NEWSLETTER

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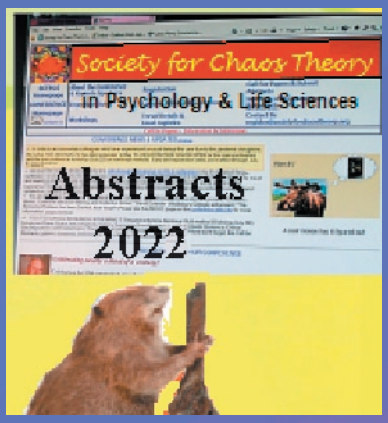
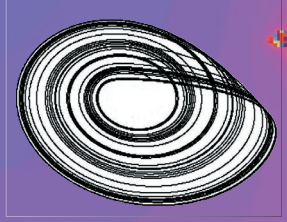
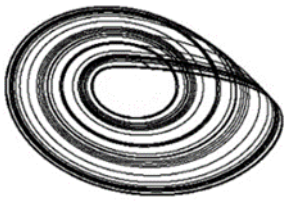
Society for Chaos Theory in Psychology & Life Sciences



Abstracts for the 32nd annual int'l Conference





Society for Chaos Theory in Psychology & Life Sciences

ABSTRACTS presented at the 32nd Annual International Conference ONLINE in Virtual Utopia August 4-6, 2022

Key Notes Speakers' Abstracts

David Sloan Wilson, SUNY Distinguished Professor Emeritus of Biology and Anthropology, Binghamton University.

Two Meanings of Complex Adaptive Systems

Complex Adaptive Systems (CAS) are a key phrase in complex systems science but two different meanings need to be distinguished: A complex system that is adaptive as a system (CAS1) and a complex system composed of agents following their respective adaptive strategies (CAS2). From a policy standpoint, we are trying to evolve CAS1 systems and CAS2 systems are usually part of the problem. Hence, it is essential to know how to convert CAS2 systems into CAS1 systems. The answer is provided by Multilevel Selection (MLS) theory, which clearly shows that system-level adaptation requires a process of system-level selection and tends to be undermined by selection at lower levels. MLS theory has matured to the point of providing a toolkit for real-world change efforts at multiple scales.

Richard Taylor, Professor of Physics, Psychology and Art , Physics Department, University of Oregon.

Fractal Fluency: Using Fractal Patterns to Promote Health and Performance

Dramatically referred to as 'the fingerprint of life', fractals have been shown to be the basic building block of many of nature's patterns, ranging from clouds, trees and mountains through to our brains, blood vessels and lungs. Perhaps the most staggering factor in the story of fractals is that artists have been capturing these patterns in their artworks long before these recent scientific breakthroughs. Examples include Leonardo da Vinci's drawings of turbulent rivers, Jackson Pollock's epic organic paintings and M.C. Escher's mind-bending prints. The growing impact of fractals on cultures around the world and their prevalence in nature raises a simple and yet crucial question – does exposure to fractal patterns have a positive impact on the observer? Using sophisticated techniques such as eye-tracking, EEG and MRI, my collaborators and I are investigating fractal fluency – the idea that, through exposure to nature's fractals, the eye has evolved to process these patterns with relative ease, triggering an aesthetic experience accompanied by reductions in stress and mental fatigue. Given that the US spends over $300 billion on stress-related illnesses, incorporation of fractals into our daily living and work spaces could have a huge impact on society. In this talk, I will review the fractal fluency experiments and present applications such as fractal solar panels, window shades, ceiling and flooring patterns.

Emma Aiken, Clinical Psychologist Private Practice, NZ

Biosemiosis and the Organization of Information Flow: Implications for Therapeutic Processes and Interventions

A central task in complex systems research is to achieve parsimony in models. This may be achieved by observing how self-organizing processes generate their own parsimony: self-organizing processes can be understood as self-simplifying processes. Formal and teleological casual processes may account for the 'simplifying' coherence and co-ordination patterns observed in living systems, including 'information flow'. These causal processes of living systems can be defined as non-linear relations, created and maintained by living systems in the process of creating and maintaining themselves. Peircean triadic semiosis describes a three-way relation between an object, a sign that stands for the object, and an interpretant. Biological semiosis or 'biosemiosis' has been developed as a model for the non-linear, self-created meanings formed in the relations of biological systems at every scale. From this perspective, biological and psychological ' symptoms' can be understood as sign processes: meaningful responses generated by people in their own semiotic relations in their worlds. Likewise, the interpretation of people's symptoms (and their responses to therapy) by therapists is a semiotic process, as are therapeutic relations between patient and therapist. Triadic semiosis both overcomes subject/object dualities and captures self-simplifying patterns in complexity by describing information flow in terms of relational meaning. Moreover, it supports the contention of NLD researchers that causation is not limited to forces acting on objects; rather, low-energy but highly meaningful sign processes prompt biological and psychological causal processes including pathogenesis and healing. Examples of biosemiotic causation in medicine include the placebo effect and psychosomatic phenomena.

Nangui Bao, Najia Bao, B & B Institute of Human Brain Potential, **Nasha Bao,** Jiangnan University, China

Block the Deterioration of Alzheimer Disease and then Reverse to Normal Memory Ability

The true cause of Alzheimer disease is still unknown. There are only a few ways to temporarily alleviate or improve symptoms. Alzheimer disease is a disease that consumes the most social resources. The majority of medical and scientific circles believe that the pathological causes of patients with Alzheimer disease may come from the death of neurons, the failure of neural information transmission or the loss of the original neural network connection. This study has achieved promising results. Project Title: Using episodic memory training to block Alzheimer disease progression and restore normal memory. Overview of treatment process: watch the film accompanied by the patient's family caregiver (spouse is the best candidate) Schedule: one in the morning and one in the evening. After each film, the caregiver must talk to the patient about the content of the film. Especially the most moving clips inspired by the caregiver, the patient poured out his experience. Caregivers should watch more reviews of such films on weekdays to play an effective guiding role. The caregiver should help the patient reach such a state: as long as the content of a film is mentioned, the patient can briefly say the theme of the film, then talk about the content of the film, and imitate the wonderful dialogue between the male and female protagonists in the film. The course of treatment is 6-9 months. The theoretical basis and specific implementation of the experiment: Episodic memory is a key element of long-term memory. Long-term memory is divided into two types: episodic memory and semantic memory. Episodic memory learns quickly, while semantic memory learns slowly. For the same number of repetitions of information, the solidification of episodic memory is much higher than that of semantic memory. Adults have rich life experiences, which is the basis for patients as memory subjects to create episodic memories. Therefore, we urgently need to choose the most suitable art form for patients to evoke intense emotional shocks in patients. A film full of humor and tragedy is ideal We have selected forty films from the 1940's to the 1960's to treat Alzheimer for three reasons: 1. First of all, the background of these films is very familiar to today' 75-90 old people. 2. The selected films are tragic, but the ending is happy. It is in line with the mood of the elderly. 3. Today, fast-paced movies with frequent camera changes are not liked by the elderly. Those bizarre sci-fi movies are not close to reality and are difficult to touch the hearts of the elderly. This article cites a film titled "It Started with Eve" for analysis. 1. This film full of storytelling and human touch contains a deep and powerful emotional force, which can reach the weakest and most tender place in the patient's heart in an instant. 2. The dialogues in the film are full of beauty and philosophy, attracting patients to listen and imitate. 3. In the film, three piano scores with different styles appear in different scenes. The heroine plays and sings, sometimes cheerful, sometimes crying, and the scenes are moving. The combination brings people a pleasant, straight-to-the-heart beauty. It will make the patient sing endlessly. This "episode memory training method" helps to restore long-term memory that was forgotten in the past, which is because the neurons touch each other and the information is transmitted smoothly. Experiment detection and effect: The subjects of this study were: 12 women (79-87 years old); 5 men (74-85 years old), all volunteers. Among them, 8 had moderate symptoms and 9 had mild symptoms. The detection methods are: assessment with CVLT, WMS-R and other scales, and analysis of the entropy value of brain waves of patients before and after treatment. Experimental results: significant positive effect. 17 patients recovered to

varying degrees. Most excitingly, 2 of the women felt that their memory had returned to pre-retirement levels ((They are 79 and 83 years old, respectively). These 2 subjects enthusiastically supported brain research, including interviews, tests, and recorded EEGs. Based on the brain waves obtained in the experimental test, the topological map of approximate entropy was used to construct the distribution map of cerebral cortex function. From the entropy brain topographic map, it can be seen that the right brain activation of the two people is obvious and abnormally active. The high complexity of T4 and T6 in the right brain area indicates that the images are retrieved many times in long-term memory.

Nangui Bao, Najia Bao, B & B Institute of Human Brain Potential,

Nasha Bao, Jiangnan University

China "Health Diary" is the Brain Staff and the Best Family Doctor

Why is it that the more advanced modern medicine is, the more difficult it is to treat people's diseases? The conclusion given by medical experts is that over-reliance on doctors and drugs has greatly reduced our body self-healing ability, and the human immune system has opened its doors under the interference of external forces. As a result, health and medicine have formed a vicious circle to a certain extent: the more developed medicine is, the more health problems will be... To end this cycle, we should respect the laws of the body and give full play to the potential of our self-healing power. Make it a true protector of our health. To a certain extent, when a doctor treats a disease, it is just to stimulate and support the self-healing power of the human body. It is not the medicine that cures the disease, but the people themselves. Researchers have found that 60% to 70% of diseases can be cured by themselves as long as they pay attention to health care and improve their living habits. The "health diary" we put forward is the dialogue and communication between the brain of a healthy person and various internal organs. (A) There are 12 specific columns in the "Health Diary": 1. Sleep time; 2. Do you have dreams during sleep? 3. Physical exercise profile: 4. The amount of water you drink in a day; 5. Oral status; 6. Nasal cavity Status; 7. Skin status; 8. Vision status; 9. Mental status; 10. Anus and stool status; 11. Are you feeling unwell? 12. The last item is the summary of the "health diary" on that day, that is, self-assessment: very healthy or generally healthy; A little bad, or pretty bad? If it's bad, how should I adjust myself? Each column should be detailed, for example, anal and stool status: smooth or difficult discharge? Strip, half strip, or crushed? Is the color yellow, light yellow, dark yellow, brown, or black? Is the excretion smooth? The function of the gut is much more than just digesting the food we eat. The microbial population in our gut has a major impact on our physical and mental health. Since the majority of immune cells live in the gut, gut health is critical to boosting the body immunity and warding off disease. Dream description is a big part of "health diary". When describing some content, don't be shy and stick to the real record. (B) Why does the "health diary" have to use written records (pen and paper)? Because the written records are closer to the physical condition at that time. From the words and handwriting of the written records, one can see the mood and health status at the time of writing. For example, when writing the records, Sentences are fluent, seldom altered, and written in great detail, reflecting a good physical condition; on the contrary, scribbling and rewriting, and making mistakes in many places indicate slow thinking and general or even poor physical condition. If you are typing on a computer, before the end. After adjusting the typos or the sentences that are not smooth, the traces of thinking at that time cannot be seen after the event. If you use a scoring method like an intelligence test scale to save trouble, it will be even worse. You will lose a lot of important information. "Health Diary" The implementation has achieved ideal results. Example 1: Wilson is a middle-aged man. Last year, his stool color was abnormal, dark brown, and almost black for 3 consecutive days, but he was not panic because he did not feel uncomfortable. He checked the Internet through the computer medical knowledge, careful analysis of the "health diary" recorded in the past two weeks, and taking corresponding measures, the stool was normal on the 4th day. Another example: Maria is a woman over 54. One day, suddenly near her right forehead. Severe tinnitus occurred for two consecutive days. The medical information on the Internet pointed out more than a dozen possibilities. She opened her "health diary" and checked them one by one, and found the cause. This group praised the "health diary", because they are all beneficiaries. They were happy to fill out the psychological questionnaire we sent them, and let us record their brain waves. We did brain wave entropy analysis.

Punit Gandhi, Michael Robert, John Palacios, David Chan, Virginia Commonwealth University, Richmond, VA

Effects of Contact Tracing and Self-Reporting in a Network Disease Model

Contact tracing can be an effective measure to control emerging infectious diseases, but the efficacy of contact tracing measures can depend upon the willingness of individuals to get be tested even when they are symptomatic. In this paper, we examine the effects of symptomatic individuals getting tested and the use of contact tracing in a network model of disease transmission on different epidemiological metrics. These metrics include the length of the epidemic, number of people infected, number of tests performed, and the likelihood of an epidemic occurring. We utilize a network model to resolve the influence of contact patterns between individuals as opposed to assuming mass action

where all individuals are connected to each other. We find that the effects of self-reporting and contact tracing vary depending on the structure of the network. We also compare the results from the network model with an analogous ODE model that assumes mass action and demonstrate how the results can be dramatically and surprising different.

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Tanuja Presad, Complexity in Medicine**,** *ComplexityinMedicine@gmail.com*

Claire Classidy, Associate Editor Journal of Alternative and Complementary Medicine

Lisa Taylor-Swanson, University of Utah, Salt Lake City

Do Patients Use Complexity Models to Heal?

Introduction Common scientific belief is that blinding to treatment assignment is necessary for placebos to have an effect. However, placebos administered without concealment (ie, open-label placebos [OLPs]) have recently been shown to be effective in some conditions. The parent RCT from which we found our data had 2 objectives: first, to determine whether OLP treatment is superior to no-pill control (NPC) in irritable bowel syndrome (IBS) and, second, to compare the efficacy of OLP against double-blind placebo (DBP). In a 6-week, 3-arm, randomized clinical trial, participants were randomized in equal proportions to 3 arms: OLP, DBP, or NPC. Participants treated with OLP reported clinically meaningful improvements in IBS symptoms that were significantly greater than those on NPC. Open-label placebo and DBP had similar effects that did not differ significantly, suggesting that blinding may not be necessary for placebos to be effective and that OLP could play a role in the management of patients with refractory IBS. This project uses qualitative interview with subjects from each treatment group to hear about their experience and consider if those subjects that use the ideas of complex adaptive systems are better able to heal. Methods We used a qualitative technique of interviewing, to identify and describe variations in illness models and heuristics that describe how subjects understand healing to happen (n=28). Results We have completed the development of codes and are currently double coding for themes of complexity. Found codes include aspects of complex systems including emergence, adaptation, feedback loops, fractals, self-organization, non-linearity, and a critical phase change in clinician's thinking. Conclusions Complex systems exhibit similar behaviors, even across disparate players and situations. Considering the TCM diagnostic process as a complex system may offer insight into the operation of other complex systems. Our findings can improve medical care by understanding how patients heal.

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Traditional Chinese Medicine

Traditional Chinese Medicine (TCM), on which acupuncture is based, uses diagnostic and treatment procedures that are complex and tailored to each patient's specific symptoms. Although this individualized treatment ideal is often replaced in clinical research with standardized protocols for the purposes of reliability and simplicity, the complexity of the medicine is a core concept and strength of traditional acupuncture and can be maintained successfully in an RCT format and often with better results than standardized protocols. This project aims to describe clinicians' reasoning during the provision of individualized treatment. We used a qualitative technique, Diagnostic Interviewing, to identify and describe variations in diagnostic reasoning and heuristics as described in retrospective accounts given by acupuncturists in response to their review of clinical records of a small sample of patients they treated in a clinical trial of acupuncture for Complex Medical Illness. Purposive sampling was used to create a sample of practitioners from the parent study (n=4) with variation in training, offered diagnoses, and years of experience. Each clinician completed 2 interviews covering 2-3 patient cases. Results We have completed the development of codes and are currently double coding for themes of complexity, toward considering the TCM diagnostic framework as a complex system. Found codes include aspects of complex systems including emergence, adaptation, feedback loops, fractals, self-organization, non-linearity, and a critical phase change in clinician's thinking. Conclusions Complex systems exhibit similar behaviors, even across disparate players and situations. Considering the TCM diagnostic process as a complex system may offer insight into the operation of other complex systems, in addition to adding to the medical education literature. In finding such trends, we can improve medical care by better understanding how other systems succeed in this quest.

Rosalia Condorelli, University of Catania, Italy

Naturalizing Semantics? Beyond Cognitive Neuro-Reductionism: From Varela's Systemic Cognitive Neuroscience or Neurophenomenology to Complex Realism Sociology

Is it possible to naturalize semantics? To biologize ethics? Starting from Libet's 1983 studies, current research developments in neuronal bases of behavior and cognitive activities involve the overcoming of Cartesian dualism in the direction of an increasingly pronounced physicalism which reduces the mind to the brain, with significant implications in reference to issues of free will, imputability and individual behavioral responsibility. However, many

criticisms can be made at this approach, especially in the light of the Varela's Systemic Cognitive Neuroscience or Neurophenomenology and Complexity Sociology, that is, in the light of the conception of living systems and social systems as complex systems. With Varela, the structuring of relationship between brain, mind and behavior expresses the encounter of Cognitive Neuroscience and Systemic Thinking. The Neuroscience computational and reductionist orthodoxy directs towards connectionism, to an approach centered on emergent self-organization and autopoiesis concepts (Varela, 1991). This is a holistic rather than a reductionist view of cognitive life, centered upon the human reflexivity capability or intentional awareness embodied in the biological mind of an agent which is situated in an environment and is enactive, engaged in creative processes of adaptation to environmental inputs experienced in a relationship of dynamic circularity between body-brain, world and experience. Therefore, living systems are not machines but are historical, dynamic systems. On the one hand, this idea links Enactivism to Phenomenology, leading our reflection to problematize a neuro-reductionist determinism of cognitive and behavioral processes, with its dilemmatic consequences on individual social responsibility and, ultimately, on social order possibilities. On the other hand, the Lieb's disciplined analysis is a fruitful ground for dialogue between Sociology, with particular reference to the current theoretical revision process of social systems as complex, emergent, social systems, and Neurophenomenology. Current Complex Realism, open to social systems' emergence and creativity, links structure and agency, macro and micro, in a co-determination relationship, acknowledging the autonomy of human reflexivity capability and free will beyond any reductionism, be neuro-cognitive or cultural. Hence, maintaining the point firm of social emergence and relationship between reflexivity and social morphogenesis, Sociology can dialogue well with Varela's Neurophenomenology about the understanding of that Organism which cannot be liquidated but must be reinterpreted in its function, about the understanding of neuronal circuits that mediate free will and intersubjectivity, conscious deliberative intentionality and awareness of oneself and others, self-control, perception of time and risk, in other terms, about the understanding our ability to give meaning to world, know, remember, desire, empathize, socialize.

Arianna Dal Forno, Department of Economics, University of Molise, Italy,

Giorgio Gronchi, Department of Neurosciences, Psychology, Drug Research, and Child's Health, University of Firenze, Italy

Ugo Merlone, Department of Psychology, University of Torino, Italy

Mask Usage and Quantum Cognition Theory

Face mask was, and still is, one of the most used prevention measures to contain the spread of the COVID-19 virus. Wearing or not a mask is an individual two-choice decision, which repeats over time, and affects and is affected by others' behaviors. This framework is similar to Schelling's main idea when he focused on binary choices with externalities. We introduce quantum cognition in Schelling's model to describe the time evolution dynamics of population behaviors, as psychological theory and empirical observations suggest that previous actions could affect future choices. Following one of Schelling' s examples, if Alice has been cycling to work in the last two days while Bob did not cycletwo days ago but yesterday did, albeit they are indistinguishable with regard to individual differences, this could lead to a different choice about the decision to be made today. This is consistent with the fundamental principle of quantum theory: the measurement operation simultaneously creates and records the property of the system. This makes it an ideal approach for improving the way of modeling agents within the Schelling's framework. The nonlinearity of the piecewise linear map we obtain, exhibits interesting characteristics such as organizing bifurcation centers and coexistence of equilibria, that may help understand different observed behaviors across countries. By considering the available data on face mask wearing and government restrictions, we are able to perform some grounded simulations of different population behaviors, compare them, and predict possible behaviors in different contexts.

Jazmin S. De la Cruz-García, Aldo Ramirez-Arellano, UPIICSA-Instituto Politécnico Nacional

A Two-Parameter Decision Tree

Decision trees are represented in a tree-shaped diagram where the non-leaf node tests a given attribute, and the leaf nodes give the classification. A decision tree is built by the C4.5 algorithm to obtain the information gain for every attribute to select the best and create a split criterion. In previous investigations, parametric entropies such as Renyi and Tsallis have been employed instead of Shannon entropy in C4.5. Renyi and Tsallis trees have the parameter q that can be adjusted by the trial-and-error approach to improving the classification, which is a limitation. A recently introduced two-parameter (q, α, β) fractional Tsallis entropy is the cornerstone of the two-parameter fractional decision tree introduced here. This work develops a method to calculate the parameter values of q for Tsallis and Renyi decisión trees and q, α, β used in the two-parameter fractional tree. It consists of representing a dataset in a network. Then the box coverage algorithm and complex network renormalization are used to calculate q, α, β. The Shannon, Renyi, and Tsallis decision trees are compared with the two-parameter fractional tree. Experimental results on psychological and life science datasets such as cancer diagnostic and survival and cognitive development show

that two-parameter fractional trees improve the classification measured by area under the receiver operating characteristic curve. References: 1. Maszczyk, T. and W. Duch. Comparison of Shannon, Renyi and Tsallis Entropy Used in Decision Trees.

Adam Gadomski, Bydgoszcz University of Science & Technology**,** http://zmpf.imif.utp.edu.pl/ag_publikacje/

Roy Cerqueti, La Sapienza Roma, https://web.uniroma1.it/disse/node/7444

Hungarians like Poles, Vicsek-Sierpinski Fractals Serve for the Rest of the World

At our disposal we have got squares that we divide in an algorithmic way into smaller pieces. The division is relying on exclusion of four subpieces from nine subpieces in total in a square but iterated which results in attaining the fractal dimension as ln5/ln3. The n-th iteration of the fractal pattern in terms of its total area goes to $(3/5)^n$. This can also be proved by a well-known Sierpinski formula (Gadomski) for the total area of Vicsek's pattern (Anitas et al.). If n tend to infinity the total area would unambiguously approach zero. However, for finite n it reads (3/5)^n. The total perimeter in turn goes to infinity with n. The consequences of the above firm reasoning have always to be presented to distinguished mayors of big cities, emphasized policy makers of any region, economy "developers" (Cerqueti, Ausloos), cognition scientists and practitioners, also sociologists, psychologists, specialized biologist as well as biomaterials scientists and technologists, etc. It is concluded that the fractal model assessed can be a prerequisite of many social, psychological/cognitive dynamical systems and related phenomena to be elucidated in depth by the fractal rationale.

Orlando Gomes, ISCAL - Lisbon Accounting and Business School

I, Robot: The Three Laws of Robotics and the Ethics of the Peopleless Economy

I, Robot is the title of a collection of short stories published in 1950 by the science fiction author Isaac Asimov. It is also the title of a 2004 movie starring actor Will Smith. In both cases, a dystopian future is the scenario for the plot. Science and techniques have progressed to the point in which robotic intelligence is capable of assisting people in most of their daily tasks. Nevertheless, in such settings, the pervasiveness and indepthness of artificial intelligence also poses risks. These risks are eventually mitigated by programming machines to obey the three laws of robotics (a robot may not injure a human being; a robot must obey to human beings; a robot must protect its own existence). Possible conflicts emerge when robots try to interpret the laws in face of ambiguous situations, eventually leading to severe cases of social disruption. The world imagined in I, Robot is not a distant fiction. In fact, in most sectors of economic activity, artificial intelligence has, nowadays, a dominant presence, and human intervention is no longer required to develop many of the productive tasks that create value in the economy. Therefore, it is now more pertinent than ever to pose the question: are we heading to a utopian society of unimaginable abundance and unlimited leisure time, or can artificial intelligence lead us down some dark path? The question is addressed by conceiving an analytical dynamic model that highlights the pros and cons of further artificial intelligence developments. Ethical rules for the people less economy may be thought off, and these rules might be decisive in shaping patterns of economic growth and inequality.

Stephen Guastello, Cooper Bednarczyk, Ryan Hagan, Camerhon Johnson, Laura Marcisek, Laura McGuigan, Anthony Peressini, Marquette University

Team Situation Awareness, Cohesion, and Autonomic Synchrony

This study evaluated the relationships among situation awareness (SA), cohesion, and autonomic synchrony (SE) within teams. SA is often a team effort and should be more accurate in better-functioning teams. Cohesive groups perform better overall, although the relationship appears reciprocal; the relationship to SA has not been considered previously. SE is a collective neurocognitive activity that has been connected to team coordination, communication, and performance in some circumstances. In this experiment, 71 undergraduates, organized into 16 groups, played two matches of a first-person shooter computer game and completed self-report measures of cohesion and SA. SE was determined through time series analysis of electrodermal responses using the driver-empath framework. Empaths and those who came from more synchronized groups reported less cohesion in the group. Granger-type regression showed reciprocal relations among SA, SE, and cohesion that were both positive and negative after controlling for match difficulty. Conclusion: The cohesion-SA relationship is similar to the reciprocal cohesion-performance relationship. SE plays an important and independent role in both the social and cognitive aspects of group behavior. It is possible, furthermore, that individuals who are more attuned to their co-workers reported a more accurate, and less obliging, social situation. Results are applicable to situations requiring teamwork in a fast-moving environment.

Stephen J. Guastello, Laura McGuigan, Henry Vandervelde, Ryan Hagan, Cooper Bednarczyk, Camerhon Johnson, Laura Marsicek, Anthony F. Peressini, Marquette University

Team Situation Awareness, Cohesion, and Autonomic Synchrony 2: Group-level Effects

This study evaluated the causal relationships among situation awareness (SA), cohesion, and autonomic synchrony within teams. Our previous study examined

these relationships at the level of individual data, where group-level dynamics presumably had a top-down impact on individual experience. The present study examined the effects at the group level of analysis, where presumably individual experiences exert a bottom-up effect on the group. Experimental conditions assessed changes in task difficulty, group size, and method of obtaining SA measures. Participants were 136 undergraduates organized into 32 teams of 3-5 members. Teams played two matches of a first-person shooter computer game and completed self-report measures of cohesion and SA. Synchrony was determined through time series analysis of electrodermal responses using the driver-empath framework. ANOVA results showed that cohesion and SA improved over the two matches, and SA was better in smaller groups. Synchrony was stronger in larger groups. Synchrony showed interesting interaction patterns across game segments, suggesting punctuated equilibrium effects. Granger regression indicated no causal relationship between SA and cohesion in either direction. Sync had a small positive effect on cohesion during the first match, which dissipated afterwards. SA had a strong negative impact on sync early on, which also dissipated afterwards.

Marcus Hausner, Institute of Educational Sciences, University of Heidelberg, Germany,

Complexity Competence: Principles of Complexity-Adequate Action of Leaders in Business Organizations

Management action today is still largely shaped by a Newtonian-mechanistic world view when it comes to leadership, decision making or problem solving. Although 'wicked problems' – problems which stay regardless of the solutions offered – seem to grow in number and scale. Theories of Nonlinear Dynamics such as Chaos Theory (Lorenz), Theory of Dissipative systems (Prigogine), Fractal Geometry (Mandelbrot) and the Theory of Synergetics/Self-organisation (Haken) try to shed light on this phenomenon of complexity which cannot be addressed through mechanistic means. The poster summarizes the work in progress of my Phd-Thesis I am currently working on 'complexity competence | an approach to describing, identifying and developing complexity-adequate action by managers'. It will start with a brief introduction to the theories used. Based on a working definition of complexity there will be offered a set of principles (heuristics) to adequately deal with complexity in social systems such as in teams, organizations or markets. In the third part there will be a performance-oriented concept of competence presented which could be used as frame of reference to 8escribe a complexity competence model.

Gus Koehler, Time Structures, Under revision

A Philosophical Essay: Recovering the Full Range of Human Knowing

We are in deep need of reconciliation between our current more limited ways of knowing and key elements of our evolved knowing foundations if we are to address a key problem of our times: climate change. It is this limited set out of which we now create ourselves, relationships with each other, define and manipulate nature, and other living beings that poses difficulties for addressing major problems of our times. In terms of ourselves, it may be the gap between having an evolved physical body with limited but multiple ways of knowing for a particular complex environment that has been reduced to one way by the knowledge of speculative-reason compromising our survival niche by global warming. Based on my review of published literature and personal experience, a loosely derived estimate of 206 methods of knowing and 102 different forms of knowledge have been identified. Hindu Yogic methods are very old and diverse with the 110 Radiance Sutras each with a practice, making up the majority of our list. The types of knowledge practices and tools used suffer from how complete or duplicative the listings are. Probably the greatest weakness is the failure to identify the number of Shamanistic practices and manner of knowing in both contemporary and ancient peoples' communities. This requires sources outside of Western Anthropology which is for the most part heavily biased due to its dependence on the conceptual-scientific paradigm and the effects of colonialism. Even within this limitation the creation of art reaches the same current standards of excellence across 45,000 years of time. Statements by Shaman show a similar divergence from Western knowing. Ideally the approach used by the editors of Science News to identify their magazines biases are applied in this essay. The questions that guide me are: 'What are our current biases? Where are the gaps in our coverage? When are we narrow minded? Whose voices are we amplifying and whose experiences are we omitting?' (Science News Reckoning Team and Senior Staff (2022). The Darkness in our Past: Science News reconnects with its past prejudices. Science News, 3-26-2022.) By combing these ways of knowing a common meta-language could be created expressing both quantitative and intuitions as 'true' of complex-adaptive systems at whatever scale. Traditional people's cultures, as with the 14 extinct hominids, did go extinct after lasting for thousands of years. While the events may have been linked to a Hominid body issue or to a community created local environmental affect, it did not destroy the planet as global warming is doing. This suggests to me that there is something about the full range of knowing, even opening to them in a narrow way, to the adaptive requirements of our life is important but the barrier of its accepted narrownes' could fail us. Equally important is that validation of the knowledge was linked to personal and community survival which failed in the fourteen of fifteen Hominid cases suggesting that a supplemental form of validation is needed for us. This also suggests that our unique evolutionary adaptations, being abstract language, creativity, and adaptability, allowed us to extend our reach to multiple niches across the planet but

may have also created conditions for our dramatic reduction through climate-warming. The task before us is to gain the expertise to personally explore the walled off ways of knowing and their products which requires achieving expertise and validation of its results in direct consultation with validated practitioners. Christian biases and Background-Dependent space-time as well as dependance on merely the biological body should be set aside and an integrated three-body concept considered to clearly see what is involved in this exploration and if it opens the current dilemma. An explore association should be established to validate the explorers, their competencies and results. Particular attention should be given to exploring what the poet Robert Bly calls twofold consciousness (News of the Universe,1980, Sierra Club Books) as pointed at in this poem: From *The Signature of All Things* by Kenneth Rexroth: I went out on my cabin porch, And looked up through the black forest At the swaying islands of stars. Suddenly I saw at my feet, Spread on the floor of night, Ingots of quivering phosphorescence, And all about were scattered chips Of pale cold light that was alive.

Matthijs Koopmans, Mercy College, School of Education

Complexity in Educational Leadership: Classrooms, Schools, and Districts at the Edge of Chaos

Ever since the A Nation at Risk report (1983) identified a rising tide of mediocrity (p. 9) in the public education sector, there has been a clamoring for educational reform. Meanwhile, we found that the system is difficult to change. Complexity theory helps identify facilitators and inhibitors of transformation and thus can aid in the reform efforts. There is no question that the educational system is complex. Classrooms are nested within schools, who, in turn are nested within districts, etc., and the behavior at the higher systemic levels cannot be readily reduced to the interactive behavior of its lower-level components. While both classrooms and schools share a strong accountability relationship with the systems in which they are nested, the units themselves function relatively autonomous from each other, a situation that the dynamical literature refers to as loose coupling, often seen as inhibiting educational reform efforts. In line with that view, strengthening the relationships between these lower-level components is one of the keys to educational reform through initiatives such as distributed leadership to have teachers share school building management responsibilities, professional development of teachers and principals, and frequent interaction between these subsystems and other stakeholders (parents, community, elected representatives, teachers unions). This presentation argues that such interactions have the potential to create meta-stability in the system (self-organized criticality, edge of chaos), and as such, the individuals residing within the system have the power to transform the system beyond its initial settings, provided they get adequate support from above to do so.

Matthijs Koopmans, Mercy College, School of Education

Update on the Estimation of Fractal Dimensions in Time Series Data: The Fractaldim Package

The search for fractal dimensions in time series data is important. It enables the investigator to rule out unaccounted sources of variability in time series due to long-range dependencies. Moreover, fractal patterns can have substantive interest. Mandelbrot and others have suggested that they point to complex adaptive behavior in the system being studied. A variety of statistical techniques is available to conduct fractal estimation in time series. An overview of these indicates that used by themselves, they lack consistency in their responses to short and long-range dependencies, and therefore, most require a statistical adjustment for autoregression and moving average processes before fractal estimation is undertaken, which in turn requires conventional time series for data preparation. The newly developed fractaldim package is not included in this review. This presentation makes things right by evaluating its response to several real data sets: annual recordings of the flow of the river Nile (N = 663), daily recordings of births to teenagers in the state of Texas (N=1,460), and daily school attendance in a middle school in New York City (N=735). In addition, one hundred realizations are shown of simulated time series (N=2,048) at various persistence levels. Estimators generated from these real data are difficult to interpret, but fractaldim proves unusually robust in its estimation of the absence of dependencies, long-range or otherwise, in the residuals from models fitted through other methods, suggesting that its best use may be as a goodness of fit indicator of the absence of any fractal or other dependencies.

Joshua Landvatter, Department of Psychology, University of Utah

Machine Learning & Blood Glucose in Type-2 Diabetics

Approximately 37 million Americans (1 in 10) have diabetes, the vast majority being type-2 diabetes. In both cases, BG management is the primary difficulty associated with health outcomes. Using sparse identification of nonlinear dynamical systems (SINDy), we explored potential predictors of blood glucose in type-2 diabetics. With a better understanding of contributing factors of blood glucose management and associated outcomes, we may curve the negative effects of diabetes seen on life expectancy and healthcare costs. Across twenty type-2 diabetics, using LASSO regression, SINDy found individual dynamics for six individuals, accountable by income differences. This corroborates present research linking socioeconomic status with glycemic control and supports current literature that supports an association between

health disparities and socioeconomic status (SES). It is possible that SINDy may be more successful at identifying predictors in type-1 diabetic populations, due to the blood glucose self-regulating processes still in effect within type-2 diabetic populations. Whereas in type-1 populations there is no insulin is produced, in type-2 populations, there is still a functioning (albeit reduced) insulin response to blood glucose levels. Nonetheless, future studies should acknowledge the inherent stochastic limitations of using machine learning techniques and be aware that such techniques often assume that there are only few important terms that govern dynamics.

Terry Marks-Tarlow, Pacifica Graduate Institute, Topanga, CA

A Fractal Epistemology for an Integrated World View

The Western mind has been entrenched within a reductionist perspective, propelled by principles of Euclidean geometry within a Cartesian framework. A reductionist conceptual framework asserts that complex systems can be broken down into simpler elements. This results in a highly ordered, clockwork view of the Universe as mechanism where all can be deterministically predicted and controlled. Through the discovery/invention of fractal geometry, a more holistic perspective is available. Here, complexity emerges organically, dynamically and spontaneously in line with naturalistic processes. Presented in a highly visual format, this presentation lays out principles of a fractal epistemology. These include observer-dependence of complex, unique, and nonlinear events; fuzzy boundaries between dynamically negotiated domains; the capacity to hold the paradox of contradictory elements as well as the ambiguity of ill-defined elements; and emergent patterns of perception, feeling, thinking, and relating across the objective-subjective divide. A meta-reductionist approach inspired by fractal geometry helps to bridge theoretical divides within psychology that impact consciousness studies, such as brain vs. mind, objective vs. subjective, rational vs. intuitive, conscious vs. unconscious, and personal vs. transpersonal domains.

Chikoo Oosawa, Kyushu Institute of Technology, Japan.

Model Particle Trajectory Prediction with Reservoir Computing

Collective dynamics of such as pedestrian flow, birds and sheep of flock, fish school and cell motion during development exhibit very complex behaviors or trajectories that consist of many interacting agents. Their behaviors are interesting but hard to get a blue print of the dynamics. To predict an accurate future position of such agents is important for elucidating and controlling the dynamics in real-time processing. Reservoir computer (RC) that one of machine learning framework with recurrent neural network may be suitable tool for the purpose since the RC can be trained by time series of input data and predicted data can be read out from by a simple learning algorithm in a short time. For the first step of the purpose, here we use a model for generating complex trajectory in 2D with single agent. The model has been used as a hopping rule for pedestrians is well-known as dynamic floor field model. The model consists three processes of footprint such as putting footprint from an agent, diffusing and the decaying of the footprint. The moving rule of agent is subject to the intensity of the footprint via soft-max function that leads to non-Markovian style of motility. We put the non-Markovian trajectory for echo state network (ESN) one of the software RC. In addition, footprints data surrounding the agents were also being used as training data, showing good performance for the prediction of 2D trajectories indicate that the spatial information surrounding the agents contribute to increase of predictability.

David Pincus, Psychology, Chapman University.

Emotional Balance and Resilience at the Start of the Covid-19 Pandemic: Might IPL Shape be a Bifurcation?

Self-organizing systems are capable shifting between flexibility and robustness in response to perturbation, which highlights their potential to provide theoretical grounding for understanding human resilience. Prior research has found that self-organization as evidenced by Inverse Power Law (IPL) patterns predicts health and resilience in psychological systems including personality structure, patterns of physical activity, affect, behavior patterns, and interpersonal dynamics. The present research extends this theoretical line of inquiry to understanding emotional resilience. The study used ratings of intensity (1-5 Likert scale) across 12 emotions (six positive and six negative) collected as part of a survey of adults' (N = 4142) pandemic experiences and health in the USA in April 2020 (at the start of the USA pandemic response). The individual distributions of emotion scores for were tested for fit with an IPL distribution, and the shape of the distribution was tested for its association with mental (i.e., stress, anxiety, depression) and physical (i.e., fatigue, headache, diarrhea) health symptoms. Results suggested a generally strong mean IPL fit across participants (Mean R-squared = .75). A steeper IPL shape parameter, indicative of a relatively strong positive emotional ' home base' (i.e., attractor) was associated with better mental and physical health. However, this association was also quadradic, suggesting some drop off in resilience at the highest levels of positive emotional robustness. Moreover, when total positive and negative emotion were statistically controlled a flatter IPL distribution was associated with better health, providing additional support for the role of flexibility into negative affect in emotional resilience. This conclusion was further

supported by a significant interaction effect between a measure of COVID-19 Impact, and IPL shape, with a steep shape interacting with higher COVID-19 Impact to predict worse health outcomes. Altogether, these results support the conclusion that emotional balance, the combination of positive robustness and flexible negativity, underlies emotional resilience. Interestingly, there may be a bifurcation effect lurking beneath this process, with more flexible (i.e., flatter) emotion IPLs showing a normally distributed range of health symptoms, while those with a steeper IPL shape (i.e., a larger positive home base) showing a split, with either high or low symptoms. A catastrophe model may help to elucidate this potentially interesting phenomenon.

David Pincus, Psychology, Chapman University,

Adam Keifer, Exercise and Sport Science, University of North Carolina,

Self-Organizing Biopsychosocial Resilience: Updates to a ' Common Framework'

Applications of nonlinear dynamical systems to human resilience have been steady over the past decade, with theoretical and empirical models covering a wide range psychological experience and situational contexts. Indeed, the growth of work in this area recently led to calls for a common framework to understand human resilience and ultimately two separate reviews on the subject (Kalisch et al., Sheffer et al.). These reviews present important content, particularly related to modeling resilience using networks and time series (i.e., critical slowing) methods. However, these recent publications also have entirely overlooked prior work on this topic (e.g., Pincus & Metten). Most ironically, this prior work has included the very common framework these more recent publications have claimed that the field needs. This presentation will cover the original integrative framework proposed by Pincus & Metten will provide an overview of the empirical results that have tested some of the hypotheses generated from the framework, and will suggest some updates and extensions to the original framework.

Rosmawati Rosmawati, Centre for Communication Skills, Singapore Institute of Technology, Singapore

Wander Lowie, Department of Applied Linguistics, University of Groningen, The Netherlands,

Multifractality in Language: A Case Study of the Finite Verb Phrases (FVP) in English

This presentation will show the results of our study on multifractality in language. We applied Multifractal Analysis to English texts and explored the nature of fractals in language. Both Menzerath-Altmann law and Zipf-Mandelbrot law note that language is a fractal structure and, like any other fractals, follows the power laws. In the few studies on fractal linguistics that are available, most studies successfully showed that the relation between the scaling measures and the number of constituents in language indeed follow the power law probability distribution. However, the nature of fractality in language has not been explored much beyond this proof. Now with the wider recognition of Complex Dynamic Systems Theory (CDST) in the field of linguistics recently (Evans, Lowie et al.), which also posits that fractality is a property of language, we believe it is time to venture beyond proving the power law relationship, and into exploring the nature of fractality in language. We used Multifractal Analysis to explore the distribution of the finite verb phrases (FVP) in English texts. Not only did our results show that the FVP construct manifested the characteristics of multifractality, the resulting parameters also offered rich information about (1) the level of complexity and (2) the characteristics of its distribution that converge with the current understanding in linguistics and its sub-disciplines. Our findings lend support to CDST's tenet on the fractal property of language and have the potential to offer a novel avenue for measuring the level of complexity in linguistic outputs.

Barkley Rosser, James Madison University

Complexity and Aesthetics: How Arts, Sciences, and Economics Coevolve

This paper presents the ideas of the late Tonu Puu regarding how arts, sciences, and economics interact and coevolve. This involves complex nonlinear dynamics with critical bifurcations at crucial points that transform the paradigm or system involved. Centrally important is how influences from one area influence another, even from the arts to the sciences and economics and back again. Thus, the role of generalists is important in progress of humanity and must be encouraged.

Conor Rowland, Julian Smith, Bruce Harland, Saba Moslehi, John Dalrymple-Alford, Richard Taylor, Dept Physics, University of Oregon, Portland OR.

Automated Application of Fractal and Connectivity Analyses to Publicly Available Neuron Reconstructions

Fractal analysis has been shown to be a valuable technique for classifying different types of neurons, for quantifying changes in structural complexity across neurons from different brain regions, and for identifying alterations to neuronal morphology induced by pathology. Based on this success, we investigated the morphological features that contribute to a neuron's fractality and what functional benefits a neuron receives from adopting a fractal shape. Through an examination of the basal arbors of pyramidal neurons in the CA1 hippocampus of rats, we found that both the length distribution of a neuron's

branches and the way they fork and weave through space are important for determining a neuron's fractal dimension, D. Motivated by this, we generated distorted neuron models by altering their forking and weaving behavior and found that these distorted models occupy a wide range of D extending beyond their natural values. Furthermore, we found that the fractal morphology of the neurons establishes an optimal balance between the competing functional constraints of connectivity and material cost. Having quantified this optimization for one neuron type, we developed a tool for applying the same analyses to the broad range of neurons available on the public repository NeuroMorph.Org.

Janice Ryan, Attunement Solutions, Private Practice, TN, www.attunementsolutions.com

Applications of Nonlinear Science for Promotion and Acceptance of Neurodiversity

Progress is being made in the current neurodiversity movement as a Network Weaver approach is being used to promote trust and interdependence across sensory differences and the deeply learned social emotional patterns those sensory differences tend to magnify over time in competitive cultures. A thematically coded project journal provides applications of nonlinear science to explain how a work team with a shared understanding of Sensory Profiles used that knowledge to dampen the potentially divisive force of deep perceptual biases that commonly self-organize between two opposing Jungian Hero Tribal Architypes, now referred to as neurotribes. Previously thought of as a division that inevitably self-organizes in work team dynamics between ' idea people' and 'project execution people.' childhood and lifelong Sensory Profiles provide a plausible explanation for the tension that commonly develops between these two neurotribes. A Human Systems Dynamics Landscape Diagram is used to illustrate how work teams divide along the natural lines created by comfort zones related to environmental predictability and neurotribe power dynamics. Thematic coding is used to illustrate how points of conflict develop from the tension between ways each neurotribe experiences the feeling of flow and develops self-motivation to see project tasks through to completion. Gottman's Mathematics of Relationships is used to explain how feelings associated with a steep slope of negative power dynamics can naturally lead to feelings of betrayal and loss of trust across this common work team bifurcation point. Recommendations are made for use of this nonlinear science to channel the energy that comes from team differences to enhance the work team dynamics benefit of sharing complementary skills.

Janice Ryan, Attunement Solutions, LLC,

A Nonlinear Exploration & Discussion of Mind-Body Dualism

Current thought is that mind-body dualism causes each of us to perceive the world through our "native mind-body language' resulting in inevitable perceptual bias. Spiritual essence has been called a ' mind creation' while physical essence might be considered a ' body creation.' Whether or not we see our minds as a receptacle for God' s messages or autonomous from any higher power' Sensory Profiles and the neurodiversity movement have allowed us to see this conceptual difference more clearly than ever before. At least for special needs service professionals, this has made an ancient dichotomy relevant again. After a person recognizes that their spiritual essence represents an infinity that (by definition) goes beyond their physical sensory life experience, they learn how to recognize their own perceptual bias as such. An overview of mind-body dualism will be provided as it has now been clarified by the standardized assessment titled, Sensory Profile 2, created by occupational therapist Winnie Dunn, PhD. Open discussion will follow regarding whether the mathematical infinity symbol is adequate for representing a human mind experience that goes beyond a human physical or sensory life experience. All worldviews will be welcomed.

David Schuldberg, Professor Emeritus**,** University of Montana.

If Health is a Strange Attractor, Then What is Illness?

Understanding health has been a conceptual and definitional conundrum since ancient times (Schuldberg, 2022). Similarly, the relationships between health and illness are also puzzling. Current work has argued that healthy or ' normal' functioning is best understood as the output of Nonlinear Dynamical Systems (NDS), and that healthy variability shows hallmarks of an NDS, for example chaotic fluctuation (Goldberger & Rigney, 1989). This suggests that healthy ' states' are dynamic regions around strange attractors. But if we accept an NDS view of health, where then is illness? How do we understand pathology? Historically health has been viewed as an absence of illness, as the opposite of illness, or as some kind of mirror image. Within an NDS framework, illness has been portrayed as a lack of variability, or as non-chaotic variation (Goldberger et al., 1988). Importantly, we must view both health and illness as he emerging from the same systems, and both as representing ' life under altered conditions,' Virchow's (1849/1958) description of illness. This paper develops the idea of both health and illness as attractors, regions in the same state space. It focuses on boundaries and transitions back and forth between wellness and illness, as well as the importance of ' mixed states,' emphasizes seperatrices, the interstices and porous, sometimes fractal, boundaries between attractors, and discusses the place of mortality in models of health and illness.

Jack Emerson Stanfield, Colorado Preparatory Academy

The Origin of Patterns

From subatomic particles to galaxies, everything in existence is made up of patterns. At some point, almost every human has asked themselves, ' What is the

meaning of life?' To me, the answer is clear: patterns. My own theories about patterns came from instinct, and from growing up in a family of scientists and engineers where I began exploring big ideas from an early age, and yet patterns are a growing topic of interest within many different scientific fields. So, how do scientists study patterns? Mathematics is the language that physicists, chemists, biologists and many other scientists use to analyze and describe phenomena, which are facts, occurrences, or circumstances which can be observed. (Oxford English Dictionary, 2018) According to mathematician Keith Devlin, 'Mathematics is the science of patterns.' (Devlin, 1994) In his book Our Mathematical Universe, Max Tegmark tells us that patterns shape every part of the knowable universe, even the person reading the book. As Tegmark says, 'You're a pattern in spacetime. A mathematical pattern. Specifically, you're a braid in spacetime' one of the most elaborate braids known.' (Tegmark, 2014) So, it seems that every living thing is a pattern. But where do these patterns come from, and how do they form? This very question has inspired some of the greatest discoveries in modern science. Alan Turing was a mathematician with a deep interest in patterns. He wrote a paper on process of pattern formation, titled: ' The Chemical Basis of Morphogenesis' to model how an embryo develops from a single cell into a complex being with many different features. Turing showed how ' a system of chemical substances, called morphogens, reacting and diffusing through a tissue' allow an embryo to ' develop a pattern or structure' by signaling which cells should live, and which cells should die. (Turing, 1952) The living cells form patterns like the fingers on a hand, while the death of the neighboring cells creates the spaces between the fingers. This process, which Turing calls the ' phenomena of morphogenesis,' causes many other distinctive patterns to form, such as stripes, spots, and whorls. (Turing, 1952) If you think about it, birth and death are just a kind of binary code. Binary means that something that can only occupy one of two possible states, like one/zero, yes/no, or on/off. (Oxford English Dictionary, 2018) Binary might seem kind of limiting, and yet it can include all of the information necessary for nature to create endless complexity, variety, and diversity. (Tegmark, 2014) Though Turing's original paper is quite advanced, the basic idea is easy to understand. Simple rules can create complex patterns. (Gleick, 2011) In many ways, Alan Turing's ideas have shaped life as we know it. His contributions have had a lasting impact on nearly every scientific discipline, including modern computer science. Tragically, Turing died before he could see how important his contributions would become. Despite everything he did for his country and for scientific advancement, he was arrested by the British government for the ' crime' of being gay. Because of this act of extreme bullying, Turing suffered from a deep depression that led him to end his own life in 1954. (Seeker/YouTube, 2016) Even though his life was cut far too short, Turing's legacy lives on all around us. As Seeker observes, ' Once one starts to look, there seems to be no end to Turing patterns: their forms can be seen in weather systems, the distributions of vegetation across landscapes, and even the constellations of galaxies.' As you can see, patterns are everywhere. Mathematics is the science of patterns, and patterns are the science of life. Turing showed us how patterns are embedded into every living thing from the very beginning. Nature is constrained by patterns, and yet patterns are also the source of the infinite diversity we can observe in the natural world. Patterns are the language of the universe. Patterns determine our fate: growth or decline, evolution or extinction, life or death. I am a pattern. You are a pattern. Everyone' and everything' is a pattern. That is why, to me, patterns are the meaning of life.

Jeremy Swartz, University of Oregon

William Schoenberg, ISEE Systems Inc.

Nonlinear Dynamics and Systems: Feedback, Validation, and Feedforward

This presentation reviews modeling of nonlinear behavior in systems through a brief history of the field of system dynamics (stock and flow analysis), critiques of the process, as well as how technologies are emerging to potentially deal with the problems of validation. By studying the nature of feedback in various forms of relationships, including "balancing feedback" (inhibitory) and "reinforcing feedback" (amplifying), the analysis of the output can show, for example, growth or decline in a system. In identifying which feedback loops to analyze, we can also determine the likelihood that a loop has a high level of importance or relevance to a given system. It is increasingly incumbent upon on modelers to be able to demonstrate that the models they have produced are reproducible via structural validation. Case studies and emerging research will be offered to help articulate and clarify feedback-based explanations of nonlinear dynamics across agent-based, black/white boxes, and natural systems.

Mike Unrau, PhD, UBC, Canada

Novelty: A Multidisciplinary and Complex Systems Approach

Most scholarly discussions of novelty offer only partial or specified views of how it is generated or assessed particular to a discipline or study. This paper investigates novelty with the specific goal of offering a multi-systemic (and generalizable) approach to be applied across multiple disciplines. It also offers an alternative view of how novelty arises in a breach of causal normality or in a causal “breakthrough,” thus placing emphasis on a temporal context in both description and assessment. Through both a qualitative view that honours subjective experience and a quantitative view that addresses nonlinear dynamics, the paper investigates novelty generation and its assessment and includes a specific temporal section on low-recurrence self-organization. It sums up novelty through four preconditions and offers a

practical heuristic for novelty assessment usable across multiple disciplinary contexts and studies.

Ken Ware, NeuroPhysics Therapy Institute, Gold Coast, Queensland Australia

Psychophysical Elasticity? Spongy Attractors? Rogue Attractors? Degrees of Freedom within the Laws of Conservation of Energy Relative to the Onset and Incubation of Disease and Disorder, Rates of Healing and Peak Performances?

NeuroPhysics Therapy (NPT) has developed a global reputation over the last few decades for the ability of individuals harbouring very complex psychophysical diseases and disorders, to access the intrinsic ability of their systems to be able to build up enough ' escape velocity' to pull away or out of the confines and rigidness of the rouge attractor landscape, that would have mathematical portrayed the scale free nonlinear dynamics of their conditions and elastically settle into a much more desirable and functional ' spongy' attractor landscape. Hence the emergence of unprecedented enhancements in very small time scales (with no comparisons) to the psychophysical functionality of systems that were limited to the confines of a degenerative rogue attractor, not excluding people with complete or incomplete spinal cord injuries. To an inquisitive observer observing the NPT process, they would witness not just one panoramic phenomenon that would in many ways create a set of challenges to the conventional scientific wisdom of the day in many disciplines, but several non-partitioned phenomena occurring at various time scales. It is virtually a throw away statement and urban knowledge that an individual's attitude and belief system influences rates of healing. One would imagine that even the most devoted physicists, quantum mechanics theorist or thermodynamicist may agree that healing is not set and stable linear mechanism and that individual differences positively or negatively affect the healing outcome, without too much thought put into what this means to the studies and findings of the phenomena they are devoted to. However many unresolved problems for science remain lurking in the background when it comes to the presentation of a suitable and reliable framework of understanding concerning the laws of conservation of energy relative to living systems and the hugely variable degrees of freedom there are involved with the psychophysical human nonlinear dynamical, non-equilibrium complex adaptive system and its relationship with its environment, the nonlinear effect the environment has of these system and the potentially even more nonlinear effect these systems have on the environment. Decades ago, new NPT related discoveries were made relating to the greatness of the human system when given the right sets of initial conditions and prescribed perturbations to self-organize to higher states of complexity within very small time scales. Dis-ease and disorders are viewed as a loss of the systems complexity. The unprecedented repeatable outcomes of NPT speak for themselves, therefor without any need to validate the effectiveness of NPT via pre-existing theories, It has always been a process of reverse engineering these outcomes to develop a framework of understanding to assist others better understand the nature of the phenomena that they are interested in and perhaps assist in better awareness of what happens when things go against their predictions. During this presentation, the foundation of a testable hypothesis will be discussed based upon tens of thousands of patient outcomes over the last few decades that has reliable structure, functionality and the introduction of a stable grid to harvest reliable measurements from at any point in space time within enabling for much greater predictions regarding the future of the system, governed by some sets of rules and initial conditions. These data enable an aggregate formation of a math--based measuring stick that can be applied in principle to all studies and inquiries relating to living complex adaptive system in particular.

Arin You, Bethany College, Bethany, WV

Different states of the self as the energy and entropy dissipation mechanism: Using quaternion mathematics by Martin Hay.

The current paper aims to unpack a linkage between different states of the self as entropy and energy dissipation mechanism using a model of a Quaternion Mathematics created by Martin Hay. The current understanding of the self is paradoxical due to opposite notions of co-existing states of the self, such as the presence of the self, absence of self, and escape of the self (escapement theory, Baumeister, 1990). As addressed by other researchers, these paradoxical states may lie in religious backgrounds founded on Judaism-Christianity and Hinduism-Buddhism. Earlier, Shia (2015) asserted that the two states of presence and absence of the self are based on functions of the self in the case of Western thinking and transforming the self-state to a nonself state when it comes to Eastern thought. States of the absence and the presence of the self are founded upon the notion of presence and/or absence of ego (Csikszentmihalyi, 2014; Shia, 2015). In addition to the argument of states of the self, mentioned above, the current psychologists provide another potential state of the self that is absent (Csikszentmihalyi, 2014). Here, we can ask why the self needs to go through different states by functionally changing, maintaining, and expecting itself, and thus transforming its information about ego, removing, and extinguishing ego. Here, we can borrow fundamental ideas from physics on living organisms that have to follow the natural law to sustain themselves in the universe. If the human system is alive, then there must be dynamism in the human system (You, 2020). As a function of the dynamism in self, escaping to a different state as a means to sustain, maintain, and escape may appear. Thus, polarizing processes by showing two opposite states may drive the evolution of the self and is one mechanism by which a system may dissipate an increasing amount of energy and/or entropy over time. To begin with, essentially, the escarpment theory based on the notion of self tells us that individuals switch between two states. That is, the state of the self at Time1 is different from the state of the function at Time2. The intriguing part here is that presence and absence of the self are the states of the self are opposites. Such as nonself from eastern philosophy and the notion of self is the opposites. In addition, we can add another opposite:

the escaped and non-escaped state of the self. I define all states (i.e., presence and absence) of the self as the TAO self by showing the order and orderly transition in the self-system. This axiom satisfies both presence and absence of the self locally and the notion of nonself globally by solving paradoxes in the self-system. Using quaternion mathematics by Martain Hay to prove the absence and presence of self, let us assume that the presence of self equals '1' and the absence of self equals '-1' , then the total self equals 0. The three opposites configure a pair of star tetrahedron necker cubes associated with three paired Mobius strips that would function as a torus and/or a Klein bottle (Friston, Wiese, & Hobson, 2020; Rosen, 2017; Yü, 2007). I will discuss this process.

Mikhail Zimin, 2554620 Ontario Ltd.

Oksana Kulikova, The Siberian State Automotive and Highway University, Omsk, Russia

Svetlana Zimina, 2554620 Ontario Ltd. Mr.

Estimation of Public Image to Vaccination Against Covid-19 in Canada with the Help of Non-Linear Dynamics Methods and Analysis of Time Series

Public image in any country is one of the key developments of effectiveness measures implementation of public health system. Therefore, estimation of public perception to vaccination against COVID-19 present some features of interest. Research was performed with the help of statistical data describing vaccination in Canada in 2021 and in 2022 from «Our World in Data» (https://ourworldindata.org/). To assess people's attitude to vaccination, parsing of responses and determination of their tonality using Python libraries was utilized. Entropy was computed by dint of Breakpoint Unit Root Test, Granger causality test, and sentiment analysis. Calculations were performed with the aid of Python language. It was found that time series characterizing attitude of Canadian population to vaccination is characterized by high entropy values and doesn't contain points of structural changes. Herewith, positive public image predominates. Results of the study can be used to solve problems of operational and strategic planning in the fields of healthcare and development of state measures to contain the pandemic.

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Instability of Probability Densities Functions of Predictors of Equipment Condition and Human Factor

Taking into account human factor may be useful for adequate forecasting remaining life of equipment. Indeed, more qualified personnel can provide better maintenance and operation condition. Therefore, estimation of such influence and accompanying effects present some features of interest. Temperature control is an important tool for ensuring the safety and reliability of technological equipment and machines. It is a significant predictor of equipment condition. Hereat, its probability density functions for reduction gear at a production area and influence human factor on them are studied. It was found that samples of the reduction gear temperature have statistical instability, which correlated with experience of operation and maintenance staff. The more qualified employees are, the lower and stable temperature is. Samples were detected to be like as though mean value and root mean square deviation would be stochastic values themselves with their own distributions. Such modeling permitted to build real confidence intervals and estimate probability of temperature to exceed allowable value. This approach provide means for setting adequate requirements for staff experience and training, reducing downtime, and select suitable reduction gears or operation conditions.