The language of uncertainty

What uncertainty?

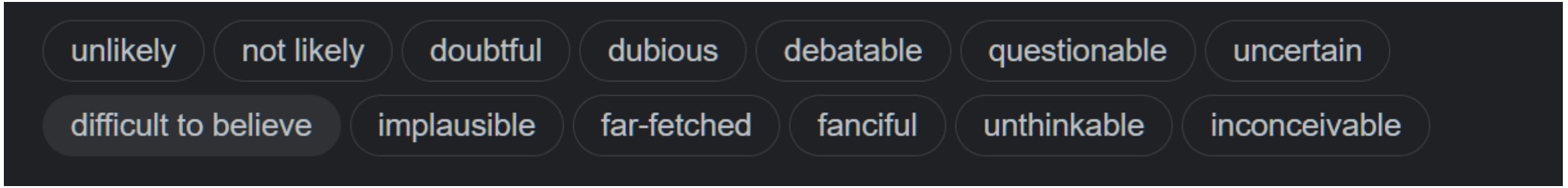
- In July 1997, the proposed new Scottish Parliament building was estimated to cost up to **£40m**.
- By June 1999 the budget for the building was **£109m**.
- In April 2000, legislators imposed a ‘cap on costs’ at **£195m**
- By November 2001, they demanded an estimate of ‘final cost’, which was set at **£241m**.
- That estimated final cost rose twice in 2002, ending the year at **£294.6m**.
- It rose three times more in 2003, reaching **£375.8m**.
- The building was finally completed in 2004 at a cost of roughly **£431m**.

Thinking fast and slow, Daniel Kahneman, 2011.

"The prevalent tendency to **underweight or ignore distributional information** is perhaps the major source of error in forecasting. Planners should therefore make every effort to frame the forecasting problem so as to facilitate utilizing all the distributional information that is available." (p. 251)

D Khaneman. Thinking, Fast and Slow

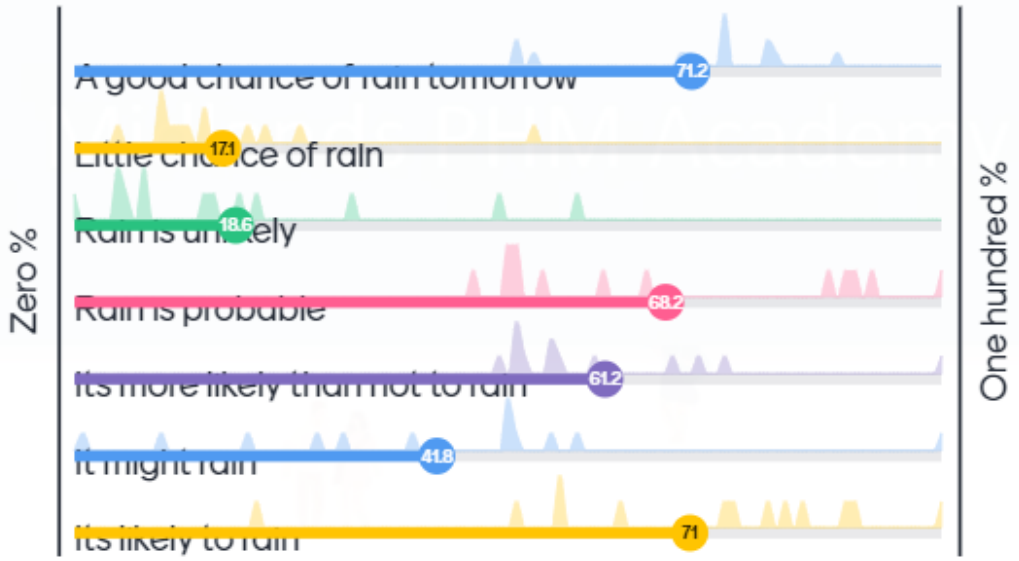
The language of uncertainty

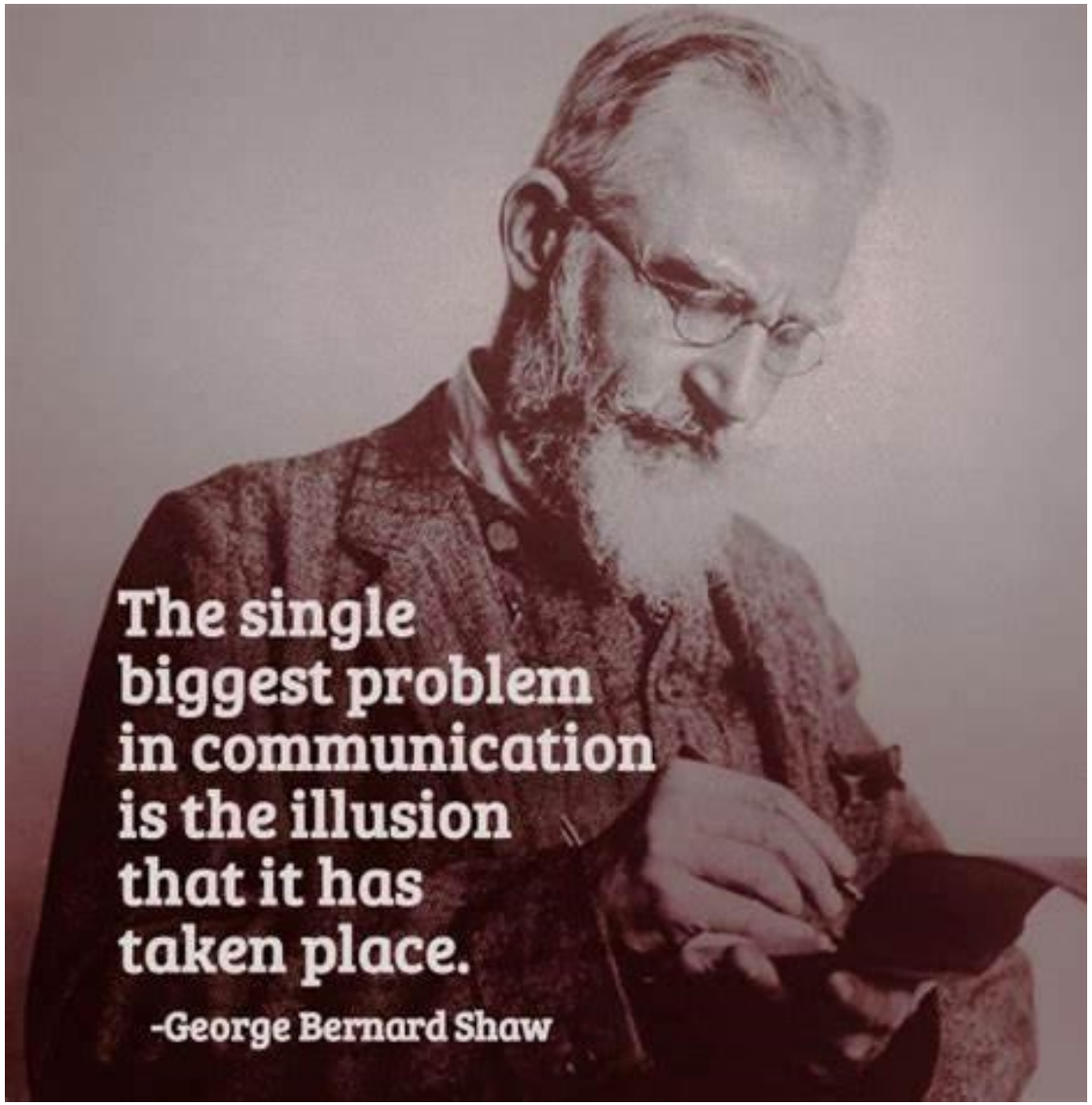


Uncertainty is a distribution that ranges from 0% to 100%

Assign a probability (0% to 100%) to each statement

Statements ?
A good chance of rain tomorrow
Little chance of rain
Rain is unlikely
Rain is probable
Its more likely than not to rain
It might rain
Its likely to rain


Zero %
A good chance of rain tomorrow
71.2
Little chance of rain
17.1
Rain is unlikely
18.6
Rain is probable
68.2
It's more likely than not to rain
61.2
It might rain
41.8
It's likely to rain
71
One hundred %

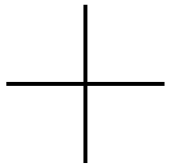

The single biggest problem in communication is the illusion that it has taken place.
-George Bernard Shaw

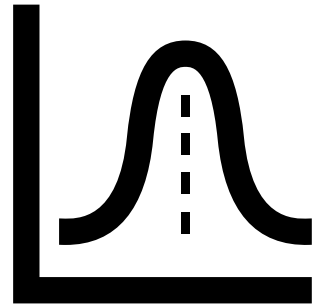
Forecasting

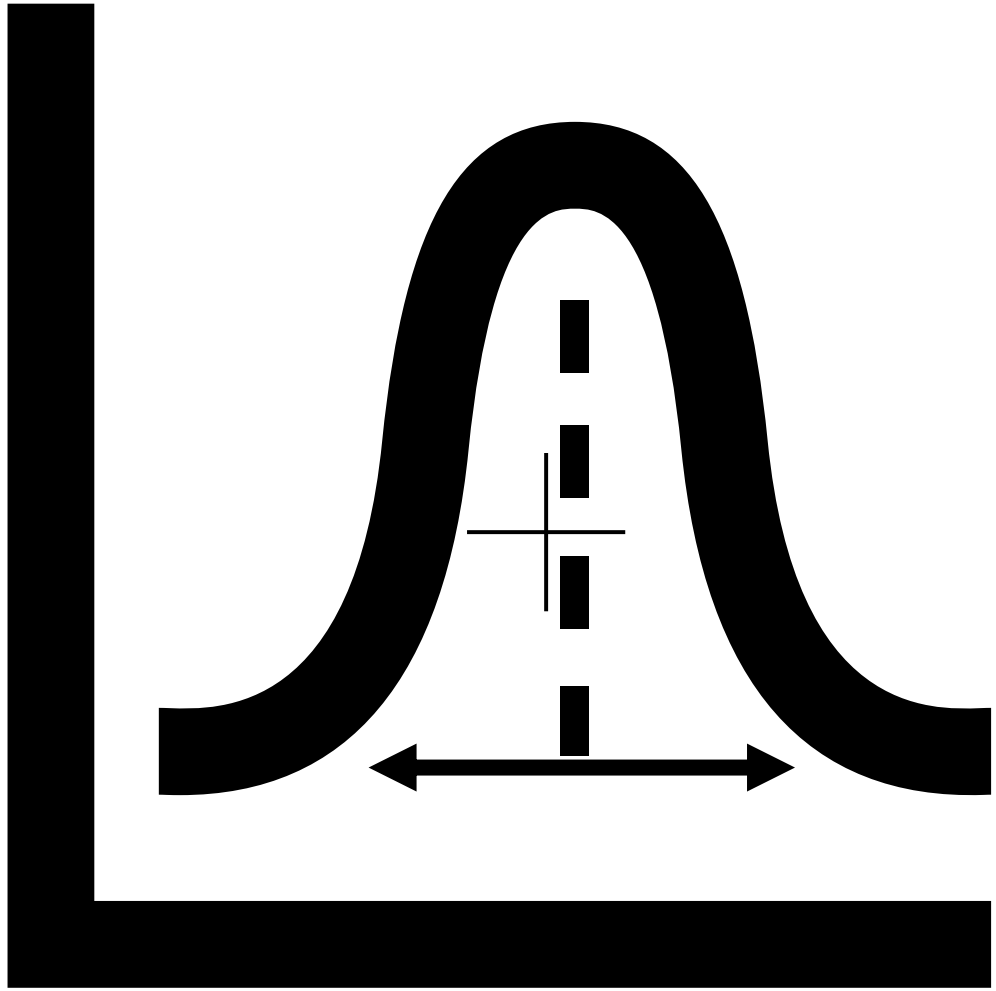
- The current price of gold (24 ct) is £48 per gram

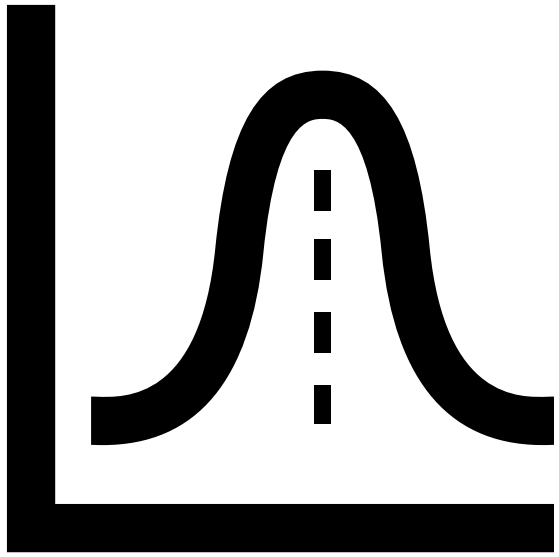
- What will the price be this time next year?

What sort of response did you give









- Probability is the language of uncertainty
- Probability is a distribution
- Probability works for
  - “objective” and “subjective” degrees of belief (Bayesian)
- Probability is a number (but we can add text)

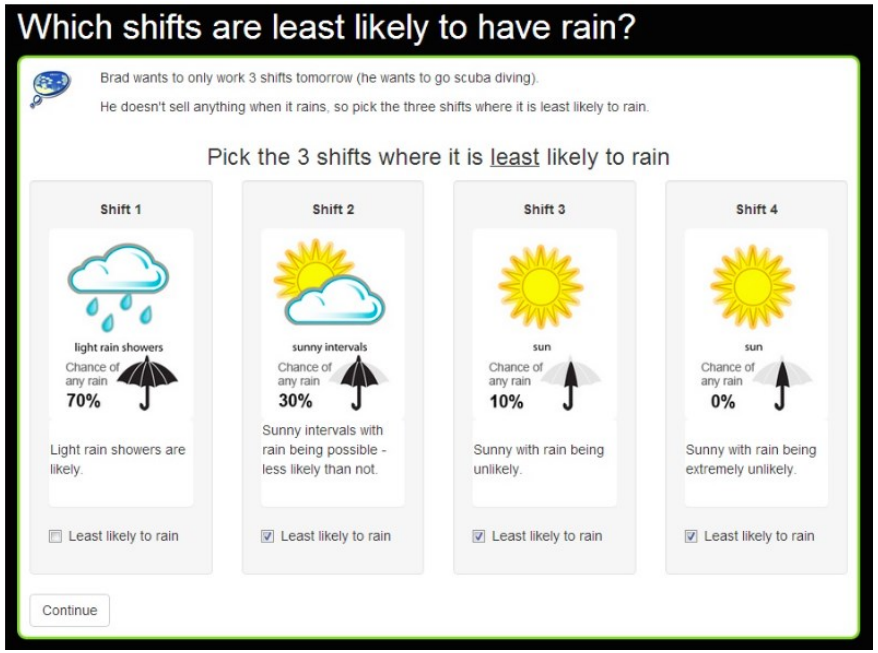
Translating numbers into text

But why is there a need to translate numbers into graphics and textual descriptions in the first place? Why can't we just show the numbers? This relates to the problem of numeracy, which describes how well we can understand numerical expressions. Psychological studies on decision making have found that a high percentage of people do not understand and can't act upon numerical uncertainty. For example, a recent study finds that about 30% of Germans and Americans are unable to answer the question: "Which of the following numbers represents the biggest risk of getting a disease: 1 in 100, 1 in 1000, 1 in 10?".

Likelihood of occurrence	Lexicalisation
p >0.99	"extremely likely"
$0.90 \leq p \leq 0.99$	"very likely"
$0.70 \leq p \leq 0.89$	"likely"
$0.55 \leq p \leq 0.69$	"probable - more likely than not"
$0.45 \leq p \leq 0.54$	"equally likely as not"
$0.30 \leq p \leq 0.44$	"possible - less likely than not"
$0.10 \leq p \leq 0.29$	"unlikely"
$0.01 \leq p \leq 0.09$	"very unlikely"
$p<0.01$	"extremely unlikely"

Table 1: WMO-based mapping of likelihoods.

Women listen and men look? How to best communicate risk to support decision making



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https://understandinguncertainty.org/women-listen-and-men-look-how-best-communicate-risk-support-decision-making

The language of uncertainty is probability

- Probability can be
  - used for subjective and objective degrees of belief (0% to 100%)
  - augmented with words to aid intuition
  - visualised
  - Insightful to decision making

- Reflections…

Share your insights...

Any key insights...

So what…

(any scope for application)

One wish…