What Science Is

Seventh Edition

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Written for and Dedicated to my Host, the Kiwi Farms

The purpose of this text is to inform the Kiwi public about the nature of science. Too often its image is distorted by “popularizers,” “communicators,” and outright liars who discredit science for their own personal gain: whether through payment, reputation, or shallow popularity.

I have provided some definitions for technical terms found throughout at the end of this paper.

What Science is not

Science is not truth. Science is not the verification of truth in particular, nor verification in general. Science is not the repeatability of experiment; it is not uncontroversial consensus, nor is it testable proof. It is certainly not “objective,” for no two people will ever see it the same way. The limits of our human lives prevent us from ever fully exploring the contents of human knowledge. The average university library may contain fifty thousand books, yet a dedicated reader may complete only ten thousand in a lifetime. Every scientist, no matter how diligent, is left with gaps in the content of their knowledge.

Human experience, the sum of perception and theory, is too vast to be encompassed by any one person. The absence of knowledge is two-fold: an unaware person is unaware even of their unawareness. Because of these epistemological limits, no human can ever contemplate all of science, nor imagine themselves capable of such a feat. And if no human fully understands the available science, how can anyone claim to be a scientist in the absolute sense?

Science, therefore, is not the repetition of facts, the ability to recite taught lessons, or the reiteration of solutions to known questions. It does not depend upon familiarity with already discovered things. It does not require formal training in procedures, traditions, dogmas, or inherited narratives. Just as no single individual can contemplate the whole of science, no one can construct a single, unifying, and easily communicated theory of science to act as its standard.

This leads to the disturbing fact that any individual may operate highly technical scientific machinery, in an abstract conceptual sense, without ever realizing that they are doing so: acting under a false understanding, or perhaps while not thinking at all. The phenomenon is no

different than the average person operating a motor vehicle without any comprehension of its internal mechanics or chemistry.

Yet it seems that the postmodern public has taken science as their new religion: a way for them to achieve knowledge over exactly these unrealized things, something that isn't even necessarily needed. Modern science is infected by a pseudo-religious hunger for authority, seeking that legitimacy to back its claims. To it have been fastened the ceremonial ornaments once worn by religion: the promise of truth, the assurance of verifiability, access to ultimate knowledge, control over nature, mastery of fate and destiny, the explanation of man's place in the world, and even the hope of higher life or an afterlife. In my experience science has led me to no conclusive answer: just my own satisfied opinion.

Science is far too dangerous for such blind assignments. Scientific claims must be clear and distinct; they cannot be incorrectly stated, for the weight of their implied consequences is too great to bear. For this reason, I do not accept the notion of "innocent" knowledge, nor that of a "privileged" position from which one may claim detachment. Every act of acquiring and expressing knowledge is, at its core, an exercise of influence, or, at the very least, carries the potential for such influence. Knowledge is inherently power.

This kind of limited thinking, which I am arguing against, stands in direct opposition to the spirit of genuine scientific exploration. Such vulgar interpretation of appearances does not yield understanding, nor does it provide guidance for future inquiry.

Human Experience

The origin of science lies in human sense perception. Lacking any other tools to explore the world, man begins with what his senses provide. The situation remains the same today. No further progress has been made in directly seeing nature: for true understanding is not mere sight. Actual apprehension of things is achieved only through abstract understanding of what cannot be seen. Man has not expanded his senses, but instead must arrange the experiences (pointer readings from calibrated instruments, whatever other empirical evidence) that he physically collects and finally recollects in his own mind; with this mental map, he may then attempt to traverse nature.

The Error of Primacy in Sense Perception

Fools may disagree with the assertions I have made above. They may argue from sense or instrument perception: every mercury thermometer works in exactly the same way, given similar composition, they say; the microscope allows us to visibly perceive microorganisms, and the thermometer provides reliable data points. Ah, but what of the artifacts these instruments produce, the hidden assumptions carried into investigation, or the loss paid for in opportunity cost?

Let us not forget that data points are arbitrarily assigned meaning and possess no inherent value on their own. We decide which measurements matter: how convenient! Which aspects of the observation are deliberately ignored? Instruments are calibrated subjectively, and

provide no truly objective measurement. We may not always recognize our own biases when making observations or recording instrument readings, and even when we do we cannot fully eliminate them. As a result, we cannot make objective, universal statements.

Observing a microorganism from one perspective denies the observer all other perceptive possibilities at that moment. A certain opportunity cost is built into nature itself. Heisenberg already demonstrated this at a physical level with the uncertainty principle between position and momentum. No one will ever fully perceive a situation as it truly is. A substantial portion of observational information will inevitably be lost, in ways that are irrecoverable. Accuracy and precision, those supposed pillars of scientific rigor, are nowhere to be found.

Our perception of reality prevents us from seeing it as it truly is. So why not put on blinders and examine the object ever more carefully? Isn't that what science is, an exclusive focus on a single subject at the expense of all others? If so, the situation only worsens. The observer becomes even more blinded to reality than before. Excluding parts of the whole in favor of others is certain to produce error-prone models, or, at the very least, empty and disconnected theories.

Can the scientist not simply construct instruments to measure nature more precisely than our own senses? The problem, then, becomes one of precision. And if science claims to understand truth, that is, perfection, then its analyses must also be perfect. An imperfect description is merely another guess, with limited applicability. Doesn't science claim to be universal, offering understanding and applications for all cases? That is a mistake.

It is critical to recognize that information is never contained in any isolated thing; it can only be interpreted. As a consequence no sense perception or instrumental reading is implicit for any inherent meaning: each result is meaningful only through interpretation. Herein lies the fundamental problem: the distant object and the limited interpretive subject. While personal, subjective experience is often held to be the antithesis of scientific methodology, for us it will serve as the very foundation of our way of thinking.

Because of the nature of information, by virtue of its interpretation, inner experience can never be fully or accurately communicated to another. Both the transmitter and the receiver must interpret, and therefore no truly objective information can be received. This creates a rather difficult situation.

Nature

Nature does not dictate a single, definitive description to us. Instead, it allows a class of equivalent descriptions, from which we select those that serve as conventions in a given context. Without a direction of interest, observation does not occur at all. Our capacity to observe is inherently limited, so we must determine for ourselves what is important. Consumption, the arrangement of desired objects in our lives, is likewise guided by our own choices, reflecting the organization or design we impose upon it.

Science

Science can be any formal exploration of a domain of nature, arising from any organized set of ideas. While it may apply to any human experience, it is most commonly associated with physics, chemistry, and biology, the so-called “hard sciences.”[1] This process, the development of western knowledge, has been ongoing for over two millennia, and began with the Greeks.

Science is, through this exploration, the personal relationship that an individual has with nature. This relationship is often remindatory: sudden flashes of insight that I call clairvoyance, moments of brilliance that strike the scientist upon connection with some idea. Science, in this view, is not a collective or group endeavor. It is a highly personal experience: difficult to communicate and almost never understood fully by another. Marx provides a useful example here: he claimed not to be the “Marxist” that his interpreters thought him to be.

Science is frequently expressed in the form of ideas, stories, mathematics, logics, abstract forms, or conceptual architectures. The most common scientific product is the model, or a very precise tool scientists use to understand some one part of nature, but we must remember that the model in no way represents nature in the slightest. It is also becoming more common for science to be referred to as poetic. A modern form of the scientific theory is the metaphorical story, a means of carrying to the reader's mind the ideas of the author. Journals, monographs, textbooks and university classes are all just stories told from this highly personal experience.

Throughout their careers, scientists package these clairvoyant moments into narrative commodities, placing them on the “market” for other scientists to consume and interpret. Despite the veneer of formal writing and presentation, scientific products are fundamentally this kind of story consumption, not unlike fiction. Scientists label this process “scientific theory.”

Science as Personal Interpretive Activity

Science is each individual’s interpretive relationship with nature. It is highly personal, subjective, and incommunicable.

Theory

Nature, by its substance, is capable of being understood through theory. A theory is a hierarchical classification and organization of ideas: sequential, structured, and consumptive. Just as a house is more than a pile of bricks, a scientific theory is more than a disorderly collection of facts. While no individual fact proves anything on its own, many facts arranged within a coherent structure can produce a meaningful claim.

This understanding rests on two principles: completeness and consistency. Completeness is the theory’s capacity to explain and provide a framework for known facts; consistency is the absence of contradictions among its propositions. As already noted, no human can construct a complete model of nature, so every model will remain in some sense inconsistent and incomplete. Loose ends are inevitable, but they serve as markers for further investigation. Following these paths does not yield entirely new ideas; it reveals implications:

potentially accessible but as yet unexplored avenues. Implication is crucial in scientific exploration.[2]

Theoretical abstraction is the organization of knowledge acquired across a given field. These ideas and implications must be arranged into a classification: a web of interconnecting concepts and their relations. This abstract structure will inevitably contain gaps, which themselves become indicators for further study. Consumption is the act of managing these systems of thought: balancing ideas into a coherent alignment, carefully attending to their ordering, sequencing, and interrelations. Absences must also be acknowledged, either as implications or as structural features in themselves.

Ontology is crucial here: it provides the sequential ordering of ideas, origins, and teleology. A good idea placed in an insufficient theoretical frame loses its explanatory power, only to be rediscovered when properly integrated into a stronger ontology. Strong ontological theories reveal identity in seemingly dissimilar phenomena, unifying diverse parts of nature under a single framework. The prediction of future observations is both the goal and the test of scientific practice: theory maps what is known while hinting at what is missing, supplying predictive parameters. Finally, ideas themselves must be examined through self-reflection, ensuring that the theorist critically engages with their own conceptual framework.

Theory and the Origin of Hypothesis

But where do these ideas come from? Are they merely the caprice of the individual investigator? Yes! Indeed, they are. It should hardly be necessary to state that I have no interest in a theory of knowledge that is uninspired, devoid of curiosity, or lacking in remindatory insight. This is, after all, a matter of personal taste: of personality, experience, and my understanding of the very fact of our existence. Nature is these things, and through us, it recapitulates an already completed ontology.[3] Through its substance and function, nature generates an organ capable of reflecting upon itself. The evolutionary development of this organ, its trajectory in the ecological context, is unique to each individual.

This uniqueness, this subjectivity, is precisely the problem I am presenting. Unless the investigator relies upon himself, he has nothing. Disinterested fools never think of anything and live poor, yet they have had a guide that is not their own thought!

(*Applause*)

The Role of Experiment

Experiment is the testing of an a priori assumption, a hypothesis imagined by the scientist. Experiments can only ever verify the assumptions already made by the investigator; they cannot generate the original idea. The hypothesis, the origin of the idea, resides in the experimenter’s mind. For us, the concern is the remindation of the idea, not the relationship between what happened in the mind and the result of a physical experiment nor its resulting truth value. Consequently, all experimental parameters are presupposed: verified experiments confirm an idea already assumed, rather than creating it. Experimental results are useful only as

verification tools for assembling theory, providing data points to refine understanding and suggest further implications.

In conducting an experiment, the scientist seeks to limit outlying factors in order to examine the phenomena more precisely. No limit is ever perfect, yet a degree of exactitude is achieved, and a measurement is taken. Subsequent experiments refine these measurements, providing the verification of the hypothesis.

Application arises from the interaction between theoretical science and nature. It involves the repetitive and casual use of scientific instruments, material or mental, to assess the reliability of theoretical predictions. Data points that consistently correspond to natural outcomes reinforce the applicability of theory. In this sense, nature itself, through the inquiring and imaginative scientific investigator, regularly confirms the validity of theoretical assumptions.

The Relationship between Abstract Theory and Application in Practice

Nature provides an abundance of phenomena, overflowing with things to be seen, touched, and recorded. Yet the question arises: given this vastness, what should we take with us, and what should we leave behind? Not every fact is equally valuable. Many will appear verifiable, even authentic, yet lack true significance. The work of theory is not merely to arrange what is gathered, but to test which facts deserve to be carried into the realm of thought. The question, then, is this: how can we confirm for ourselves the connection between nature's abundance and the abstract models that seek to represent it?

Science, by its nature, can only ever provide partial explanations. Given human limitations we must rely on personal understanding and accept that full proof is unattainable. However, we can enhance reliability by seeking the same underlying phenomena in multiple contexts. It is highly unlikely that identical mechanisms appear independently without connection.

A classic example is Sir Isaac Newton's insight, inspired by the falling apple: the same force governs both planetary motion and the apple's descent, as well as the moon's orbit and the action of the tides. These phenomena were explored through theory, verified by experiment and mathematical formalization, finally discovered to be unified under a single principle. This demonstrates how experiment serves as the bridge between abstract theory and empirical confirmation, linking ideas in the mind to observable patterns in nature. Unifications, then, are the most powerful form of scientific advancement; perhaps another could be related to symmetries.

Other Epistemological Issues

In the first edition of this text, I received a comment asserting that falsification is the only path to truth: a distinctly Popperian view. I find this philosophy lacking in creative power. Such a negative methodology only provides a way to show how ideas are wrong; it can never reveal what a thing is, nor guide us toward knowing it. If a soulless science is desired, Popper provides it. Probability suffers from similar limitations. I am not concerned with the "how" or the statistical

likelihood of a result, but with the why. Probability may inform the experimenter of the chance of a given outcome, but it cannot explain why that outcome occurs. Empiricism would be acceptable if facts could exist independently of interpretation, but they cannot. Every fact is necessarily mediated by personal understanding. Please explain to me the “interpreted empirical fact”.

The Difference Between Science and Medicine

Medicine is not science. It is a separate domain with its own traditions, instruments, and epistemology. While physicians may use the products of scientific investigation, they are not themselves scientists, nor do they engage in science proper. Their training includes some exposure to scientific disciplines: cell biology, molecular biology, organic chemistry, virology, physiology, and anatomy, but this does not amount to an understanding of science as such.

Medical practice rarely engages with scientific theory, the philosophy of science, or the history of ideas. It remains largely indifferent to questions of epistemology and ontology. Physicians, in my view, often share with the broader public a postmodern conception of truth: attaching themselves to terms like certainty, reliability, and truth: all of which are foreign to the scientific spirit, but essential to medicine.

Indeed, medicine has a peculiar advantage not shared by natural investigation: its subject of study is, in crucial respects, the same every time. Human physiology provides stable constants: heart rate, blood pressure, metabolic response, and behavioral patterns that can be charted, normalized, and compared against an expected control. Here, the “why” is not the point. Medicine does not concern itself with ontology, but with action: with doing what preserves life or reduces suffering. The Hippocratic oath enshrines this principle, subordinating speculative curiosity to immediate application.

For this reason, medicine is best understood as downstream from science. It applies results discovered elsewhere, but without engaging in the deeper theoretical or philosophical structures from which those results emerged. Medicine, then, is a craft of application, not a science of discovery.

Provided Definitions

Clairvoyance
: The claim or capacity to acquire knowledge through the realization of, or becoming aware of, an already existing thing, and one’s relation to it.

Epistemology
: The systematic study of the nature, scope, and limits of knowledge, including its sources, justification, and reliability.

Existence
: The condition of being real in itself, prior to perception or interpretation, and persisting whether acknowledged or not.

Experience

The immediate awareness or consciousness of phenomena as encountered by a subject, as well as the organizing theoretical structure used to understand that perception.

Experiment
: A deliberate and controlled intervention into conditions of reality to observe and measure their outcomes.

Instrument
: Any tool, physical or conceptual, employed to extend perception, enable measurement, or guide inquiry.

Interpretation
: The act of assigning meaning to data, signs, or phenomena within a given conceptual framework by the three part act of transcription, translation, expression.

Nature
: The totality of phenomena, processes, and structures that constitute reality, both observed and unobserved.

Knowledge
: A justified and reliable relation between a knower and what is known, integrating truth and belief within a coherent framework.

Objective
: Independent of personal perspective, feeling, or bias; belonging to reality as it is, not merely as it appears to an individual.[4]

Perception
: The process by which sensory data are received and organized into coherent experience by a subject.

Power
: The capacity to act, influence, or produce effects within a system of relations.

Proof
: A systematic demonstration that a proposition follows necessarily from accepted principles or evidence. Not to be confused with a mathematical proof.

Science:
: A system of consistent concepts and terminologies that link together seemingly unrelated ideas into a coherent framework of detailed explication.

Truth
: Sublime. Unknowable.

Verification
: The process of testing whether claims, models, or theories correspond reliably to experienced reality through observation, reasoning, or experiment; the correspondence or adequacy of proposed statements, beliefs, or models to experience.

Notes

1. The hard sciences have earned the reputation they have by a consistent record of accomplishment over the course of the last 2000 years. Other potential sciences about anything at all could, but conspicuously have not, formed.
2. About these principles of scientific theoretical abstractions, see further my: *Theoretical Systematics*.
3. I am assuming that nature is, regardless of my ability to know such a thing, complete.
4. This is not to suggest that, because there is such a thing as the objective, we can come to understand such a thing. This is not the case: whatever objective reality truly is, we will never know because of interpretive barriers caused by our subjective nature in being only a part of a larger universe. Just because objective reality exists does not mean to imply that we can know such a thing: to know that it exists, to know what it is, and to know how to know it.

Further Reading

Jean Baudrillard, The System of Objects, Verso 2020
Ernst Cassirer, Substance and Function, Dover 1980
Pierre Duhem, The Aim and Structure of Physical Science, Princeton 1954