Some Considerations on Seriality and Synchronicity

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Abstract
This paper presents an overview of the results that have been obtained lately on seriality and synchronicity, and their link, in the light of the new theories and within the frame of complexity science.
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1. Introduction

From the late17th Century until the early 20th, the Laws of Motion and other linear, mechanical principles discovered by Isaac Newton dominated the understandings of science and filtered down into every aspect of the Western world. This view of reality over time penetrated our education system, our culture, our language, our organizations and our management practices so completely that it became taken for granted [1]. This view of reality assume that:

- Things happen because something causes them to happen (cause and effect).
- We can understand what happened by reducing things to their components or parts and examining those parts (reductionism).
- The universe is orderly, follows natural laws, and works like an incredibly complicated machine.
- The best way to manage people is to organize them into a clear structure and control them with clear directions.
- The best results occur when work is streamlined to be as efficient as possible, with a minimum of wasted effort, producing the most output in the least amount of time (the "lean machine").

In the early 20th Century, the certainty of Newton's mechanics was undermined by quantum mechanics and the Uncertainty Principle developed by Werner Heisenberg. Albert Einstein found that time is relative, space is curved, matter and energy are interchangeable, and many other new challenges to the old Newtonian view of reality. Modern science has come to realize that all scientific theories are approximations to the true nature of reality; and that each theory is valid for a certain range of phenomenon. Beyond this range it no longer gives a satisfactory description of nature, and new theories have to be found to replace the old one, or, rather, to extend it by improving the approximation. Studying complexity, with the help of computers, scientists have discovered many things about "the real world" with practical applications for business, management, community and economic development. They have discovered some profound properties of life forms, order and structure using advanced computer modelling, which suggest powerful new ways by which organizations can emerge, evolve and thrive in the increasingly complex technological-economic environment. Therefore, complexity science has been regarded as a means of unification for otherwise disjoint and unrelated sciences and has also been evoked to explain unexplainable (until now) phenomena such as patterns in music, arts and sociology.

Paul Kammerer’s theory of seriality and Carl Jung’s theory of synchronicity are examples of such phenomena. In light of complexity science, the combined theories of seriality and synchronicity are genuine attempts to explain natural laws by scientists that did not know about the existence of those laws. Patterns in seriality and synchronicity show power law distributions and lognormal patterns so fundamental to and characteristic of other fields within the science of complexity.

2. Seriality and synchronicity

A "series" is noted in every-day life when a random event that is considered extremely rare happens more than once in a relatively short period of time. In the common sense, the law of series asserts that such series occur more often than they intuitively should, indicating the existence of an unexplained physical force or statistical rule provoking them. The Austrian biologist Paul Kammerer (1881 – 1926) was the first scientist who studied this law [2] and described it as follows: "A series manifests itself as a lawful recurrence of the same or similar things and events - a recurrence, or clustering, in time or space whereby the individual members in the sequence - as far as can be assertained by careful analysis - are not connected by the same active cause". The central idea of Kammerer's theory is that, side by side with causality of classical physics, there exists another basic principle in the universe which tends towards unity: it correlates by affinity, regardless whether the likeness is one of substance, form or function, or refers to symbols. Kammerer points to analogies on various levels, where the same tendency towards unity, symmetry and coherence manifests in conveniently causal ways: gravity, magnetism, chemical affinity, sexual attraction, biological adaptation, symbiosis, protective coloring, imitative behavior.

On the other side, Swiss professor of philosophy Carl Gustav Jung (1875 – 1961) and Austrian physicist Wolfgang Pauli (1900 – 1958) were fascinated by examples of "meaningful coincidences". They conjectured the existence of undiscovered and mysterious "attracting" forces driving objects that are alike, or have common features, close together in time and space and used the word "synchronicity" to describe situations like these. In [3], Jung emphasizes his belief that the interrelationship between the internal states of consciousness and the external world is not bound by cause and effect, but something more difficult to define, something like "meaning". For example, after the disaster at Chernobyl in 1986, interviews showed that large numbers of people had dreamed in advance that the plant was unsafe and a nuclear accident was imminent. If an event has no meaningful importance for the individual, then the event is simply a coincidence and not a synchronicity. He noticed that synchronicity often appears when people are in states of crisis, transformation or pushed to extreme limits – meaningful times in life.

Jung and Pauli's common reflections went far beyond psychology and physics, entering into the realm where the two areas meet in the philosophy of nature. In fact, as a consequence of their collaboration, synchronicity was transformed from an empirical concept into a fundamental explanatory-interpretative principle, which together with causality could possibly lead to a more complete worldview.

Where Jung's synchronicity deals with the relationship between subjectivity and the external world, Kammerer's seriality is more concerned with patterns and groupings of objects that occur in the environment. In [2] we get a topology of non-causal occurrences related to names, numbers, situations, as well as a morphology of series: according to the number of successive similar or identical events we distinguish between series of the first, second, third,… order, while according to the number of parallel concurrences of similar events we can observe series of the first, second, third,… power. Besides order and power, series can also be classified according to the number of their parameters – that is, the number of shared attributes. Further on, Kammerer offered a systematization of series in: homologous and analogous, pure and hybrid, inverted, alternating, cyclic, phases series.

Beyond simple situations that can be evoked to illustrate seriality (incidents under various headings: numbers, words, names, meeting people, disasters and so on) there are fields where manifestation of seriality required serious scientific studies. For example, in the insurance industry, the question of storm seriality has raised some intriguing scientific questions such as: Are storms more clustered than one could expect only from chance? What processes could cause such clustering? How well can clustering be predicted? Will the nature of clustering be different in the future? In general, one should expect all hazards that depend on factors with time-varying rates to exhibit clustering. Most meteorological hazards fall into this category since weather systems generally depend on either large-scale flow patterns and/or boundary conditions (for example, sea surface temperatures) that vary in time. This source of clustering is often overlooked by hazard models which generally assume that a) the individual hazard events are independent of one another, and b) the rate of the hazard remains stationary in time. Although convenient for estimating the parameters in hazard models from past event data, both of these assumptions are highly questionable for most types of meteorological hazard. It has been proved that meteorological hazards are neither completely independent of one another nor have constant rates [4].

3. Information – an unification principle

In [5], Chalmers argues that each informational state has two different aspects: one as conscious experience, and the other as a physical process in the brain, that is, one internal/intentional and the other external/physical. This view finds support in the developments of so-called "information physics" [6], that proposes that the physical entropy would be a combination of two magnitudes that compensate each other: the observer's ignorance, measured by Shannon's statistical entropy, and the disorder degree of the observed system, measured by the algorithmic entropy which is the smallest number of bits needed to register it in the memory. During the measurement, the observer's ignorance is reduced, as a result of the increase in bit numbers in its memory. However, the sum of these two magnitudes – that is, the physical entropy - remains constant. In this informational view of the universe, the observer remains included as part of the system, and the quantum universe changes not because it was widely influenced by the mind, but because the observer's mind unleashed a transfer of information at a subatomic level. In [7], the idea that "entropy shouldn't be understood as a disorder measure, but much more as a measure of complexity" also appears.

Consciousness' conception as something essential, primary and irreducible is also found in the consciousness maps obtained from thousands of psychotherapeutic reports and consistent and converging experiences, observed by several researchers of the medical and psychological areas. These maps reveal an ontology in which consciousness cannot originate from, or be explained in terms of other things [8]. Matter, life and consciousness appear as meaningful activities, that is, intelligent quantical-informational processes, "order" that is transmitted through the cosmical evolution. Quantum theorists see things and events, once conceived as separate, as being so integrally linked that they seem to abandon the previous reality of separate space and time proposed by classical theories. It is as if things were always in touch with other things.

We can understand information as an unifying principle, capable of connecting consciousness to the universe and to the totality of space and time. This allows a better understanding of phenomena and theories related to consciousness – among them, synchronicity.

4. Mathematical and computational models for seriality and synchronicity

An event A repeats in time "by pure chance" when it follows a Poisson process. Such a process is characterized by one parameter λ, equal to the average number of signals (occurrences of A) per time unit. In a typical realization of such a process, the distribution of signals along the time axis is far from being uniform: it reveals a natural tendency to create clusters. Such purely random distribution is called stochastically unbiased and the resulting clustering is called spontaneous. In order to specify the meaning of seriality, mathematicians have defined attracting as a deviation of a signal process from the Poisson process toward stronger clustering rather than spontaneous clustering. Similarly, repelling is defined as clustering weaker than spontaneous, that is, a more uniform distribution of signals in time.

Recently, Downarowicz and Lacroix [9] have obtained a strong result in ergodic theory: a theorem that supports the law of series as predominance of attracting for certain types of events. In a typical realization of any stationary and ergodic signal process, in a sufficiently long run, the ratio between the number of signals and the elapsed time will approximately equal λ. Thus, in a randomly selected time interval of length t, the expected value of the number of signals equals λt. If F is the distribution function of the waiting time for the first signal, then the value $F(t)$ is the probability that in such interval there will be at least one signal. The ratio $t/F(t)$ hence represents the conditional expectation of the number of signals in all these time intervals of length *t* in which at least one signal is observed. If $F(t) < 1 - e^{-t}$, this conditional expectation is larger than in the Poisson process – in other words, if we observe the process for time *t*, there are two possibilities: either we detect nothing or, once the first signal occurs, we can expect a larger global number of the observed signals than if we were dealing with Poisson process. The first signal "attracts" further repetitions, contributing to an increased clustering effect. Repelling is the converse: the first signal lowers the expected number of repetitions in the observation period, contributing to a decreased clustering, and a more uniform distribution of signals in time. The main result in [9] proves that, with regard to elementary events (basic sets of very small probabilities), any deviation from independence may generate only attracting. So, the conclusion is that in the universe there exists a natural advantage of attracting over repelling. The "decay of repelling" in positive entropy processes appears to agree with the intuitive understanding of entropy as chaos: repelling is a "self-organizing" property that leads to a more uniform, hence less chaotic, distribution of an event along a typical orbit. Although, we have to notice that the attracting is explained in purely statistical terms, without needing to understand the nature of the dependencies. This theory may apply to some rare events in computer science or genetics.

Another interesting model is the Cardland model, introduced by Forster [10]. In this case, complexity science is used to explain Kammerer's law of seriality and, by inference, Jung's synchronicity. However, due to the nature of synchronicity, this paper primarily focuses on seriality. The Cardland model is introduced and presented as a theoretical basis for seriality, to show how simple events are self-organizing and how they show the signature of complexity, a power law distribution. In essence, the Cardland model uses a simple pack of playing cards that are observed in some experiments. For example, an outcome for a single iteration of Cardland with the categorical type of red and black cards may be the following: *b* r *b b* r *b b b* r *b b* r r r r *b b* r r *b* r r r r r *b b b b* r r r *b b* r r *b* r r *b* r *b b b b b b b* r *b b* r. The clustering phenomenon of Kammerer can be observed. The pattern or r's (red cards) and b's (black cards) appears random but when consecutive sequences are presented, a power law distribution is observed. An outcome for a single iteration of Cardland with the categorical type of spade, club, heart and diamond cards may be the following: c h s s d s s s h c c d d h d c s h h s h h d d h d c c c s h h d c s h d c d h s d s c c c c s d s s d. The pattern or s's (spades), c's (clubs), h's (hearts) and d's (diamonds) appears random but the clustering phenomenon of Kammerer and a power law can also be observed. These theoretical experiments have been supported with real-life observational data. For example, male subjects have been observed with respect to their facial growth in Circular Quay Railway Station, Sydney, Australia, chosen because of a regular flow of people from a wide range of cultures and socio-economic backgrounds. The distribution of the number of consecutive sequences of males with and without facial growth closely followed a power law.

The results for the Cardland model and real-life observational data are consistent with patterns in self-organization and power-law distributions. Events tend to be self-organizing when there are no inherent constraints on those events to behave in a particular fashion. This conclusion is consistent with previous findings in the fields of economics, finance, physics and population evolutionary biology: Mandelbrot, 1963 [11], Kauffman, 1993 [12], Lewin, 1993 [13], Newman, 1996 [14], Bak, 1997 [15], Laherree and Sornette, 1998 [16], Mantegna and Stanley, 2000 [17], Ward, 2001 [18].

5. Conclusions and future work

If we look at the evolution of life over millions of years, we can see a pattern in which life forms become more communicative, more richly creative, more able to process complex information, more spontaneous in their capacities to respond to change. So while some regions of the world are "closed systems" in states of equilibrium, in order for life to develop there had to be other regions of the world that were "open systems" where new types of order could spontaneously form [19]. As the computer sciences developed so that very large amounts of data could be processed rapidly, models began to be developed of these different types of information systems. Complexity theory has depicted four basic types of information systems, based on levels of connectivity, that seem to emerge from the logic of mathematics. It turned out that these four types of systems can be documented throughout the natural world, in laboratory experiments, in social environments, and in business corporations. Class 1 systems have too few connections to develop creatively and fall into entropy. Class 2 systems have more connective links, and settle into patterns. Class 3 systems are turbulent and chaotic and no stable patterns ever emerge. Finally, in Class 4 systems, where just the right level of connectivity is reached, beautiful, complex, and coherent structures begin to develop suddenly. Through emergence*,* objects and patterns can arise from simple interactions in ways that are surprising and counter-intuitive. With respect to synchronicity, numerous studies in neurosciences, medicine, psychology, or philosophy showed that the question of a-causality in "meaningful" coincidences can be reassessed in terms of the concept of emergence, which explores holistic phenomena supervening from interactions among component agents.

While complexity theory has been very useful in helping to conceptualize how synchronicity might connect with the sciences, no model can ever be a final resting point in our understanding [20]. Jung had essentially a post-structuralist view of knowledge: "All knowledge is the result of imposing some kind of order upon the reactions of the psychic system as they flow into our consciousness... It is not a question of asserting anything, but of constructing a model which opens up a promising field of inquiry. A model does not assert that something is so, it simply indicates a particular mode of observation".

In a future work we intend to realize a computational model in order to observe how schemas in Genetic Algorithms search process, within the framework formalized by Holland [21], may link with the law of seriality.

6. References

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