

The Ontology of Scientific Methods

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What is ontology?

Ontology is an identification of what exists, i.e., existents.

“That department of the science of metaphysics which investigates and explains the nature and essential properties and relations of all beings, as such, or the principles and causes of being.”

(www.dictionary.com)

Importance: We should know that something is before talking about it.

What is a scientific method?

A scientific method is an epistemology, a way of knowing.

Essential steps:

1. Observe some aspect of the universe.
2. Invent a tentative description (a *hypothesis*) consistent with observation, and use it to make predictions
3. Test those predictions by experiments or further observations (including data collection), and modify the hypothesis in the light of your results. Note: You never prove a hypothesis, but confirm/fail to confirm
4. Analyze and derive conclusion. Repeat steps 3 and 4 until there are no discrepancies between theory and experiment or observation.

Justifications of the scientific method

- **Open environment – No one is excluded from having a voice.**
- **Value-neutral – As with any tool, use of the method depends on the person.**
- **Universal - Method is accessible by all.**
- **Critical thinking – All views are subject to questioning and testing.**
- **Peer-review – Experts examine findings and report.**

All these help make science effective in making predictions.

Belief... is ours not for ourselves but for humanity. It is rightly used on truths that have been established by long experience and waiting toil, and which have stood in the fierce light of free and fearless questioning. ... It is desecrated when given to unproved and unquestioned statements, ... The danger to society is not merely that it should believe wrong things,... but that it should ... lose the habit of testing things ...; for then it must sink back into savagery. It is wrong always, everywhere, and for anyone, to believe anything upon insufficient evidence. ... Inquiry into the evidence of a doctrine is not to be made once and for all It is never lawful to stifle a doubt; for either it can be honestly answered by means of the inquiry

Assumptions of a scientific method

- **Multiple observations of event from competent unbiased witnesses to establish credibility**
- **Accounting of environmental factors, such as cultural prejudice, belief systems, an organism's response to environmental conditions, and objective background knowledge used to interpolate events - enter into reported results.**
- **Known laws of the universe sufficient to allow for event**
- **Event reproducible independently by re-creating conditions for its existence**

Central idea:

***Principle of Induction* – Future resembles the past**

Seminar Topic: Nanotechnology

- A hypothetical fabrication technology in which objects are designed and built with the individual specification and placement of each separate atom

<http://dictionary.reference.com/>

Adapted version: Creating something from the very smallest unit.

The method of nanotechnology (next item):

Reductionism –

- 1: A theory that all complex systems can be completely understood in terms of their components**
- 2: the analysis of complex things into simpler constituents**

<http://dictionary.reference.com/>

Adapted definition: Breaking down into the smallest units and attempting to explain something in terms of these units.

What is the Lowest Common Denominator of Our Universe?

- **Use reductionism to conceive of the smallest “particle”. It is the size of Planck Length - (roughly equal to 1.6×10^{-35} m or about 10^{-20} times the size of a proton).**
- **What are the parameters allowing “particles” of this size?**
- **Think of the smallest allowable change, or movement, that would allow our existence as a universe. This is the smallest “inflection of space-time”, the object-process dimensional boundary parameter.**

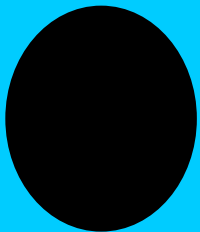
**Principle of Induction - the basis for the method -
found everywhere - Search for uniformity.**

Process:

**Subdivide a thing. Source: Rene Descartes –
*Discourse on the Method of Rightly Conducting the
Reason- 1637.***

Why?

**Reductionism seeks “building blocks”. Limit to expansion is
uniform distribution of energy (entropy).**



Etc.

Object is Process. Process is object.

This object-process dimensional boundary parameter may be regarded as, the “Character of Physical Law” (borrowing from Feynman). For example, we have these constants:

- The speed of light**
- Newton's gravitational constant**
- Smallest size limited as Planck length**

A process defines these objects, and the objects, in turn, give process its existential status.

Something exists in terms of what it is not!!!!

This helps us to understand such apparent paradoxes as “particle wave duality”. As an analogy: Wave may be regarded as process. The “particle” is evidence. In turn, without the particle, we would not know about the wave.

The Abstract is real; the real is abstract.

- **Process exists in terms of object, object in terms of process.**
- **The universe exists in terms of what it is not.**

At this level, a binary world exists.

John A. Wheeler (the physicist):

"...a machinery for the combination of yes-no or true-false elements does not have to be invented. It already exists."

(Misner, C.W., Thorne K.S., Wheeler J.A. (1973)

***Gravitation* New York: W.H. Freeman and Company)₁₃**

Binary world/space repeats itself, and is uniform. Because of the reduction process, everything is expressible in binary form with the 16 dyadic functions $[(f_n)(p,q)]$:

| f_0 | f_1 | f_2 | f_3 | f_4 | f_5 | f_6 | f_7 | f_8 | f_9 | f_{10} | f_{11} | f_{12} | f_{13} | f_{14} | f_{15} |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|----------|----------|----------|----------|----------|----------|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
| 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 |
| 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 |

$F_a(f_i, f_j) \rightarrow f_b \quad f_a(f_b, f_j) \rightarrow f_c \quad f_a(f_c, f_j) \rightarrow \dots$ - outputs are forwarded as inputs into succeeding functions, until the original function is repeated.

(Recursion of logical operators and regeneration of discrete binary space June 2000, Informatica, Josef Stefan Institute, Ljubljana, Slovenia)

Summary

- ▶ **Ontology means, “What exists”.**
- ▶ **Scientific methods are based on the “Principle of Induction”.**
- ▶ **Look at the nature of things by expansion or reduction. Discarding expansion to infinity, reduce to Planck Length.**
- ▶ **Planck length is expressed in terms of a process-giving rise to it. In turn the process is expressed by Planck length.**
- ▶ **The recursion of this binary relationship and its space is uniform throughout our phenomenological universe, thus affirming the Principle of Induction.**
- ▶ **The ontology of scientific method is: “That which exists does so in terms of what it is not.” It is a process ontology.**

Abstract

A common habit is attempting to discern the smallest in terms of an object, such as a subatomic particle. The process of Cartesian¹ successive subdivision takes us to a binary world seen by philosophers from Hesiod² to physicists (such as John A. Wheeler – “It from bit”)³. It is Hesiod’s chaos developing into what we know and experience. It is the singularity exploding to our universe. In descending to the smallest, we discern the universe as confined by a process boundary, as opposed to a physical boundary. Feynman might agree that this process boundary exists because of a “Character of Physical Law” true for this dimension.⁴ The Hegelian process describes that which is in terms of what it is not, and vice versa.⁵ Our dimension is in terms of what it is not – either other dimensions with different parameters or “nothingness”. Such process not only is the foundation for binary existence but also might be considered analogous to Aristotle’s “substratum”⁶ underpinning all of what we think of as reality. This view underpins the philosophy for scientific methods, i.e., uniformity, or the “Principle of Induction”. That is, the future resembles the past.⁷ However, this approach, drawn in large part from philosophers such as William Whewell (1794-1866)⁸, is only an assumption. The methodology that discerns the smallest in terms of process may assist in providing a philosophy of uniformity, thus clarifying why scientific methods “work”⁹. Underscoring our epistemology is the most fundamental law: something is apprehended in terms of what it is not. This presentation seeks to show why this is the case.

References

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