EADM Lifetime Contribution Award, SPUDM 2025 – Karl Halvor Teigen

First of all, I want to say that I am deeply grateful and honored (and amazed) for standing here today as a recipient of the EADM Lifetime Contribution Award.

In February, I was recruited to a screening study about heart function in the elderly. I was supposed to carry around a small cardiogram recorder for ten days or so. Of course, I put it off. But finally, one bright winter morning, with nothing else to do, I summoned courage, went to the bathroom and glued the apparatus to my chest. Back to the computer, I opened my e-mail account. And there it was: a message from Mandeep Dhami about the EADM Lifetime Award.

It came as a complete shock. I had no idea that I was nominated! In fact I had supported another candidate.

My heart jumped and missed a beat or two. So, by accident: The first reaction of a recipient to the lifetime award is scientifically recorded.

This summer I received a follow-up questionnaire. (Not from Mandeep, but from the Health Authorities.) They probably want to find out, confidentially of course, if I was still alive.

And here I am.

I feel this is an occasion for looking back on one of the themes that has kept me alive and busy, in different disguises, for most of my professional life, and implied the input from several students and colleagues, namely:

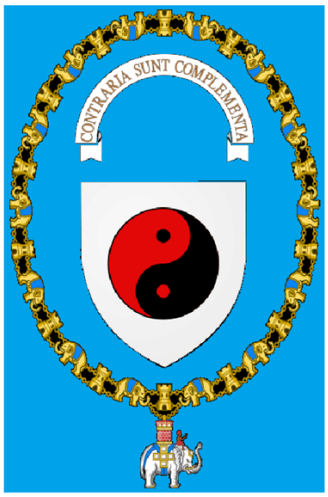
The two faces of probability – and their reflections in language

You all know this picture. It is all over the place in psychological textbooks, illustrating figure / ground-perception.

You probably also know that it was introduced in psychology by the Danish psychologist Edgar Rubin (1886-1951) in 1915 to demonstrated a basic peculiarity of perception, namely our tendency to organize the visual field in two layers. One that catches our attention, and has a thing-like identity, the *figure*, and a more diffuse, more formless *ground*, in which the figure is embedded, apparently extending *behind* the figure.

Normally we are not aware of the visual system's role in this organization, but occasionally we have a choice, with figures that are *reversible*. Interestingly we cannot see these two aspects simultaneously. When we take the vase perspective, the faces disappear, and vice versa.





The picture on the left is a portrait of Edgar Rubin. But to see Rubin's profile we have to force ourselves to neglect the three-dimensional vase.

Rubin had a close friend, actually a relative (second cousin), whose name was Niels Bohr (1885-1962). They were close in age, went to university together, and founded an academic discussion club. They remained friends throughout life (Pind, 2014). But Bohr became even more famous than Rubin in his career as a nuclear physicist. One of his basic ideas was what he called the *complementarity principle*, which says that physical phenomena like light and the smallest components of matter, can be given alternative descriptions, that seem incompatible with each other, and yet can be equally true.

When, late in life (1947) Bohr was knighted and bestowed the Danish *Order of the Elephant*, originally intended for the nobility, he had to make up a coat of arms, and designed this one. You recognize the Yin and Yang symbol in the middle. The device or motto says: *contraria sunt complementa*. Opposites complement each other.

Not so far away from the vase and face emblem of his friend Edgar Rubin.

Bohr famously said: "Physics is not about reality, it is about descriptions of reality"

With this quote we can return to psychology and classical demonstrations of ***framing***, which are precisely about alternative descriptions of reality.

- A glass half full contains the same amount of water as a glass half empty.
- The same person can be described as half-dressed or half naked
- A program saving 200 of 600 lives at risk can be described as losing 400 lives.
- An audience of more than 100 people is at the same time less than 200

These descriptions are mathematically compatible, but communicatively different, conveying contrasting, but complementary messages. They invite us to perceive a profile, or a vase, depending on perspective.

Percentages and probabilities are especially well-suited for framing.

- A yoghurt containing 25% fat can be described as 75% fat free, but sounds less healthy in the first case than in the second.

- A 20% chance for a new pandemic within the next ten years sounds quite alarming, but implies a 80% chance of no pandemic, which is more reassuring.

But probabilities can also be described with words. They also have two faces. Should we say that a future pandemic is *unlikely* or *not* unlikely*?*

Words are baffling

I described to a class of JDM students a lottery with 1000 numbered tickets.

There was ten prizes of 100 dollars each, and one top prize of 1000 dollars.

I asked them to complete this sentence with an appropriate (natural) number:

- "In this lottery, it is **possible** to win ……. ".

Most of them (80%) wrote $1000.

Next, they received this sentence:

- "In this lottery, it is **almost impossible** to win …….".

They smiled and wrote $1000 again.

So, is it possible for "possible" and "almost impossible" to mean almost the same?

Directionality

My first talk at a SPUDM conference was in Cambridge in 1987. It was entitled *The language of uncertainty,* and was later published in *Acta Psychologica*

I claimed in this talk that a verbal probabilistic statement phrased in daily language, for instance, "a possibility", "a chance", or "it is uncertain", has several communicative, pragmatic functions.

True enough, they say something about high vs low probabilities *Likely* indicates a higher probability than a mere *chance*

But they also indicate, among other things:

Either an emphasis on occurrences (affirmations) or non-occurrences (refutations). This characteristic I labeled "**directionality**", in the absence of a better term.

"A chance" and "a possibility" are positive, or affirmative phrases, with the target outcome as the figure, highlighting its likelihood; whereas "a doubt", or an "uncertainty" are negations, reminding us that it may not happen after all. The picture is reversed, bringing the non-occurrence of the target to the fore.

I did not think of this distinction as a discovery or a finding in need of evidential support, because it is a property of everyday language familiar to everybody.

But just to demonstrate that directionality was something different from high vs low probability, I introduced two economic forecasters, A and B.

- A said: It is *possible* that the oil price will reach $20 in October

- B said: It is *not quite certain* that the oil price will reach $20 in October

I asked in one condition:

- Which forecaster has a higher probability in mind, A or B?

A 2/3 majority responded B. "Not quite certain" implied for them a probability less than 100% but more than 50%. Perhaps 70%

I told a second group:

- Imagine that the oil price *did* in fact reach $20. Who was more right?

Now 2/3 responded A. The forecaster with lower probability turned out to be more right. By using a positive term, he was, so to speak, on the right track.

A few years later, in the 1990's, we began to investigate the phenomenon in a more systematic way, and invented an "acid test" for determining a phrase's directionality (Teigen & Brun, 1995) - by simply asking people to complete statements featuring a probability expression, with reasons for why the statement would be true.

A's statement: "It is *possible* that oil prices will go up, because ….." will be continued with reasons for their growth, as for instance a greater demand, while statement B: "It is *not quite certain* …", invites a different set of reasons, like … new fields are opened, there is an increased supply of oil available. In short reasons for why prices are **not** going up.

We (and others) found:

1. A greater variety of positive (upward) than negative (downward) verbal probabilities, and they are used more often. The term "Likely" is much more frequent than the term "unlikely" in most texts.
2. VP statements may be vague in terms of probabilities, but they are *not* vague with respect to directionality (Teigen & Brun, 1995). People agree that "possible" is positive and "uncertain" is negative.
3. They act as frames, indicating higher or lower reference values (Juanchich et al., 2010; Honda & Yamagishi, 2017).
4. They are received by recipients as expressions of recommendations (or warnings), reflecting attitudes of speakers.
5. They influence decisions in opposite direction. A treatment will be tried when it is said to have *some possibility* of being helpful, but not when it is said to be *somewhat uncertain* (Teigen & Brun, 1999). Thus they are in a way more informative for decision makers than mere numbers (Collins & Mandel, 2019)
6. They facilitate or prevent conjunction fallacies. The conjunction of two "likely" events may be (mistakenly) perceived as more likely to occur than just one of them, while the combination of two "uncertain" outcomes is perceived as even more uncertain (Teigen & Brun, 1999).
7. Marie Juanchich and colleagues have recently shown that when low p events are called *unlikely,* as recommended by IPCC, people will tend to disregard them. To

make sure they are attended to, they should be acknowledged positively as *low probabilities* (Juanchich et al., in press).

So far, so good. I concluded that by introducing directionality, I had made my contribution to the theme of verbal probabilities and was ready to move on to other themes. But in vain. I have in fact repeatedly tried to leave this issue, but every time new insights, or new students, or simply serendipity have enticed me to come back. For the remainder of this talk I will discuss more "recent" developments. That is: from the last 15 years.

To exemplify, I will outline our attempts to understand the pragmatics of three key VP concepts - namely the elusive **can**, the ubiquitous **likely**, and the treacherous **certain**.

They all have reversible profiles: one literal, plain, semantic meaning, and one that is tacit, and more slippery, pragmatic. Needless to say, I am most keen on bringing out the *implicit* profiles in the open; research is more fulfilling (to me, at least) when one can make the tacit message speak.

The elusive "can"

Standard VP terms like possible, likely, certain and uncertain, do not exhaust people's verbal lexicons when speaking about chances.

Once upon a time, we did a study about how people, in a normal conversation, reasoned about the magnitude of risks (Teigen, Brun & Frydenlund, 1999). Why is mountain climbing and alcohol consumption considered risky (or not risky)?

- We know that risks are typically defined as a product of **severity** and **probability** of aversive consequence
- In line with this, when people explain risks, severity is *always* mentioned
- In contrast, probability or frequency of occurrence are *rarely* mentioned (actually in less than 10-15% of cases).
- People use another word instead. Their favorite term is **can.** They say:
  - Mountain climbing involves risk, because «you **can** fall and be killed»
  - Alcohol is risky because «it **can** ruin your health»

Yet ***can*** is not to be found on lists of how people translate words into numbers. It is elusive and elastic, characterizing all degrees of risk.

I wondered whether there was a way of capturing and quantifying more specifically the usages of "can".

Verbal probabilities and graded outcomes

A potential answer to this question required a change of focus, from binary (dichotomous) to graded outcomes.

It seems that we have focused almost exclusively on the probability of binary (dichotomous) events: We are discussing what it means that global temperatures are *likely* to rise (vs not to rise. Or that a battery will *possibly* work (or not). Either / or.

But outcomes also have a quantitative dimension, they can be graded according to their magnitude.

We say, for instance that …

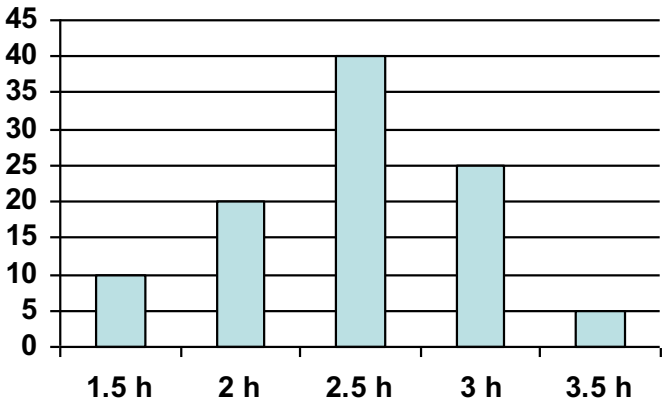
- It is *likely* that global temperatures will rise by xx degrees
- It is *possible* that the battery in my computer will work for xx hours

By asking speakers to fill in numbers such sentences we hoped to capture another, pragmatic aspect of the usages of verbal probability terms, including *can.*

I started making thought experiments where it occurred to me that if we have a range of uncertain phenomena (like temperatures) and are asked to predict what **can**, or what **could** happen, we are drawn towards values at the top of the range.

Inspired by these thought experiment, we conducted a series of empirical studies of how **can** and other verbal phrases are used to describe graded (quantitative) rather than binary (qualitative) events.

Imagine that a sample of computer batteries are tested to check how long they last, resulting in this distribution (Teigen, Juanchich & Filkukova, 2014).



Based on these results what is natural to say? Complete the sentences below

- The battery will last for … hours / can last for …. hours.
- It is possible / a chance / certain / unlikely that it will last for … hours

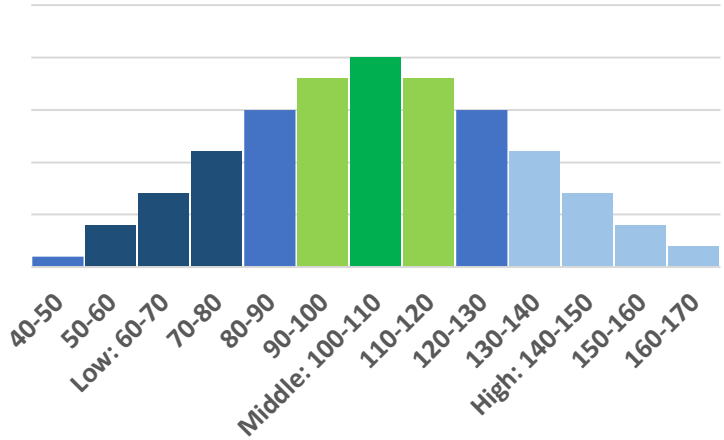
Several of these verbal probability phrases, including "can" and "possible" were completed with extreme values which in most probability distributions have a very low probability of occurrence. We might call that an *extremity effect.*

This is bad news for organizations like IPCC and NATO who have tried to develop standard lexicons for the numeric meaning of probability words. They forgot that these "translations" are only valid for dichotomous events and are not applicable to graded outcomes.

The ubiquitous likely

Likely can be studied with a similar approach. Which values in a graded distribution are considered likely?

In a study of projected highway costs (Teigen, Juanchich & Løhre, 2022), people were asked to indicate a *likely* range, based on a probability distribution for expected costs in millions of dollars, as shown here:



Not surprisingly, they selected a range comprising values in the middle. But even the three most central values – here in green - do not cover more than 42 percent of the distribution, whereas *"likely*", according to the guidelines, should indicate a probability of 60-70 percent or more.

When we specifically asked whether costs in the narrow band between 100 and 110 millions – here in dark green - were *likely* or *not likely*, 79% of the participants said *likely*.

So a 16 percent chance could mean likely, despite the standard interpretations.

But when we asked about outcomes in the upper tail (the light blue ones) or in the lower tail (dark blue), which in fact also covers 16 percent of the distribution, few said that such costs were likely. Such outcomes were "not likely" they said.

It seems that we are back to the good old representativeness heuristic: Outcomes are **likely** when they are typical and central, and **not likely** when they are peripheral, regardless of the areas they cover in a probability distribution.

Certain

Let's explore the most solid and seemingly unassailable verbal probability term, namely certain. What do we stand to gain, or lose, by adding "certain" to a factual statement? For instance, a speaker says that "Jack has two cars", simply, or adds that it is certain.

When saying that it *is certain* that Jack has two cars, the statement appears to come with a guarantee. If nothing is said about certainty, this guarantee is missing. So is it more believable to say that it is certain?

But when we asked participants which statement do you trust more: A statement qualified with certainty, or a plain, unqualified statement, It turned out that simple, unqualified statements were judged to be more believable. Why?

Perhaps by mentioning certainty The speaker implicates that the claim is contentious, that other speakers may have doubted it or found it questionable.

Moreover, by adding certainty the speaker acknowledges that the number of cars that Jack owns belong to the realm of estimates, it is not just a fact, it is a *judgment*.

On top of it, an estimate that someone is certain about might indicate a lower bound. If I am certain Jack has two cars, he might have three. If I drop the qualifier *certain*, people are more willing to accept the number as factual and exact. In the battery vignette, it was quite common to say that it is *certain* the battery will last 1.5 hours (i.e., at least).

We found accordingly that unqualified statements are perceived to be more trustworthy and more exact than statements that are claimed to be certain.

All research is about translations

This talk has summarized highlights of my lifetime journey of research on **translations**: Numbers translated into words and vice versa: verbal statements back-translated into numbers.

This may look like a rather specific and narrow topic. But I claim it is not, because I think that in a fundamental sense, all research and everything scientists do can be regarded as translations.

First*, observations* – of nature, instrument readings, or behavior – must be translated (coded) into *data* (Coombs, 1964). Answers are classified as right or wrong, opinions measured on a Likert scale. Expectations are converted into probabilities. Sometimes the translations are done by us, the experimenters, but very often we are happy to leave this task to our participants.

Then these data are summarized, labelled and fed into organized into more elaborate structures called theories.

And to communicate with the scientific community (and less so to the public) we must translate our findings in the lingo of our discipline, IMRaD structures, and in the style of APA. We are like traditional poets who are obliged to speak in formal verse, adhering to approved conventions, even when they appear unnatural and forced.

Remember Bohr:

- Physics is not about reality. It is about *descriptions* of reality

and Amos Tversky (support theory)

- Probability judgments are attached not to events but to *descriptions* of events (Tversky & Koehler, 1994)

But all translations come with a cost.

There is a saying in Italian about translations, which is especially fitting since this conference is taking place in Tuscany. *Traduttore traditore* – the translator is a traitor.

This saying originated, I am told, in the Renaissance, when French scholars published a French translation of Dante (who by the way, lived for a period here in Lucca). But Italians felt that the musical beauty of Dante's poetry was betrayed and lost.

Similarly, I have felt that JDM researchers are sometimes traitors. We are betraying language by assuming that verbal expressions are just imperfect ways of communicating probabilities. In retrospect, I think I have been, since my first SPUDM presentation almost 40 years ago, an advocate of a complementary view. Language is richer and sometimes more efficient and precise than numbers, because words can convey so many aspects of meaning in addition to the purely probabilistic one.

As scientists we have to adopt the translator's role, but we should realize that we are also traitors. As Rubin and Bohr suggested, perspective shifts are sometimes not only possible, but required. In probabilistic framing studies, we confirm one of their insights, namely that it is difficult, if not impossible, to see the vase and the profiles at the same time.

However, both are needed. In Bohr's device*: contraria sunt complementa*

Two profiles may be needed for a vase to emerge.

Dante Alighieri (1265-1321)

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