

HOW EINSTEIN SOLVED THE PUZZLE

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EINSTEIN

BIOLOGY

VALUE INVESTING

The object of all science, whether natural science or psychology, is to co-ordinate our experiences and to bring them into a logical system.

Albert Einstein

(The Meaning of Relativity, 1923, p.1)

ALBERT EINSTEIN, in the context of producing his theory of general relativity to describe gravity, gave us the equivalence principle, which states that locally the **effects** of:

- **1. GRVAVITY** (the warping or concentration of space-time) and
 - **2. ACCELERATION** (simply put, more and more speed)
- are the same, i.e. are identical, symmetric.

Translated into abstract mathematical terms, this means that:

- **1. ADDING UP/CONCENTRATION/UNITY** (**gravity** as the concentration or warping of space-time) and
 - **2. THE ADDITIONAL/MORE/INFINITY** (**acceleration** as more and more speed, simply put)
- are the same, i.e. symmetric.

Einstein's equivalence principle then abstractly states:

ADDING UP/UNITY/CONCENTRATION = THE ADDITIONAL/MORE/INFINITY

This is also the definition of the mathematical operation PLUS, which at the same time represent both:

- **1. ADDING UP/CONCENTRATION/UNITY** and
- **2. THE ADDITIONAL/MORE/INFINITY**

Based on our experiences so far, we have reason to be confident that nature is the realization of the simplest conceivable mathematical concept.

Albert Einstein

(On the Method of Theoretical Physics, June, 10, 1933, own translation)

Einstein's great advance in 1905 was to put symmetry first, to regard the symmetry principle as the primary feature of nature (...) this point of view scored a spectacular success with Einstein's construction of general relativity.

David Gross

(The role of symmetry in fundamental physics, PNAS, vol.93 no.25, 10.12.1996, p. 14256)

*... two things cannot be rightly put together without **a third**; there must be some bond of union between them. And the **fairest bond** is that which makes the most complete fusion of itself and the things which it combines ...*

Plato

(Timaeus, translated by Benjamin Jowett, p.18,
<http://www2.hn.psu.edu/faculty/jmanis/plato/timaeus.pdf>)

Einstein's equivalence principle can, due to its all-encompassing, symmetric and mathematical nature (**Unity=Infinity**), serve as the underpinning simplicity for all phenomena.

Einstein's description of gravity uses the structure of symmetry:

- **1. ADDING UP/CONCENTRATION/UNITY** (**gravity** as the concentration or warping of space-time) and
- **2. THE ADDITIONAL/MORE/INFINITY** (**the total amount of all the involved energy**, with energy meaning: the ability to do work, i.e. MORE)

... the most impressive fact is that gravity is simple. It is simple to state the principles completely and not have left any vagueness for anybody to change the ideas of the law. It is simple, and therefore it is beautiful.

Richard Feynman

(The Character of Physical Law, 1992, p.33)

Einstein's theory of relativity has advanced our ideas of the structure of the cosmos a step further. It is as if a wall which separated us from Truth has collapsed. (...) It has brought us much nearer to grasping the plan that underlies all physical happening.

Hermann Weyl

(Space—Time—Matter, 1922, p. xi)

...the effects we ascribe to gravity and the effects we ascribe to acceleration are both produced by one and the same structure.

Albert Einstein

(as quoted in: "Einstein", by W. Isaacson, 2008, p.147)

Quantum mechanics, too, uses Einstein's equivalence principle as its structure:

- **1. ADDING UP/CONCENTRATION/UNITY** (**unity** as the universe as a whole) and
- **2. THE ADDITIONAL/MORE/INFINITY** (**infinite possibilities that get tried out at the same time**)

... because we live in a quantum universe the correct thing to do is to add all the possibilities together. The vacuum, in other words, has an incredibly rich structure, made up out of all the possible ways that particles can pop in and out of existence.

Brian Cox & Jeff Forshaw
(The Quantum Universe, 2012, p.209)

With respect to BIOLOGY, one can find the same principle being implemented everywhere: In his seminal, groundbreaking book *“Arrival of the Fittest”*, mathematical biologist Andreas Wagner from the ETH in Zürich, discovered recently that nature—to drive ahead innovation—is using, as a mechanism, a simple principle, that is simultaneously both:

- **1. ROBUST/ADDED UP/CONCENTRATED/UNIFIED** and
- **2. COMPLEX/THE ADDITIONAL/MORE/INFINITY**

Genotype networks (encoding phenotypes like eyes, feathers or a metabolism) which themselves are, in accordance with the simple, all-underpinning principle, both:

- **1. ROBUST/UNIFIED** and
- **2. COMPLEX/CONTAINING COUNTLESS POSSIBILITIES**

enable organism to roam through so called endless libraries, as the robustness of a genotype network makes it possible that organisms can use the many alternatives within a genotype network to move around in these vast libraries, that are—due to the simple, basic principle—also both:

- **1. UNIFIED** and
- **2. COMPLEX,**

as these libraries are purely mathematical configurations (**UNITS**) containing myriads of dimensions filled with endless possibilities (**MORE/INFINITY**).

That way, these organisms can—without having to move far, because these libraries are full of data, tightly packed into countless dimensions—integrate or **ADD UP** endless amounts of data (**i.e. MORE/INFINITIY**) and create and keep new features or new **UNITS** containing new ingredients (**MORE**), a process known as Darwin’s natural selection.

There is grandeur in this view of life, with its several powers, having been originally breathed by the Creator into a few forms or into one; and that, whilst this planet has gone cycling on according to the fixed law of gravity, from so simple a beginning endless forms most beautiful and most wonderful have been, and are being, evolved.

Charles Darwin
(On the Origin of Species by Means of Natural Selection, 1859)

The simplicity of nature is (...) producing a great number of phenomena (...) by means of a small number of general laws.

Pierre Laplace
(Exposition du système du monde, 1813)

... the mathematics of biology allowed us to see that these libraries [of genotypic texts] self-organize with a simple principle, as simple as the gravitation that helps mold diffuse matter into enormous galaxies. This principle—that organisms are robust, a consequence of the complexity that helps them survive in a changing world—brings forth the intricate organization of these vast libraries.

Andreas Wagner
(Arrival of the Fittest, 2015, p.219)

As one can see, both:

- **1. the general, all underpinning idea—Einstein’s equivalence principle**—and
- **2. the process** based on this basic, simple idea (principle, framework, concept, code, standard)

are identical, the same, symmetric.

In his book “Arrival of the Fittest” Andreas Wagner—at the end of chapter 3 about the notion of the universal library, which contains myriads of different libraries—points out that:

... [all] libraries are organized the same way.

Andreas Wagner
(Arrival of the Fittest, 2015, p.106)

Einstein’s equivalence principle tells us to expect something like this, because all is based on one, timeless mathematical idea encompassing both **unity** and **infinity** in its symmetric fashion, which represents Plato’s timeless and space-independent mathematical world.

Why is it necessary to drag down from the Olympian fields of Plato the fundamental ideas of thought in natural science, and to attempt to reveal their earthly lineage? Answer: In order to free these ideas from the taboo attached to them, and thus to achieve greater freedom in the formation of ideas or concepts.

Albert Einstein
(Ideas and Opinions, 1982, p. 365)

THIS IS MATHEMATICAL SIMPLICITY creating a:

- **1. SELF-SIMILAR,**
- **2. SELF-ORGANIZING**

universe based on implementing 1 simple, mathematical, timeless and space-independent idea: Einstein’s equivalence principle.

... the creative principle resides in mathematics.

Albert Einstein
(Ideas and Opinions (lecture: On the Method of Theoretical Physics), 1982, p.274)

This is common to all our laws; they all turn out to be simple things, although complex in their actual actions (...) Nature uses only the longest threads to weave her patterns, so each small piece of her fabric reveals the organization of the entire tapestry.

Richard Feynman
(The Character of Physical Law, 1992, p.33-34)



The more and more symmetry you have, the better you exhibit the simplicity and elegance of the theory (...) So here are the themes. We believe there is a unified theory underlying all the regularities. Steps toward unification exhibit the simplicity. Symmetry exhibits the simplicity. And then there is self-similarity across the scales -- in other words, from one skin of the onion to another one. Proximate self-similarity. And that accounts for this phenomenon. That will account for why beauty is a successful criterion for selecting the right theory. Here's what Newton himself said: "Nature is very consonant and conformable to herself."

Murray Gell-Mann

(Ted Talk "Beauty, Truth in Physics", March, 2007)

Self-organization permeates the universe so completely that most of us don't even notice it. Much older than life and natural selection, self-organization is how stars and solar systems form, how the earth accreted (...) We shouldn't be surprised to find self-organization in life's precursors, because it is everywhere else too.

Andreas Wagner

(Arrival of the Fittest, 2015, p.57)

It becomes obvious time and again, that Einstein's equivalence principle is Plato's mathematical world:

- **1. UNITY** containing
- **2.** an infinite amount of possibilities (**MORE/INFINTIY**).

Platonic essentialism is making a comeback (...) The essentialism of the twenty-first century, though is much richer than Plato's world of simple geometric shapes.

Andreas Wagner

(Arrival of the Fittest, 2015, p.34)

Information is then timeless, because the core of information also implements Einstein's equivalence principle. The core of information is the **bit**, a binary system:

- **1. A UNIT** containing
- **2. MORE (1, 2 bit values).**

All the information was there all the time. It was just a matter of putting things together and 'seeing' the answer! This is very much in accordance with Plato's own idea that (say mathematical) discovery is just a form of remembering!

Roger Penrose
(The Emperor's New Mind, 1999, p.555)

VALUE INVESTING is based on Benjamin Graham's insights and concept of investing, which at its core simultaneously includes both aspects of symmetry:

- **1. CONCENTRATION (ADDING UP)** and
- **2. THE ADDITIONAL (MORE):**



All other aspects of value investing—such as investing long-term, controlling one's behaviour, the concept of the intrinsic or fair value, the margin of safety, the moat, thinking like an owner and capital allocator, learning continuously, etc.—follow from this basic, simple, symmetric configuration as either aspects of:

- **1. CONCENTRATION** (e.g., controlling one's behaviour, thinking like an owner or capital allocator, etc.) or
- **2. THE ADDITIONAL** (like a durable, competitive advantage, learning continuously, having a margin of safety, investing long-term, etc.).

Take a simple idea and take it seriously.
Charles Munger

The business schools reward difficult complex behavior more than simple behavior, but simple behavior is more effective.
Warren Buffett

Likewise, in investing, if I want to see big ideas, I need a peaceful and contented mind.
Guy Spier
(The Education of a Value Investor, 2014, p.131)

In his wonderful book “*The Education of a Value Investor*”, value investor Guy Spier presents a very symmetric description of value investing, which balances both:

- **1. CONCENTRATION** and
- **2. OPENNESS**

by using simple ideas to create a system that is both **serene** and **active** at the same time. It is rare to find a book that is so simple and yet so deep, because the element of openness is being integrated with so much joy and without compromise, that it sets a valuable standard and guideline.

Value investor John Mihaljevic in his landmark book “*The Manual of Ideas*” presents to the reader a more general look at value investing emphasizing the technical aspects.

In this regard, we consider a stock selection framework that is (1) flexible enough to allow for analysis of any stock, regardless of company size or industry, yet (2) concrete enough to be useful in making informed investment decisions.

John Mihaljevic
(The Manual of Ideas, 2013, p.17)

Being both:

- **CONCRETE** and
- **FLEXIBLE**

at the same time is again the definition of Einstein’s equivalence principle, and the book therefore unfolds value investing in deep clarity.

Scientific research is based on the idea that everything that takes place is determined by laws of nature, and therefore this holds for the actions of people.

Albert Einstein
(Albert Einstein’s Letter to Phyllis, 1936)

From physics to biology and human behaviour, one can discover, or rather rediscover, Einstein’s equivalence principle (symmetry or Plato’s mathematical world) in all its:

- **SIMPLICITY** and
- **RADIANT BEAUTY**

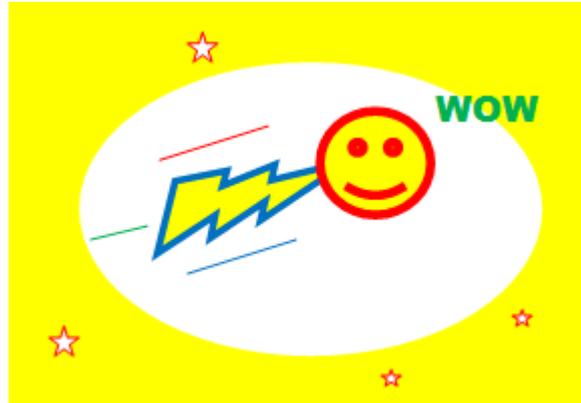
The most beautiful and most profound experience is the sensation of the mystical. It is the sower of all true science. He to whom this emotion is a stranger, who can no longer wonder and stand rapt in awe, is as good as dead. To know that what is impenetrable to us really exists, manifesting itself as the highest wisdom and the most radiant beauty ...

Albert Einstein
(as quoted in: “The Universe and Dr. Einstein”, by Barnet Lincoln, 1950)

It is a glorious feeling to perceive the unity of a complex of phenomena which appear as separate entities to direct sensory observation.

Albert Einstein

(Letter to Marcel Grossman, 14 April 1901, Collected Papers, vo.1, doc.100)



ALBERT EINSTEIN,

THE FREE THINKER, SLOVED THE GREATEST PUZZLE

What I see in Nature is a magnificent structure that we can comprehend only very imperfectly, and that must fill a thinking person with a feeling of "humility." This is a genuinely religious feeling that has nothing to do with mysticism.

Albert Einstein

(as quoted in: "Albert Einstein: The Human Side",
edited by Helen Dukas & Banish Hoffman, 1979, p.39)

