# Non-trivial Time Flows in Anticipation and Action Revealed by Recent Advances in Natural Science, Framed in the Causality Network of Differential Ontology

Stein Erik Johansen
Norwegian University of Science and Technology, Department of Social Anthropology
Institute for Basic Research, US, Division of Physics
Home address: Jacob Rolls gt. 22, N-7016 Trondheim, Norway
stein.johansen@svt.ntnu.no

**Abstract**
The article reports some far-reaching results from Chris Illert's research in conchology. Illert discovered that growth of all sea shells follow a universal algorithm. This discovery presupposed a lifting from Euclidean space to a 6D iso-Euclidean space executed by means of hadronic mechanics and the corresponding new mathematics initiated by Santilli. Illert also found that growth of *branching* sea shells required the existence of non-trivial categories of time with information jumping forward in conventional time, as well as backward from there; this last time category implying the existence of isodual spacetime connected to the antimatter 'universe'. Some other recent advances in theoretical and experimental science with radical implications for the comprehension of time are also reported. These findings are then approached from the differential ontology and causality nexus of our own philosophical informatics, with the aim of comprehending more complex anticipatory systems as integrating more complex 'objective' non-trivial time flows with 'subjective' time flows from the organism's modelling faculty.
**Keywords**: time theory, isogeometry, hadronic mechanics, universal rewrite, causality

## 1 The Time of the Sea Shell

Chris Illert is the world leading expert in conchology, and succeeded in specialist studies during the 1980's and early 1990's to find a universal algorithm to explain the growth pattern of all known sea shells (Illert 1983, 1987, 1989, 1990a,b, 1992, 1993, 1995, 1995b). This modeling of sea shell growth was only possible by a primary description of the growth trajectory in a certain supra-Euclidean space, projected through geometric deformation into sea shell growth as it appears for human perception. The supra-Euclidean description of the growth trajectory required was not possible with traditional supra-Euclidean geometry, such as Riemannian or Minkowskian, but required a more general geometry, which it is appropriate to name *hadronic geometry*. The mathematical physicist Ruggero Maria Santilli (I) initiated the development of huge new classes of number fields with corresponding geometries and mathematical techniques, named *hadronic mathematics*, a scientific enterprise with revolutionary and already well established implications for physics as well as other disciplines. This development has now gone on for four decades and with a rising numbers of

contributions from professional mathematicians. Hadronic mathematics encompasses, in progressive complexity, the new and more general fields of *isonumbers*, *genonumbers* and Santilli *hypernumbers*, with corresponding liftings of the totality of preceding mathematics, and with corresponding development of iso- , geno- and hypergeometries.

For a certain class of sea shells, namely sea shells with bifurcation, Illert proved that sea shell growth could only be understood by the acknowledgement of certain NON-TRIVIAL time categories presupposing hadronic mathematics and mechanics for a precise comprehension. For this class of shells, such non-trivial information flows in supra-Euclidean space is projected from isospacetime (and its asymmetric isodual spacetime) through deformation into the ordinary Euclidean time line, where these information flows manifest as forward and backward LEAPS in time.

Illert's representation (first part of Illert and Santilli 1995) revealed a UNIVERSAL algorithm (cf. eqs. 3.1 p. 72 and 3.2 p. 73, and also equation 5 in Illert 1989:768) for sea shell growth, "from a solid empirical base encompassing 100.000 or so (living or extinct) molluscan shell varieties" (p. 4), more specifically "a unique second-order coupled differential equation (3.2) describing all of the several major categories of shell geometries found in the real world" (p. 101). The universal algorithm was tested against the most intricate and complex sea shell structures (among them *Nipponites mirabilis* – cf. p. 91) through extensive computer simulations, and with impressing empirical matching.

The most general assumption in Illert's systematic presentation – as in most theoretical mechanics – is the concept of energy (p. 3) and the principle of least action for energy flow to "dissipate stresses" during sea shell growth to resemble "optimal tensile clocksprings" (p. 9). To reveal the hidden universal growth algorithm, Illert uses the principle of self-similarity (including scale-invariance) of growth – elaborated from Aristotle's notion of *gnomon* (pp. 27-64) from which Illert derives and explains "in a natural way" the self-similarity differential equations with two specified constraints (eqs. 2.41 and 2.42, p. 67), this leaving only two arbitrary constants which values Illert groups in different classes leading to various classes of clockspring trajectories (p. 1 and p. 9) corresponding with the empirical variations of sea shell forms (pp. 72-105).

In developing the equation for the universal growth algorithm, Illert discovered the necessity of moving – technically speaking – from a real to a complex Langrangian which requires a LIFTING from Euclidean space to what is called ISO-EUCLIDEAN space in the modern iso-mathematic branch of mathematics (cf. p. 101). This was necessary because the two mentioned "critical constants, associated with trajectory "curvature" and "torsion" often have to be complex numbers" (p. 2). Iso-Euclidean space is a certain multi-dimensional complex space, in Illert's case basically with SIX dimensions. The concept of such space was NOT known before the initiation of iso-mathematics (Santilli 1988), and is not to be confused with trivial multi-dimensional modeling or with hyperdimensional geometry in general, dating back to Riemann in 1854. Iso-mathematics is a new and more extensive landscape of mathematics where ALL earlier known mathematical operations, supposing the number of 1 as the basic unit, is GENERALIZED and LIFTED to encompass ANY other unit which COINCIDES with the original basic unit, and at the same time has an ARBITRARY

functional dependence on other variables. Hence, iso-mathematics rose from detrivializing and generalizing the conventional unit of mathematics.

This means that Illert's systematic examination revealed a highly non-trivial general result: that the hidden universal algorithm for sea shell growth could ONLY be discovered with the extension of 3D space to "at least five space-like and one time-like dimensions" (p. 2). This has far-reaching implications for an adequate understanding of the ontological architecture of space itself, degrading the ordinary 3D perception of space to a MANIFESTATION of a higher order (in the sense of David Bohm) of space organization. Some quotes from Illert in this regard: (In this article comments of mine are in brackets, and emphasizes of mine are in boldface.)

*the growth-trajectory that we see (hereafter called a CLOCKSPRING) is only the real part of a* ***more general*** *(-) curve through a multi-dimensional space. Even the underlying physical principles (such as HOOKE'S LAW)* ***only*** *emerge coherently, and seem to make sense, within our full complex-space formalism (-). Real space <Euclidean 3D> just doesn't seem adequate. So are seashell geometries profound enough to tell us that we live in a world that doesn't quite* ***make sense*** *unless we assume that it has at least five space-like and one time-like dimensions? (-) Certainly, if we do take shell geometries seriously, our insights are all the more powerful because they emerge from totally* ***classical****, non-quantum, reasoning. (p. 2)*

*forms that are* ***different*** *in normal* ***Euclidean*** *space may be* ***unified*** *in this more* ***general*** *geometry <i.e. isospace>. (-) We already* ***know*** *that shell growth trajectories are iso-euclidean, but, if we tried to force them into purely Euclidean space,* ***they would wrinkle and the shells would crack or explode****.(-) the iso-euclidean trajectory of Nipponites mirabilis starts out in a* ***regular planar spiral*** *before eventually becoming serpentine. But if we force it to exist in a more "Euclideanish" space (-) the whole curve* ***meanders grossly*** *from beginning to end, it is just like stuffing elastic piano-wire into a smaller box thereby forcing it to wrinkle more severely. (pp. 101-2)*

Illert classifies clocksprings in first and second kind, depending on if their representation requires first or second order discrete mathematics. Even quite simple sea shells, classified as clocksprings of the first kind, can have a growth trajectory where the imagined "wire" may pass through itself. Illert argues this to not represent any crucial difficulty since the "wire" is imagined as INFINITELY thin in his approach (cf. p. 82). (However, there exists ONE topological structure, the *diagonal woven Klein-bottle* discovered by Morgan (I) and further discussed by Purcell (2006), where the wire passes through itself in 3D WITHOUT being infinitely thin.) While sea shells with self-intersection as such may not be too big a deal in Illert's theory, there is a certain sub-class of such shells that poses a huge and highly interesting challenge for the scientific understanding, namely the so-called BRANCHING clocksprings. I prefer to quote Illert at length here, because this may be a discovery in the history of science of uttermost importance for a more profound and extended understanding of the nature of time:

*shells such as Yochelcionella, Rhaphaulus, Rhiostoma and Spiraculum all utilize self-intersecting clockspring trajectories; actually* ***BRANCHING at points of trajectory-intersection****, there after growing* ***simultaneously*** *along two separate branches of the clockspring! Some shells branch during the* ***earliest*** *developmental*

*stages (as in Yochelcionella daleki, a self-intersecting clockspring of the* ***First*** *Kind (-) ), whilst others (such as Janospira nodus, a self-intersecting clockspring of the* ***Second*** *Kind) wait almost till the* ***end*** *of ontogeny before branching. The palaeontologists who first studied these branching clockspring geometries described the shells as "curious", "ridiculous" "absurdities" but we can now see them as the* ***same*** *optimale tensile spirals which other* ***non-branching*** *shells also utilize. And as trajectory-branching seems to occur widely, in* ***unrelated*** *species, the usual "once-off" biological explanations won't suffice...there is a deeper geometrical principle at work! (-) how can the trajectory at the branchpoint (-) be causally linked to the* ***FUTURE*** *ongoing pathway (-)? It seems as if Janospira, at the instant of branching,* ***"knew" (ahead of time)*** *about the existence and location of a future portion of the clockspring trajectory...even though the outermost whorl had not, at the time of branching,* ***actually*** *looped about to (and indeed, never ultimately would)* ***physically*** *create the future intersection-point. We are talking here, about* ***action with foreknowledge****, action outside the expected linear Newtonian sequence, rather as if an impending future event acted* ***BACKWARD*** *THROUGH (future) TIME to influence the present! (pp. 93-4)*

Illert illustrates the issue with the following vector-spiral diagram from his vector-equation for the clockspring trajectory (p. 95):

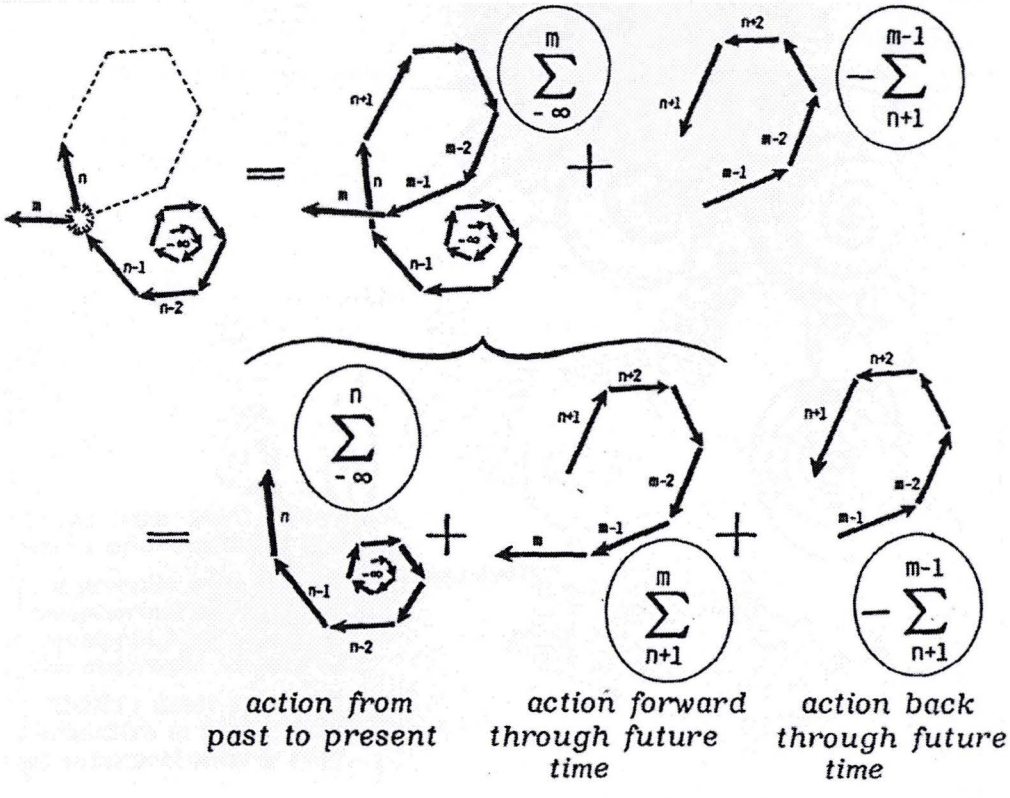


**Figure 1** (from Illert, in Illert and Santilli 1995:95): Time flows in branching sea shells.

The universal algorithm with the adequate value of the two critical constants gives the growth trajectory for this sea shell INCLUDING the dotted part of the trajectory. The dotted trajectory is NOT manifested in the physical structure, but the PROLONGED trajectory (m) from the branching point CONTINUING this dotted and 3D-VIRTUAL trajectory is. Hence, the prolonged trajectory (m) can ONLY be discovered from assuming that the dotted part has a crucial HIDDEN reality, obviously because the universal algorithm has an even HIGHER reality. Also, for this to be the case, the hidden algorithm has to include a determination of the LENGTH in space (both in hyperspace and 3D space) and time (cf. later) of the hidden part, and by this also the exact LOCATION in space and time of the branching point.

Illert's interpretation in and of fig. 1 is to view the growth trajectory as a combined result of three different trajectory parts with three corresponding different categories of time:

1) Interval [-infintity, n] with ordinary time flow or "action from past to present".
2) Interval [n+1, m] with "action forward through future time *(isotime).*
3) Interval [n+1, m-1] with "action back through future time" *(inverse isodual isotime).*

2) and 3) represent highly non-trivial categories of time, and if Illert's theory is adequate, this of course must have crucial implications for ALL sciences. With regard to the non-triviality Illert writes:

*The main thing to realize is that branching clocksprings arize naturally from the* ***same*** *theory that describes* ***all*** *other known shell geometries, and that examples such as Janospira occur in Nature. To be* ***predicted*** *by theory and* ***observed*** *in practice is a powerful* ***metaphysical*** *position: how one mentally reconciles the causal implications is a* ***psychological*** *problem.* (p. 96)

The discovery of the universal growth algorithm was only possible by looking for it and formulating it in ISO-Euclidean space. Such discoveries were predicted from hadronic mechanics, which also includes two additional categories of non-trivial time flows (Santilli 2001:102): *inverse isotime* (backward in past time) and *isodual isotime* (forward in past time). The two categories connected to isodual spacetime presuppose a universe in nilbalance between matter and anti-matter (as well as positive and negative time), a notion that was a presupposition for Illert's discoveries. In Johansen (2008a) we present a much more extensive discussion of non-trivial time flows related to hadronic mechanics, as well as some analysis of possible implications with regard to extending the understanding of MENTAL spacetimes, including elements of non-trivial time flows (as precognition from dream space).

## 2 Causality and Time from Differential Philosophical Informatics

Hadronic mechanics is not the only paradigmatic shift advanced and potent enough to facilitate huge progress in science and technology in the global scientific ecology of today. Johansen (2007) traces and highlights five such grand theories: Hadronic mechanics and chemistry (initiated by Santilli), nilpotent universal computational rewrite system (Peter Rowlands 2007, I), Global Scaling Theory (Hartmut Müller I),

causal mechanics (Kozyrev Ia,b) and topological geometrodynamics (Matti Pitkänen I). Apart from Kozyrev (see Johansen 2008b for discussion of Kozyrev's theory of Time) all these theories have blossomed from significant advances in sophisticated mathematical physics. Johansen (2007) argues these five theories to be the most advanced, judged from six criteria, with special emphasis on the criterion of inducing technological breakthroughs not possible from conventional physics. These five theories are argued to be reasonably compatible with each others, with potential for further compatibility and mutual synergy effects. Together the five grand theories constitute a quite solid assembly of superior natural science compared to the century old standard physics with related theories and restrictions in technology.

From his theory Müller (2001, 2004a,b,c) was able to develop new technology which in 2001 experiments succeeded in INSTANT transfer of energy and information applying "gravitational standing waves", hence confirming Kozyrev's theory of such instant transfer being possible. This astonishing experimental results is also in agreement with Rowlands' theory which states that the force of gravity does not have any (non-infinite) speed, but is instantaneous (Rowlands 2007: 444-9). With regard to time, Pitkänen's notion of the "causal diamond" is also of great interest:

*The basic construct in the zero energy ontology is the space $CD \times CP_2$, where the causal diamond CD is defined as an intersection of future and past directed light-cones with time-like separation between their tips regarded as points of the underlying universal Minkowski space $M^4$. (Pitkänen Ib)*

This statement of Pitkänen indicates the significance of ONTOLOGY for further advances in time theory. The same is even more the case with regard to Rowlands, whose *opus magnum* (2007) represents a hall mark in the history of science with regard to originality, abstraction, broadness and ultra-ambitious systematic DEDUCTION of Nature's codes and rules, with special emphasis on demonstrating in rigorous detail the explanatory power of his abstract-elementary-universal theory with regard to the foundations of physics. We will therefore attempt to qualify the discussion of time with some short – and necessarily somewhat cryptic – reference to and underpinning from our own work in "differential philosophy".

The book *Outline of Differential Epistemology* (Johansen 1991, 2008c) presents a universal differential ontology (including epistemology) from a systematic, abstract and quite rigorous philosophical unfoldment of what is enfolded in the very category of INFORMATION (anything) comprehended in its most abstract and elementary sense as Bateson's "difference that makes a difference" (with some qualifying modification). In general, the inspiration for the differential philosophy worked out in the book was the epistemology of Gregory Bateson, acknowledging the universal "metapattern which connects". The theory was developed in constructive confrontation with Bateson's theory, leading as a spin-off to a concise evaluation of the insights and shortcomings of Bateson, from the build-up of an autonomous theory, which is a systematically differentiated ontology and epistemology from philosophical informatics.
The method is to systematically unfold, by micro-philosophical strict and abstract reflection what is enfolded in information as such.

This states information as a DIFFERENCE that makes a difference for something (i.e. a SUBJECT), as described from a meta-subject.

The category of BORDER is enfolded and presupposed in the category of difference. Always the category is projected from the subject existing on the upper ontological level, down to a lower level as a "knife" of perception or thought making a distinction in a continuum, and transporting the created difference forwards to a level ABOVE the level from which the knife was thrown. Hence, one step back to take anything one step forward is universally embedded in the category of border and therefore in all information processing, CONSERVE&CREATE as universal (re-)write. This is the Fibonacci algorithm, constituting the basic and universal bridge between qualia and quantities of Nature.

The abstract category of CAUSALITY is the movement of the input-difference (cause) into the output-difference (effect) and therefore enfolded universally in information as such. Causality is not the glue between the two autonomous differences, it is more like the magnet with two poles. Notions contrasting causality to for example chance are mistakes of thought, chance causality constituting a certain and quite developed sub-type of causality.

All information processing, in its broadest and most abstract sense imaginable, is only intelligible as an alternating between discontinuation and continuation, between something happening, and this novelty unfolding until something new happens. A description of this must operate in a figure of logic with TWO different dimensions, one for the continuation (physical process in 3+1D), and one for the discontinuation (algorithmic and non-physical, including timeless, in the reference frame of the relevant description). Regarded along the algorithmic dimension, the algorithm is continuous, and the physical process discontinuous (Gestalt switch).

Any algorithm has a SEMANTICS as a set giving

1) types of ELEMENTS (variables and parameters) it can manipulate;
2) ORDERING RULES between the elements (as mathematical operators);
3) RELATIONS between elements (as <, > and =);
4) TRANSFORMATION RULES between "expressions" (as implication).

Any algorithm also has a SYNTAX giving the SUCCESSION between the signified elements.

This emphasis on semantics is in some agreement with the approach of Rowlands (2007) leading to a new informatics for quantum holographic computation in cooperation with Bernard Diaz and Peter Marcer in the Cybernetic Machine Specialist Group of British Computer Society (BCS I).

The SUBJECT is the instance which RECEIVES the input-difference (from the semantics of the algorithm), TRANSFIGURATES it to the output-difference (depending on syntax and internal semantics) and SENDS it as an output-difference (from the semantics).

Such differences are PHYSICAL at the OUTSIDE of the subject's border surface, ALGORITHMIC at the INSIDE. The reception is logarithmic as a necessary tendency, following the Weber-Fechner relation when the meta-subject compare the magnitudes at the outside and the inside of the subject's border surface. This implies ERASMUS

SYLLOGISMS (a is b, c is b, therefore a is c) as basic in nature, in spite of not being true as judged by formal logic. This is due to ECONOMICS of information processing, most classifications being TRACELESS (without memory of the received elements), not REFLEXIVE (with such memory).

NUMBERS can be conceived as the most primary and universal sign of algorithmic semantics, implying all languages as sub-codes.

From this some crucial definitions are unfolded/determined:
SUBSTANCE (physical level) vs. IDEAS (algorithmic dimension).
SUBSTANTIAL IDEAS: Combinations of the two.
CONSCIOUSNESS: The total relation net of substantial ideas.
SUPRA-CONSCIOUSNESS: Information not yet projected into consciousness.
SUB-CONSCIOUSNESS: Information transported back from consciousness by traceless classification.

In the physical dimension (comprehended as the unity of classical 3+1D) something leads to something somewhere in 3D space in a PROCESS, i.e. during duration of conventional TIME. In the algorithmic dimension some information leads to some other information in a TRANSFIGURATION, WITHOUT duration of conventional time. Informational transfiguration has zero extension in the physical dimension, and physical process has zero extension in the algorithmic dimension. However, transfiguration and process are with necessity linked in a movement of diagonal gait, where the output from one is received as the input of the other. Process is completely determined from the output of an informative transfiguration, and must be comprehended as an automatic 'differential movement'. This is for the process comprehended at the most micrological level implied in the description. All broader spans of the dynamic systems consist of PLURAL directed sets of alternating processes and transfigurations, that can be assembled at higher levels of systemic description.

Further, a description of a dynamic system also implies a third TRANSALGORITHMIC dimension with meta-algorithms, meta-meta-algorithms etc. The relation between meta-algorithmic and algorithmic transfiguration is analogous to the relation between algorithmic transfiguration and physical process. An implication of this is that algorithmic transfiguration has zero duration of time (and space) in the framework relating it to its physical process, while it MUST HAVE duration of time (and space), of the second order, in the framework relating it to meta-algorithmic transfiguration where it is to be comprehended as physical process itself. Therefore, there is no description or understanding without time, but what is to be considered as time vs. algorithm is RELATIVE to the level of system description, and the timeless algorithm always holds the upper hand. In COMBINED descriptions of PLURAL pairs of algorithmic transfiguration and physical process, with the pairs being of different transalgorithmic order, the time unit at an upper physical order can be compared to the time unit at a lower physical order and hence constitute a meaningful concept of TIME VELOCITY. The time unit being identical for different physical orders, appear as only a special case. Hence, this is consistent with the differences between the time unit in Euclidean spacetime vs. in iso- or genospacetimes. Hadronic geometry's description of projective deformation from genotime to Euclidean time can be interpreted as the

relation between two such physical orders with the interlaying transalgorithmic order giving the deformation modes and quantities. Also, transalgorithmic transfigurations include the possibility of CHANGES in the ratio between an upper and a lower time unit, which means changes in time velocity, a notion only meaningful measured by the unit of ANOTHER time unit, corresponding to the physical process and the spacetime from another transalgorithmic order. Then the last time unit has to be comprehended as absolute and constant in THIS combined system description, which does not mean that the same has to be the case in ANOTHER combined system description.

This work establishes the abstract, universal and elementary category of causality as with necessity implied in the abstract category of information, CONSTITUTING the input-difference and the output-difference as its necessary relata or "poles". The ordinary notion of "implication" in formal logic is the set of three pairs of truth values in two ordered expressions different from the pair of (true, false). Such a notion of causality is not sufficiently profound, because it assumes the "cause" and the "effect" to be ALREADY separated. Therefore it also leads to classes of logical expressions contra-intuitively being deduced as true. Johansen's work establishes the category of causality as a rigorous back-reflection on what *de facto* has to be operative in the "atom" of thought as such, which is more in line with the notion of 'strict implication' in modal logic, but with the difference that Johansen causality is developed with rigor from the already established differential ontology it has to be anchored in, since this ontology unfolds from information as such.

This implies that any notion of non-causal relations reflects flaws in the thinking or a notion of causality that is too shallow to precisely back-reflect and make coherently explicit what is implied in the heart of the information or thought atom. With regard to notions claiming the possibility of opposing causality to chance, such shortcomings with necessity lead to corresponding shortcomings in scientific results and their ontological interpretation, as in the case of the Copenhagen branch of quantum physics (Johansen 1991:191-205; Bohm 1987, 1993).

To adequately frame the exploration and place its results, the whole causality nexus must be unfolded systematically and precisely from differential ontology as its anchoring. This is done in Johansen (1991:124-225) where a typology of eleven basic TYPES of causality is DEDUCED FROM the universal, abstract and elementary category of causality, shown to constitute the necessary and sufficient types existing in Nature and its description. Ten significant secondary types of causality are then treated as elaborations from the basic types (Johansen 1991:181-218). These types are as follows:

***Formal logical.*** This category is universal for all thinkable information, i.e. for ANY information flow in ANY described information matrix, i.e. in the imagination of a pure and free-standing logical universe. Formal logical causality is deduced in its precise form from specified classification logic between the thinkable classes and elements from ontology differentiated vertically. All other causality types are subtypes and "clothes" of this abstract one, which is what qualify them as causality types. They unfold from specified additions of different SIMILES, NECESSARY in any dynamic system description, explicitly stated or not.

***Algorithmic***.This is the causal relation from an input-value to an output-value inside the algorithm.

***Intra-physical.*** This is the causal relation from start point to end point of a process.

***Dynamic.*** This is the causal relation with the two sub-classes:

a) From end point of a process to start point in an algorithm.

b) From end point of an algorithm to start point in a process.

***Projective***. This is the causal relation from the meta-subject to the thought object as a whole, the potential inner classifications and causal relations being actualized in this projection (including formal logical causality). (In fig. 2 the arrow of projective causality derives the whole indigo field with its nexus, from the corresponding nexus generated in the green field denoting a segment INSIDE the thinking meta-subject that makes the description. The frame of the green field is marked with broken white lines to distinguish its ontological status from the nexus projected into the indigo field.)

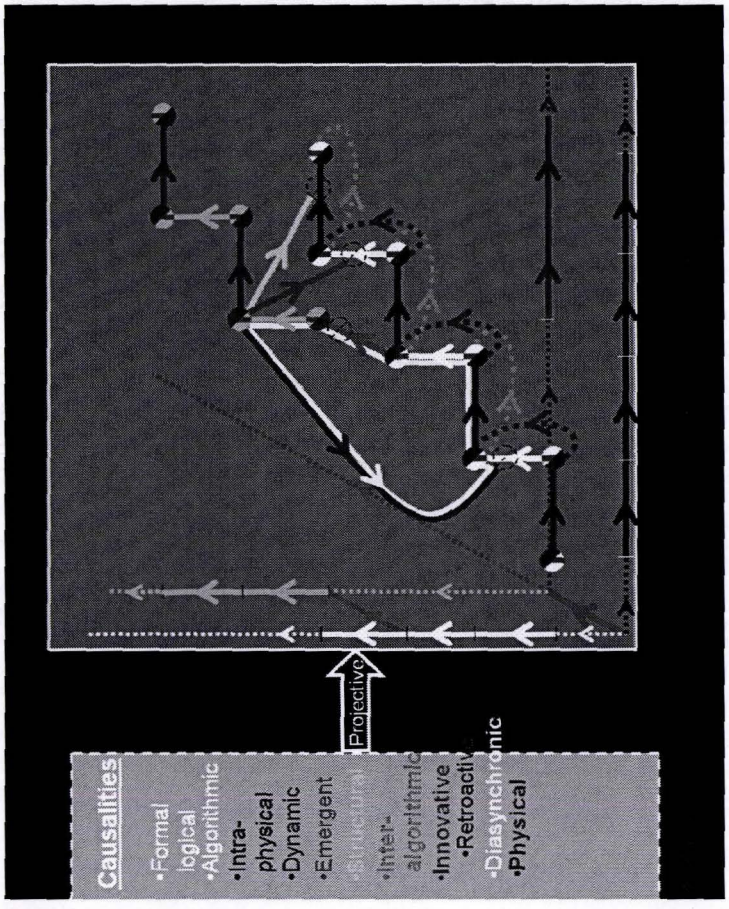


**Figure 2**: The causality nexus of reality.

***Structural.*** This is the meta-algorithmic causality relation directing the process-output from an algorithm to the process-input for another algorithm and hence positioning all algorithms in a structure.

***Inter-algorithmic***. This is the causal relation from an algorithmic output to the algorithmic input for another algorithm, hence ignoring the intermediary physical process by a projection to the vertical algorithmic axis.

***Emergent.*** This is the causal relation from an algorithm to a meta-algorithm.

***Innovative.*** This is the causal relation from a meta-algorithm to a first order algorithm. An important sub-type of innovative causality is the ***retroactive*** causal relation from a meta-algorithm to a first order algorithm earlier connected to the meta-algorithm by emergent causality.

***Diasynchronic.*** This is the causal relation made up by a CIRCUIT of algorithmic, physical, intraphysical, dynamic, projective, emergent, structural, and retroactive innovative causality.

***Physical.*** This is the physical relation from a process output to the process input of the next process, hence ignoring all intermediary algorithmic and transalgorithmic transfigurations by a projection from the vertical axis or the depth axis to the horizontal axis.

It follows from this illustration of the causality nexus that the conventional notion of physical causality is far from constituting the most fundamental causality type. It is also far from trivial, due to its condensation of many involved causality paths through lots of shortcuts and similes.

The result of the deduction of the basic causality types, moving in specified succession, is indicated by the fig. 2.

The causality nexus is anchored in the three dimensions physical (black; 3+1D compressed as 1D time), algorithmic (yellow) and transalgorithmic (red). Description of first order alternates between process (black) and transfiguration (yellow), second order between blue and orange. Higher orders activate from emergence (red) and unfold as structural change in process (light blue) or innovative change in transfiguration (dark green), with the possibility of the last being retroactive (purple). Whatever degree of order the illustrated conglomerate of causality types and arrows constitute the nexus of the whole information in the cosmos.

If all points and paths in the 3D illustration of the causality nexus are imagined as activated, this constitutes the totality of relations imaginable in the free-standing universe of logic. This universe of logic exists as a part of the cosmic whole, but only as a PART. Far from all of the points and paths of the causality nexus is REALIZED in the cosmos APART from its segment constituted by the universe of logic. From the architecture of the causality nexus it follows that the cosmos changes by ACTIVATION of POTENTIALLY already existing points and paths, with the changes being more far-reaching with activations from increasing transalgorithmic order. (Connected to fig. 2 the potential-for-actualization nexus may be imagined as broken path lines, distinguished from unbroken lines denoting the segment of the nexus being actualized at

a certain time.) This is consistent with the results from the ontological mapping and investigation by Bohm (1987). In general this gives some credit to the Aristotle paradigm of potentiality/actuality. Also, it offers a general reconciliation of the paradox consisting in complexity science highlighting the key connection between "emergent relations" and increasing order/complexity, while other scientists and philosophers like Bohm have highlighted top-down causation and the "formative cause" for in-formation. The reconciliation appears from acknowledging emergent causality as inputs triggering activation of the potential causality points and paths already existing on higher/deeper ontological order, and where what appear as emergent causality in a combined description appear as mere intraphysical causality between two algorithms in the description from the higher order.

The 3D illustration of the complexity nexus does not specify the paths and points corresponding to anti-homomorphic universes, at the lowest transalgorithmic order considered as antimatter universe(s) with time arrows manifesting as negative observed from the coordinate system of the matter universe. For such a completion we may consider the 3D nexus as inscribed in a CUBE anchored in one corner points as its origin, to complement it with its asymmetric anti-cube anchored in the corner point in 3D diagonal opposition to the first origin, and to consider the 3D superposition of the two asymmetric coordinate systems as the whole complexity nexus. In this way the overall Cube can be imagined as nil-balanced across the inner midpoint or Origin of the Cube. One possibility to account for bound states of matter and antimatter, or of positive and negative time, is to imagine such states as being located in an inner cube around the Origin, for example by transporting the two origins of the two cubes to opposite corner points of the INNER cube.

The Origin may further be considered as the singularity in the neck of the Klein-bottle, with the cube and the anti-cube manifesting in tandem through this point in some analogy to the implied Klein-bottle dynamically manifesting as the two alternating aspects of the Necker cube. In this sense the Origin could be said to not only constitute nil-balance but also nil-potency.

There is also the possibility to consider the sign of the time unit to alternate in tandem with increasing transalgorithmic order for each of the two cubes. If so, the structure of Cube would be somewhat similar to two 3D chess boards in mutual superposition as when combining the view of the board from one player and the view from his opponent on the diagonally opposing corner point, and with the inner cube acting as a glass structure.

Further research is necessary to work out the architecture of an adequate superimposed model with required detail, including the role of holographic projections, probably in some synergy between philosophical informatics, mathematical physics and sophisticated interpretation of crucial experiments and facts. However, to reach a more complete comprehension of the co-existence and co-influence of negative time arrows, it is NECESSARY to establish a superposition of the causality nexus and its asymmetric nexus. Then the points and pathways of negative time in the superimposed causality nexus can be tracked down directly from the comprehension of the causality nexus ALREADY worked out.

It seems quite obvious that not all points and paths of the causality nexus as imagined in the universe of logic exist as POTENTIAL points and paths possible to activate from emergent causality, OUTSIDE the segment of cosmos constituted by the universe of logic. This poses the question of HOW the architecture of this potential-for-real causality nexus is and how it is generated by constraints and direction.

The causality nexus is universally valid for any description and explanation of any phenomenon. However, far from the WHOLE potential-for-real causality nexus is mapped or unfolded by a specific description, and a specific description does not always have a good match to the targeted segment of this nexus which it ATTEMPTS to reveal by the amount of bits applied in the description. Adequate descriptions are not accidental constructions but matching RE-constructions which "hit the mark" (Bohm) in a "snap of recognition" (Rowlands; cf. Rowlands 2007:598). Thus, the whole potential-for-real causality nexus has a PRECISE architecture, more or less recognized in the description generated from it.

The question then arises if it is possible to tell something more qualified and universal about the GENERATION of this reality architecture.

From universal key properties of the category BORDER as unfolded from differential philosophical informatics (Johansen 1991:66-73), and sketched above, it has been deduced, as already mentioned, by Johansen (2006) that the FIBONACCI ALGORITHM is THE abstract, universal and elementary algorithm of Nature, all other algorithms manifesting as mere epi-phenomena of this as "organic" results of the Fibonacci algorithm's unfoldment into complexification. This provides the basic bridge between the qualitative and quantitative aspects of Nature. If this deduction is correct, it implies that the whole potential-for-real complexity nexus is to be comprehended as a gigantic cosmic Fibonacci nexus with the differentiations between different layers and orders in the 3D nexus, as well as their interlinkings, generated from FIBONACCI SELF-REFERENCE on and of the Fibonacci-algorithm itself into hyperstructures in stead of mere progressing as the linear Fibonacci series. Some closer examination of the Fibonacci "reality atom" itself may therefore be fruitful also for the general understanding of the Time complex. (For some acknowledged discussion of, in the words of the mathematician Laurent Schadeck, "Johansen's Fibonacci paradigm", cf. Quartieri 2006 and Rowlands 2007:530, 550.)

An imagined timeline divided into the three time categories past, now and future, covering their respective and successive intervals of the timeline, is only thinkable INSIDE another and ontologically UPPER now, which we therefore term 'supra-now' or 'Now'. Therefore, the past, now and future are manifested aspects from and by the Now, and the Time complex must have a vertical architecture with an upper category manifesting into three lower ones. (More complex Time structures are then easily constructed or reconstructed by operators making different groups and movements between these four categories.)

Let's relate the Fibonacci algorithm to this elementary "atom" for time differentiation and complexification. Just for illustration we take the Fibonacci number "3" picking the preceding Fibonacci number "2" and creating the proceeding and new Fibonacci number "5" from adding "2" to "3". This procedure constitutes a TIME relation: The

subject starts at a certain time point (and space point) with the "object" 3. Then the subject moves from present to future by stepping back to the position in its PAST with "2". Then the subject moves ACROSS its past now to its next now with "2" and steps forward to its next future now at the position of "3"+"2"="5". This whole operation is ANTICIPATED in a present Now before it is REALIZED in the next future Now which is DISCONTINUOUS to the Now of anticipation. In the anticipation of the first Now the past "2" has to be RECALLED as a conjugation to NEGATIVE time. In the realization this negative time is conjugated to POSITIVE time. Also, after the realization to the Now at "5", there is a discontinuous jump to the Now at "5" ANTICIPATING the next operation picking "3" from the base of "5" and adding them into "8".

Without working out the further details of this, it ought to be sufficient to indicate that the reality atom of the Fibonacci algorithm provides a vertical differentiation of time (and therefore also the vertical split between algorithmic and physical, or between relational and substantial time) with a corresponding horizontal differentiation of three time categories at the lower level, just as in the elementary and universal time atom of Now/(now,past,future). Therefore, already the Fibonacci algorithm provides a differentiation in positive and negative time, and qualifies this differentiation in a certain alternating and successive procedure, involving conjugation, superimposition and discontinuous jumps from one Now/(now,past,future) to next Now/(now,past,future). Hence, a detrivialization and concise comprehension of the Fibonacci algorithm may reveal some of the most profound mysteries of the Time complex.

It seems significant that the Fibonacci algorithm holds a paradoxical unity regarding the absolute and relative properties of time. One step in the Fibonacci series is always relationally identical to the preceding step (as well as the proceeding step). Also, INSIDE the framework of one whole Fibonacci step, i.e. from the observation post of the Fibonacci subject, the length of the step backward is identical to the length of the step forward because this length all the time IS the basic unit of the Fibonacci "walk". On the other hand, these relations are never (quantitatively) identical when observed in the COMBINED framework covering both whole Fibonacci steps, or when observing the backward and forward step of each from an OUTSIDE observation post. With regard to time it might be that this is related to Time influence from the specified past position of a star being mirrored also in its symmetrical future position, but with a weaker quantity. Korotaev (1996:13), following Kozyrev (1980b), gives a tempting explanation of this striking triplet phenomenon from a quite simple argument applying Minkowski geometry as its framework for interpretation. However, it may be that this also is consistent with interpreting the macro-phenomenon as fractally generated from a fundamental Fibonacci structure. It might be fruitful to check by experiment if EARLIER past positions of stars, as well as positions FURTHER away in the future, would relate, in positioning on the sky or magnitude of influence, to the positions and influences discovered from the specified past and future positions by precise Fibonacci series.

## 3 Complex Anticipatory Systems

As we have seen, even a sea shell is complex enough to include anticipation in the sense of forward time flow in forward time (as well as retrospective backward time flow in forward time). However, it seems farfetched to equalize this with a comprehension of the sea shell as a subject KNOWINGLY executing such anticipation; rather the anticipation from supra-Euclidean spacetime is MANIFESTED into the sea shell and its growth. Therefore, anticipation in the familiar human sense is a MORE COMPLEX phenomenon than anticipation connected to sea shell growth. This does not mean, as discussed in our last section, that anticipation involved in human systems EXCLUDES the "objective" anticipation of the type connected to sea shell, but that it involves ADDITIONAL "subjective" anticipation WITHOUT any direct link to the "objective" anticipation (this being the reason for most humans DENYING the existence of the "objective" anticipation). To comprehend anticipatory systems as complex as human systems, a TWOFOLD complexification of the issue must be respected: partly the complexification of the "objective" anticipation, and partly the addition of the "subjective" anticipation (superimposing space with a model of it) to constituting the hallmark of more complex organisms. Also, these two elements must be INTEGRATED in a combined model. Models IGNORING "objective" anticipation, as most philosophy and science about time has done, do not possess any potential for developing such a model, and do not seem compatible with state-of-the-art of cutting edge natural science.

For such integration it seems required with some crucial PHILOSOPHICAL clarifications or developments. In our differential philosophy action is understood as a result of a procedure in three steps:

1) ANTICIPATION of possible alternatives.
2) SELECTION of one alternative.
3) REALIZATION of the alternative.

We distinguish between FUNDAMENTAL causality types (those shortly listed in connection to Fig. 2) and specific ELABORATIONS of causality types, the last ones representing different kinds of combinations or extrapolations of the fundamental ones. INTENTIONAL causality and SELECTIVE causality represent two such elaborations analyzed in chapters 3.2.8 and 3.2.9 in Johansen (1991, 2008c).

INTENTIONAL causality is not to be adequately comprehended in any CONTRAST to causality, but constitutes a sub-class of DYNAMIC causality b), characterized by the subject-internal algorithmic output including an IMAGINATIVE ANTICIPATION about the following process. Intention is a preference the subject has WILL to realize. Will is the instance connecting the preference with its realization. This may be illustrated as a bobble with an arrow inside, and the arrow crossing into the process by will.

SELECTIVE causality constitutes a sub-class of ALGORITHMIC causality, giving a causal relation from a set of alternative inputs to an algorithmic output of the chosen alternative. Also selective causality must include pre-conceptions of the effect of the causal relation.

Intentional and selective causality of described subjects are already included minimalistic in ANY description, due to the structure of LANGUAGE posing some quasi-anthropomorphism on described objects (including physical objects).

EMPHATIC subjects in a description are considered to use intentional and selective causality in a stronger sense. This can be understood as a combination of intentional and selective causality to maximize DELIGHT defined as *tertium comparationis* for any comparison of alternative actions. Subjects in the WEAKER sense are to be comprehended as a SIMILE of this.

We may distinguish between PREDICTION as intentional causality triggering process leading to an algorithm of the same order as the firing, and RECONSTRUCTIVE INNOVATION as the COMBINATION of intentional and selective causality from a meta-algorithm to a) a process from an algorithm restructuring the set of first order algorithms by structural causality; or to b) a first order algorithm changing the last by innovative causality.

This distinction, as well as the above distinction between "objective" and "subjective" anticipation, may be relevant to adequately frame, or perhaps reconstitute, the distinction between strong and weak anticipation introduced by Dubois (2000), in some combination of differential philosophy and the discovery of non-trivial time flows from recent advances in natural science and mathematics. An amazing break-through in this combined regard seems recently to have been achieved by Diego Rapoport (2008), deducing oscillating time waves from Spencer-Brown axioms through Klein-bottle topology by hypernumbers for multi-state and isodual logic.

## References


Bohm, David (1987) (with F.D. Peat) *Science, Order, and Creativity*. Toronto: Bantam.

Bohm, David (1993) (with B.J. Hiley) *The Undivided Universe. An ontological interpretation of quantum theory*. London: Routledge.

BCS (British Computer Society) (I) Cybernetic Machine Specialist Group. http://www.bcs.org/server.php?show=nav.9252

Dubois, Daniel M. (2000) Review of Incursive, Hyperincursive and Anticipatory Systems - Foundation of Anticipation in Electromagnetism. *Computing Anticipatory Systems. CASYS'99*. Ed. D. M. Dubois, AIP Conference Proceedings 517, 3-30.

Illert, Christopher Roy (1983) *Mathematical Biosciences* **63**, 21-56.

Illert, Christopher Roy (1987) Formulation and Solution of the Classical Sea Shell Problem. I. Seashell Geometry. *Il Nuovo Cimento* **9**D, 791-814.

Illert, Christopher Roy (1989) Formulation and Solution of the Classical Sea Shell Problem. II. Tubular Three-Dimensional Seashell Surfaces. *Il Nuovo .Cimento* **1**D, 761- 80.

Illert, Christopher Roy (1990a) Nipponites mirabilis – a challenge to seashell theory?. *Il Nuovo Cimento* **12**D(10), 1405-1421.

Illert, Christopher Roy (1990b) The new physics of ultra-thin elastic conoids. *Il Nuovo Cimento* **12**D(12), 1611-1632.

Illert, Christopher Roy (1992) Generating irregularly oscillating fossil shells. *IEEE Computer Graphics and Applications* **12**(3), 18-22.

Illert, Christopher Roy (1993) *An Introduction to Theoretical Conchology.* East Corrimal, Australia: Chris Illert Publications.

Illert, Christopher Roy (1995) (with R.M. Santilli) *Foundations of Theoretical Conchology* (2. ed.). Palm Harbor, USA: Hadronic Press.

Illert, Christopher Roy (1995b) Australian supercomputer graphics exhibition. *IEEE Computer Graphics and Applications* **15**(4), 89-91.

Johansen, Stein Erik (1991) *Grunnriss av en differensiell epistemologi.* (Outline of Differential Epistemology.) Trondheim, Norway: University of Trondheim.

Johansen, Stein Erik (2006) Initiation of 'Hadronic Philosophy', the Philosophy Underlying Hadronic Mechanics and Chemistry. *Hadronic Journal* **29**, 111-135.

Johansen, Stein Erik (2007) Judging and Explaining Extraordinary Phenomena and the Global Science Ecology from Superior Natural Science and a Syntropic Anthropology of Science. Society for Scientific Exploration: *The 7th European SSE Meeting August 17-19, 2007, Røros, Norway. Proceedings*, 43-92. 7th Biennial European SSE Meeting (2007)August 17 to August 19th, 2007

Johansen, Stein Erik (2008a) Time out of Time. Towards an expanded, non-trivial and unitary theory of time from recent advances in the hadronic sciences. *Festskrift i anledning Johan Arnt Myrstads 60-årsdag.* Oslo: Unipub, University of Oslo.

Johansen, Stein Erik (2008b) Basic considerations about Kozyrev's theory of Time from recent advances in specialist biology, mathematical physics and philosophical informatics. L.S. Shikhobalov (ed.): *Time and Stars: The centenary of N.A. Kozyrev*, 652-703. St. Petersburg: Nestor-History.

Johansen, Stein Erik (2008c) *Grunnriss av en differensiell epistemologi.* (Second edition.) Oslo: Abstrakt.(English translation in transit: Outline of Differential Epistemology, to be published 2009.)

Kozyrev, Nikolai Aleksandrovich (Ia) *Institute of Time Nature Explorations: Library of Electronic Publications.* http://www.chronos.msu.ru/eelectropublications.html
(Ib) *Nikolai Kozyrev TIME (Supplemental Files)*
http://www.rexresearch.com/kozyrev2/kozyrev2.htm

Morgan, Sheila (I) *Kleinbottle.net.* http://www.kleinbottle.net/Morgan/index.htm

Müller, Hartmut (2001a) Telecommunication free of electric smog. *raum&zeit* 114, 99-108.

Müller, Hartmut (2001b) Schock für die Gentechnik: Gen-Information nicht in der DNA enthalten! (Shock for the genetic engineering: Gene information isn't contained in the DNA!) *raum&zeit* 109.

Müller, Hartmut (2004a) The Discovery of the Century: Telecommunications Free from Electric Smog! *Raum&Zeit special 1: Global Scaling – basis of holistic science* (2001-2004), 119-126. http://217.160.88.14/_data/G-Com.pdf

Müller, Hartmut (2004b) Der Kosmos als Provider – Premiere: Wireless Datenübertragung über kosmisches Hintergrundfeld. *raum&zeit* 127. http://217.160.88.14/_data/127_076.pdf

Müller, Hartmut (2004c) Revolution in telecommunication: no cable, no sender. *raum&zeit* 128.
(I) *Die Theorie zu Global Scaling®* http://www.info.global-scaling-verein.de/info/Global-Scaling/Global-Scaling-Theorie.htm
Pitkänen, Matti (I) *Topological Geometrodynamics.* http://www.physics.helsinki.fi/~matpitka/index.html
(Ib) *What is new in TGD as a generalized number theory. Year 2008.* http://www.helsinki.fi/~matpitka/tgdnumber/ntgdnumber2008.html
Purcell, Melanie Claire (2006) *Towards a New E.R.A. Epistemological Resolution Analysis by, through and from Klein-Bottle Wholeness and Transdisciplinary Education.* Ph.D thesis. University of Newcastle, Australia.
Rapoport, Diego (2008) *Torsion geometries, quantum physics, self reference, multi state logics, time waves and the generation of space.* Lecture at PIRT 2008, London, Sep. 12.
Quartieri, Giuseppe (2006) Irreversibilità termodinamica e freccia del tempo. *Ricerca Aerospaziale* **11**, 8-19.
Rowlands, Peter (2007) *Zero to Infinity.* Singapore: World Scientific.
(I ) *Articles of P. Rowlands.* http://front.math.ucdavis.edu/author/P.Rowlands
Santilli, Ruggero Maria (2001) *Foundations of Hadronic Chemistry With Applications to New Clean Energies and Fuels.* Dordrecht, Netherlands: Kluwer Academic Publishers.
Santilli, Ruggero Maria (2006) *Isodual Theory of Antimatter with applications to Antigravity, Grand Unification and Cosmology.* Dordrecht, Netherlands: Springer.
(I) *Hadronic Mathematics, Mechanics and Chemistry. Vol. I-V.* http://www.i-b-r.org/Hadronic-Mechanics.htm