect of directionality on decision
(Teigen & Brun, 1999)

- Would you recommend a treatment that is "**quite uncertain**" to be effective? 32% YES
- Would you recommend a treatment that has "**a possibility**" to be effective? 91% YES
- Would you recommend a treatment that has "**a 30-35% chance**" to be effective? 58% YES

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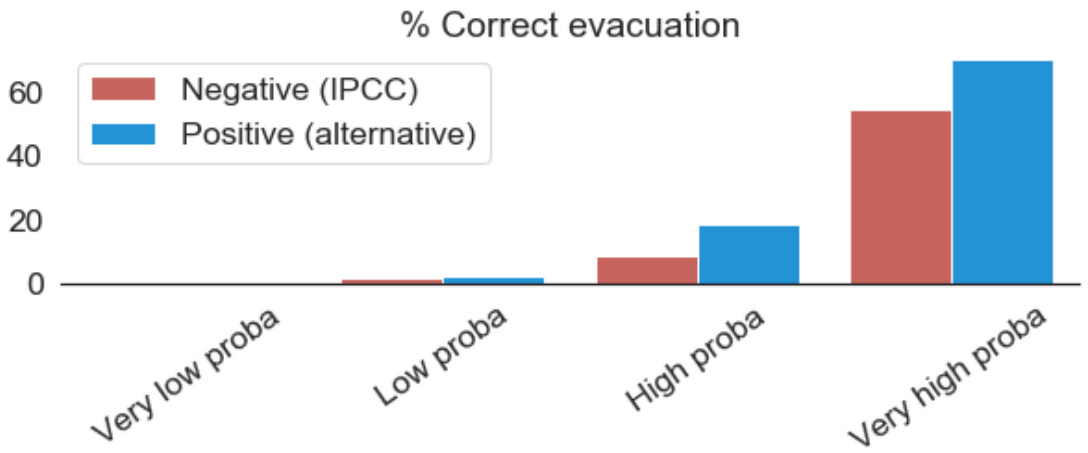
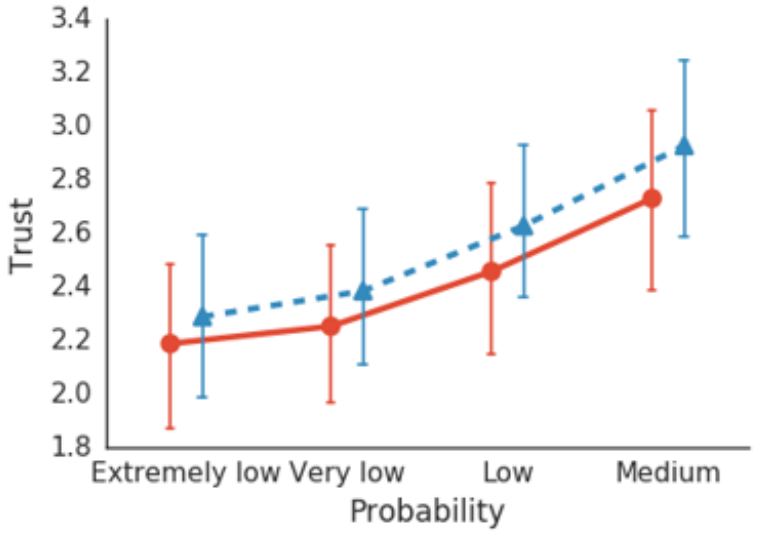
The IPCC uncertainty lexicon is negative for probabilities < 66%

Target range	IPCC lexicon
0–1%	Exceptionally unlikely
0–10%	Very unlikely
0–33%	Unlikely
33–66%	About as likely as not

- But a positive alternative – that conveys the same probability range is possible

In an evacuation task where participants were told about the risk of landslide, positive probability words led to SAFER decisions and more trust





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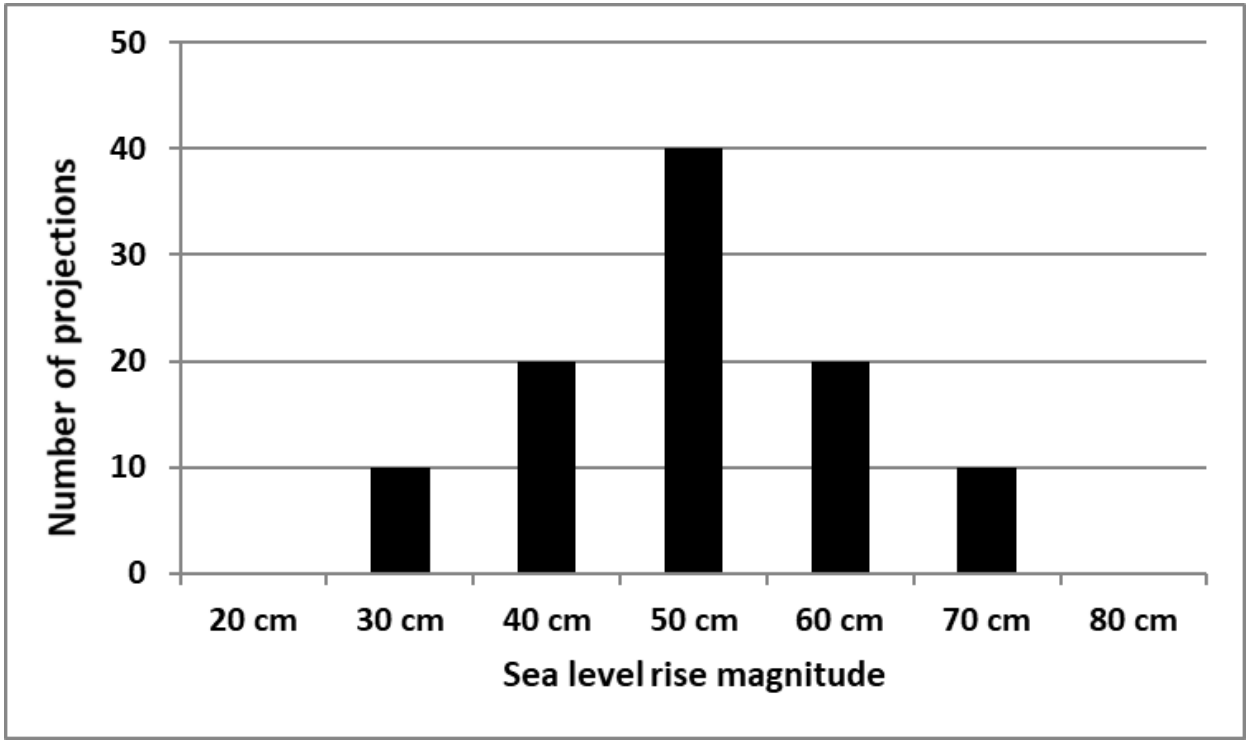
Uncertainty about quantitative values

- How can we effectively convey uncertainty about quantitative values?



What would be an "unlikely" sea level rise based on this graph?

0

20cm 0%

30cm 0%

40cm 0%

50cm 0%

60cm 0%

70cm 0%

80cm 0%

What would be a "possible" sea level rise based on this graph?

0

20cm 0%

30cm 0%

40cm 0%

50cm 0%

60cm 0%

70cm 0%

80cm 0%

What would be a "virtually certain" sea level rise based on this graph?

0

(A) 20cm

0%

(B) 30cm

0%

(C) 40cm

0%

(D) 50cm

0%

(E) 60cm

0%

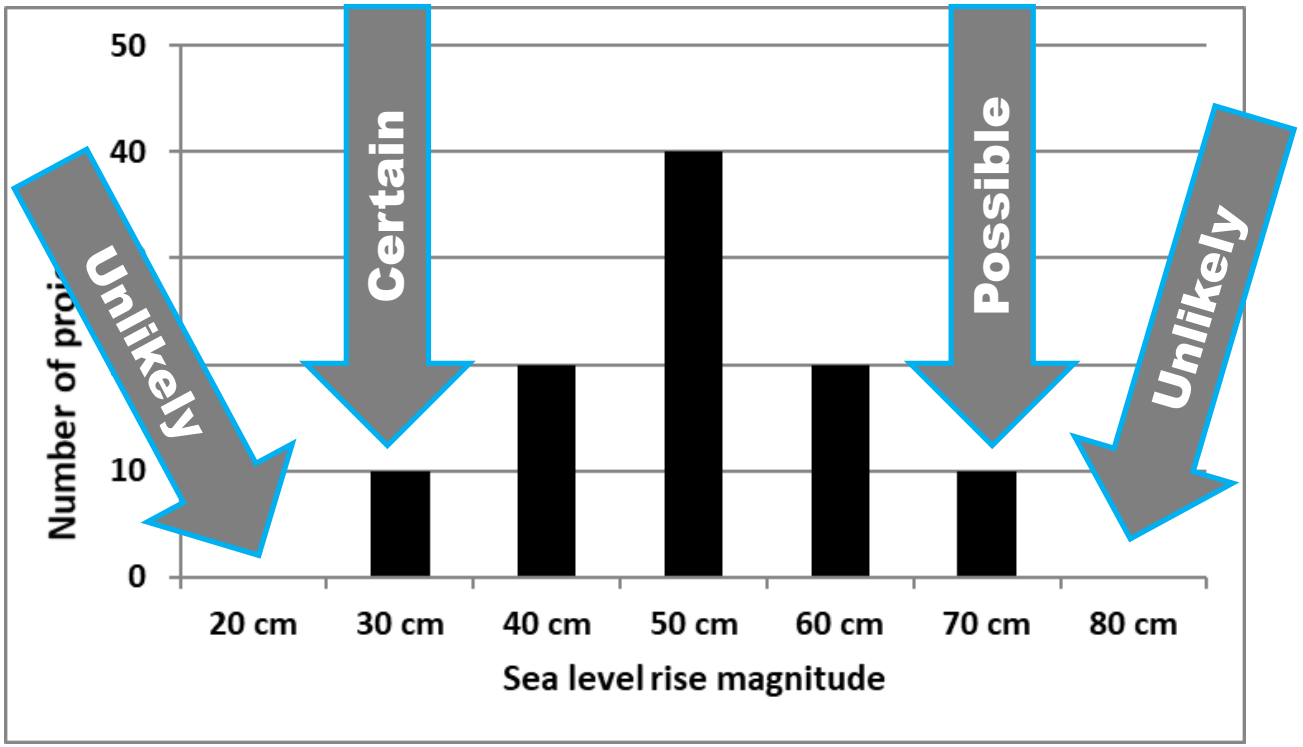
(F) 70cm

0%

(G) 80cm

0%

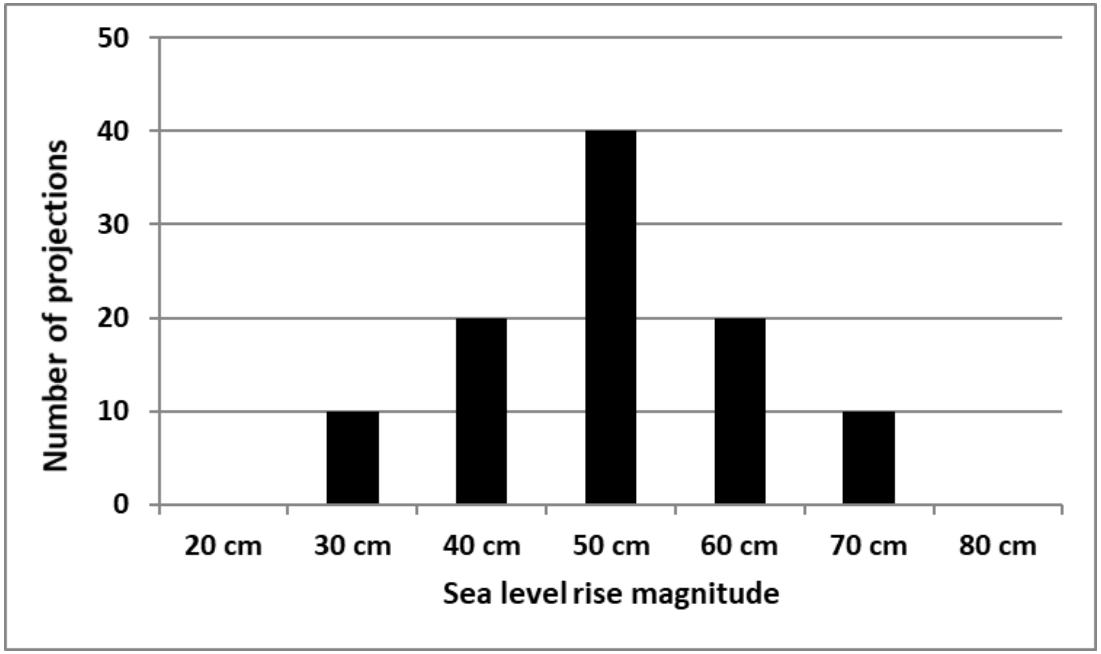
People tend to associate specific words with specific positions in a range



- Unlikely? ➔ 0% frequent (for a 20% perception)
- Possible? ➔10% frequent (for a 50% perception)
- Certain? ➔ 10% frequent (for a 90% perception)

What about intervals/outcome ranges?

- What about using ranges instead of degrees of certainty?
- The sea level will rise between 30 cm and 70cm?



Degree of certainty and outcome ranges

A says: The temperature will rise between 1°C and 5°C

B says: The temperature will rise between 3 °C and 4°C

- Who is most competent? A or B? ➔ B
- Who is most confident? A or B? ➔ B
- Who is more likely to be correct? A or B? ➔ B

- This is a precision paradox (Teigen, 1990)

Lohre, E., Juanchich, M., Teigen, K. H., Sirota, M., & Shepherd, T. (2019). Climate scientists' wide prediction intervals may be more likely but are perceived to be less certain. Weather, Climate and Society.

Take home message

- Uncertainty quantifiers should be seen as a tool box where we draw what we need.
- We need to use probability words whenever precision is not warranted (i.e., almost always).
- Choose the characteristics of your uncertainty lexicon wisely to achieve your goals (and do not hesitate to ask Marie for a chat about it!)

Take home message

- Probability words are useful to
  - Communicating vague uncertainties (vs., precise probabilities)
  - Conveying extra information about the nature of the outcome
  - Nudging decision

- Ranges can convey more uncertainty than intended
- To be used effectively we have to be clear on the probability range they mean.

Many thanks for your attention!

Here are a few questions/leads for discussion about the article

- In your professional practice, how important are predictions regarding future events (e.g., flood, drought)?
- What can be the consequences of ineffective uncertainty communication in your practice?
- Drawing from your experience, what are common methods for conveying uncertainty?
- In your opinion, what alternative approaches could enhance the communication of uncertainty?

Teigen, K.H. Dimensions of uncertainty communication: What is conveyed by verbal terms and numeric ranges. *Curr Psychol* **42**, 29122–29137 (2023). https://doi.org/10.1007/s12144-022-03985-0

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