Chapter 1 : Self-Producing Systems: Implications and Applications of Autopoiesis - John Mingers - Google

John Mingers' new volume, Self-Producing Systems: Implications and ApÂ- plications of Autopoiesis, is a much-needed reference on autopoiesis, a subject penetrating many disciplines today.

Varela and psychologist Eleanor Rosch. The MIT Press first published the book in ; the revised edition, published in January , leaves the original text unchanged except for some minor corrections but adds two new introductions, one by me and one by Eleanor Rosch, as well as a new foreword by Jon Kabat-Zinn. Let me begin by telling you a little bit about how the book came to be written. Varela and I started working on it just over thirty years ago, in the summer of , in Paris, so when I look at the book now, let alone try to write about it, I feel a kind of retrospective vertigo. Back then I was a first-year Ph. We had met in when he came to a conference at the Lindisfarne Association, an educational institute and community founded by my parents, William Irwin Thompson and Gail Thompson, in Southampton, New York. A Necessary Unity, was published in Varela in turn was our scholar in residence in at Lindisfarne in Manhattan, where he finished his book, Principles of Biological Autonomy, while doing research at the NYU Brain Research Laboratories. Living together in Manhattan, he became a member of our familyâ€”a combination of uncle and older brother to me, as well as my intellectual mentor. That relationship was the context in which we worked together on The Embodied Mind in Paris from to Varela had moved to Paris by way of the Max Planck Institute in Frankfurt where he collaborated with neuroscientist Wolf Singer in order to set up his lab investigating the neurophysiology of vision. I was about to write my Ph. Varela suggested that I use color vision science, specifically the comparative investigation of color vision in different animal species, as a lens for focusing on philosophical issues about perception. Color vision in birds was one of his main areas of experimental work at the time, so I learned color vision science and wrote my dissertation in his lab while we worked together on The Embodied Mind. Eleanor Rosch joined us in Varela and Rosch had been friends for many years. The three of us finished the book in Our central aim in the book was to create cross-fertilization between cognitive science and the phenomenology of human experience. Cognitive science was dominated by the computer model of the mind, which treated lived experience as epiphenomenal or irrelevant to understanding the workings of the mind, while phenomenology had retreated into the textual analysis of works by dead phenomenologists. Our approach was twofold. First, we reconceptualized cognition as a form of embodied action while reframing cognitive science as the investigation of embodied cognition. Second, we used Buddhist philosophy and accounts of Buddhist meditation practices to reinvigorate phenomenology. The embodied cognition research program is central to cognitive science and the enactive approach is well known. The idea that there is a deep continuity in the principles of self-organization from the simplest living things to more complex cognitive beings is a mainstay of theoretical biology and neuroscience. Subjective experience and consciousness, once taboo subjects for cognitive science, are important research topics in the philosophy of mind and cognitive neuroscience. Phenomenology in the tradition of Husserl and Merleau-Ponty plays an active role in the philosophy of mind and informs areas of experimental cognitive science. Meditation practices are increasingly used in clinical contexts and are a growing subject of investigation in behavioral psychology and neuroscience. And Buddhist philosophy is recognized as an important philosophical tradition and interlocutor in contemporary philosophy. None of this was true when we were working on The Embodied Mind. We argued for enlarging cognitive science to include transformative experiences of the self and the world, and for enlarging human experience to include insights from cognitive science.

Chapter 2 : Game of Life - Scholarpedia

John Mingers' new volume, Self-Producing Systems: Implications and Ap- plications of Autopoiesis, is a much-needed reference on autopoiesis, a subject penetrating many disciplines today. I can genuinely say that I enjoyed reading the book as it took me stage by stage through a clear and easy-to.

Cybernetic methodology has reached its limits in the study of life because it ignores the meaning of biological information. Thus it should be augmented by semiotics that studies the meaning and value of signs. According to the pragmatic definition, a sign is a biological adaptation, i. Usefulness of an action can be measured by its contribution to the reproductive value of an organism in a particular quasi-species. Reproductive values are equal to the components of the left eigenvector of the linearized model of system dynamics. Every organism is a sign, and its life cycle is a continuous process of self-interpretation. Organisms use receptors to predict changing environments. Natural selection is functionally equivalent to perception at the level of lineages. Selective survival and reproduction is analogous to selective excitation of photoreceptors in the eye. Lineages learn how to avoid harmful variation by using developmental constraints, proofreading, dominance, and other mechanisms. If intelligence is defined as the ability to learn, then lineages are intelligent systems, which we did not recognize simply because they are too slow. Cybernetics and information theory became major tools for solving the mystery of life 1, 2. However, after several decades of work in this direction, the limitations of cybernetics became clear. Cybernetics explains life through the notion of control. But control is only a tool and can be weakened in some situations in order to perform some other functions that appear more important. Thus, a living system is something more than just a control system. The theory of information also failed to explain life because it is most suited for the analysis of context-free languages where any combination of symbols is meaningful. But natural languages e. The triumph of the Newtonian physics was linked to the idea that we can predict natural events without considering purposes and meanings. But it appears that meanings may be important, especially if we deal with living systems. He viewed the meaning sign as an association between a sign-vehicle and an object via interpretant, which is a change in the interpreter caused by the sign-vehicle that makes him aware of the object. In this theory he suggested that each living organism develops its own subjective interpretation of its environment, called Umwelt. Each component of Umwelt has specific meaning for an organism e. An organism both perceives and modifies external objects as well as parts of its body. Pattee 23 suggested that meaning emerge in the evolution of self-referenced semantically closed systems. A symbol is a material structure, whose function can not be derived from physical laws, but which is selected for its contribution to the survival of an individual. Similar ideas were developed by Maturana and Varela 20 , who viewed autopoiesis as the crucial characteristic of life and mind. Rosen 27, 28 also emphasized the closed nature of biological organization. He thought that organisms are qualitatively different from machines, because in machines, each function is regulated by another function which leads to infinite regress of functions. But in organisms all functions are reciprocally closed. Each missing part or function can be repaired or produced by other parts. Mechanisms can be arranged from parts, but organisms can restore and rearrange parts themselves. Thus, organisms can not be built from parts. Kampis 17 considered life as a semi-closure; the closure is imperfect because of internal freedom in organisms. He emphasized the creative nature of life, which can not be described by deterministic models. Living organisms can invent new functions, whereas deterministic models have all possibilities built in; thus, they can not show any emergent properties. But Kauffman 18 thought that emergent behavior can be observed even in deterministic models if the number of possibilities is very large. He modeled self-organization using boolean networks and cellular automata. There is a consensus on the importance of the symbolic semiotic nature of life and its self-referential organization closure. Cairns-Smith 3 considered any self-sustaining and self-reproducing system e. Signs can be isolated or aggregated. Syntax is not present in isolated signs, but may appear in systems of multiple signs. But Rocha 25 thinks that syntax is the essential feature of signs, which is needed for an open-ended evolution. Following von Neumann 37 , he views evolution in a traditional Darwinian way as random syntactic changes followed by natural selection. This mechanism of evolution requires the presence of

a code that represents an organism. Joslyn 15 hypothesized that all living organisms can be characterized by semiotic autonomy, which means that organisms maintain cyclic relations of perception, interpretation, decision, and action for the sake of increased survival and self-reproduction. Organisms may have various levels of autonomy, and intermediate levels of autonomy are usually more beneficial compared with extremely low or extremely high autonomy. Other authors insist that self-reproduction requires high autonomy. For example, Rose 26 argued that viruses can not self-reproduce because they require a living host cell for interpreting their genetic messages. In contrast, Dawkins 6 thought that strong autonomy is not needed for self-reproduction. Thus, he viewed individual genes and even memes as self-reproducing systems. Semiotic terminology has a strong anthropomorphic context. Thus, to apply semiotic notions to other living organisms we need to remove all human-specific meanings. Also, there is a danger to expand the meaning of semiotic notions too far. For example, Deely 7 thought that even non-living systems are able to interpret signs. He viewed a stone formation that takes on the shape of a dinosaur bone as an interpreter of the bone. But then any physical interaction can be considered an interpretation, and semiotic terminology appears redundant. In this paper I will review recent publications that indicate the importance of value in semiosis. I believe that the notion of value helps to distinguish semiosis from other processes. Also, it integrates semiotics with evolutionary theory because value represents biological adaptations. The synthesis of semiotics with the evolutionary theory is known as biosemiotics 13, Fisher 11 noticed that the same method could be used to measure the reproductive value of organisms in a population. The reproductive value of an organism of a particular age is equal to its contribution to the growth of the entire population. The rate of population increase is analogous to the inflation rate in economy. For example, eggs have a lower reproductive value than reproducing adults because an adult can produce numerous eggs within a short time, whereas it takes a long time for an egg to develop into adult, and not all eggs will survive to the adult stage. In a linear model of population growth, the reproductive value of organisms is equal to the left eigenvector of the matrix that describes population dynamics. For example, in the model of Leslie 19 , the state of a population is characterized by the vector of age distribution, xt, that shows the number of organisms in each age group at time t. As they mature, their reproductive value increases to 2. Computation of reproductive values in non-linear systems is more complicated because these systems may have limit cycles or chaotic dynamics 9. A Leslie matrix A and the vector of reproductive values v. Self-production can be defined as any process by which systems increase their value. For example, development of an organism from egg to adult is self-production because the reproductive value of adults is higher than that of eggs. After laying an egg, the reproductive value of adult female decreases, but the sum of values of an egg and the female is greater than the value of the female before oviposition. They include mortality from various factors e. Values exist relative to a particular quasi-species 10 , which consists of one or several components with stable relative frequencies. Each quasi-species has a specific real eigenvalue l eq. If a quasi-species changes in evolution, its reproductive values change. For example, if an organism develops effective protection against natural enemies, then the relative value of an egg increases because it gets greater chances to survive to the adult stage. As the value of an egg increases, it becomes beneficial for the parent to invest additional resources into a single egg. Although quasi-species are discrete, they are not isolated from other systems. I disagree with Rose 26 , who does not consider viruses, genes, and memes self-reproducing systems because they require external interpretation. Rose did not notice that the meaning of a viral genome is different for the virus and for the host cell they are different quasi-species. Thus, the virus does not use a cell as an external interpreter. Instead, it interprets itself by using cell resources. Actually, the cell misinterprets the virus because it considers it a part of its own genome. A common mistake of evolutionary theory is in considering fitness l an objective i. Eigenvalues can be estimated for any given model of system dynamics, making an illusion of objectiveness. But subjectivity is hidden in the initial step of model construction. It may happen that in some situations, animals behave differently than it is assumed in the model. If we modify the model to fit their behavior, then all eigenvalues will change often considerably. Death may seem inevitable in some situations according to our current knowledge. But in a broader sense, death is optional; it results from the inability of an organism to solve its living problems. Thus, fitness shows how smart an animal is in solving its problems. It is as subjective as an

IQ measure. Generally speaking, all human knowledge is subjective because it is expressed in a language that represents the history of human experience. We are confident with our language not because it is true but because it was useful in the past. We can measure the fitness and reproductive values using our model of animal behavior and physiology. But an animal has its own model of its behavior. Of course, animals are not smart enough to solve eq.

Chapter 3 : Autopoiesis - Wikipedia

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The central themes for the workshop are interactions between life and its environment; how emerged and evolved; building and learning from synthetic living systems, and future possibilities and challenges for Artificial Life as a field. The workshop will continue on Friday afternoon and will end with a short talk from Takashi Ikegami and a discussion on the themes of the workshop and of the ALIFE conference. Schedule Outline Session 1: Synthetic and Artificial Ecologies Friday afternoon, Detailed Schedule Session 1: But how did it come to be constructed in the way it is, and how was it shaped by its environment? Are the molecules of life determined by chemistry or by history, or both, and how can we use phylogenetics and information theory to probe the deep past? The origin of life as an ongoing process Nathaniel Virgo 2. Currently, we do not have enough data to build a model. One approach to fill in the gaps is to study relevant chemical and geological processes separately. Systems science would cover more ground and tackles more prebiotically realistic processes. How much can we learn about ancient cells from sequence analysis? Shawn McGlynn and Sarah Berkemer A longstanding goal is to apply molecular phylogenetics to understanding ancient physiological and evolutionary states. With the current explosion of molecular sequencing data, it is a good time to consider how far back we can peer with the comparative molecular lens, and ask if we can understand life in its nascent years. A standard test for inferring ancient genes is to analyze phylogenetic branch positions and determine if a gene separates the archaea and the bacteria, but this is well-known to be cluttered and difficult because of phenomenon such as horizontal gene transfer and non-orthologous displacement, making inferences difficult. In this presentation, I will give an overview of recent work in this area, and also present new analyses which aim at relating inter-domain transfer to alignment sequence entropy. We find that sequence plasticity viewed through the lens of information entropy varies between functional groups of proteins and also within groups. Moreover, interdomain gene transfer can be related to sequence alignment entropy. These findings will be discussed in the context of inferring the characteristics of the most ancient cells. Chemical space is here defined by charge, size and hydrophobicity, leading to 6â€”tuples representing coverage, which is composed of range and evenness in these three physicoâ€”chemical properties. We summarize findings of previous studies on the adaptive properties of the 20 encoded amino acids and show how we extend these computational experiments to subsets of the standard alphabet. This behavior-based approach has also opened up new perspectives on a related unsolved problem, namely the origin of the genetic code, which can now be seen as emerging out of iterated interactions in a community of individuals. Thus, artificial life demonstrates that the dominant scientific strategy of searching for the conditions of Darwinian evolution should be broadened to consider other possibilities of optimization. But how can we understand and take advantage of the emergent properties and interactive nature of living systems? Finally, we discuss how a common understanding of biological emergence can draw connections between astrobiology, ALIFE, the planetary sciences and AI. Erik Hom, University of Mississippi Biology is undergoing a microbial revolution that is facilitating how we frame the search for fundamental rules of life. His main research effort over the last 15 years has been to explore, understand and construct transitions from nonliving to living materials. The Philosophical Overlap between ALife, Origins of Life, Astrobiology and Artificial Intelligence Stuart Bartlett In this talk I will discuss the complementary nature of the different forms of the emergence problem and how ideas from multiple disciplines could revolutionise our understanding of natural and artificial worlds. Neuroscience and AI have made great strides in understanding the nature of learning, stochastic thermodynamics and molecular biology have opened our eyes to microscopic means for manipulating and storing information, and the fields of geo-, bio- and artificial chemistry have helped elucidate the characteristics of complex reaction networks. With the growth of knowledge and theoretical and experimental tools, we are now primed to construct a rigorous understanding of the spontaneous emergence of open-ended learning systems, i. We can easily expect more to come! What insights can be gained from the exponential

growth of new computational platforms about the central questions of Artificial Life? Can new results in AI, including big data science and VR, inform us about and developing theories on the origin and evolution of life, or the nature of mind? How can we update our understanding of evolutionary systems with new concepts? This last session of the conference will feature talks by Takashi Ikegami and Nicholas Guttenberg, and a discussion session will bring together the central themes of ALIFE and discuss future possibilities for our field.

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Meaning. Autopoiesis was originally presented as a system description that was said to define and explain the nature of living systems.A canonical example of an autopoietic system is the biological cell.

Better than knowledge is meditation. But better still is surrender of attachment to results, because there follows immediate peace. And that is because, in the last analysis, we ourselves are a part of the mystery that we are trying to solve â€" Max Planck Much of the problems of the world can be related our ignorance of life and truth of nature. From the scientific perspective it can be directly be related to our ignorance of time and energy cycles and flow in nature. In our ignorance we have broken the day and night cycle and have interfered in to the cycle of darkness in which nature repairs herself. In our mad quest for material energy [spirit] we have created a unilateral time direction towards increase in global or back ground temperature. This is causing the increased disorder in the whole system. No system is beyond the effect of the increased disorder. It is inevitable that this increased disorder should reflect, in natural forces and the instability of the enclosed systems. We are witnessing this reality in the form increased natural catastrophes from four forces of nature which other wise supported life. The reality and knowledge that the universe is a living system, invariably means that we he human beings are simply individuated cells of the one whole living system. Our increasing alignment, with material force, actually is stressing the life of the whole system of which we are part. When the whole is stressed to suffocation and death, the parts invariably experience the suffocation first. This is reflecting it self in the form of instability of individual and collective minds at various hierarchies of the society. This instability is manifesting a as war and terrorism, revolt, suicidal tendencies and so on. At the natural level, it is manifesting as instability of natural forces, which is very clearly reflecting it self as instability of earth, sun, solar system and the distant cosmos. It is manifesting as global warming and climate change and so on There is hope for human survival. This hope comes from the reality that nature is conscious and intelligent and is designed to conquer time and survive. The signs of this hope, I see in the recent revival of spirituality in every religion. Yet there is a need for caution in this revival of spirituality. Just as material force, the spirituality is a raw force, expanding it and breaking it in wrong direction could be lethal. The mind of human that is awakened to spiritual force within the barriers of religion is potent weapon for mass destruction through self destruction. This is happening in the form of God warriors, killing in the name of God, Suicidal tendencies and so on. The only way out of this is to know the spiritual truth of nature beyond religion. The spiritual truth of nature is simple. The whole universe is one and is a pulsating living system. It is conscious, intelligent, self sustaining and self producing system. Everything in this universe exist in the field one Super Soul that is Conscious and intelligent. We humans and all the life contained it simply form from it and dissolve in to it in time. This formation and dissolution is guided by the karmic law subtly written in Vedas, Bible and other spiritual scriptures. Among all living systems, humans, specially his mind that enquires into nature and the universe take primal role in the drama of existence the universe. The ultimate solution to the problems in which humanity is caught exit in knowing the drama of the universe. The drama of the universe can be understood from Fig -3E below We the human souls are simply souls born to the left and right of one Universal Soul that exist in the center. The consciousness and intelligence of this system holds the whole system in its place. We the individuated soul born from it in time, have space time position in relation to the Central or First Soul. The law requires us to live n faith and love relationship with the Central Soul. It requires us to do the work assigned to each individual with Faith and Love. All life by instinct is anti-gravitational. It works against gravity and material energy. The First Soul requires us to work with Him and work against the gravitational force to sustain life. The interstellar space in the above figure thus contains two spirits, the Holy Spirit or Brahman and evil spirit. The Holy Spirit has its root in souls and the evil spirit has its root in matter. They form the two forms of heat, the heat that broods, creates and gives life and the heat that brings disorder and death. The nature is balanced by these spirits. The system can have life only when it favors the Holy Spirit. The law says we should not align to matter spirit. However, human breaks this law and eats the forbidden fruit. Modern world is totally aligned to matter and its force. Humans are ready to fall to

any level for money and power. The consequence is that he creates time direction to death. This time direction manifests as the increase in the heat content of the interstellar space that brings disorder. We are going through this process. The interstellar space is full of material spirit. What rules us is the market and money. Every action of ours is far from our own consciousness. It is time we align with our consciousness. But since universe is a living system there is hope for the world. The essence of the Father conceives in the body and works to recreate everything and initialize everything back to order. His Consciousness would give life back to the Soul caught in death trap and His intelligence will illuminate human mind to take guard of His Kingdom. This process is happening through Christ. I am not advocating for a religion called Christianity but speaking a Truth of nature revealed to me and well written in ancient Biblical and Vedic scriptures. Christ needs to be understood by His Word and His action. No one can understand the truth of nature by his mind. It is beyond humans to seek truth; truth comes to human by the Divine Grace. Human mind and self is the cause for the fall. I we have to see Light of Life we have to accept mind death and turn our mind towards the Heart and consciousness where the creative Light exists There is no way for humanity to survive but to Awaken to Truth. Humanity will awaken to truth and will know the Spiritual Reality of Nature and enter into the kingdom of God or the Golden Era. There is no doubt left in me regarding this. The question is that how much more destruction and suffering world has to bear before it awakens to truth. Once we know the truth of nature, we will find simple solution to some of the most stressing problems of the world. For example, if we can make small cut into our intrusion in to night cycle of nature, the nature can ease and can reorder herself less violently. A small shift in thinking about the action of force from directed in straight line to spiral one, can lead to technologies that can reduce the heat being released to the environment. The knowledge of Quantum Qualitative Reality can bring vital changes in every field of human interest, bringing health back to individual and nature. This is manifesting as disturbed natural forces resulting in an earth that is burning and flooding. It is time we stop our reckless exploitation of nature unilaterally filling space with heat that creates disorder and shift our focus into filling it with heat that creates order. We need to have shift from mind centered life to heart centered life. I have a Good News for the world. Whatever be the suffering of the world, in the end Life Force will prevail and a New Golden time would come. The world saw a negative globalization; with truth emerging we will enter the positive globalization and Golden Period of Universal Existence.

Chapter 5 : poiesis autopoiesis | Download eBook PDF/EPUB

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Meaning[edit] Autopoiesis was originally presented as a system description that was said to define and explain the nature of living systems. A canonical example of an autopoietic system is the biological cell. The eukaryotic cell, for example, is made of various biochemical components such as nucleic acids and proteins , and is organized into bounded structures such as the cell nucleus , various organelles , a cell membrane and cytoskeleton. These structures, based on an external flow of molecules and energy, produce the components which, in turn, continue to maintain the organized bounded structure that gives rise to these components not unlike a wave propagating through a medium. An autopoietic system is to be contrasted with an allopoietic system, such as a car factory, which uses raw materials components to generate a car an organized structure which is something other than itself the factory. Operationally it is impossible. That is, if the organization of a thing changes, the thing changes". Autopoietic systems are "structurally coupled" with their medium, embedded in a dynamic of changes that can be recalled as sensory-motor coupling. Marjatta Maula adapted the concept of autopoiesis in a business context. Coding and markup appear allopoietic ", McGann argues, but are generative parts of the system they serve to maintain, and thus language and print or electronic technology are autopoietic systems. In other words, we can describe autopoietic systems as those producing more of their own complexity than the one produced by their environment. Initially, Maturana defined cognition as behavior of an organism "with relevance to the maintenance of itself". On this basis it is claimed that autopoiesis is a necessary but not a sufficient condition for cognition. Relation to consciousness[edit] The connection of autopoiesis to cognition, or if necessary, of living systems to cognition, is an objective assessment ascertainable by observation of a living system. One question that arises is about the connection between cognition seen in this manner and consciousness. The separation of cognition and consciousness recognizes that the organism may be unaware of the substratum where decisions are made. What is the connection between these realms? Thompson refers to this issue as the "explanatory gap", and one aspect of it is the hard problem of consciousness , how and why we have qualia. Thompson discusses this issue from the standpoint of enactivism. An autopoietic cell actively relates to its environment. Its sensory responses trigger motor behavior governed by autopoiesis, and this behavior it is claimed is a simplified version of a nervous system behavior. The further claim is that real-time interactions like this require attention, and an implication of attention is awareness. An example is the assertion by Maturana and Varela that "We do not see what we do not see and what we do not see does not exist".

Chapter 6 : The Embodied Mind: An Introduction â€“ The Brains Blog

Self-Producing Systems: Implications and Applications of Autopoiesis (Contemporary Systems Thinking) and a great selection of similar Used, New and Collectible Books available now at calendrierdelascience.com

Autopoiesis defines life as capacities. Nicklas Luhmann extended this produce components they need for life and able to observe concept to establish a theory of social systems, where intangible themselves to apply self-regulating feedback in the face of human social systems were formed by recursive networks of perturbations that might otherwise cause them to disintegrate. Luhmann tried to resolve this iterated process of speculation followed by the elimination of apparent paradox by placing the communication networks on an errors by Darwinian or conscious selection. This easily imaginary plane orthogonal to the networked people. This biophysically based approach to understanding Keywords: However, working with complex systems hierarchy of the world. Beginning with a Maturana and Varela recognized that living things i. The world thus components and not the components themselves, where the variously observed remains, nevertheless, the same world, and autopoietic entity is recognized therefore we have a paradox. An observer, then, is supposed to decide whether something is natural or artificial, necessary or [as a] dynamic molecular entity, [that is] realized as a unity as contingent. But who can observe the observer as necessary for a closed network of molecular productions in which the this decision and the decision as contingent for the observer? The observer may refuse to make this decision, but can the a recursively constituted the same network of molecular observer observe without making this decision or would the productions that produced them; and, observer have to withdraw, when refusing this decision, to the b specified the extension of the network and constituted position of a nonobserving observer? Indeed, the system and environment. This is exactly what the concept of condition of being closed molecular dynamics is what autopoiesis is intended to designateâ€¦. The concept of constitutes them as separable entities that float in the molecular autopoiesis, then, necessarily leads on to the difficult and often domain in which they existâ€¦. It is â€¦ the necessary consequence of the trivial thermodynamic legality of physical processes that demands of conceptually tautological fact that no system can operate them that they should operate as materially and energetically outside of its boundaries. This leads to the conclusion - which open systems in continuous material and energetic interchange forms the first stage of a clarification of the concept of society with their mediumâ€¦ [where] These two laws of reproduced by communications from communications. With conservation are both relational conditions of the realization of the concept of action external references can hardly be living systems that must be satisfied for living to occur at all. Nicklas Luhmann went to esoteric A system is the form of a distinction, possesses therefore two extremes in an attempt to work with the apparent paradoxes. Only the two sides involved in the processes remains always in W1. The survival together constitute the distinction, constitute the form, knowledge i. The boundary exists only as an [58]. Popper defined W3 to include knowledge in boundary of a system is intangible; as some kind of distinction the objective sense, which includes "the world of the logical or separation between physical reality and ghostly connections contents of books, libraries, computer memories, and suchlike" of a network of intangible communications realized in some [18]: W2 mediates between W1 and W3. They have no mutually unbalancing effects. Pn is a problem in [14]; [51] , but he lacked the epistemological framework and situation the living entity faces in the world, TSm represent vocabulary to clear the fog. Because Luhmann and his a range of tentative solutions or theories in self- followers accepted that self-observation of autopoietic self- conscious, articulate individuals the entity may embody maintenance and self-production was viciously paradoxical, or propose in W2 to solve the problem. EE represents a they performed extraordinary linguistic and logical contortions process of natural selection imposed by W1 on the entity in an attempt to work within the circle. As the entity iterates the recursive writing. Campbell [59],[60],[61],[62],[63] and Karl To Popper, knowledge of the external world consisted of Popper [54],[18],[20],[21],[22] formulated evolutionary constructed solutions to problems of life; or at least claims, epistemology. World 1 "W1" - physical events and processes is dynamic As Maturana noted, autopoietic entities are physical reality and everything in it, including physiology. Cognition epistemology explains the

iterated process by which this produces knowledge embodied in living things as, adaptation evolves and is maintained. This bears closed in a paradoxically vicious circle. Thus, along the time axis, all references to internal processes [12],[13],[14],[16],[57]. In other words, W2 contains or external states are open spiral processes Figure 2 [52],[53]. Large economic organizations certainly meet requirements to be considered autopoietic. Members of the organization are typically Environment for identified with badges, and sometimes even uniforms. Money tokenizes power over energy and material resources needed for corporate existence. Cash Many Human Organizations are accounting, payrolls, internal processes and procedures, etc. Autopoietic incentivize, measure and regulate the interactions of organization members to benefit the continued survival and Using the theory of complex systems [28],[29],[30],[31] in growth of the organization. System boundaries internally determined many human organizations have the necessary properties to be by rules of association, employment agreements, oaths of considered autopoietic [23],[24],[25],[26]. The failure of many allegiance to organizational rules, deeds, etc. Processes exist to recruit, induct and train We can easily see and recognize boundaries of systems at new members and to build or procure plant, equipment or other resources the organization requires. These conclusions have been reflected in studies Possibilities of organizational knowledge management in practice [71],[72], [53],[73]. Establishing a level of focus on a system in a hierarchically complex world. References Hall argued that some human economic organizations are [1] Hayles NK. Organizations sell products and procure energy [2] Hall WP. Tools extending human and and resources. Individuals belonging to organizations use organizational cognition: International Journal of Knowledge, living. Thus measurements and observations of cash flow are Culture and Change Management 6, 10 pp. Towards a post-human distributed dissipated in the form of labor and distribution. Thus, complex cognition environment. All Life Is Problem Solving. In Proceedings of Routledge, London. Organisational autopoiesis and http: From fields to science: Biological nature of knowledge in the [6] Baskerville R, Dulipovici A. The theoretical learning organization. The Learning Organization foundations of knowledge management. Comparative population cytogenetics, diversity in hierarchically complex living systems. Modes of speciation and evolution in the Australia May Epistemology of the [26] Hall, W. A biological comparative approach and introduction to the problem. Museum of Comparative Zoology, November Emerging Autopoietic [9] Hall WP. Chromosome variation, genomics, Communities â€" Scalability of Knowledge Transfer in speciation and evolution in Sceloporus lizards. Managing maintenance knowledge in the , , Shanghai. The architecture of complexity. The organization of complex systems. Organisational management of project and technical in Hierarchy Theory: The Challenge of Complex knowledge over fleet lifecycles. Australian Journal of Systems. Their [12] Maturana HR. Columbia University Press, Communication, and Society: The Theory of Autopoietic New York. Campus Verlag, Frankfurt, Autopoiesis, structural coupling and pp. The autopoiesis of social systems. In Autopoiesis and Cognition: The concept of society. Principles of Biological Autonomy. The modernity of science. The [37] Luhmann, N. Stanford University Press, Stanford. The paradox of observing systems. An Evolutionary in Rasch, W. Stanford University Press, [19] Popper, K. The Self and its Stanford , pp. An Argument for Interactionism. Springer Verlag, [39] Moeller, H. Open Court, Peru, Illinois. The Tanner Lecture on [40] Bakken, T. Delivered at the University of Michigan. Niklas Luhmann and [21] Popper KR. Knowledge and the Body-Mind Organization Studies. Liber AB, Malmo, Sweden. In search of post-humanist theory: Open Cultural Critique No.

Chapter 7 : The Truth - Awakening to Truth

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The game takes place in discrete time, with the state of each cell at time t determined by its own state and the states of its eight immediate neighbours at t-1 the Moore neighbourhood of radius 1 , according to the following simple rules: The Game of Life rules were carefully chosen by Conway to satisfy three simple criteria Gardner, There should be no initial pattern [configuration] for which there is a simple proof that the population can grow without limit. There should be initial patterns that apparently do grow without limit. There should be simple initial patterns that grow and change over some time, before coming to end in three possible ways: The basic Game of Life is very easy to implement in almost any computer language. While John Conway was an undergraduate at Cambridge University, he would write letters to Martin Gardner on various mathematical games. Sometimes, Martin would use the letters in his Scientific American column on mathematical puzzles. While at Cambridge, John Conway used to play various games using Go board with his friends during teatime. The most popular set of rules was the following: If you have 4 or more neighbors, you die. There were many variations on the rules, leading to the perpetual fight: If the birth rule is too strong â€" everything expands. If the death rules are too strong â€" everything dies. It turned out to be quite hard to balance the rules. Game of Life using Go stones It took about 18 months of teatime and coffee time to come up with good set of rules resulting in configurations that do not tend to explode or die out too soon. A best way to experiment was to use Go boards with Go stones. Some cheap Go sets have flat stones, which are perfect for experimentation. The configuration at time t is set in white Go stones. John would put a black stone when there is a birth. If anybody is going to die, John would put a little shell on top. This would work, except for the time when there is a huge massacre and most of organisms should. Discovery of the glider John and his friends always had in mind that they might simulate a computer with the Game of Life. However, it was not obvious until they found a glider. This was the moment that John realized that he got the right set of rules. Keeping track of Go stone configuration was a daunting and a bit annoying task, especially when the configuration has blinkers. Guy, who visited him at Cambridge. Richard was responsible for watching not only blinkers, but anything else that is small and changes periodically. In hope to discover more interesting configurations, John went through an overdrive and crashed the gliders in every possible way -- 40 different ways. To make sure he does not miss anything else interesting, he offered the prize to anybody who would find an initial configuration whose population goes to infinity. The prize was won by the MIT group who discovered the glider gun. Within a few weeks after the discovery of the glider, John had proven that Game of Life is equivalent to the universal Turing machine. Game of Life vs. Patterns Since its inception there has been considerable interest in discovering novel patterns within the Game of Life. Here are some examples of some Game of Life patterns at the simple end of the scale: Patterns that change but repeat themselves after a particular number of iterations period. The example below shows a blinker, which is a period-2 oscillator. A pentomino is a pattern with five connected cells, with connections along edges not diagonals. The R-pentomino was studied extensively by Conway, as the only pentomino that does not end quickly; it does however stabilize after iterations. As the game evolves, a glider will move across the environment as a persistent entity. Another very important pattern; the first example of a pattern that grows indefinitely. As the name suggests, glider guns generate a continuous stream of glider objects. A puffer train also produces objects, but unlike a glider gun it does so while moving. Patterns within the Game of Life can be much more complex than illustrated in the above examples, and can even be organized in ways that perform functional operations. Turing completeness means that, absent any constraints of memory or time, the Game of Life has unlimited computational power. Gemini is a self-constructing pattern which creates a copy of itself while destroying its parent over the course of 34 million iterations. The exploration of novel Game of Life patterns has been supported by dedicated software which accelerates the computations needed to follow large populations over millions or billions of iterations e. A growing community of enthusiasts has developed

around this and other software platforms, continually extending the boundaries of Life patterns. Variations Recalling that the original Game of Life rules were chosen very carefully, there remain a large variety of alternative rule sets defining similar games, at least some of which also have interesting properties supporting apparently emergent behaviour. There is now a nomenclature differentiating different varieties of Game of Life cellular automata. Among the very many possible Games of Life, only a very few seem able to generate rich emergent, self-organized behaviour. The challenge of determining a priori i. Emergence, self-organization , autopoeisis, and the physics of information Emergence and self-organization are controversial topics within the science of complexity. Both appear to be exemplified by the Game of Life. Emergence is colloquially taken to mean that the whole is somehow greater than the sum of the parts. This concept can be cashed out in several ways Bedau, Concrete examples of strong emergence are hard to come by: Thus, in the Game of Life, global entities such as gliders, puffer trains and other such wonders arise from the interaction of simple components behaving according to well-defined rules. Extending this notion, a recent study has examined how some Game of Life configurations can give rise to an ever-growing variety of novel local interaction patterns Gotts, Self-organization and emergence are closely related concepts. Self-organization is usually defined as the spontaneous formation of spatiotemporal patterns without external guidance. More specifically, one may attribute self-organization to a system on the basis that i it exhibits at least weakly emergent behaviour and ii it does so without any explicit external input, given an initial configuration. On these criteria, the Game of Life is a good example of both emergence and self-organization. Beer has considered glider patterns within the Game of Life from the perspective of autopoeisis. The biological cell is a canonical example of autopoeisis; its components underlie processes supported by external energy and material flow which continually regenerate the components in a structure that defines itself against the surrounding medium. The analogy is complicated, since one may query whether states in the Game of Life can really be thought of as components, whether the glider pattern really possesses a boundary that generates and constrains it, and so on. Emergence, self-organization, and autopoeisis are important concepts applicable to a broad range of systems, biological and non-biological. By providing concrete examples of these phenomena, the Game of Life serves a useful purpose. However, some people take its implications to be considerably more far-reaching. Following this line of thought, one can consider that interactions among emergent objects within cellular automata including of course the Game of Life are equivalent to interactions among physical objects. One implication of taking this view would be that gliders could more reasonably be thought of as autopoeitic. At the limit, one can think of the Game of Life as demonstrating the plausibility of an information-based physics as a fundamental description of reality, with computation as a fundamental physical principle. One does not however need to accept these provocative notions in order to appreciate the many insights into emergence and self-organization, and the simple joys of discovery, offered by the Game of Life. Autopoeisis and cognition in the Game of Life. Winning ways for your mathematical plays, Vol. Scientific American Gardner, M. Wheels, life, and other mathematical amusements. In Collision Based Computing, ed. Measuring emergence and autonomy via Granger causality. The search for links. In Complexity, Entropy , and the Physics of Information, ed. Zurek; Addison-Wesley, Redwood City.

Chapter 8 : Self-Producing Systems: Implications and Applications of Autopoiesis by John Mingers

A self-producing system transfers information about the quasi-species from one generation to another. Inheritance means that the initial state of an offspring belongs to the region of attraction of its parental quasi-species, and a leap to another quasi-species is a mutation.

Chapter 9 : Conference CASYS in Belgium ; Abstract due April 1

The main contribution of this book is the living composition, the model of living organizations. It is a new and original interpretation of the theory of living, self-producing systems (autopoiesis theory).