# Positive vs. negative fallacy

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**Formulation of the problem.** There are diseases for which no cure is known, some of them even fatal. Suppose now that a new medicine has been proposed that cures some of the patients with this disease. This medicine is not perfect – no medicine is. Shall we approve this medicine?

Let us assume that in the tests, 30% of patients recovered. We can described it in two different ways:

- With this medicine, 30 out of 100 patients will recover.
- With this medicine, 70 out of 100 patients will remain sick.

These two statements are logically equivalent. However, the first statement is perceived as more positive and preferable. Experiments show that when presented with the first statement, people are more willing to vote for approval. How can we explain this difference?

**Our main idea.** Our main idea is that our degree of confidence decreases with each logical inference step. So, while the statements are equivalent, based on the second statement, our degree of confidence in the conclusion – that the first statement is true – is smaller.

**Why is this a paradox.** In both cases, we have a positive outcome, that 30 patients recovered, and and a negative outcome, that 70 patients remained sick. So why is there the difference in perception?

This is surprising, because in mathematics, no matter how many steps you make in following some logical reasoning, the resulting statement is still correct.

**But real life is not mathematics.** In real life, our reasoning is not perfect. When we say "if $A$, then $B$," we don't mean it as a mathematical truth. We mean that this is true with a high degree of confidence. This degree of confidence many be high, but it is never 100%. And importantly, that confidence decreases with each logical step.

**This can explain the above positive-negative paradox.** Suppose that a person says that 30% of patients recover. This is a direct statement, so we take it at face value. We can definitely deduce from it that 70% will remain sick. However, this negative statement is indirect. It comes as a result of logical reasoning. So, we have smaller trust in the deduced statements than in the original statement. Thus, the effect of the positive statement is high, while the effect of the negative conclusion is lower.

Suppose now that we say that 70% of the patients remain sick. Then the negative part is taken at face value, viewed with full confidence. However, the positive effect – that 10% will survive – requires an inferential step. So our confidence in the positive effect is smaller. In this case, the effect of the negative statement is high, while the effect of the positive statement is lower.