Temporal Structures and Observer Perspectives

SIMULTANEITY

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FOREWORD

Simultaneity — The Next Revolution in Physics

Relativity theory (Einstein), quantum mechanics (Planck) and endophysics (Rössler) are the outstanding contributions of the 20th century to the science of space and time. What they have in common is a new conception of the role of the observer. These physical theories of the world have made us aware that the existence of the world is dependent on observation. We cannot prove the existence of the world without an observer. But even more: there is a relation between the world and the observer that defines each other mutually. The world is not a physical system with purely intrinsic qualities, just as the observer, the human subject, is not either. The observer is evidently part of the world, of the system, which he observes. The three theories we have mentioned could be defined in a common book with the title "Being and Observing" or "Existence and Observation", complementing the classics of Heidegger's "Being and Time" (1927) and Sartre's "Being and Nothingness" (1943).
The observer-dependency of the world declares an end to the classical dichotomies of subjectivity and objectivity, even in physics. Questions like whether time and space are subjective modes of perception (Kant) or absolute features of an objective reality are solved in a new way. George Berkeley said already in his "Treatise Concerning the Principles of Human Knowledge" (1710): "Esse est percipi" ["To be is to be perceived"]. He contended that individuals could only directly know sensations and ideas of objects, not abstractions such as "matter". His dictum "To be is to be perceived" means precisely "to be is to be observed". Not only is physics, the science and theory of the material world, evidently a construction of observers, but also the world itself is dependent on the perspectives and interactions of the observers.

Therefore we have to investigate not only space and time, but also spatial and temporal observer perspectives.

If we understand and accept that time and space are neither subjective nor objective notions, but products of the interaction between the world and the observer inhabiting the world, in the sense of systemic qualities of the interface which constitutes the relation between the world and the observer and are, therefore, neither qualities of the world itself nor the observer alone, we will be enabled to investigate and analyze in a new way the concepts of synchronicity, simultaneity versus succession, and sequence.

The phenomenon of entanglement is not only the quantum effect of twin photons, describing two particles in a single quantum state such that when one is observed to be spin-up, the other one will always be observed to be spin-down and vice versa – this despite the fact that it is impossible to predict, according to quantum mechanics, which set of measurements will be observed. As a result, measurements performed on one system seem to be instantaneously influencing other systems entangled with it. In this example, we see very clearly the decisive role of observable physical properties of systems and their correlations. We can describe the world as a system of correlations between observable physical properties. This description evidently includes the observer in the description of the world. Therefore the classical strong assumption of the objectivity of the world can perhaps be replaced by a weaker assumption: the objectivity of correlations. But the properties of the observed system depend on the observer. Because only between observable physical properties can correlations be established. These correlations predicted by quantum mechanics, which Einstein famously derided as "*spukhafte Fernwirkung*" or "spooky action at a distance", have been theoretically confirmed in 1964 by John Stewart Bell, in what is known as Bell's inequality. It dismantles the principle of locality, which states that information about the state of a system can only be mediated by interactions in its immediate surroundings. Results of subsequent experiments have supported Bell's non-locality.

The universe, up to now built on absolute space and time, has, under the influence of relativity theory, quantum mechanics and endophysics, become a system of correlations between observable particles in space and time. It is, therefore, a system that includes not only space but also non-locality, not only time but also non-temporality. In such a system, which is characterized by observer-dependent concepts of the world, simultaneity becomes a key concept in the description of the world. This is because simultaneity can only be stated by an observer, who observes different events and measures them in the parameter of space and time. In such a universe of correlations simultaneity can be seen as the principal structure of the world. After the concepts of relativity and observability, which revolutionized classical physics, the concept of simultaneity is the logical consequence and the next step towards another revolution in physics. Simultaneity clearly is an observer perspective which calls into question all our assumptions about space and time hitherto described as a succession of events. Simultaneity describes the world as the nucleus of the Now. It divides the world not only into observable and unobservable, into measurable and immeasurable, into compatible and incompatible elements, but also into spatial and non-spatial, temporal and non-temporal states. The Now can metaphorically be described as a church where all physical beliefs and concepts of spacetime cohabit. A philosophy of the Now, described as the physics of simultaneity, is the ultimate extinction of the standard model of physics describing the material world.

Space and time, described in the classical absolute way, are “the prison bars of reality” (O.E. Rössler). If the observer is part of the fabric of the world, the prison of space and time becomes also a mutual interaction between the observer and the prison. Simultaneity becomes the escape button of the prison of space and time. Symmetry and complementarity support the concept of simultaneity in destroying the concept of a linear succession. Symmetry described as self-similarity and connected to scale theory produces a theory of scale relativity, which is a fractal structure. Fractality of space and time rather than absolute space and time turns the universe into a Cantorian spacetime manifold, in the sense of Mohamed El Naschie. The universe described as the mechanics of time and space, as a time and space machine, was one side of the story, told today in digital philosophy as the universe as a quantum computer. The brain as a time and space machine is the other side of the story. With the concept of simultaneity we start a new story of the universe. It provides the key to open a new door, a new interface into the world of space and time and a new tool to liberate us from the prison of space and time.

Peter Weibel, Karlsruhe 15 November 2007

PREFACE

The Institute for Fractal Research was founded in 1997 in Kassel, Germany, as an independent and non-profit research organization. This festschrift celebrates its 10th anniversary with a selection of research results and ideas which tackle the notions of simultaneity and temporal observer perspectives. We hope that the interdisciplinary nature of this book will trigger a fresh discussion about the notion of temporal perspective between the humanities and the natural sciences. If it gives rise cross-insemination, our purpose has been achieved. Many thanks to our friends and colleagues for their fine contributions.

Many thanks also to my husband Barry Baddock for helping with editing tasks, to Franz-Günter Winkler for solving software problems and to Lakshmi Narayan for doing an excellent job as editor.

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INTRODUCTION

Simultaneity is a fundamental concept which is implicit in all hypotheses, theories and models of the world. However, definitions vary greatly in the various disciplines and so it should not come as a complete surprise that there are numerous concepts in use which are not easily translatable into each other. In fact, some notions of simultaneity are incommensurate, as the underlying concepts of time and temporal structures relate to specific observer perspectives.

This book is an attempt to make visible implicit assumptions about temporal structures and observer perspectives in philosophy, psychology, physics, medicine, neuroscience, education, economics, logic and mathematics.

Part I deals with the epistemological background against which observer perspectives and the notion of simultaneity may be understood. **Susie Vrobel** introduces a phenomenological model of fractal time, which defines the structure of the Now as a nesting cascade of memory and anticipation. The resulting internal observer structure determines the extensions of the observer participant, whose boundaries are flexible and depend on where the interfacial cut is set between the observer participant and the rest of the world. Simultaneity arises both from a superposition of levels of description which are constrained by our perceptual apparatus and our internal nesting cascades, which together generate our Now. In order to explain our perceptions and the model we construct of our phenomenological selves, two mutually exclusive temporal dimensions of time must be assumed: Δt_{length} and Δt_{depth}: the length of time, which consists of incompatible events and generates succession, and the depth of time, which comprises compatible events and forms our simultaneity horizon.

Otto E. Rössler presents a deductive approach to brain function and temporality on the basis of the ordinary (classical) level of physics, to which he also assigns the level of Darwinian biology and brain physiology. Natural brains predictably possess two components: The force field generator, which has a preferred time direction, and the great simulator, which can, in principle, work in both directions of time. Mirror neurons are interpreted as a predictable manifestation of the great simulator. More incisive than the direction of time is the assignment of the Now. Only to people who are aware of the "double contingency" of both being at a certain moment in time and knowing why that double contingency is assigned at this very moment, does the Now have a special status. But people in love or caught in the gaze of a lizard know that time does not flow, know that it is frozen. But although we may experience frozen time, we always relapse in our daily lives and tend to forget to return afterwards. The structure of the Now may be pictured as a temporal self-similar fractal which bites itself into its own tail. Rössler introduces the notion of the "temporal fovea", which implies a self-similar structure of time over a certain range.

Mike Luetchford interprets the Japanese philosopher Dogen's concept of the Now as an indivisible whole in which we neither arrive nor leave: we are always here and now. Each Now is the universe and we are not able to escape from here-and-now reality. Remembering the past and anticipating the future also happens within our Now and it is in the Now that we construct a concept of self and the world. And when we come to accept that only the Now is real, we realize that everything is contained in the Now. There is no part of the universe we could name which is not part of the Now: apart from the present moment, it also contains both past and future. This view of time as being inseparable from the individual concrete events we experience describes the perspective of a participant rather than that of an observer.

A holistic viewpoint on systems and observers by **Franz-Günter Winkler** introduces the idea of observers and the interaction between observers and the world as two overlapping systems. Only a hypothetical outside observer has direct knowledge of the world. For the inside observer, knowledge is always about the dynamical interaction between the observer and the world. It is argued that the notion of overlapping systems, which is not inherent in the theory of self-organization, requires a holistic world view. The key assumptions of Winkler's spacetime holism are the containment of the whole's structure in the part and a duality relation for the structural properties of continuity and discontinuity in space and time.

In a systems-theoretical approach, **Nikolaus von Stillfried** suggests a Generalized Quantum Theory (GQT) to describe the phenomena of complementarity and non-locality. GQT suggests these phenomena are not the result of particular properties of elementary particles but arise from the systemic arrangement of these particles. Sufficient degrees of freedom in the subsystems and the conserved global property of the system as a whole are the most important systems-theoretical parameters for the description of non-local correlations. These are not linked by a causal interaction but may occur simultaneously. Against the background of these assumptions, synchronistic phenomena maybe interpreted as instances of system-inherent non-local correlations. The typical lack of reproducability is discussed as a consequence of experimental set-ups which do not take account of the temporal correlations which connect the whole, but rather focus on the notion of ideal isolated subsets.

Uri Fidelman's differentiation between brain time and physical time is based on Kant's idea that time and space are subjective modes of perception. If the concept of time changes according to the cerebral mechanism that deals with it, time is a subjective notion. The left hemisphere organizes the extracted data successively in time, while the right one organizes data adjacent to each other in space. The analytical nature of the left hemispheric perception of data implies the quantization of time, as that data is perceived like beads on a string and not as a continuous line. Thus, the Now is a discrete interval of time. However, the simultaneity generated by the right hemisphere causes it to perceive phenomena within continuous space. The inter-hemispheric interaction generates reality as we perceive it. In this process, both hemispheres are at work, but generate temporal structures which cannot be translated into each other but can only be mutually integrated. Based on the idea that there are physical incommensurate inputs (electromagnetic and gravitational forces) which are processed independently, Fidelman suggests that we have to assume a multidimensional right-hemispheric temporal "space", which comprises at least four independent and perpendicular axes.

In Part II of this volume, the generation and modification of temporal observer perspectives are identified. **Gerald L. Clore** looks at the impact of simultaneity on the way we construct momentary experience. Emotions are described as emergent states which exist only to the extent that multiple affective reactions to the same object occur at the same time. If lower-level affective reactions are re-iterated and re-interpreted, true emotions emerge in the shape of a meta-cognitive representation of one's embodied affective reactions to events. Clore describes how affective and emotional reactions act as information about the value of objects of judgement and of accessible cognitions and inclinations during tasks. They influence judgement and thought when they are experienced simultaneously with sensory data about the world. Affective influences thus depend on our inability to disentangle affective from descriptive perceptions. To the extent that affective reactions reflect different, incommensurate sources of value (e.g., utilitarian, moral, aesthetic), perceived persons or objects may be experienced as being transcendently good or evil. Experiments varying people's attributions for their affective experiences allow the separate roles of affective and descriptive information to be examined. However, it is the inability to parse everyday experience into its separate sources of evaluative and descriptive information that gives rise to a colourful and transcendent reality.

Hinderk M. Emrich, **Catharina Bonnemann** and **Detlef E. Dietrich** suggest envisaging the brain as containing aspects of a "time machine": The brain is a neurobiological physical system like other systems – existing in time – being an object of understanding by physics, by biophysics, especially of neurochemical oscillators and thus is subject to the concepts of chronobiology. The human brain is a "time machine", since it can memorize "stored regularities" and can recall them. It thus contains aspects of "time transcendence". Human beings are – in the sense of the phenomenology of Edmund Husserl – able to perform protension, i.e. the conceptualization of the future as well as retention, a reference to the past. We are also able to generate the time experience of the "now", of the "presence within time". This raises the question how to relate, how to synchronize the "outer", the so-called Aristotelian or "physical" time to the "time of inner experience", i.e. the time of Augustinus, and the Bergsonian time. Psychiatric disorders as well as extraordinary experiences of normal life tend to induce problems within this type of coordination, and depression represents a mood disorder, within which, also experimentally, a disturbance of the inner organization of time in relation to objective time can be demonstrated. The brain is a "time machine" in a Kantian understanding, insofar as the human mind can construe the universals of perception, especially the category of "time". The authors give an account of how emotionality of subjective time experience in depressed patients relates to the dominance of the past in relation to the spontaneity of the subject within a present moment of time. The role of forgetting to overcome such memory-related impairments is discussed within the context of possible functions of consciousness.

Martina Piefke and **Hans J. Markowitsch** describe memory formation and retrieval in episodic memory, which includes both autobiographic recollection and laboratory episodic memory. The episodic memory system operates on the level of explicit processing of information (conscious memory). Episodic memory is highly dependent on context, such as mood states, and is strongly interconnected with the ability to take a self-perspective and the formation of a self-concept. Vice versa, self-concepts can provide mental contexts against the background of which autobiographical events may be re-interpreted. While in studies of laboratory episodic memory, context parameters can be assessed by experimental manipulations, this proves difficult for autobiographical memory, for which context parameters are far more complex and cannot be easily controlled. Laboratory experiments suggest that contextual variables mainly affect prefrontal functions. In autobiographical memory, not only prefrontal, but also further medial temporal and posterior parietal regions, which mediate there-experience and emotional evaluation of personal memories, are highly susceptible to changing context variables of memory encoding and retrieval. The authors suggest that experimental and autobiographic episodic memory are influenced by both overlapping and differential context parameters.

Peter M. Allen looks at the hierarchical temporal organization in the evolution of systems and shows why investigation into temporal aspects of evolution needs to take into account multiple levels if description: Individuals are bundles of their internal components, the local community or organizations they form are bundles of these individual types, and ecosystems and larger structures they form are bundles of these local communities. The co-evolution of the successive layers of interacting elements is at work both horizontally and between levels, driven by the generation of microdiversity: diversity at the level below. His notion of "Evolutionary Drive" may be summed up by saying that evolution is driven by the noise to which it leads. Evolution and the creation of structures of seeming stability and large temporal spans are driven by the internal temporal hierarchies of processes. Allen denotes temporal islands of stability of emergent clusters of ideas, components, practices or forms "Structural Attractors": dynamical systems that emerge and persist for a time. Descriptions of seemingly stable structures may be useful in the short term, but will fail to provide a real indication of the potential for instability and structural change. Complexity teaches us, therefore, to permanently distrust our current knowledge and maintain constant doubt as to its truth.

Jerry LR. Chandler introduces a hierarchical nesting scheme to visualize the emergence of biological dynamics from predicate, sub-ordinate, ordinate and co-ordinate logics. The development of the capacity for scientific communication depends on creating synthetic symbol systems. Many such symbol systems co-exist, each justified by a localized interpretation of distributive and associative concepts. Therefore, communication among technical disciplines is difficult to realize in practice. Chandler introduces the concept of ur-symbols, which create a common basis for the ordinate logics. These, in turn, provide a common basis for integrating mathematical, physical and chemical reasoning. Multiple encodings and decodings of symbols play a crucial role in quantitative thinking. For example, the information encoded in atomic numbers is functionally separate and distinct from the information encoded in real numbers. The concept of ur-symbols facilitates multiple interpretations. Thus, correspondence between observations and scientific calculations depends on the choice of meaning for symbols used in the calculations.

Martin F. Gardiner discusses how skill of every kind must depend on brain processing that allows the individual to engage behaviourally to the extent of observed capability. For behavioural capability to improve the opportunities of the processing ensemble for brain engagement must improve as well. Gardiner discusses three types of context in which development of skill takes place, which can influence the extent and nature of capability achieved. These include context of use for the capability expected and intended by the learner, context of relationships of outside authority and personal experience of the capability, and context of relationship of processing components called upon by capability in one area of skill to similar processing components used to develop capability in other areas of skill. Gardiner proposes that learning connects arts skill to other skill learning may be especially useful to the skill learner by fostering incorporation of forms of processing especially favored by brain evolution. He proposes that the use of processing favored for other reasons by evolution can help to explain the appearance of the arts within human culture.

Terry Marks-Tarlow describes the advantages of perceiving time not as a linear, one-dimensional extension, but as a fractal structure, which reflects and resonates with the temporal nested structures within and around us. By adding the vertical axis of simultaneity to the horizontal axis of succession, time can be made arbitrarily dense. The nesting of temporal intervals of various lengths allows us to keep in mind the whole while being immersed in the moment. The simultaneity of fractal time is the opposite of multi-tasking, which leads to a fractured focus. In contrast, utilizing fractal time means focussing on the level of description of the current task or activity. Long-term projects embed projects which require shorter time spans. The art of utilizing fractal time consists of a level-hopping approach, in which total attention is given to a certain activity on one nested level of description, which fits the temporal extension available. Activities linked with longer or shorter time spans, which embed and are nested in the currently focussed level, form a background against which the momentary activity is connected to the whole fractal temporal nesting cascade. As our bodies are fractal timepieces, tuning into and becoming aware of temporal fractal patterns increases our ability to self-reflect on our unconscious knowledge.

Part III of this volume takes a closer look at temporal simultaneous contrasts and how they can be disentangled. **Laurent Nottale** and **Pierre Timar** present the theory of scale relativity, which is an extension of the principle of relativity to scale transformations of the reference system, in a fractal geometry framework where co-ordinates become explicitly dependent on resolutions. Applied to an observer perspective, this means that the scales of length and of time, usually attributed to the observed object as being intrinsic to it, have actually no existence by themselves, since only the ratio between an external scale and an internal scale, which serves as unit, is meaningful. Oliver Sacks' observations on patients suffering from temporal and spatial distortions in Parkinson's disease and encephalitis lethargica disease offer a particularly relevant field of application for such a scale-relativistic view.

Bill Seaman unpacks simultaneity for differing observer perspectives and qualities of environment. He writes about differing modes of observation including direct human observation; human observation that is augmented by differing tools and/or machines; computational models functioning as machinic observers, in which humans become super-observers; chemical observers where particular changes register particular qualities; and potential future observers: neosentient machines. For each of these different kinds of observer, Seaman discusses how simultaneity might potentially be seen to be problematic. In particular, he points out that notions of time are different on the micro and macro scale. He also discusses the fact that humans have been observed to include up to a one half-second time buffer before awareness of an event is registered, adjusting for the body's distributed sensing functionality and, potentially, its embodied relation to memory and past thought.

Dieter De Grave talks about the link between the theory of complexity (philosophy) and Freudian/Lacanian thinking (psychoanalysis). Using two key concepts – sexuality and death – he talks about the castration complex as a way to apply complex thinking to the human mind and human existential suffering. In this enterprise, the overlap and the differences between these two fields are brought to the fore. Both fields stand in a synergetic relationship and, with a little effort towards translating certain insights from one approach to the other, we can come to novel ideas and advances in each field. But in the synergetic approach we always have to keep in mind that certain concepts are specific to the field itself and if we simply equate them with other ideas from the other field important losses should be considered. The idea of self in self-organization is used as an example of these bridging difficulties.

Serge F. Timashev and **Yuriy S. Polyakov** present a review of Flicker-Noise Spectroscopy (FNS), a time-series analysis which is based on the idea of measuring chaotic signals simultaneously on nested levels of description. Correlation links between irregularities and discontinuities in derivatives of various orders on all levels of the spatio-temporal hierarchy of a system are treated as the main information carriers. Apart from determining the characteristic parameters of open complex systems, FNS, identifies precursors to abrupt changes in the state of open dissipative systems and determines flow dynamics in distributed systems on the basis of correlations in stochastic signals which are measured simultaneously. FNS has been applied in the analysis of the structure and dynamics of physiochemical, electrochemical, biological, medical, geophysical and astrophysical processes. An overview of FNS is presented and exemplified by an analysis of EEG signals.

Raymond Pavloski's approach to conscious observer perspectives portrays the emergence of phenomenal experience as a kind of hidden pattern formation. His neuron models support the hypothesis that some recurrent networks can generate hidden patterns which may be interpreted as hidden perspectives. In these models, clusters of neurons represent meta-states as whole entities, some of which are capable of generating emerging properties. A circular causality emerges as a result: model neurons use indices of cluster states to determine their own states, which are in turn parts of cluster states. The states of cluster-cluster interactions determine their influence on the states of other clusters. Descriptions of subjective perspectives may fit self-organized patterns embodied in the dynamics of the neural network. These patterns are revealed only by considering each neuron's perspective on this network.

Michail Zak defines common sense as feedback from the self-image and proposes a physical model of common sense: Human behavior is governed by feedback from the external world, a process which can be simulated by control systems. However, if the external world does not provide sufficient information, human beings turn for "advice" to their experience, which is associated with common sense. As many natural and social phenomena exhibit some degree of regularity only on a higher level of abstraction, i.e. in terms of some invariants, within the mathematical formalism of the model of mental dynamics, this means that only variables of the highest level of abstraction are capable of classifying changes in the external world. As follows from this model, the difference between behaviours of living and non-living systems is fundamental: The evolution of living systems is progressive in the sense that it is directed to the highest levels of complexity if complexity is measured by an irreducible number of different parts that interact in a well-regulated fashion. This property is not consistent with the behaviour of closed Newtonian systems, which cannot increase their complexity without external forces.

Part IV of this volume focusses on the notion of synchronization. **Fabian Ramseyer** and **Wolfgang Tschacher** approach the phenomenon of synchrony from a framework of embodiment and embodied cognition. A review of the evidence of nonverbal synchrony in human communication reveals the complexity of synchrony in interactive systems. Synchronized nonverbal movement of patient and therapist in dyadic psychotherapy is a readily accessible example of synchrony and an observable (embodied) manifestation of relationship formation. The authors introduce a new empirical approach for the study of nonverbal synchrony in psychotherapies under field conditions that is based on an automated video-analysis algorithm. This new technique allows them to explore the connection between nonverbal synchrony and the evolution of the quality of the therapeutic bond during the course of psychotherapeutic treatment. Their findings indicate that synchrony as a global concept of interrelatedness has high integrative value and its application can be broadened to human interaction in general.

Gerold Baier and **Thomas Hermann** describe the advantages of multi-scale auditory inspection of experimental data over approaches which are based on visual signals only in the diagnosis of dynamical diseases. Sonification provides a means of highlighting the temporal aspects of a time series rather than static ones as are associated with data in a visual representation. As bodily rhythms occur on many nested time scales, from milliseconds for neural firing to minutes for intracellular messenger signaling to hours for episodic hormone release, an integrated understanding of a dynamical disease requires that many or all parallel rhythms of the body must be studied. Sonification allows the almost real-time study of multirhythmic processes, such as those associated with dynamical diseases. Our ability to detect highly differentiated parallel temporal patterns with our ears creates a new temporal perspective in the scientific observer.

Christian Tschinkel introduces the concept of spatial composition which results from the perception of simultaneous auditive contents. Simultaneity is created by dichotic listening, which means that each ear is fed a different content. Dichotic listening was originally employed in lateralization experiments on brain hemispheres. This new kind of hearing emerges as a result of the superposition of auditive contents. The degree of complexity associated with dichotic hearing correlates with the degree of attention given by the listener and his appreciation of the auditive content. Thus, the internal complexity of the listener decisively determines the soundscape of the auditory reality he generates.

Gus Koehler shows that two-dimensional simulation programs do not take account of heterochrony and the time-ecology of nested temporal systems, which are based on Frazer's five hierarchically nested temporal levels in nature (nootemporality, biotemporality, eotemporality, prototemporality and atemporality). As multiple layers of temporal levels are interconnected both locally and, via pipes, also to other local portions of the time-ecology, causal relationships are difficult to identify. Therefore, Koehler calls for a program which takes account of varying nested hierarchies of time, heterochrony and limitations imposed by velocity cones. A virtual time-ecology landscape could produce emergent higher-level agents as a result of evolutionary selection of, among other parameters, temporal boundaries, such as velocity cones, and heterochronic flows and rates.

Artur P. Schmidt and **Otto E. Rössler** offer an endo-view on economics. A new interface is described that systematically analyses hidden patterns in complex systems. Economic temporal structures evolve through parallel processes that are correlated through feedback loops. It is only possible to reach an endo-economic-perspective and make hidden structures visible when they are able to design a simultaneous interface that is capable of looking behind the curtain of attractors and forces. The authors' first article proposes a new damping method for the rational exploitation of flaring-type economic phenomena. When systems flare or get out of control, they can show irrational exaggeration. The so-called Livermore Indicator (calculated through the software I-Matrix) can be used for anti-flaring steering procedures, for example, by the Federal Reserve Bank. The second article shows the existence of a new attractor in economics which can be made visible through matrix analysis. This software-based observing method reveals the existence of an organizing force vector in complex dissipative systems like the economy. The third article proves that the cybernetic analysis of inflation can be used as an x-ray tool to show hidden patterns in the economy. Any boom-and-bust cycle can be identified if one uses the spectacles of a detached observer in an approach called endonomics.

Uwe Kämpf investigates the possibility of accounting for cortical synchronization as being the result of the Wheeler-Feynman absorber effect. In quantum brain dynamics, this interpretation would provide an anticipative resonance coupling model for aspects of cortical synchronization and recurrent visual action control. This model describes registered activation patterns of neuronal assemblies in synfire chains not as resulting from retarded communication in processing but, rather, as the surface of a system of standing waves generated by visual processing. An analogy is drawn between the resonant transactional control mechnisms of visual space-time representation and spatio-temporal non-locality as observed on the quantum scale. In his time-loop model, Kämpf suggests that findings about mirror neurons may be at least partially associated with temporal rather than spatial mirror functions of visual processing, similar to the phase conjugate adaptive resonance coupling of nonlinear optics. On a speculative note, Kämpf suggests that the reported findings, which support the hypothesis of the existence of macroscopic, mesoscopic and microscopic absorber effects, may provide us with an analogy between the resonant transactional control mechanisms of visual space-time representation and the spatio-temporal non-locality effects which have been found on a quantum-mechanical scale and, possibly, also on a neurophysiological and even on a cosmological scale.

Otto van Nieuwenhuijze describes how time is always connected to our involvement with/in our context. Time is therefore always related to the functioning of our body. In our body, our experience of time is very complex: there are many different cells, each of which has its own time base. All of these cell processes are interrelated, because all of our body cells have a common origin in the zygote, the first cell of our body. This approach offers a basis for unifying our understanding of time, and for understanding the experience of time and timing in our body and provides a fundamental notion for the understanding of health. All cells synchronise their actions (for this purpose, each cell has a Gap Phase for adjusting the timing), thus diseases of timing may arise in our bodies. Van Nieuwenhuijze concludes that Vrobel's Time Fractal offers a useful research tool for integrating all of these aspects.

The notions of simultaneity and temporal observer perspectives presented in the various chapters differ with respect to their presuppositions and logical distinctions. They comprise hierachical and non-hierarchical models, nested and overlapping structures as well as local and non-local perspectives.

It is the aim of this book to trigger a fresh discourse between disciplines on the nature of time, temporal perspectives and the structure of our Now: our interface and only access to the world.