

The Logic of Hypothesis Testing

by Potluri Rao In Seattle ©2018 (CC BY 4.0)

The modern science of Newton and Einstein uses a system of logic called the Logic of Hypothesis Testing. It is different from the Aristotle's logic of Induction and Deduction.

What follows is a logical structure of the modern hypothesis testing.

Nature consists of material (Matter). Matter is made of atoms. It is physical. Induction and Deduction are systems of logic that explain physical properties of Matter. Matter is real; it does not change. Its properties do not change.

Humans have Mind. Mind is beyond Matter. It is not made of atoms. It is the capacity to imagine things that have no real counterparts in Matter. It is the mental abstraction to "see" things that are not obvious in the world of sensory perception. It is the inner-eye that can see beyond the naked-eye. It is like an X-ray machine that can penetrate deeper than the naked-eye.

Mind lives in the world of Matter. Mind needs Matter. Matter has no need for Mind. Mind must understand Matter for self-preservation. It is in the self-interest of Mind to look beyond what is obvious to the naked-eye. It must be able to see the dangers that lurk in the shadows beyond the reach of the naked-eye.

Mind and Matter are different concepts. They have nothing in common. Matter has no Mind. Mind has no Matter. They speak different languages. Mind needs an interpreter, someone who speaks both languages, to interpret Matter. The Logic of Hypothesis Testing is the interpreter. It is a dictionary to interpret Matter to Mind. The dictionary does not exist. Mind has to invent it. The need for a dictionary is that of the Mind, not Matter.

How to build the dictionary? It is the Logic of Hypothesis Testing.

A dictionary is a set of linked objects, with matching words from two languages.

The need for a linked object originates in Mind, not Matter. It starts as a hypothesis.

A hypothesis is articulation of an idea conceived in Mind. It is a speculation, intuition, or inspiration.

To become a linked object in the dictionary, the hypothesis of Mind must bond with a matching word in Matter.

What is the logical guarantee that the correct word in Matter is found? We need rigorous validation rules to ensure that we achieved our objective. The logic is still evolving. So far, we have established certain standards.

The first requirement is that a stated hypothesis must be consistent with Matter. It is called the necessary condition. The two selected words for a link must be compatible.

It is entirely possible that several hypotheses of Mind are also consistent with the same Matter. In such a case, we cannot be Certain that we have a valid pair of words for a linked object in the dictionary. To be Certain, we need proof that the selected Matter is consistent with only the stated hypothesis and nothing else. It is called the sufficient condition.

For a link in the dictionary to be unique, it must be both necessary and sufficient.

The necessary condition tells us when we may use a hypothesis. The sufficient condition tells us when not to use a hypothesis. To be Certain that we are using a hypothesis properly, we must know when to use and also when not to use it. If we do not know when not to use a hypothesis, then we are Uncertain, taking a chance of failure. We realize our mistake only after an accident. We need sufficient conditions when we cannot afford an accident.

We learn from our mistakes and try not to repeat them because they are Certain. The same mistake would happen every time. It is a sufficient condition.

Our knowledge of Matter (surroundings) is limited to the vocabulary in our dictionary. How we interpret Nature, based on our dictionary, is called Reality.

Nature is what we see with our naked-eye. Reality is what we see with our inner-eye. Reality is not the same as Nature. Nature is static. Reality is dynamic. Mind needs Reality for self-preservation.

We see a snake with our naked-eye. It is Matter. Based on our past experiences, the dictionary in our mind, we see that snake can kill. The naked-eye sees only the snake. The inner-eye sees potential death in a snake. The connection between the two words Snake and Death is Reality. Reality is beyond the grasp of naked-eye. Reality is Matter plus dictionary. The dictionary is in the Mind, not Matter. Each element of the

dictionary is like a molecule consisting of one atom of Matter (snake) and one atom of Mind (death). Mind and Matter are atoms. Reality is a molecule. Mind has no Matter. Matter has no Mind. Reality molecule has one atom of Matter and one atom of Mind.

Reality is essential for self-preservation. The need for a dictionary is real.

The process of scientific inquiry starts with a statement.

Statement

A well constructed sentence is a statement. Not all statements are verifiable with Matter. Non-verifiable statements have no place in science.

For example, the statement, “People who do not eat their spinach do not go to Heaven,” is not verifiable with Matter. Such statements are nonsensical.

A statement that can prove that it is verifiable with Matter is called a Hypothesis.

Hypothesis

To be a hypothesis, a statement must prove that it can be verified with Matter.

The evidence maybe of natural occurrence or manufactured in an experimental setting.

A hypothesis originates in Mind, not Matter. It is a speculation, intuition, or inspiration. It is not a fabrication of Matter. It initiates the process of inquiry.

Theory

A hypothesis that is consistent with Matter is called a Theory. It satisfied the necessary validation condition. It is a potential candidate for the dictionary. It must be certified to enter the dictionary. Only eligible candidates can be certified.

A verifiable statement is a Hypothesis. A verified hypothesis is a Theory.

A theory is only a necessary condition. It tells us about a situation where the hypothesis worked. There is no guarantee that the hypothesis would work in a different context. We are Uncertain. Random application of a theory could result in disastrous consequences. To be Certain, we must know when not to use the hypothesis.

We know that mistakes (accidents) are Certain. We can depend on them to repeat with Certainty. If a hypothesis failed (rejected, false) under certain conditions, then we can be Certain that it would always fail under those conditions.

A theory that is not rejected is Uncertain. It works sometimes, not always. A theory rejected by Matter is Certain. To be Certain, a theory must be both validated and rejected.

A rejected theory is a False hypothesis. Logically, a not-rejected theory is a Not-False hypothesis. Logically, Not-False is the opposite of False. The colloquial word True is not logic; it is avoided. The word True does not exist in Hypothesis testing. A single experiment can prove a hypothesis to be False. Not even a thousand experiments can prove a hypothesis to be True. There is no such a thing as a True Hypothesis.

A hypothesis is always either False (falsified, certified) or Not-False (falsifiable, eligible), never True. The words False and Not-False are a bit confusing at first, but they are required for logical clarity in scientific applications.

A False hypothesis does not mean it is worthless. To the contrary, it is solid as gold. It is Certain. It is certified to enter the Dictionary. We know with certainty when to use it and also when not to use it. It is necessary and sufficient. The Dictionary is a collection of False hypotheses.

Science

A False hypothesis is called Strict Science. A Not-False hypothesis is called Science. Strict Science is Certain. Science is Uncertain.

Science is only a necessary condition. Strict Science is both necessary and sufficient. Only Science (eligible) can become Strict Science (certified).

To be Strict Science, a theory must be falsified by Matter. Only Strict Science is a valid link in the dictionary. It is Certain. It tells us when to use and also when not to use.

Science is an eligibility condition. It needs certification to become Strict Science. For a theory to become Science (eligible) it must prove that it can become Strict Science. It is the responsibility of a theory to supply proof that it is falsifiable with Matter.

A falsifiable theory is Science. A falsified science is Strict Science.

Strict Science

We need Strict Science when error is unacceptable.

We conduct controlled experiments to reject a hypothesis to establish its limits, so we do not exceed its limits. It is the only way to avoid a failure. We simulate failures in a laboratory, to avoid them in real life.

The Logic of Hypothesis Testing is a set of rules accepted by the scientific community. The logic is still evolving.

