**Degrees of Belief: How much do you believe something?**

When speaking informally, English speakers often exaggerate for the sake of emphasis. For example, the statement “I *never* eat hamburgers” or “I *always* eat there” should not be taken literally. When a scientist is speaking formally, however, he/she should be more precise.

In all real-world situations, answers are not perfectly accurate and we are usually not 100% certain, so we are usually working with approximate answers and probabilities. How do we express these in English? One very accurate way is to use numbers, but having numbers in all sentences is awkward.

There is a 75% probability that it will live. The probability of success is 0.47.

In less scientific English we might refer to the “chance”, “chances”, or “odds”.

The odds are 3 to 1 that it will live. The odds of it dying are 3 to 1 against.

The odds are 1 in 4 of it dying. There is a 1 out of 4 chance it will die.

We can also give a range into which we believe the exact value will fall.

There is a 70% to 80% chance of rain. The increases were 43% plus or minus 3% (43% +/-3%).

Although scientists use words like “must”, “probably”, and “might” in a fairly standard way, the numeric probability expressed by such words is not strictly defined. Below are some ways of expressing probabilities without using numbers, along with estimates of the numeric probability associated with each. For this example, we consider the question of life on the planet Mars.

 **Is there life on Mars?**

[100%] There is life on Mars. / It is absolutely certain that there is life on Mars. / This data proves that there is life on Mars.

[97%] It is certain that there is life on Mars.

[90%] There must be life on Mars. / Mars must have life on it. / This data shows that Mars has life on it.

[80%] There is probably life on Mars. / Probably, there is life on Mars. / It is probable that there is life on Mars.

[75%] There seems to be life on Mars. / There appears to be life on Mars. / It appears that there is life on Mars. / This data indicates that there is life on Mars.

[60%] It seems likely that there is life on Mars. / There may be life on Mars. / There could be life on Mars.

[55%] There might be life on Mars. / This suggests that there is life on Mars.

[50%] There might or might not be life on Mars. / There may or may not be life on Mars. / (***But*** “~~could or could not~~” is ***not*** acceptable.)

[35%] It is unlikely that there is life on Mars.

[3%] It is impossible for there to be life on Mars.

[0%] There is no life on Mars. / Life on Mars is absolutely impossible.

Technically “It is impossible for...” should be 0% belief but the word “impossible” is used informally to mean extremely low probability. *Rule of Thumb: The shorter the statement, the more sure you are of the truth of it.*

Probabilities less than 50% can be expressed by using a negative (“not”, negative prefix like “un-”) with the probability word but often the two are not exact opposites in probability. For example, “could”~60% but “could not”~25%. “Impossible”~3% but “possible” has a wide range of meanings. “Certain”~97% but “uncertain” can be used even when the probability is high (“Everybody believes our team will win but the outcome is uncertain.”)

A good way to deal with probabilities less than 50% is to express the probability of the opposite outcome. “There must be no life on Mars” means 10% probability of life on Mars (“must” means 90%).

Other expressions of degrees of belief:

As far as we know, there is life on Mars. [95% but usually informal]

It is possible that there is life on Mars. [1% to 50%, depending on voice expression]

Theoretically, there could be life on Mars. [Expresses doubt it could really happen.]

**The Main Point**: Avoid saying “I think...” in oral presentations (and in scientific writing).

 Be more precise by using one of the good probability expressions above.

Bad: “~~I think there is life on Mars.~~” Bad: “~~I think the new animal would eat meat.~~”

**Warning**: Do not mix probability words together. (Exception: “seems likely” is ok)

Bad: “~~Probably there could be life of Mars.~~” Terrible!: “~~I think there is probably…”~~