

Observer Effect

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Abstract

The two slit experiment or the observer effect is not just a quantum phenomenon but witnessed in the classical world too, where the causal determinism of today fails tomorrow. The history of Science is full of paradoxes which are hard to explain and can only be understood probabilistically. The author theorizes a dual state of Information where information flits probabilistically from relevant to irrelevant state and how such dual states could explain how effect can influence cause. At a quantum level such retrocausality is plausible but historical examples of clock mechanisms suggest that both quantum and classical states could be driven by temporal mechanisms. This demystifies the observer effect and paradoxes like the Maxwell demon.

Funerals, Demons, and the Replication Crisis

Electrons when observed passing through two slits behave like particles and when left unobserved show wave interference like a ripple action in a pond. Why electrons calm down and get into a meditative state somehow obliging the observer is a quantum mystery, which has its roots back in 1901 when Max Planck [1] first used the word quanta. Nature is intelligent because she conserves and prospers seamlessly and perpetually and understanding her intelligence mechanism is where Science begins.

Before we understand science, we need to realize that the progress of Science is connected to funerals.

"A new scientific truth does not triumph by convincing its opponents and making them see the light, but rather because its opponents eventually die"

Max Planck

In 1773 Laplace [2] came with the idea of causal determinism but it took more than a century for the quantum theorists to bury the thought of Laplace's demon, which claimed that access to nature's database can open doors to all knowledge and hence certainty.

"An intellect which at a certain moment would know all forces that set nature in motion, and all positions of all items of which nature is composed...for such an intellect nothing would be uncertain and the future just like the past would be present before its eyes."

Pierre Simon Laplace

In 1867 Maxwell's Demon [3] was set up as a thought experiment to explain how Nature overcame the failure of the second law of thermodynamics. Since entropy was always increasing, how could natural systems create free energy and keep going perpetually despite burnout? The thought experiment involved a demon that would catch the fast molecule and allow the slow one to pass was Nature's way of extracting order from the state of disorder, hence reducing entropy [4].

Even Einstein and Leo Szilard believed the breakdown of the second law to be an impossibility.

"Fluctuations which temporarily reduce the entropy without compensation and, therefore, violate the laws of thermodynamics [is an impossibility]"

Albert Einstein [5]

"One who is continuously and exactly informed of the existing state of nature and who is able to start or interrupt the macroscopic course of nature at any moment without the expenditure of work. A system in which such measurement occurs shows a sort of memory"

Leo Szilard [6]

Manipulating disorder is not a phenomenon just observed in Physics but in other biological systems. John Christopher Willis [7] born in 1868, early in his professional life as a botanist became dissatisfied with the theory of natural selection as an explanation of the mechanism of organic evolution. As the basis for his attack on the Darwinian theory [8] of natural selection, Willis accepted mutations, usually very divergent from the parent form as the cause for evolution compared to the general belief that adaptation was the driver for evolution. The role of mutations in evolution is becoming mainstream in areas as diverse as Cancer therapy today [9].

The story of economics, finance, and psychology is full of debates, counter-arguments, centered around mutations in behavior, loosely referred to as inefficiency [10] or disequilibrium. The story struggles to reach an evolved state of systematic intelligence and continues to rely on the thesis of exuberance laid down by Charles MacKay in his 1790 'Memoirs of Extraordinary Popular Delusions and The Madness of Crowds.' [11] A mechanism driving individual or collective psychology seems unimaginable.

The observer effect even haunts investment management as relevant causes of today fail to work tomorrow. The investment discipline suffers from a similar inexplicability and confusion and hence has polarized around meta segmentations with only a few Nobel prize-winning economists like Robert Solow [12] stating that "it is a mistake to think of

economics as a Science with a capital S. There is no economic theory of everything and attempts to construct one seems to merge toward a theory of nothing”.

All this scattered debate in sciences, social sciences, and pseudo-sciences has transformed the society into a cargo cult [13] that engages deeper in predatory publishing exacerbating the replication crisis [14], making it harder to replicate scientific research.

Information and the Epistemological Paradox

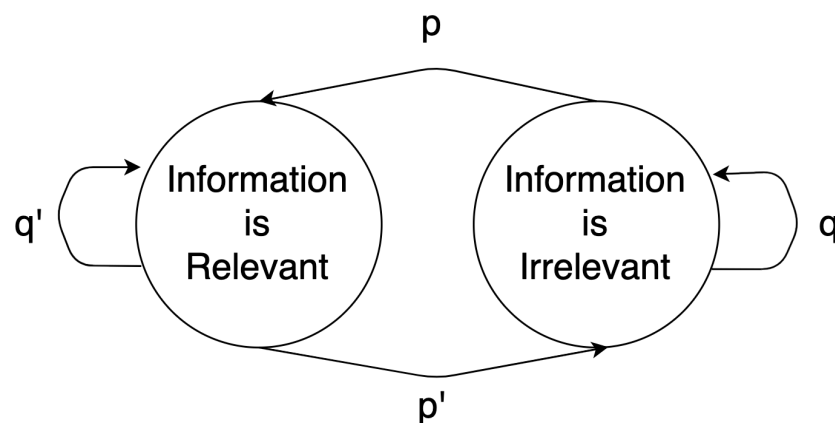
Interdisciplinary research has a real chance to discover the intelligence mechanism as it practices its craft at the boundaries of various disciplines. At the soul of any intelligence mechanism lies information and without appreciating the bounds of information, limits of rationality, or the character of information, its architecture [15], any initiative to seek intelligence is bound to generate more alternative information, which needs more transformation and more computation, a circular process.

Kenneth Boulding [16] preceded the modern finance thought and despite his emphasis on information's flipping nature between states of relevance to irrelevance, the generation of researchers after him preferred queuing up separately under the relevance and irrelevance groups rather than accept that just like the electron, expressing duality, what if Information itself had a split personality and the only way to understand information was to measure its state-based probabilities.

“We have heard a certain epistemological paradox, that where knowledge is an essential part of the system, knowledge about the system changes the system itself. This is a kind of generalized Heisenberg Principle, which is particularly troublesome in the social sciences. What this means, of course, is not that the knowledge is unattainable, but that we must regard it as a part of a total dynamic system.”

Kenneth Boulding

Informational States



Information can be expressed as a dual state system, a Markov probability chain [17] where information flits between relevance and irrelevance and is based on the observer's action at a certain point of time, like Schrodinger's cat, spins outcome, one at a time. This informational state as one may call it can be used to conceptualize particle or wave behavior, inefficient and efficient market, quantum or classical states, the cat is dead or alive, effect and cause, etc.

"The point of the famous Schrodinger cat thought experiment, into a superposition of "alive" or "dead", was not to make people say, "Wow, quantum mechanics is really mysterious." It was to make people say, "Wow, this can't possibly be correct." But to the best of our current knowledge, it is."

Sean Carroll [18]

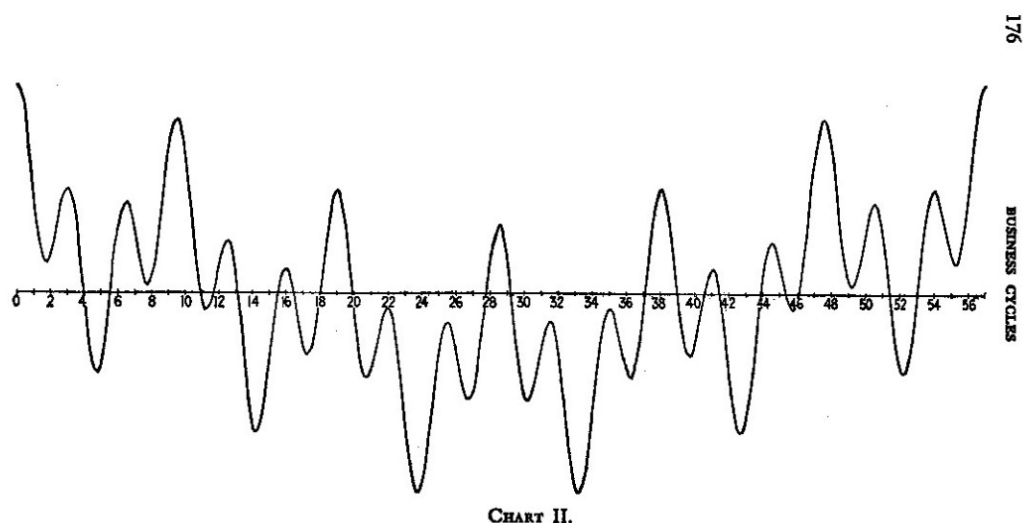
The informational state is the new knowledge that challenges our current conception of information and could give us a new insight into mutations and into the duality of effect and cause.

Effect and Cause

The observer effect is one outcome at a time that is connected to the Maxwell demon. An intelligent system does not need two demons to do things because it is energy-conserving and efficient. The quantum decoherence or dissipation is connected to the breakdown of the second law of thermodynamics, which suggests that while the demon may be extracting order from the disorder for the perpetual machine, in the case of the slit experiment, it empowers the particle with awareness of its future and hence the particle knows when the observer is going to look. The idea of retrocausality [19] or effect preceding the cause may seem philosophical but if we assume there was a clock that could see the future, the slit experiment, and the demon demystify themselves and disappear leaving us with a better comprehension of the intelligent mechanism.

The Clock

Reality is more vivid than fiction, and history is the only database. In 1874 Karl Lamprecht, [20] a German historian said that history is a mathematical model, which can be used to predict the future. Whether Isaac Asimov read Lamprecht's work or got quantumly entangled to create psychohistory [21] is another mystery. Lamprecht was not alone to think about Time as a mechanism.



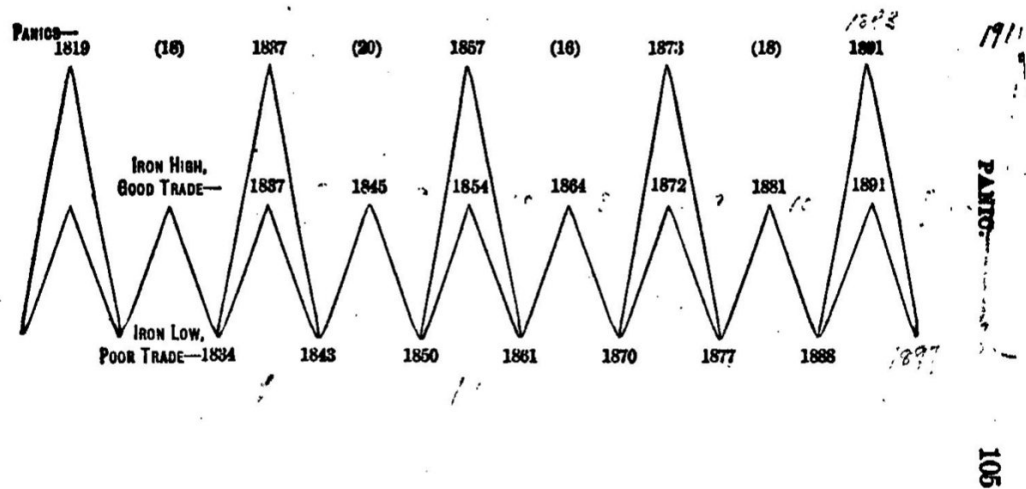
Composite Cycle

Joseph Schumpeter's 1939 "Business Cycles" [22] carry a composite cycle of time, which supersedes all business cycles.

"...feeding upon itself and of setting into motion a mechanism which, considered in isolation, could run on indefinitely under its own steam."

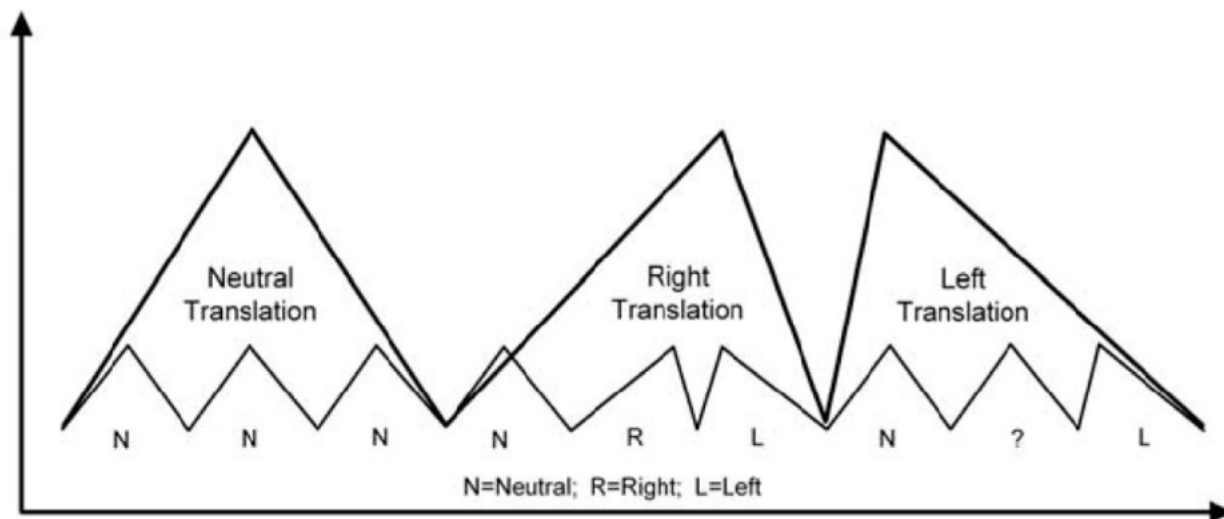
Joseph Schumpeter

Samuel Benner's 1875 clock might seem a primitive work of geometry, but it stands out as a mechanism with its nested 8-9-10 years and 16-18-20 years pattern. He was the first one to talk about hierarchal 'Time' in 1875. The farmer from Ohio wrote about price fluctuations [23]. The 19th century was also the time of Laplacian probability, Gaussian distributions, Peano curves, and Cantor set.

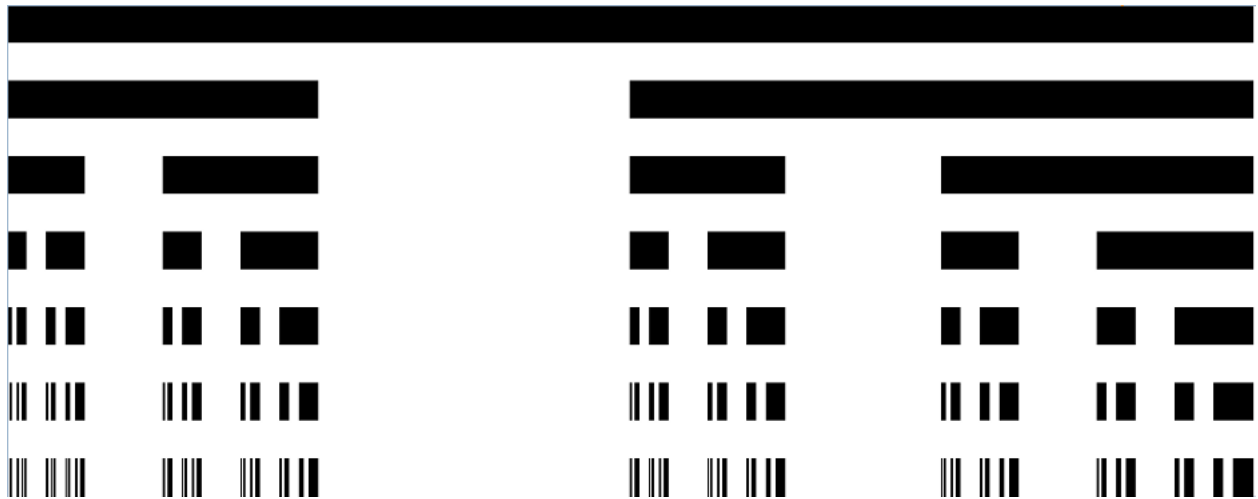


Benner Cycle

The idea of Time fractals [24] or multiplicity of durations is provable trigonometrically into a translating 'head and shoulder' prominent pattern in nature but the significance is not really in the clock, it's in the idea that information lends itself to the mechanism, flitting between relevance and irrelevance as the clock commands. To make the case more mathematical, one can see that the idealized time fractals structure is nothing but the Cantor set [25] with more geometrical similarities with other fractal structures like the Pascal triangle [26] or Sierpiński triangle [27]. Eventually Time fractals should explain the Mandelbrot set [28] and hence the functioning of Chaos [29].



Time Fractals



Cantor Set

A Time fractal, multiplicity of durations structure could be powering the intelligent mechanism that allows the effect to influence cause and information to flip from irrelevance to relevance, creating intelligence. The fractal translates [30] smaller temporal signals which anticipate short-term events into longer-term temporal signals which anticipate longer-term events. Despite external causalities, noise and chaos, the longer-term signals keep the mechanism robust allowing effect to influence the cause. At a degree higher, the effect transforms into the cause, which feeds into another future, a nested time mechanism moving into infinity allowing agents to think they have free will but still driving them to their particle-like destiny. The distinction between philosophy and science gets blurred as we dig deeper, we find new demons and new Science persevering, as it slays one demon after the other.

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