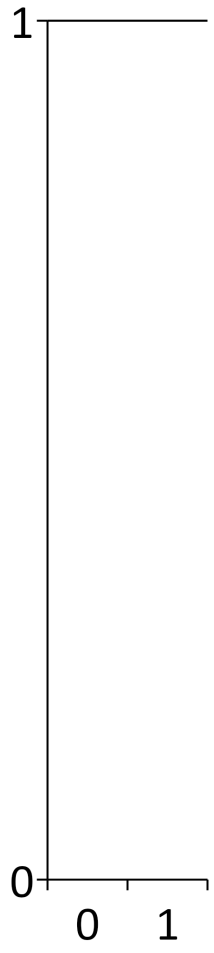
The probability scale is from 0 to 1.



Probability is in itself a Janus-faced construct.

All probabilities between 0 and 1 carry two messages:

- they indicate that a particular outcome may happen, but not necessarily so;
- we are told that something may be the case, but again, maybe not.

Positive and negative are used not in an evaluative sense (as good or bad), but in the **linguistic and logical sense** of affirming or negating a target outcome.

For instance, “T is possible” clearly refers to the potential occurrence of T, whereas “T is uncertain” refers to its potential non-occurrence.

Positive phrases are thus, in a sense, pointing upwards, directing our focus of **attention to what might happen**.

Negative phrases are pointing in a downward direction, asking us to consider that **it might not happen after all.**

Choice of phrase determines whether we are talking about the content of the celebrated glass in terms of how full it is or rather in terms of how empty.

Tests for Directionality

The positive or negative direction of probabilistic expressions:

- Adding Adverbial Quantifiers
- Introducing Linguistic Negations
- Combined Phrases
- Continuation Tasks
- Answering Words

Adding Adverbial Quantifiers

Adverbial quantifiers such as “a little”, “somewhat”, “rather”, “entirely” and “very” **serve to weaken or intensify the message** of a probability phrase in various degrees.

Such adverbs function as “multipliers”, moving the meaning of an adjectival or adverbial phrase up or down the dimension in question.

Positive phrases will accordingly become more positive by adding a strong quantifier (such as “very” or “extremely”), whereas negative phrases will become more negative.

If the probability equivalent of “extremely doubtful” is perceived to be lower than the probability of “somewhat doubtful”, doubtful must be a negative term.
Similarly, if “very uncertain” indicates a lower probability than “a little uncertain”, uncertain has also a negative directionality. In contrast, likely has a positive direction, as “highly likely” corresponds to a higher value on the probability scale than “somewhat likely” or just “likely”.

If “completely certain” is a **positive phrase**, “not completely certain” must be **negative**.

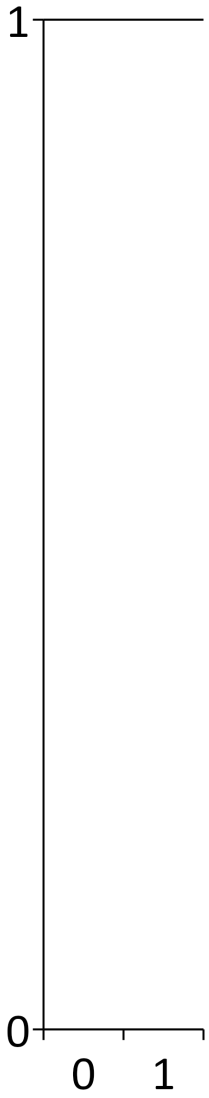
If “probable” and “possible” are **positive**, “improbable” and “impossible” will be **negative**.

And “not improbable” and “not impossible” will be **positive again**, being negations of negated positives.

The two main forms of linguistic negations are not equivalent.

Whereas a phrase P and its complement not-P are logical contradictions, in the sense that both cannot be false (law of the excluded middle).

P and un-P are contraries, or opposites, which cannot both be simultaneously true. But both may be false if we allow for something in between.



For instance, there is a middle ground between being “efficient” and being “inefficient”

Combined Phrases

Positive verbal phrases can easily be combined with other, stronger positive expressions.

For instance, we may say, “it is possible, even probable”, or “it is probable, yes, indeed, almost certain”.

Similarly, negative phrases got one there with other negatives, as “it is improbable, in fact, almost impossible”.

Positive and negative phrases cannot be joined unless their contrast is explicitly acknowledged, for instance, by “but”:

“it is possible, but rather uncertain”, or “it is unlikely, but not impossible”.

Thus, the way phrases are combined can tell us whether they belong to the same or to different categories; it can also give information about the relative strength of the phrases.

Continuation Tasks

The attentional focus of quantifiers can be empirically determined by asking subjects to continue incomplete sentences.

For instance, “not many MPs attended the meeting, because they...”.

This sentence was typically completed with reasons for the absence rather than for the presence of MPs at the meeting, showing that “not many” directs the reader’s attention to the non-present set of MPs (the compset).

The continuation task was adapted for verbal probabilities by Teigen and Brun (1995).

Participants in one experiment were given 26 incomplete statements containing different verbal probability expressions.

For instance,

“It is very improbable that we left the keys in the car, because...”,
“It is almost certain that Clinton will become a good president, because...”.

The sentence completions were then categorised as

1. **pro-reasons** (if they contained reasons for the occurrence of the target issue—for example, reasons for the keys being left in the car),
2. **con-reasons** (reasons against the target issue—why the keys would *not* be in the car) or mixed reasons (reasons both for and against the target).

The results showed that nearly all phrases could be unambiguously classified as either positive or negative.

Only the phrases “a small probability” and “a small chance” were ambiguous, as some participants completed them with pro-reasons (probabilities and chances being positive words), whereas others gave reasons against (presumably because of their smallness).

Phrases involving the term “uncertain” were also distinct by being evaluated either as purely negative or mixed.

Moxey and Sanford (2000) also suggest other continuation tests.

For instance, a negatively valenced target event must be combined

- if the proposition is to be evaluated as “good” with a negative probability expression ,

- if it has to be evaluated as “bad” with a positive probability expression

"It is possible that someone will die, which is a bad/good∗ thing"

"It is improbable that anyone will die, which is a bad∗/good thing"

(asterisks indicate unacceptable propositions)

The point here is that the relative pronoun "which" has an opposite reference in these two cases, depending upon the attentional focus created by the probability term.

Answering Words

In a communicative context, answers containing positive words will naturally be preceded by “yes”, whereas negative words go naturally together with “no”.

For instance, if someone says,
"I think we left the keys in the car",
and receives the answer
"——, it is possible",
we would expect the answer to contain "yes" rather than "no".

If the answer is "——, it is improbable", the first (missing) word would be "no".

This was confirmed in a second experiment, reported by Teigen and Brun (1995).

This experiment also showed that the combination “no, but” was mostly acceptable in conjunction with positive phrases,
such as “no, but there is a chance”,
whereas “yes, but” preceded (mildly) negative phrases (“yes, but it is somewhat uncertain”).

The general picture emerging from this research is that verbal probability phrases are not at all vague as far as their directionality is concerned.

Their location on the probability scale may be debatable, but their categorisation as either positive or negative expressions leaves, with few exceptions, little room for doubt.

What determines the choice of verbal phrase?

According to the traditional approach, speakers choose expressions matching the probabilities they bear in mind.

With a probability approaching certainty, we say it is “highly probable” or “almost certain”. Probabilities around 50 per cent will be characterised as “50/50” or “uncertain”.

Generally, one might think that positive phrases will be used to characterise probabilities above 5, whereas negative phrases will be used to characterise probabilities below

Examples of directionally positive and negative probabilistic expressions

Positive expressions (pointing to occurrences)	Negative expressions (pointing to non-occurrences)
Probable	Improbable
Very probable	Highly improbable
Somewhat probable	Rather improbable
Quite probable	Quite improbable
Not improbable	
Likely	Unlikely
Highly likely	Somewhat unlikely
Not unlikely	
Possible	Impossible
Entirely possible	Almost impossible
A slight possibility Not impossible	Not sure

Positive expressions (pointing to occurrences)	Negative expressions (pointing to non-occurrences)
A chance	No chance
Good chance	Not quite certain
Certain	Uncertain
Almost certain	Somewhat uncertain
Not uncertain	Very uncertain
Not doubtful	Doubtful
Doubtless	Very doubtful
A risk	Not very risky
Some risk	
Perhaps	Perhaps not
A small hope Increasing hope	Almost no hope

From the overview of representative positive and negative expressions, portrayed in Table, it is evident that most, but not all, directionally negative phrases also contain linguistic negations (lexical or affixal).

Furthermore, most of them, but not all, describe low probabilities.

Positive phrases seem generally to be more numerous, more common and more applicable to the full range of probabilities.

In typical lists of verbal phrases designed to cover the full probability scale, positive phrases outnumber the negatives in a ratio of 2:1

From a linguistic point of view, this model appears to be overly simplistic. Affirmations and negations are not simply mirror images of each other, dividing the world between them like the two halves of an apple.

Linguistically and logically, as well as psychologically, the positive member of a positive/negative pair of adverbs or adjectives has priority over the negative:

◊ it is mentioned first (we say “positive or negative”, not “negative or positive”; “yes and no”, not “no and yes”),
◊ it is usually unmarked (probable vs. improbable, certain vs. uncertain),
◊ it requires shorter processing time.

Can we can speak about

- a “highly uncertain success”?
- a “highly uncertain failure”?

We can speak of a “highly uncertain success”, but rarely about “a highly uncertain failure”.

If focus of attention, or perspective, is a decisive characteristic of the two classes of probability phrases

- **positive phrases** should be chosen whenever we want to stress the **potential attainment** of the target outcome (regardless of its probability),

- **negative phrases** should be chosen when we, for some reason or another, feel it is important to draw attention to its **potential non-attainment**.

Task

Imagine a medical situation in which the patient displays three out of six diagnostic signs of a serious disease.

How should we describe the patient's likelihood of disease?

Regardless of the actual (numeric) probability, a doctor who wants to alert the patient, and perhaps request that further tests be administered, would choose a **positive phrases or negative phrases.**

Positive phrase, saying, for instance, that there is “a possibility of disease”, or “a non-negligible probability” or “a significant risk”.

If, however, the doctor has the impression that the **patient has lost all hope**, or that his colleague is about to draw a too hasty conclusion, he might say that the **diagnosis is "not yet certain", or that there is still "some doubt"**.

In the same vein, the three diagnostic signs may be characterised as "some" or "several" in the positive case, and as "not many" or "not all" in the negative case.

This prediction was tested by presenting three groups of introductory psychology students at the universities of Oslo and Bergen with the following scenario.

Polycystic syndrome (PS) is a quite serious disease that can be difficult to detect at an early stage. The diagnostic examination includes six tests, all of which must give positive reactions before PS can be confirmed.

Note:

- *positive reactions* here mean an indication of disease;
- *negative reactions* indicate an absence of disease.)

Here follow the statements from six different doctors that have each examined one patient suspected of having PS.

Group A: the task is to estimate the number of positive tests you think each of these doctors has in mind.

Group B: the task is to estimate the probability of PS you think each of these doctors has in mind.

Group C: the task is to complete the statements to make them as meaningful as possible, choosing the most appropriate expression from the list below each statement. You may, if you choose, use the same expression in several statements.

All groups were then given the following six statements:

1. The examination showed positive reactions to some of the tests.
2. The examination showed negative reactions to some of the tests.
3. The examination did not show positive reactions to all the tests.
4. The examination did not show negative reactions to all the tests.
5. The examination showed positive reactions to several of the tests.
6. The examination showed negative reactions to several of the tests.

Numeric and verbal probabilities of polycystic syndrome (PS) based on verbal descriptions of the outcome of six medical tests

Results of medical examination	Group A (*n* = 46) Mean estimated number of positive tests	Group B (*n* = 35) Mean estimated probability of of disease	Group C (*n* = 34) Choices of verbal probabilistic phrases	
			Positive	Negative
Positive reactions				
On *some* of the tests	2.48	46.4%	25	9
Not on *all* the tests	3.98	53.7%	3	31
On *several* tests	3.67	61.3%	32	2
Negative reactions				
On *some* of the tests	3.09	44.0%	4	30
Not on *all* the tests	2.59	39.2%	16	18
On *several* tests	2.56	27.1%	0	34

For group C, each statement was followed by a second, incomplete sentence, “It is thus _____ that the patient has PS”, to be completed with one of the following expressions: certain / uncertain / probable / improbable / possible / impossible / doubtful / no doubt.

Positive reactions to “some” or to “several” tests direct the reader’s attention to tests that indicate PS.

How many are they?

According to the answers from group A, “some of the tests” typically refer to two or three of the six tests, whereas “several tests” typically mean three or four tests (mean estimates are presented in Table, first column).

Both these estimates are lower than “not...all the tests”, which was usually taken to mean four out of six tests. But the latter expression is directionally negative, pointing to the existence of tests that did not indicate disease.

The question now is whether this change of attention would have any impact on (1) the numeric probability estimates produced by group B and, more importantly, on (2) the choices of verbal phrases designed to complete the phrases by group C.

Table, second column, shows the mean probability estimates for PS given by group B.

Participants in this group thought that a doctor who refers to positive reactions on “some of the tests” has a mean disease probability of 46.4 per cent in mind.

Whereas a doctor who refers to “several tests” has a significantly higher probability of 61.3 per cent in mind.

These results are clearly in line with the number of tests corresponding to “some” and “several”, as estimated by group A. However, the probability estimate for “not all of the tests” was lower than for “several”, despite the higher number of tests it implies.

The three statements about negative test reactions formed a mirror picture.

“Some” tests with negative reactions imply positive reactions on three or four tests, whereas **“several”** and **“not all”** tests showing negative reactions imply two or three positive tests.

Translated into probabilities, **“not all”** lies again between the other two, with significantly higher probability for disease than in the case of **“several”** negative tests.

Thus, even if probability estimates are in general correspondence with the estimated number of positive or negative tests, there is an indication that the numeric probabilities are influenced by the (positive or negative) way the test results are presented.

When we turn to group C, who were asked to choose appropriate verbal expressions, the way the test results were described turns out to be of central importance (Table, last two columns).

When “some” test results are positive, most participants thought it most appropriate to conclude, “It is thus possible that the patient has PS.” Some participants said it is probable, whereas only 26 per cent preferred one of the negative phrases (uncertain, improbable, or doubtful).

With “several” positive test results, PS was considered probable by a majority of the participants, and only 6 per cent chose any of the negative phrases.

However, when “not all” test results are positive, more than 90 per cent of the participants switched to a negative phrase, claiming that it is **uncertain** (14), **doubtful** (12), **impossible** (3) or **improbable** (2) that the patient has PS.

With “some” or “several” negative test results, a complementary pattern emerges, as nearly all respondents concluded that PS is, in these cases, improbable, doubtful or uncertain.

But again, **if “not all” tests are negative, the picture changes.** In this case, about half of the respondents preferred a positive characteristic (it is possible).

These results demonstrate that choices of phrase are strongly determined by how the situation is framed.

The way the evidence is described appears to be more important than the strength of the evidence.

Thus, the half-full/half-empty glass metaphor strikes again. If the glass is half-full, the outcome is possible. If it is half-empty, the outcome is uncertain.

Perhaps we could go one step further and claim that any degree of fullness, or just the fact that the glass is not (yet) completely empty, prepares us for possibilities rather than uncertainties.

Whereas all degrees of emptiness, including the claim that the glass is just not full, suggest uncertainties and doubts.

The above study demonstrates how similar situations can be framed in positive as well as in negative verbal probability terms. This will draw attention either to the occurrence or the non-occurrence of a target outcome, or determine the reader's perspective.

But does it matter? If I know that "possible" and "uncertain" can both describe a 50/50 probability, I could mentally switch from one expression to the other, and more generally translate any positive phrase into a corresponding negative one, or vice versa.

Effects on Probabilistic Reasoning

The rules of probability calculus dictate that a conjunction of two events must be less probable than each of the individual events.

People seem sometimes to be intuitively aware of this rule, as for instance, when discussing the improbability of coincidences, but in other cases, they incorrectly assume that the combination of a high-probability event and a low-probability event should be assigned an intermediate rather than a still lower probability.

The outcomes or events to be evaluated serve as temporary hypotheses, to be confirmed or disconfirmed by the available evidence. From the research on hypothesis testing, we know that people often bias their search towards confirming evidence. Such a bias inevitably leads to inflated probability estimates.

Negative phrases appear to counteract the conjunction fallacy.

But this does not make people better probabilistic thinkers in all respects.

Correct disjunctive responses require the probabilities to be higher, or at least as high as the probability of the individual events. Such answers appeared to be facilitated by positive verbal probabilities but hindered by negative verbal phrases.

Effects on Predictions

Verbal probabilities sometimes better reflect people's actual behaviour than their numeric probability estimates do.

If so, we should pay more attention to people's words than to their numbers. Moreover, since they appear to have a choice between two types of words, we should perhaps be especially sensitive to how they frame their message.

Imagine asking two students at a driving school about their chances of passing the driving test without additional training.

Onesays, “It is a possibility.”

The other says, “It is somewhat uncertain.”

What are their subjective probabilities of success? And will they actually take the test?

Experiment 2. One group were asked to answer the first of these questions (along with several other, similar questions), whereas another group received the second type of questions.

The positive phrases in this study were translated into probabilities between 44 per cent and 69 per cent, whereas the negative phrases were estimated to lie between 36 per cent and 68 per cent.

In the above example, “a possibility” received a mean estimate of 57.5 per cent whereas “somewhat uncertain” received a mean estimate of 52 per cent.

These differences in probability estimates were, however, minor compared to the differences in predictions. More than 90 percent of participants predicted that the first student would take the test, whereas less than 30 percent believed that the “uncertain” student would do the same.

Similar results were found for a scenario in which employees gave verbal statements about their intentions to apply for promotion.

Positively formulated intentions (“a chance”, “possible”, or “not improbable”) led to 90 percent predictions that they would apply, whereas negatively formulated intentions (“not certain”, “a little uncertain”, or “somewhat doubtful”) led to less than 25 percent apply predictions.

In a second study, the same participants gave numeric probability estimates as well as predictions, based either on the driving school scenario or the application scenario.

This made it possible to compare predictions based on positive phrases with predictions based on negative phrases, with matching numeric probabilities.

The results clearly showed that the same numeric probabilities are associated with positive predictions in the first case, and negative predictions in the second.

For instance, positive phrases believed to reflect a probability of 40 percent were believed to predict positive decisions (taking the test or applying for promotion) in a majority of the cases, whereas negative phrases corresponding to a probability of 40 percent were believed to predict negative decisions (put off test and fail to apply).

Effects on Decisions

Despite the vagueness and interindividual variability of words, decisions based on verbally communicated probabilities are not necessarily inferior to decisions based on numeric statements.

They are, however, more related to differences in outcome values than differences in probabilities, whereas numeric statements appear to emphasise more strongly the probability magnitudes.

Decision efficiency appears to be improved when probability mode (verbal versus numerical) matches the source of the uncertainty.

With precise, external probabilities (gambles based on spinners), numbers were preferred to words; with vague, internal probabilities (general knowledge items), words were preferable.

These studies have, however, contrasted numerical with verbal probabilities as a group, and have not looked into the effect of using positive as opposed to negative verbal phrases. Our contention is that choice of term could also influence decisions.

Suppose that you have, against all odds, become the victim of the fictitious, but malignant PS, and are now looking for a cure.

You are informed that only two treatment options exist, neither of them fully satisfactory.

According to experts in the field, treatment A has “some possibility” of being effective, whereas the effectiveness of treatment B is “quite uncertain”.

Which treatment would you choose?

If you (like us) opt for treatment A, what is the reason for your choice?

Does “some possibility” suggest a higher probability of cure than does “quite uncertain”?

Or is it rather that the positive perspective implied by the first formulation encourages action and acceptance, whereas the second, negative phrase more strongly indicates objections and hesitation?

To answer these questions, we presented the following scenario to five groups of Norwegian students.

Nina has periodically been suffering from migraine headaches and is now considering a new method of treatment based on acupuncture.

The treatment is rather costly and long-lasting.

Nina asks whether you think she should give it a try.

Fortunately, you happen to know a couple of physicians with good knowledge of migraine treatment, whom you can ask for advice.

They discuss your question and conclude

- that it is quite uncertain (group 1)
- there is some possibility (group 2)
- the probability is about 30–35 per cent (group 3)

That the treatment will be helpful in her case.

On this background, would you advise Nina to try the new method of treatment?

Two control groups were given the same scenario, but asked instead to translate the probability implied by quite uncertain (group 4) and some possibility (group 5) into numeric probabilities on a 0–100 per cent scale.

They were also asked to indicate the highest and lowest probability equivalents that they would expect if they had asked a panel of 10 people to translate these verbal phrases into numbers.

The control group translations showed that “quite uncertain” and “some possibility” correspond to very similar probabilities (mean estimates 31.3 per cent and 31.7 per cent, respectively), with nearly identical ranges.

Yet, 90.6 percent of the respondents in the verbal positive condition recommended treatment, against only 32.6 per cent of the respondents in the verbal negative condition, who were told that the cure was “quite uncertain”.

The numerical condition (“30–35 per cent probability”) led to 58.1 per cent positive recommendations, significantly above the negative verbal condition, but significantly below the positive verbal condition.

These results demonstrate that the perspective induced by a positive or negative verbal phrase appears to have an effect on decisions, over and beyond the numeric probabilities these phrases imply.

System analysis and decision making

System analysis and decision making