For probabilities, use Fermi numbers, not words

Puzzle · Solution

PROBABILITY WORDS

Words have fuzzy meanings (Figure 1), but that alone doesn't mean words are useless.

However, we find serious problems when we examine these words in more detail. Another study gives us even more insight (Figure 2).

Note that the median intended probability of the word "likely" is 70%, whereas the intention of "unlikely" is 20%. Since that is the same word, just negated, we should expect the numbers to be symmetric like 70/30 or 80/20, but instead we're biased.*

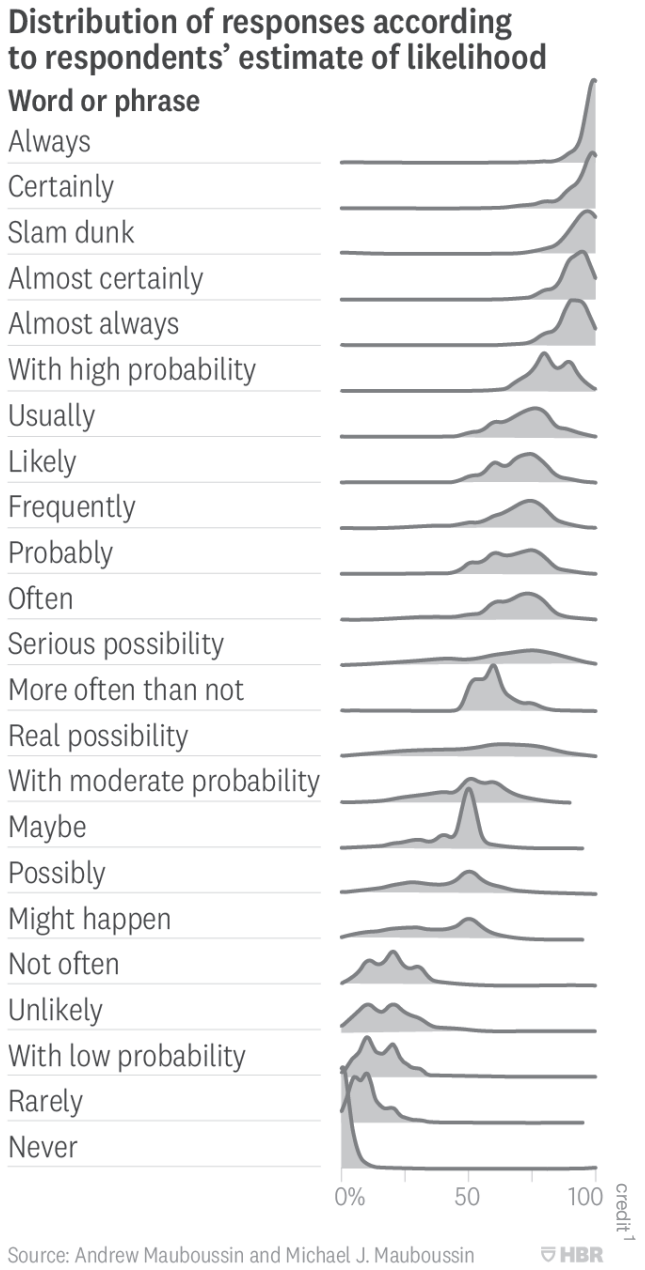


Figure 1: Study: Distribution of numeric probabilities implied by probability-words

* There is extensive literature on our innate bias regarding both rare and common events; people are surprised how often 5% things happen, and how often 95% don't. Nassim Taleb's *Black Swan* expounds on this, and it's obvious in our everyday experience, like how we get upset when a "10% chance of rain" rains out our picnic.

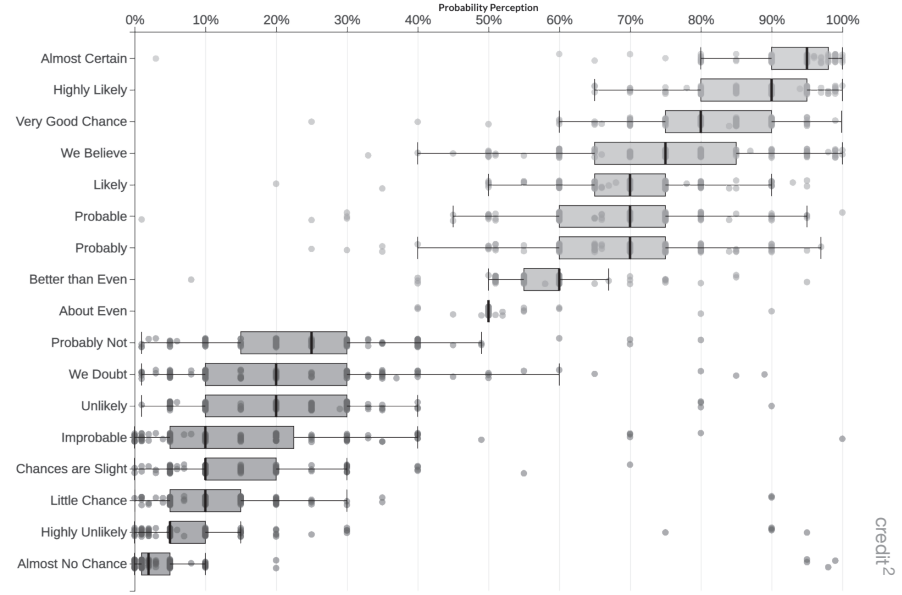


Figure 2

Even worse with "probable / improbable" at 70/10, and strangely while "probable" and "probably" are the same at 70%, "probably not" is 25% while "improbable" is 10%. Perhaps that makes sense to a grammatician, but surely this causes confusion in normal people, especially when we're applying these words in analytical contexts like risk-analysis or debating a strategy.

The communication problem is even worse because *individual people* disagree to an even larger extent. For example, these dots are a single person's evaluation for these words (Figure 3).

Note how pessimistic they are on the positive words, scoring "probable," "probably," and "likely" as only 50%. Then matching the median of 20% with their negatives ("probably not," "we doubt," "unlikely"), but then they claim "improbable" is a straight-up 0% while "highly unlikely" is still 30%.

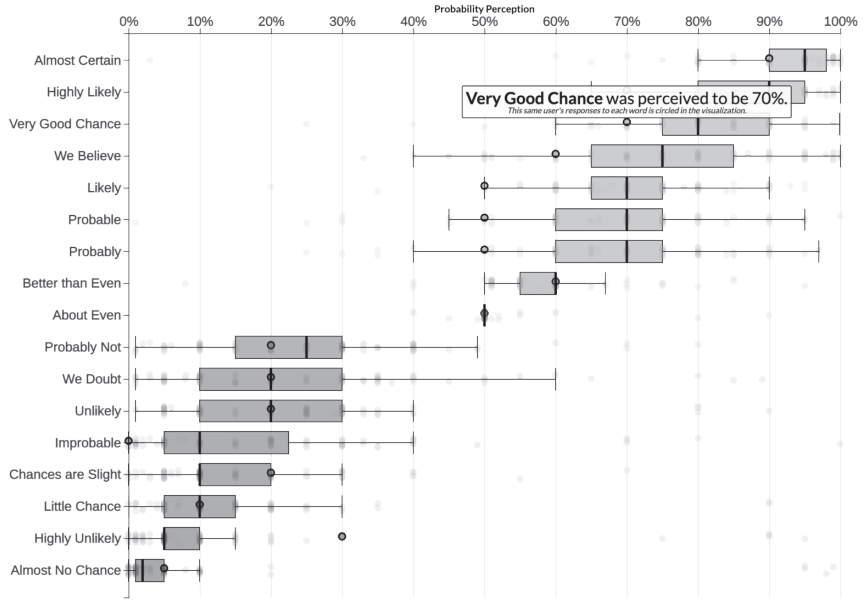


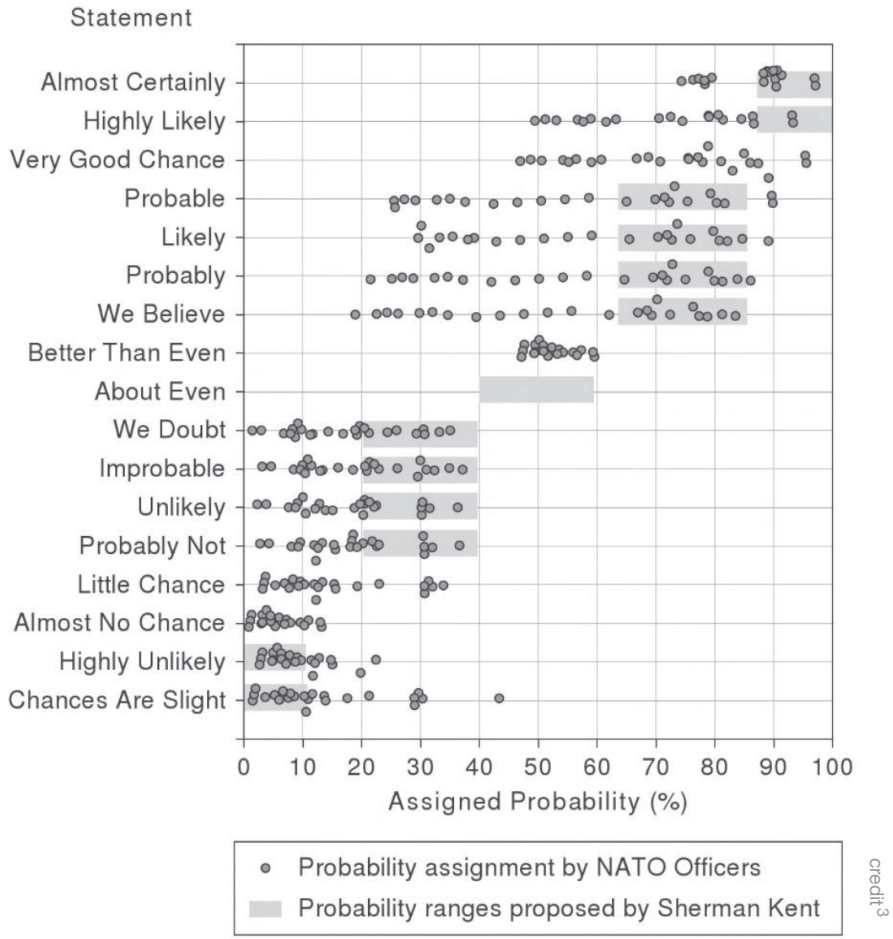
Figure 3

I feel for this person. Although I admit the formal definition of "improbable" cannot be exactly 0%, what do I think in real life? If the consensus is that some project is "improbable" to complete on-time, I would certainly *act* as though that probability were 0%.

So that's the point: Words don't work, because *the differences between individual interpretations are larger than the differences between the words themselves*!

Furthermore, even if you assign an official numeric probability to words, and train competent people to adhere to those definitions, it still doesn't work. The CIA attempted exactly this,[3] publishing what they call the "Sherman Kent Scale." It explains, for example, that "probable" is defined as 75% and "almost certainly not" is defined as 7%. However, when officers were assessed against the scale, fully half the time they failed to stay in-range (the grey bars) (Figure 4).

We should give up on using words to describe probabilities.



credit[3]

Figure 4: "Clearly, the readers in this experiment were not using the Sherman Kent scale even though they were familiar with it." —*Scott Barclay, author of this study*

THE SOLUTION: SPECIFIC PROBABILITIES, FERMI-STYLE

An obvious solution is to force people to use numeric probabilities, never* using vague words. Indeed, this one rule will already improve communication.

But writing down precise probabilities is hard.

It's hard because usually** we cannot specify the probability with precision. The world is often*** unpredictable[4] even with expertise and data, so we *need* fuzzy ranges of probability to gesture towards our intent.

In this sense, it could appear more accurate to say "the project is unlikely to succeed" exactly because it's unknown whether the true probability is 10% or 40%. Still, given individual interpretations of the word "unlikely," we're not accurately communicating that range.

Furthermore, as we know from Fermi Estimation[5] in domains like "impact" and "time estimation," it's unproductive to haggle over details like "is it a 20% or 30% probability." None of us likely**** knows the true number, and anyway we need crisp signals to make smart decisions.

Therefore, the solution is a Fermi-style probability:

1. Use numbers, not words.
2. Select from a small set of options.

This is the same conclusion the CIA came to in the above-referenced 1964 study. Their mistake was to continue using words, but their categorical probabilities were Fermi:

Probability Word	Probability Value	Expected Range
Certain	100%	100%
Almost Certain	93%	87% … 99%
Probable	75%	63% … 87%
Chances About Even	50%	40% … 60%
Probably Not	30%	20% … 40%
Almost Certainly Not	7%	2% … 12%

* Oops, I mean 0.2% of the time.
** Oops, I mean 83.6% of the time.
*** Oops, I mean 62.9% of the time.
**** Oops, I mean 9.1% of the time.

Probability Word	Probability Value	Expected Range
Impossible	0%	0%

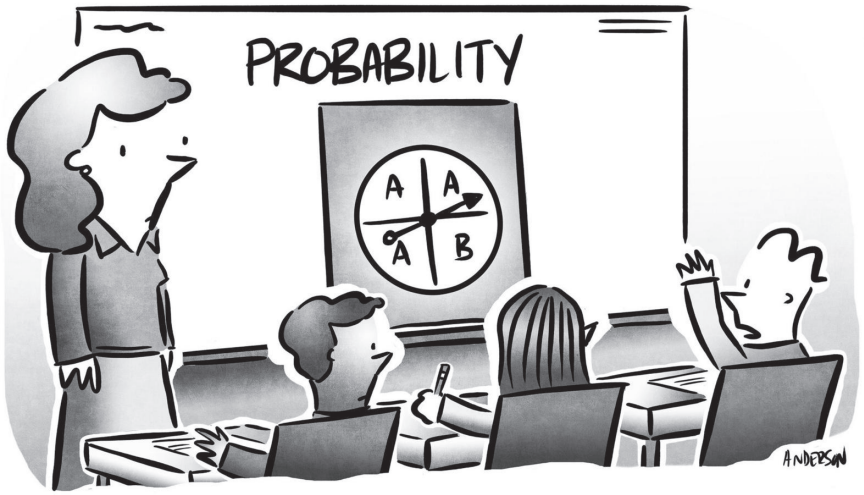
My recommendation is to use just a few raw numbers, without words, with instructions for "rounding off" that depend on the context.

For example, in estimating the likelihood that a project completes on time, we know that in general things are more likely* to be late than early, therefore we should "round off" towards the lower probability.

So go to your "risk" slides, and use Fermi probabilities to force yourself to decide what you think the risk *really* is, so everyone can decide whether or not to act.

Go to your strategy, and put Fermi probabilities on each assertion, so people know what is more or less likely to change as we learn and grow.

Go to your work-prioritization system, and put Fermi probabilities on the "value" or "estimate" metrics that you're using for decision-support.



"I know mathematically that A is more likely, but I gotta say, I feel like B wants it more."

credit[6]

* Oops, I mean more than 51% of the time.

Ask everyone in the team to supply their own numbers independently; where there's disagreement, that's worth a discussion; where there's agreement, you can save time by just moving along.

Perhaps the real reason we use wishy-washy probability words is because we really don't know the probability, and rather than admitting that, we just glide past the challenge. That's the worst reason of all.

Now you have no excuse.

Be brave, and put a number on it.

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References

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