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Welcome to ISSS 2018

Dear Colleagues,

Welcome to ISSS2018 Corvallis at Oregon State University. Welcome also to our partners and collaborators from INCOSE, MITRE, ISEE Systems, Systems Journal, Argonne National Laboratory, IFSR, Systems Dynamics Society, Bertalanffy Centre for the Study of Systems Science, and the College of Exploration.

This year's conference will explore foundational discoveries about the nature of complex systems. These insights are now arising from research in a spectrum of systems disciplines, delivering new understandings in areas such as biology, complexity, politics, ethics, aesthetics, business studies, engineering and general systems theory. We will also look to the future, anticipating and planning for how these insights could drive convergence across the spectrum of systems traditions. Such a convergence has the potential to:

- enhance our capability for multi-, inter- and transdisciplinary working;
- advance the perspectives, insights and methods of the systemologists and others who will help us address the social and personal challenges of globalization, the Anthropocene and the Fourth Industrial Revolution; and
- bring new opportunities to enhance the potential and wellbeing of individuals and communities.

The complexity of the systems we undertake to establish or curate is increasing without limit, and globally systems are rapidly becoming more interconnected and interdependent. This radically increases the risks of instability, insecurity, and critical failures for the projects we undertake and the communities that they aim to serve. However, we are also seeing rapid advances in the systems disciplines, and these insights may be pivotal for generating insight, opportunity and coherence as we co-create a resilient and evolvable society.

ISSS2018 offers the opportunity for a wide diversity of systemologists and others to explore common interests and challenges, learn from each other, align and consolidate progress, and gather inspiration, collaborators and momentum for future work in the systems sciences.

To facilitate this the morning programme is organized into themes, with Monday providing an overview of the current systems landscape from the perspective of the ISSS, industry and academia, Tuesday on systems principles in Engineering and Practice, Wednesday on systems principles in Society and Culture, Thursday on systems principles in Science and Business, and Friday on building a prioritised research agenda and forming teams for future research in the systems sciences.

A special feature of the program design is that, in response to member requests, we have reserved the last plenary slots of Monday and Wednesday morning to provide opportunities for member networking.

The afternoon programme is devoted to parallel tracks of SIG sessions and workshops. In response to member requests we have increased the number of workshops available.. One of these is a special workshop event to collect inputs from attendees for a systems science research programme, collecting inputs on challenges, urgent needs, and potential collaborators, leading up to the definition of a research agenda and formation of research teams on Friday morning. This special workshop will be repeated every day, and hopefully this will give everyone a chance to engage with it. Please come along and give your inputs

to this important initiative. A related event will take place on Monday afternoon, when there will be a facilitated conversation around the needs and challenges for “Systems Engineering of the Future”.

We hope that you will enjoy the conference and the surroundings, and have a rich and fruitful experience at ISSS2018.

David Rousseau
President, ISSS (2017-2018)

Javier Calvo-Amodio
VP for Conferences, ISSS (2017-2018)

Conference Program and Schedule
ISSS 2018

Sunday: July 22, 2018 – Pre-Conference Workshops

REGISTRATION DESK OPEN 08:30 – 18:00 (Foyer – Kelley Engineering Center, Oregon State University, Corvallis)

	Workshop **3308** Scientific & Philosophical Foundations for Systems Engineering and a Possible Basis for the Unification of Systems Science Kent D. Palmer; Kenneth Llloyd.	**Room: KEC 1001**
1.	**Workshops** **3300, 3401 and 3402** Knowledge Mapping for Literature Reviews: A Science of Conceptual Systems Approach Steven E. Wallis	**Room: KEC 1005**
2.	**3340** Nurturing Living Systems Awareness through Movement, Music, Creativity, and Play Widhalm, Barbara	**Room: KEC1007**

Evening Opening Reception in Kelley Engineering Center, Oregon State Campus. Tickets available at registration desk ($15).

Monday: July 23, 2018

MORNING REGISTRATION DESK OPEN 08:00 – 18:00 (Foyer, CH2M Hill Alumni Center, 725 SW 26th Street, Corvallis)

07:45 to 08:45 ISSS Roundtable Discussion, Sue Gabriele **(**CH2M Hill, Room: Johnson Lounge**).**
08:00 to 08:45 Open Café, Open for Conversations before the plenaries each morning. (CH2M Hill, Cascade Ballroom)

09:00 Welcome and Announcements

09:15
WELCOME REMARKS
Professor Cindy Sager, Vice President for Research at Oregon State University.

09:25
THE FUTURE OF SYSTEMOLOGY: CONVERGENCE, TRANSDISCIPLINARITY AND IMPACT
Dr David Rousseau, current President of the ISSS, a Visiting Fellow in the Centre of Systems Studies in the University of Hull, and Scientific Council Member of the Bertalanffy Centre for the Study of Systems Science.

10:00
SHAPING SYSTEMS ENGINEERING FOR THE FUTURE
Garry Roedler, current President of the International Council on Systems Engineering (INCOSE), and Fellow and Engineering Outreach Program Manager at Lockheed Martin.

11:15
SYSTEMS SCIENCE EDUCATION AND RESEARCH IN ACADEMIA: PAST, PRESENT, AND FUTURE
Peter Roolf and Prof. Wayne Wakeland, current Director of the longest-running Systems Science PhD Programme in the history of the systems sciences. This programme has been ongoing for nearly five decades at Portland State University. Peter is a current PhD student in this programme.

12:00
NETWORKING OPPORTUNITY
Facilitators: David Rousseau and Javier Calvo-Amodio

13:45 to 15:15 Parallel Sessions – CH2M Hill Center					
1	**2**	**3**	**4**	**5**	**6**
Willamette 115A SIG: Designing Educational Systems Chair: Amber Elkins **3428** A Proposed Methodology for Developing Systems Thinking Lessons By and For Non-Experts Taylor, Seth; Calvo-Amodio, Javier; Well, Jay **3411** Learning with Nature's Pattern Language: A Pedagogical Framework for Designing Learning Experiences as Vibrant Living Systems Widhalm, Barbara **3305** Systems Concepts in the Fourth Generation Evaluation Methodology Torres-Cuello, Maria Alejandra; Pinzon-Salcedo, Luis Arturo	**Willamette 115B** SIG: Systems Engineering and Systems Modelling Chair: Sage Kittleman **3446** Framework for Generating Trade Spaces for Complexity Allocation in Complex Systems Bonilla, Farouk Harold **3341** Vision for Knowledge-centric Integrated Systems Modelling Natarajan, Swaminathan **3452** A Systems Analysis of Communication: Defining the Nature of and Principles for Communication within Human Activity Systems Kittelman, Sage McKenzie	**Trysting Tree** SIG: Systems Psychology and Mental Health Chair: Pamela Buckle **3336** Towards Fractal Properties of Cognitive Processes in the Human Brain under the Complexity Science Approach Lina, Ixchel Reyes; Contreras Troya, Teresa I.; Morales Metamoros, Oswaldo ; Rojas Ramirez, Jorge A.; Moreno Escobar, Jesus J. **3394** Professional Identity as a System in Integrated Healthcare: A Preliminary Report Johnson, Randy Glenn **3423** What it Means to Do Research on the Psychology of Systems for ISSS: Basic Principles Buckle, Pamela	**Burlingham** SIG: Systems Pathology Chair: Len R. Troncale **3450** Motion Sickness as a Metaphor Leonard, Allenna **3441** Linking Lists of Reoccuring Human Systems Problems and Prescriptive SPT Solutions Troncale, Len Raphael **3442** Status Report on Initiating an International Society for Systems Pathology Troncale, Len Raphael	**Elle** Workshop Chair: Gary Metcalf **3359** Handbook of Systems Science Metcalf, Gary	**Johnson Lounge** Workshop Chair: David Rousseau and Javier Calvo 3478 Identifying the Systems Science Research Agenda for the Future. This workshop is repeated every afternoon Monday to Thursday.

15:45 – 17:45 Parallel Sessions – Parallel Sessions – CH2M Hill Center					
1	**2**	**3**	**4**	**5**	**6**
Willamette 115A SIG: Action Research Chair: Roelien Goede **3362** Methodology for the Development of an Agent-Based Model to Support Logistical Problems of Refugees in the Netherlands Goede, Roelien; van Burken, Christine Boshuijzen **3460** Bridging the Distance between the View from the Balcony and Clients' Perspectives in Framing Action Research Dissertation Projects: Systemic Wisdom from the Sufi Story of Fire Pinsker, Eve C **3350** Research for Living: Forum Theatre as Second-Order Cybernetic Action Research Scholte, Thomas Donald	**Willamette 115B** SIG: Systems Engineering and Systems Modelling and Digital Services Chair: Anand Kumar **3453** Management-led Participative Continuous Process Improvement Joshi, Siddhesh Pradeep; Calvo-Amodio, Javier **3445** Understanding Human Activity Systems: A Study of Team Using General Systems Science Principles Wang, Siqi **3364** Clarifying and Supporting Root Causes in Organization Behaviour: Toward a Science of Social Systems Gabriele, Susan Farr **3329** Digital Disruption in the Context of Social Welfare Kumar, Anand; Reddypogu, Jose Kumar; Lokku, Doji Samson; Zope, Nikhil Ravindranath	**Trysting Tree** SIG: Health and Systems Thinking Chair: Thomas Wong **3431** A Successful Use of Systems Approaches in Cross-disciplinary Healthcare Improvement Smith, Gary Robert; Johnson, Julian; Harding, Alan; Beck, Fran **3390** The ∞ Influence Model of Multidimensional Intelligences Linguistics as an Innovation in Linguistics of General Systems Theory Lin, Kingkong **3433** Applying Process View to Active and Healthy Aging (AHA) Problems Chroust, Gerhard; Aumayr, Georg **3313** Perfect Technology of the Human Being Crespo, Fabiana	**Burlingham** SIG: Socio-Ecological Systems Chair: Stefan Blachfellner **3444** Opportunities and Limits of an Eco-Systems View beyond Socio-Ecological Systems Blachfellner, Stefan F. **3385** Patterns as Connectors of Multiple Realities Finidori, Helene **3430** Models of Second-Order Social Change Silverman, Howard **3449** Sea and Life Barrera, Ricardo; De Vreese, Patricia; Sarka, Eva; Valladares, Javier.	**Elle** Workshop Chair: Sara Castiglioni **3321** Innovation and Optimization: Effective Paper Presentations Castiglioni, Sara Noemi	**Johnson Lounge** Workshop Chair: Bill Miller **3480** Systems Engineering of the Future
Dinner available at nearby local restaurants					

Tuesday: July 24, 2018

MORNING REGISTRATION DESK OPEN 08:00 – 18:00 (Foyer, CH2M Hill Alumni Center, 725 SW 26th Street, Corvallis)

07:45 to 08:45 ISSS Roundtable Discussion, Sue Gabriele **(**CH2M Hill, Room: Johnson Lounge**).**
08:00 to 08:45 Open Café, Open for Conversations before the plenaries each morning. (CH2M Hill, Cascade Ballroom)

[redacted]

09:00 Welcome and Announcements

09:15
SYSTEMS ENGINEERING POSTULATES, PRINCIPLES, AND HYPOTHESES RELATED TO SYSTEMS PRINCIPLES
Dr Michael Watson, NASA's Marshall Space Flight Center (MSFC) System Engineering Management Office, and lead for the NASA Systems Engineering Research Consortium.

10:00
ACQUISITION SYSTEM DEVELOPMENT: A COMPLEX SYSTEMS GOVERNANCE (CSG) PERSPECTIVE
Prof. Charles Keating, Professor of Engineering Management and Systems Engineering in Old Dominion University and Director for the National Centers for System of Systems Engineering.

[redacted]

11:15
PRINCIPLES FOR DESIGNING HUMAN ACTIVITY SYSTEMS
Dr Javier Calvo-Amodio, Assistant Professor of Industrial and Manufacturing Engineering at Oregon State University, Director of the Change and Reliable Systems Engineering and Management (CaRSEM) research lab at OSU, and Chair of the ISSS SIG on Systems Modelling and Systems Engineering.

12:00
THE SYSTEM PHENOMENON, HAMILTON'S PRINCIPLE, AND NOETHER'S THEOREM AS A BASIS FOR SYSTEM SCIENCE
William D. (Bill) Schindel, President of ICTT System Sciences, President of the INCOSE Crossroads of America Chapter, Chair of the INCOSE Patterns Working Group.

[redacted]

13:45 to 15:15 Parallel Sessions – CH2M Hill Center					
1	**2**	**3**	**4**	**5**	**6**
Willamette 115A SIG: Systems Applications to Business and Industry Chair: Isiais Badillo-Pina **3290** Human Capital Management Innovation for Mexican Lodging through Autopoiesis and Self-Organisation Nuñez-Ríos, Juan Enrique; Sánchez-García, Jacqueline Yvette; Coria-Paez, Ana Lilia; Tejeida-Padilla, Ricardo **3327** Innovation in Services: A Viable System Model Design for Tourist MSMEs Integration in Mexico Sánchez-García, Jacqueline Yvette; Nuñez-Ríos, Juan E.; Badillo-Piña, Isaias José **3383** Systemic Integration of Space Integrations in Mexico Leon Vega, Cirilo Gabino; Hinojosa, Luís A. Itirri; Villarreal, Elvira Ávalos	**Willamette 115B** Workshop Chair: Kambiz Maani **3292** Multi-Stakeholder Decision-Making in Complex Scenarios: Using Systems Thinking Maani, Kambiz	**Trysting Tree** SIG: Leadership and Systemic Innovation (LaSI) Chair: Alexander Laszlo **3382** Leadership and Systemic Innovation: Socio-Technical Systems, Ecological Systems, and Evolutionary Systems Design Laszlo, Alexander **3392** Measuring the Level of Political System Literacy Through the Election Pledges of South Korean Electoral Candidates Shim(Sim), Yeon-soo(Youn-soo)	**Burlingham** Continuing the IFSR Conversation Chair: Shankar Sankaran and Gerhard Chroust **3281** Active and Healthy Ageing Workshop, Part 1. Follow-on conversation from Linz. Sankaran, Shankar; Chroust, Gerhard, Allenna Leonard, Pam Buckle	**Elle** Workshop Chair: Anthony Friend **3478** The How, rather than the Why, of Entropy Accounting	**Johnson Lounge** Workshop Chair: David Rousseau and Javier Calvo 3478 Identifying the Systems Science Research Agenda for the Future. This workshop is repeated every afternoon Monday to Thursday.

15:45 – 17:45 Parallel Sessions – Parallel Sessions – CH2M Hill Center					
1	**2**	**3**	**4**	**5**	**6**
Willamette 115A SIG: Socio-Ecological Systems Chair: Stefan Blachfellner **3366** A System Dynamics Model of the Fire Suppression "Tipping Point" Thompson, Matthew P; Masarie, Alex; Dunn, C J; Wei, Yu; Calkin, David E. **3351** From Mosaic to Systematic: Applying Systems Thinking to Water Resource Management Burgess, Richard Allen; Horbatuck, Keith; Beruvides, Mario **3332** Sustainability of Socio-ecological Systems and Soft Systemic Approach Fan, Dongping; Fu, Qiang **3337** Comments on the Model-Building Phase of Soft Systems Methodology in the New Millennium: A Review of Publications 2000-2017 Liu, Yiyu; Dong, Chunyu	**Willamette 115B** SIG: Research Toward a General Theory of Systems Chair: David Rousseau **3349** A Theory of Systems Langford, Gary **3440** Natural Systems Phenomena are Already Deep Applications of the Systems Processes Theory (SPT) Troncale, Len Raphael **3311** A Mapping of the Conceptual Models of Systems to its Architecture Kumar, Anand; Lokku, Doji Samson; Swaminathan Natarajan; Nori, Kesav Vithal. **3372** From Survivability to Flourishing and Sustainability to Thrivability: An Emerging Conceptual Framework Swartz, Jeremy David	**Trysting Tree** SIG: Critical Systems Thinking Chair: Pam Sydelko **3315** Cascading Risks of Climate Change on Water Security and the Potential for Rapid Adapatation McIntyre-Mills, Janet Judy **3299** Developing Critical Reflexivity to Improve our Understanding of Complex Systems Pinzon-Salcedo, Luis Arturo; Ramirez-Tovar, Silvia Elena **3421** Exploring Practical and Ethical Implications of Applying Systems Thinking to Real-world Problems Preiser, Rika; Woermann, M. **3443** Developing a Systemic Program Evaluation Methodology: A Critical Systems Perspective Torres, Maria Alejandra	**Burlingham** Continuing the IFSR Conversation Chair: Shankar Sankaran and Gerhard Chroust **3281** Active and Healthy Ageing Workshop, Part 2. Sankaran, Shankar; Chroust, Gerhard, Allenna Leonard, Pam Buckle	**Elle** SIG: Science, Spirituality and Systems Science Chair: Delia Pembrey MacNamara **3339** Time Has Gone Today Piontek, Frank A. **3477** Robot Futures versus Co-ops in Nature: Transcending Singularity Li, Jon **3476** AI: Creating G.O.D. or G.O.O.D.? MacNamara, Delia Pembrey	**Johnson Lounge** Student SIG Meeting Room Chair: Amber Elkins
Dinner available at nearby local restaurants **18:00 Council Meeting (Board, SIG chairs, Trustees) – Johnson Lounge**					

Wednesday: July 25, 2018

MORNING REGISTRATION DESK OPEN 08:00 – 18:00 (Foyer, CH2M Hill Alumni Center, 725 SW 26th Street, Corvallis)

07:45 to 08:45 ISSS Roundtable Discussion, Sue Gabriele **(**CH2M Hill, Room: Johnson Lounge**).**
08:00 to 08:45 Open Café, Open for Conversations before the plenaries each morning. (CH2M Hill, Cascade Ballroom)

[redacted]

09:00 Welcome and Announcements

09:15
ART, ARCHITECTURE, AND SYSTEMS THINKING
Tom McDermott, Deputy Director and Director of Research at Georgia Tech Research Institute.

10:00
SYSTEMATIC ETHICS AND ETHICAL SYSTEMS
Dr John Vodonick, Director of Two Ravens Consulting and Chair of the ISSS SIG on "Systemic Ethics".

[redacted]

11:15
ETHICAL IMPERATIVES IN THE ERA OF CLIMATE CHANGE: LESSONS FROM STANDING ROCK.
Dr Debora Hammond, Professor of Interdisciplinary Studies at the Hutchins School of Liberal Studies in Sonoma State University, former Program Director of the Hutchins School's MA in Organization Development, and a Past President of the ISSS.

12:00
NETWORKING OPPORTUNITY
Facilitators: Dr David Rousseau and Dr Javier Calvo-Amodio

[redacted]

13:45 to 15:15 Parallel Sessions – CH2M Hill Center					
1	**2**	**3**	**4**	**5**	**6**
Willamette 115A SIG: Health and Systems Thinking Chair: Thomas Wong **3396** Modelling Health as an Emergent Property of Socio-ecological Systems: An Agent-based Approach Mallery, David M.; Bunch, Martin J. **3343** Attempts in co-relating the theory of Tree of Life, Taichi Yin-Yang Five Elements Trinity i±1 System, Traditional Chinese Medicine Differential Diagnosis-Cure Process, Schemas Theory, Relational Science, DSRP Theory, Five Aggregates of Human Mind System by Buddha, and Cognitive Process of Consciousness Wong, Thomas Sui Leung; Huang, E C Yan **3283** Spectrum Distribution for the Satellite System Leon Vega, Cirilo Gabino	**Willamette 115B** SIG: Systems Engineering and Systems Modelling Chair: Javier Calvo **3427** Organizing, Acquiring, and Architecting for Strategically Proactive Obsolescence Management of Mission Critical Avionics and Electronic Control Systems Morgan, Markeeva **3457** Evaluating the Impacts of Drought Conditions in California with an Emphasis on Sanitary Sewer Overflows Gabriele, Antony **3286** Seismic Lens-Type Shear Panel Damper for Bridges and Buildings: Innovation and Optimization in Nature and Design to Engineering Fields Takaku, Tatsumasa	**Trysting Tree** Continuing the IFSR Conversation Chairs: Swami Natarajan, Anand Kumar **3335** Linking a Systems Science Framework to Systemic Practice and Systems Engineering. Part 1. Follow-on Conversation from Linz. Natarajan, Swaminathan; Kumar, Anand; Smith, Gary; Makar, Jennifer; Metcalf, Gary; Mobus, George	**Burlingham** Workshop Chair: William Toth **3466** Definitions and Characteristics of Various Safety and Security System Domains Toth, William Joseph	**Elle** SIG: Systems Applications Chair: Delia Pembrey MacNamara **3376** Violence and Impasse MacGill, Victor Ronald David **3472** Biocybernetics and Sustainability: Rules of Nature as a Model for Viability Harrer-Puchner, Gabriele; Goellinger, Thomas **3310** The Mind as an Artifact Bigirimana, Stanislas	**Johnson Lounge** Workshop Chair: David Rousseau and Javier Calvo **3478** Identifying the Systems Science Research Agenda for the Future. This workshop is repeated every afternoon Monday to Thursday.

15:45 – 17:45 Parallel Sessions – Parallel Sessions – CH2M Hill Center					
1	**2**	**3**	**4**	**5**	**6**
Willamette 115A SIG: Systems Engineering and Systems Modelling Chair: Sage Kittleman **3288** Using Interactive Management to Explore the Factors Causing Delay of Modification Project in a South African Power Station Ntoyanto, Sikholiwe; Tuan, Nien-Tsu **3416** Evaluating the Effectiveness of Remote Alcohol Monitor Interventions in Reducing Motor Vehicle Crashes Involving Drunk Driving in Traffic Systems in the United States, Texas, and CA. Elkins, Amber D.; McDonald, G. Wade; Gorman, Dennis M.; Shipp, Eva M.; Wunderlich, Robert C.; Lawley, Mark A. **3393** Systems Approach: Concept Proposal to Develop Saudi Arabia Low-Complexity - Defense-Spare-Parts Manufacturing Industries, Utilizing Technology Transfers and Business Incubator Fallatah, Basem Abdullrahman **3371** Heterarchies and the Grid Sparber, Joshua Hamlin	**Willamette 115B** SIG: Research Toward a General Theory of Systems Chair: David Rousseau **3352** A Requisite Variety Based Framework to Increase System Resilience to Emergent Perturbations Keating, Chuck; Katina, Polinpapilinho **3324** Foundational Concepts Underlying a Formal Mathematical Basis for Systems Science Kenneth Lloyd **3439** Systems Processes Theory (SPT) as a Candidate General Systems Theory, Prototype Systems Science, & Knowledge Base of Widespread Utility Troncale, Len Raphael **3399** Speculative Realists Question Reality before Homo Sapiens and after Extinction Takahashi, Kazuyuki I.	**Trysting Tree** Continuing the IFSR Conversation hairs: Swami Natarajan, Anand Kumar **3335** Linking a Systems Science Framework to Systemic Practice and Systems Engineering. Part 2. Follow-on Conversation from Linz. Natarajan, Swaminathan; Kumar, Anand; Smith, Gary; Makar, Jennifer; Metcalf, Gary; Mobus, George	**Burlingham** SIG: Systems Applications to Business and Industry Chair: Shankar Sankaran **3448** Technological Surveillance Competence for Entrepreneurs: A key factor to boost the number of science-based startups Castiglioni, Sara Noemi; Adam, C. **3285** Governance of Organizational Project Management and Megaprojects using the Viable Governance Model Müller, Ralf; Drouin, Nathalie; Shankar Sankaran **3283** Spectrum Distribution for the Satellite System Leon Vega, Cirilo Gabino **3361** MICE Network Topology as an Innovation in the Complementarity of a SSM Application Badillo-Piña, Isaias José; Ramírez-Gutiérrez, Ana G.; Tejeida-Padilla, Ricardo; Morales-Matamoros, O.; Romero-García, L. Elizabeth.	**Elle** Workshop Chair: Fabiana Crespo **3322** Tantra: The Most Powerful Human Technology Crespo, Fabiana	**Johnson Lounge** Student SIG Meeting Room Chair: Amber Elkins
Dinner available at nearby local restaurants					

Johnson Lounge — Workshop: **3418** Batesonian and Rosennean Brainwaves, Judith Rosen and Nora Bateson.

Thursday: July 26, 2018

MORNING REGISTRATION DESK OPEN 08:00 – 18:00 (Foyer, CH2M Hill Alumni Center, 725 SW 26th Street, Corvallis)

07:45 to 08:45 ISSS Roundtable Discussion, Sue Gabriele **(**CH2M Hill, Room: Johnson Lounge**).**
08:00 to 08:45 Open Café, Open for Conversations before the plenaries each morning. (CH2M Hill, Cascade Ballroom)

09:00 Welcome and Announcements

09:15
DEFINING SIX KEY ORGANIZING PRINCIPLES FOR A TYPOLOGY OF GENERAL COMPLEX ADAPTIVE SYSTEM FEATURES AND DYNAMICS.
Dr Rika Preiser, Senior Researcher in the Centre for Complex Systems in Transition at the University of Stellanbosch, South Africa.

10:00
RECONSTRUCTABILITY ANALYSIS: A SYSTEMS SCIENCE DATA MODELING METHODOLOGY
Prof. Martin Zwick, past Director of the Systems Science PhD Program at Portland State University.

11:15
DESIGNING SUSTAINABLY AGILE AND RESILIENT ORGANISATIONS
Dr Linda Holbeche, Co-Director of the Holbeche Partnership, Adjunct Professor at Imperial College London, a Visiting Professor at City University's Cass Business School, at the University of Derby, and at London Guildhall Faculty of Business and Law where she is Co-Director of the Centre for Progressive Leadership

12:00
REFLECTIONS OF A BIOLOGIST ON SOME INTERSECTIONS BETWEEN BIOLOGY, SYSTEMS SCIENCE, AND BIOMIMICRY/BIOMIMETICS/BIOINSPIRED DESIGN
Dr Peter Niewiarowski, University of Akron Biomimicry Research and Innovation Center.

13:45 to 15:15 Parallel Sessions – CH2M Hill Center					
1	**2**	**3**	**4**	**5**	**6**
Willamette 115A SIG: Human Systems Inquiry Chair: Daryl Kulak **3468** Case Study of Soft Systems Methodology Applied to Small Company Scaling Up Kulak, Daryl **3346** A Study on the Learning Mode of Tourism Experiences Lu, Hsin-Chuan **3377** Toward a Transdisciplinary Framework of the Field of Study of Communication based on the Cybersystemic Approach Badillo-Piña, Isaias; Murillo-Sandoval, Sandra Leticia; Tejeida-Padilla, Ricardo; Peón-Escalante, Ignacio Enrique	**Willamette 115B** SIG: Systems Philosophy and GST Chair: David Rousseau **3436** A Systematic Worldview Model and its Generalization as a General Inquiry Framework Rousseau, David; Billingham, Julie **3342** Systems Theory and the Metaphysics of Composition Zwick, Martin **3412** Systems Philosophy and Engineering Thermodynamics Bristol, Terry	**Trysting Tree** SIG: Reconstructability Analysis Chair: Joe Fusion **3469** Data Mining and Analysis with the OCCAM Software System Fusion, Joe **3447** Interpreting RA Models of Note-Onset Interactions to Discern and Explain Clave Direction Vurkaç, Mehmet **3456** Beyond Spatial Autocorrelation: A Novel Approach using Reconstructability Analysis Percy, David; Zwick , Martin	**Burlingham** Workshop Chair: Helene Finidori **3380** Co-exploring the Role of Patterns in Adapting the Original Spirit of General Systems Theory to the Needs of our Time: Towards Systems Literacy, Part 1. Finidori, Helene; Tuddenham, Peter David; Troncale, Len **3438** Relations of SPT to Systems & Pattern Literacy: Odum Models of Ocean, Freshwaters, and Forest Troncale, Len Raphael	**Elle** **OPEN ROOM**	**Johnson Lounge** Workshop Chair: David Rousseau and Javier Calvo **3478** Identifying the Systems Science Research Agenda for the Future This workshop is repeated every afternoon Monday to Thursday.

15:45 – 17:45 Parallel Sessions – Parallel Sessions – CH2M Hill Center					
1	**2**	**3**	**4**	**5**	**6**
Willamette 115A SIG: Organisational Transformation and Social Change Chair: Louis Klein **3330** The Challenge of Complexity in Society: Meaning Making at the Edge of Chaos Jacobs, Marty **3309** Communities-of-Practice and Systems Theory: A Case Study Jordan, Robert Anthony **3435** Narratives of Ingenuity: Using Stories of Coworking Spaces to See Systems Change Rosencrans, Kendra **3360** Killing the Modern Theatre: A New Medium to Augment Stage Performances Buckner, Richard Lee	**Willamette 115B** SIG: Systems Philosophy Chair: David Rousseau **3323** Advances in Schemas Theory as well as Special Systems Theory Palmer, Kent Duane **3347** Establishing an Umbrella Philosophy - Required to Underpin General Systems Unification in a Singular Encompassing Paradigm Rose, James N. **3271** Actionable Knowledge Mapping to Accelerate Interdisciplinary Collaborations for Research and Practice Wallis, Steven E. **3475** Recent Progress in R-Theory: An Integral Philosophy of Nature Kineman, John J.	**Trysting Tree** SIG: Reconstructability Analysis Chair: Martin Zwick **3333** Reconstructability and Dynamics of Elementary Cellular Automata Zwick, Martin **3373** Predicting Cost of Care in Total Hip and Knee Replacement Surgery with Reconstructability Analysis Froemke, Cecily; Zwick, Martin **3381** Prediction Comparison of Bayesian Nework and Reconstructability Analysis Applied to Electric Grid Data: Preliminary Results Harris, Marcus; Zwick, Martin **3391** Granularity Measures on the Lattice of System Structure Models Joslyn, Cliff; Purvine, Emilie; Nowak, Katy	**Burlingham** Workshop Chair: Helene Finidori **3380** Co-exploring the Role of Patterns in Adapting the Original Spirit of General Systems Theory to the Needs of our Time: Towards Systems Literacy, Part 2. Finidori, Helene; Tuddenham, Peter David; Troncale, Len **3438** Relations of SPT to Systems & Pattern Literacy: Odum Models of Ocean, Freshwaters, and Forest Troncale, Len Raphael	**Elle** Workshop Chair: Thomas Wong **3** **317** Systems Basics: Learning from the Principles Embedded in Nature to Optimize the Principles affecting Insomnia and Consciousness: The Systems Thinking in the Eastern Taichi Yin-Yang Five Elements System in Traditional Chinese Medicine and Five Aggregate Human Mind System by Buddha. Wong, Thomas Sui Leung	**Johnson Lounge** Student SIG Meeting Room Chair: Amber Elkins

18:00 – 21:00	**ISSS Conference Dinner** **Tyee Winery, Corvallis. Buses will leave from CH2M Hill Alumni Center at 6 pm** **Tickets available at the Registration Desk until Monday evening ($35).**

Friday: July 27, 2018

MORNING REGISTRATION DESK OPEN 08:00 – 18:00 (Foyer, CH2M Hill Alumni Center, 725 SW 26th Street, Corvallis)

07:45 to 08:45 ISSS Roundtable Discussion, Sue Gabriele **(**CH2M Hill, Room: Johnson Lounge**).**
08:00 to 08:45 Open Café, Open for Conversations before the plenaries each morning. (CH2M Hill, Cascade Ballroom)

09:00 Announcements

09:15
IFSR PRESENTATION
Stefan Blachfellner and Louis Klein

09:25

THE FUTURE OF SYSTEMOLOGY

Dr David Rousseau and Dr Javier Calvo-Amodio

The morning will be devoted to integrating the inputs from the plenaries, SIG presentations and special workshops into a vision and action plan for systems research. This will be an interactive session involving audience participation and on-stage facilitators.

11:15
ISSS ANNUAL GENERAL MEETING -- MEMBERSHIP MEETING – ALL WELCOME
Chairs: Dr David Rousseau and Dr Jennifer Wilby

12:00
NATURE'S ENDURING PATTERNS
Peter Tuddenham, Incoming President, ISSS

13:30 Post Conference Feedback and Planning for 2019. Chairs: Peter Tuddenham and Jennifer Wilby

14:30 Field Trip to the Forest, sign up at the Registration Desk.

Plenary Speakers

MONDAY

Dr. David Rousseau – ISSS President 2018

Dr David Rousseau is the President of the ISSS. He is the Director of the Centre for Systems Philosophy (UK), a Visiting Fellow of the Centre for Systems Studies in the University of Hull (UK), and member of the Scientific Council of the Bertalanffy Centre for the Study of Systems Science (Austria), an Honorary Research Fellow of the Alister Hardy Centre in the University of Wales TSD, and a Fellow of the Royal Society of Arts (UK). He is the Chair of the ISSS SIGs on 'Systems Philosophy' and on 'Research towards General Theories of Systems'. He leads the 'Systems Philosophy for Systems Engineering' project in the Systems Science Working Group of INCOSE, and he is a member of the core team of the INCOSE project "Systems Engineering of the Future". He is a past Editor-in-Chief of the journal Systema (2013-2017). His current research is focused on developing scientific principles for a general theory of systems, and developing systems methods for exploratory science.

Garry Roedler – INCOSE President

Garry Roedler is a Senior Fellow and the Engineering Outreach Program Manager for Lockheed Martin and the President of the International Council on Systems Engineering (INCOSE). He has over 33 years of systems engineering (SE) experience that spans the full life cycle and includes technical leadership roles in both programs and business functions. He is also an INCOSE Fellow, holds systems engineering certification at the Expert Systems Engineering Professional (ESEP) level, and received the INCOSE Founders Award. Garry has held key leadership roles in several industry associations and standards development organizations, including editor of ISO/IEC/IEEE 15288, Systems Life Cycle Processes and several other standards; and key editor roles for the Systems Engineering Body of Knowledge (SEBoK) and the INCOSE Systems Engineering Handbook. This unique set of roles has enabled Garry to influence the technical co-evolution and consistency of these key Systems Engineering and System of Systems resources.

Peter Roolf

Peter is a systems science PhD student at Portland State University where he currently studies general systems theory, complex adaptive systems, and computer modeling & simulation. He earned his Bachelor's degree in Emergency Medicine from the University of Pittsburgh, gained valuable field experience working as a paramedic in the United States and Kuwait, and began to consider the interaction of social, politico-economic, and healthcare systems while serving as the lead consultant for an emergency medical service (EMS) development project in Kerala, India. Leveraging his ability to work in crisis situations and resource constrained systems he decided to focus his problem solving abilities on these larger scale, systemic issues. His current interests include: resilience, transformation, and management of social-ecological systems (SES), systems dynamics modeling, reconstructability analysis, network modeling, ethics and value systems, community and infrastructure development, and economics. Peter's ultimate goal is to assist local and regional communities, governments, and organizations in becoming more resilient, self-sufficient, and healthy in a changing world.

Prof. Wayne Wakeland

Wayne Wakeland is Professor and Systems Science Program Chair at Portland State University. He earned a B.S. and a Master of Engineering at Harvey Mudd College (1973); and a Ph.D. in Systems Science at Portland State U. (1977). He teaches computer simulation methods, and recent research has focused on recovery from concussion, health policy related to drug diversion and abuse, and environmental/ecological sustainability. Emerging collaborative research includes the dynamics of toxic stress in children, and computational models to study complications during human pregnancy.

TUESDAY

Dr. Michael Watson

Michael D. Watson is in the National Aeronautics and Space Administration (NASA) Marshall Space Flight Center (MSFC) System Engineering Management Office. He is leading the NASA Systems Engineering Research Consortium responsible for definition of elegant product focused systems engineering. He has served as the Space Launch System (SLS) Lead Discipline Engineer for Operations Engineering. He started his career with NASA developing International Space Station (ISS) operations capabilities. He also worked to develop remote operations support capabilities for the Spacelab Program in the United States, Europe, and Japan. He subsequently served as Chief of the Optics Branch responsible for the fabrication of large x-ray telescope mirrors, diffractive optics, and telescope systems. He served as Chief of the Integrated Systems Health Management (ISHM) and Sensors Branch and led a NASA team defining Vehicle Management System capabilities for human missions to Mars. His branch work included the definition of ISHM capabilities for the Ares family of launch vehicles. He graduated with a BSEE from the University of Kentucky in 1987 and obtained his MSE in Electrical and Computer Engineering (1996) and Ph.D. in Electrical and Computer Engineering (2005) from the University of Alabama in Huntsville.

Prof. Charles Keating

Chuck is a Professor in the Engineering Management and Systems Engineering department at Old Dominion University. A faculty member since 1994, he also serves as the Director for the National Centers for System of Systems Engineering (NCSOSE) and focuses on teaching and research in the areas of Systems Engineering, System of System of Systems Engineering, Management Cybernetics, and Complex System Governance. He is a Fellow and Past President of the American Society for Engineering Management and in 2015 was awarded the society's most prestigious award (the Sarchet Award) for his pioneering efforts in the field. He has authored over 110 peer reviewed papers, generated over $20M in research funding, and graduated 25 Ph.D.s. His research has spanned a variety of organizations including defense, security, aerospace, healthcare, R&D, and automotive. Prior to joining the faculty at ODU he served in leadership and technical engineering management positions for over 12 years in both the U.S. Army and private industry. He holds a B.S. in Engineering from the United States Military Academy (West Point), a M.A. in Management from Central Michigan University, and a Ph.D. in Engineering Management from Old Dominion University. He is a member of the American Society for Engineering Management and the International Council on Systems Engineering.

Dr. Javier Calvo-Amodio

Javier Calvo-Amodio is an assistant professor of Industrial and Manufacturing Engineering at Oregon State University, where he directs the Change and Reliable Systems Engineering and Management Research Group (CaRSEM). He received his Ph.D. in Systems and Engineering Management from Texas Tech University, his MS in Business Management from the University of Hull in the United Kingdom, and his B.S. in Industrial and Systems Engineering from Tecnológico de Monterrey in Mexico. Javier's research focuses on developing fundamental understanding of how to engineer and manage systemic change in organizations by combining engineering management, industrial engineering, and systems science. His research group works with Oregon's industry, state agencies, and NSF to derive fundamental theory and test how organizations can engineer and maintain systemic change under an action-research format.

Mr. William (Bill) D. Schindel

William D. (Bill) Schindel is president of ICTT System Sciences, and has been active in systems engineering for four decades. His engineering career began in aerospace systems with IBM Federal Systems, included faculty service at Rose-Hulman Institute of Technology, and founding of three systems enterprises. Bill is an INCOSE Fellow, chair of the INCOSE Patterns Working Group, and a member of the lead teams of the INCOSE Model-Based Transformation and Agile Systems Engineering Life Cycle Discovery Project. He is an active member of the ASME Model VVUQ Standards Committee working on guidelines and standards for establishing the credibility of models.

WEDNESDAY

Tom McDermott

Tom McDermott is the Deputy Director of the Systems Engineering Research Center at Stevens Institute of Technology. He previously spent 15 years with Georgia Tech Research Institute including Interim Director and Director of Research, and 18 years with Lockheed Martin including product team manager for the F-22 fighter avionics program. He advises and teaches system architecture concepts, systems thinking, decision-making, and composite skills required at the intersection of leadership and engineering. Tom is a Georgia Tech graduate with degrees in Physics and Electrical Engineering.

Debora Hammond

Debora Hammond is Professor Emerita of Interdisciplinary Studies in the Hutchins School of Liberal Studies at Sonoma State University. Her doctoral work in the history of science was published in 2003 as The Science of Synthesis: Exploring the Social Implications of General Systems Theory. She served as President of the International Society of the Systems Sciences and hosted the annual conference in 2006. In the fall of 2009 she assumed the role of Program Director of the Organization Development MA Program at SSU, which has broadened her interest and experience in the practice of applied systems theory.

Dr. John Vodonick

I teach, write and consult in the areas of corporate social responsibility, change management, organizational design and social ethics. Most organizations come to a place in their evolution when the needs of the stakeholders are not being met and if that continues to be the norm the sustainability of the organization can be in jeopardy. I work with organizations in partnership to understand what the needs of all the stakeholders are and where the organization made a wrong turn. I help with mediating the organizational course so that it becomes more attune to its environment and the goals of the stakeholders. I spent my undergraduate years pursuing a business degree and then followed that up with a law degree a masters degree in ethics and social theory and a doctorate in Organizational Systems. I am a high altitude mountain climber, a technical diver, a pilot and a reasonably good cook.

THURSDAY

Dr Rika Preiser

My research explores the conceptual development of complexity and how the study of the features and dynamics of Complex Adaptive Systems inform novel ways for thinking and anticipating more equitable social-ecological transformation processes toward resilient Anthropocene futures.

Prof. Martin Zwick

Martin Zwick was awarded his Ph.D. in Biophysics at MIT in 1968, and joined the Biophysics Department faculty of the University of Chicago in 1969. Initially working in crystallography and macromolecular structure, his interests shifted to systems theory and methodology, the field now known as the study of chaos, complexity, and complex adaptive systems. Since 1976 he has been teaching and doing research in the Systems Science PhD Program at Portland State University; during the years 1984-1989 he was director of the program

Dr Linda Holbeche

Linda Holbeche PhD is an experienced leader in a range of business, public and not-for-profit organisations. Her diverse career portfolio includes being Visiting Professor at five UK universities and holding governance positions with a range of private and public organisations and international charities. Now an independent consultant, researcher and author, with over 25 years' experience as a leadership developer, mentor and executive coach, Linda has helped many corporate executives, directors of multi-lateral organisations and university leaders to achieve beneficial outcomes for their organisations and themselves.

Prof. Peter Niewiarowski

My current research includes several broad areas in ecology and evolution. I have active projects in population biology (spotted salamanders), physiological ecology and life history variation (fence lizards), and evolutionary biology/bio-inspired design (geckos). The thread which has always tied these seemingly disparate activities together is a firm foundation in evolutionary theory and analysis. Although I am active (publishing papers, seeking funding and mentoring students) in all of the areas mentioned above, I am focusing much of my energy on new work with geckos, in collaboration with a colleague in Polymer Science. Dr. Dhinojwala's lab was one of the first to produce a synthetic version of the gecko adhesive system with

performance capabilities equaling or exceeding natural toepads. My collaboration with Ali is one of many examples of faculty collaborations within our new Integrated Bioscience PhD program. Please take a look at my research website (http://www.uakron.edu/ib/) for more information on active projects and personnel.

FRIDAY

Peter Tuddenham – ISSS President 2019

Mr. Peter Tuddenham is a co-founder of the College of Exploration, which over the past 20 years has engaged over 15,000 learners worldwide in online collaborative learning environments. Participants from a wide variety of disciplines and countries meet online to explore, learn and create with each other on a variety of ecosystem topics especially ocean, earth and climate systems. He is a Co-Principal Investigator on a number of National Science Foundation and National Oceanic and Atmospheric Administration grants researching and educating the topics of literacy, change and learning in complex national systems. Mr. Tuddenham served for three years as guest faculty in Executive Development at the US Army War College studying personal transformation for mid-career officers. This action research was part of a 5 year research project on the selection and development of 3 and 4 star generals in the US Army. He has studied Systems Design at Saybrook University in San Francisco and the Open University in England. He has a BS in Business from Regis University in Denver Colorado. Before moving to the USA he was commissioned as an officer in the British Army Corps of Royal Engineers from the Royal Military Academy Sandhurst.

Plenary Abstracts

MONDAY

THE FUTURE OF SYSTEMOLOGY: CONVERGENCE, TRANSDISCIPLINARITY AND IMPACT

Dr David Rousseau

We are entering a period of unprecedented technological progress and cultural change. Emerging opportunities provided via big data, the internet of things, autonomous physical systems, AI, renewable energy, low-cost computing, deep learning, 3D printing, genomics, quantum and nano technology, biomimicry etc. will increase the intelligence, capability and connectedness of the products and infrastructure that supports and enables persons and societies. This "Fourth Industrial Revolution" will not only transform our technology space – it will also transform both the kind of society we are and what it means to be an individual in this society. These emerging changes pose a huge challenge for the evolution of Systemology, both in terms of improving our ability to elegantly develop systems of increasing complexity and variety, and in nurturing change that protects or enhances the welfare of our communities.

SHAPING SYSTEMS ENGINEERING FOR THE FUTURE

Garry Roedler

Look around us and what do you see regarding the systems of today? It is hard to find a relevant system that is a stand-alone system, not interconnected to other systems or interacting in some significant way with other systems. And the increases in the functionality of our systems, as well as the level of technology adoption, has continued to outpace our practices to fully harness the technology and technically manage the Systems and Systems of Systems to our greatest advantage. This presentation will look at our current situation and how our environment has changed, providing an understanding of the challenges we are facing with some examples using specific technology areas. It will then provide a look at some of the work in process to advance our processes, practices, and performance of Systems Engineering towards addressing those challenges. This includes working towards the realization of the INCOSE SE Vision 2025, progress being made in the area of Systems of Systems, and changing the way we look at Systems Engineering. And finally it will address what we are doing and need to accomplish within INCOSE to address this change.

SYSTEMS SCIENCE EDUCATION AND RESEARCH IN ACADEMIA: PAST, PRESENT, AND FUTURE

Peter Roolf and Prof. Wayne Wakeland

The roots of systems science can be found in the physical, biological and social sciences, in cybernetics, and in operations research dating from the early to mid-twentieth century. Portland State University launched its graduate program in systems science in 1970, and it is one of the few remaining autonomous such programs. This presentation, collaboratively developed by program faculty, students, and alumni, reprises the history of systems science in academia and provides useful background for understanding the current state of the field. It also identifies recent trends, opportunities, and challenges regarding the future of systems science in higher education. A key feature of the systems field is its reliance on collaboration and teamwork to yield powerful insights into the general and specific nature of complex systems and what can be done to improve their performance. This talk describes the students and their incredible enthusiasm and resourcefulness, discusses the curriculum with emphasis on ideas, theories and methods employed to train well-versed generalists, and gives a sense of student and faculty research. Lastly, this presentation addresses organizational considerations, partnerships, and funding for the future, and suggests ways to strengthen interdisciplinary offerings across the university and to foster a collaborative approach to addressing global challenges.

TUESDAY

SYSTEMS ENGINEERING POSTULATES, PRINCIPLES, AND HYPOTHESES RELATED TO SYSTEMS PRINCIPLES

Dr Michael Watson

The NASA Systems Engineering Research Consortium has generated a set of Systems Engineering Postulates, Principles, and Hypotheses to guide the approach to systems engineering. These Principles guide the engineering of the system and provide guidance in the application of systems engineering processes. Systems Engineering Principles address both the physical system and the integration of the engineering disciplines (i.e., social system) needed to develop and operate the system. System Principles describe the characteristics of the system itself. Various sets of Systems Principles have been reported in literature. The distinction between Systems Engineering Principles and System Principles is an important aspect to understand. The Systems Principles provide the scientific basis of the system and are fundamental to proper engineering of the system. The System Principles are related through this scientific basis of the system to the Systems Engineering Principles. This important relationship will be discussed to provide a more complete picture in understanding the principles of systems and of systems engineering.

COMPLEX SYSTEM GOVERNANCE (CSG)

Prof. Charles Keating

We constantly hear the mantra that our systems (education, transportation, energy, defense, security, healthcare, etc.) are failing. In contrast, Complex System Governance (CSG) starts from the premise that our systems are not failing us, we are failing our systems. In response, CSG seeks to better understand and respond to underlying sources of 'deep system failure'. CSG views system failures as stemming from violations of the laws of system science and cybernetics. This viewpoint opens the possibility for a different level of thinking and corresponding decisions, actions, and interpretations in response to failure. CSG is not offered as a 'silver bullet' or 'magic elixir' promising to cure all ills of failing complex systems. Instead, CSG seeks improved system performance through purposeful design, execution, and evolution of essential system functions. These functions are performed by all complex systems, are governed by inescapable systems laws, and are directly responsible for all system behavior and performance. This discussion of CSG explores four major themes: (1) The nature of the problem domain that our systems must confront, (2) An alternative view of system failure and some ineffective popular responses, (3) Introduction to CSG as an emerging approach to stop failing our systems, and (4) three critical challenges we must address to get out of the mess.

PRINCIPLES FOR DESIGNING HUMAN ACTIVITY SYSTEMS

Dr Javier Calvo-Amodio

The scope, cost, and time needed to design and realize complex systems continues to rise as technological advances allow adding more functionality to our designs. While engineering organizations have achieved great success in design and realization of complex systems methods, they still encounter barriers when forming the human activity systems that will design, realize, and manage their complex engineered systems. Human activity systems exist within and act according to an organization's purpose and context, and as such engender its culture. Consequently, creating an organizational culture capable of evolving because of changing organizational purpose or context is a critical requirement for success in any modern organization. An organization's culture emerges from the interaction between human activity systems, their purpose, and their context, while at the same time, the evolution of human activity systems is inhibited by the organization's culture and their context. This creates a discordance between how an organization thinks about what their culture is and how the organization must act consequently. In this presentation, we will explore the use of principles as a primary guide to manage the discordance between organizational thinking and doing, and therefore establish a foundation for designing and developing human activity systems that can adapt to ever-changing organizational contexts and purposes.

THE SYSTEM PHENOMENON, HAMILTON'S PRINCIPLE, AND NOETHER'S THEOREM AS A BASIS FOR SYSTEM SCIENCE

William D. (Bill) Schindel

The consumers and users of the physical sciences include the engineering disciplines, as well as others. Each of the traditional engineering disciplines (EE, CE, ME, ChE, etc.) are concerned with certain physical phenomena, and founded on related explanatory theories and math-physics models of those phenomena, strengthening ability to perform the engineering practices of the discipline. However, it is sometimes suggested that Systems Engineering (and systems work in general) so far lacks, and is still seeking, some equivalent underlying theory that is grounded in base phenomena and described by explanatory model content, on an impactful par with those of the other engineering disciplines. Here we argue that:

1. there is such an underlying System Phenomenon,
2. its explanatory, model-based theory already exists in the form of Hamilton's Principle,
3. this phenomenon and theory are the more general parent cases of the more familiar phenomena and model-based theories of each of the traditional engineering disciplines and their physical sciences, and
4. for the emerging larger-scale systems of practical interest to systems engineering and society, new larger-scale phenomena, explanatory model-based theories, and engineering disciplines may be derived from this same general parent.

WEDNESDAY

ART, ARCHITECTURE, AND SYSTEMS THINKING

Tom McDermott

Systems engineering has been considered for a long time both an art and a science. In fact, previous work has shown that principles and practices of systems engineering are exhibited in the creation of a film original score, a major artistic endeavor, and that some of the concepts employed in artistic painting to convey beauty are also used by system architects to reduce complexity and achieve elegance. This presentation discusses a common linkage between art and systems architecture through systems thinking, which has a unique role in helping us conceptualize the dynamic nature of complex systems. A learning model is proposed that relates art, systems thinking, and systems architecture, which results in a number of propositions to improve the systems thinking skills of systems architects via learning aesthetic interpretation of art. Initial experience in use of the framework in a graduate systems engineering program is also discussed.

SYSTEMATIC ETHICS AND ETHICAL SYSTEMS

Dr John Vodonick

There are over a thousand entries for the word ethics in the Stanford Encyclopedia of Philosophy and nearly a thousand entries for the word systems. You would think that with that many entries between the two words there would be numerous combinations of the two and you would be wrong. Although there are entries for business ethics systems, medical ethics systems and so forth.; there is a void when you look for intersections between systems and ethics. Ethics is the branch of philosophy that is concerned with how people ought to act and the search for a definition of right conduct and the good life. Systems seem to be an understanding of the circular nature of the phenomenal world that we inhabit and an appreciation that every utterance we make, every step we take may and probably will have consequences beyond what we can see in front of us. For the most part, systems thinking or systematic thinking has not informed ethics and ethics has not informed systems thinking. I hope that we can have a conversation about the intersection of systems thinking and ethics; I think that an appreciation of both could lead to a new epistemological experience

ETHICAL IMPERATIVES IN THE ERA OF CLIMATE CHANGE: LESSONS FROM STANDING ROCK.

Dr Debora Hammond

In his "Framework for Understanding Systems Principles and Methods," David Rousseau describes principles as fundamental rules for making judgments or taking action. In that sense, principles entail an implicit ethical dimension. The challenges confronting humanity, in what has become known as the Anthropocene, require an integrated systemic approach to addressing the interwoven social, political, economic, ecological, and technological aspects of our globally interconnected lives.

THURSDAY

DEFINING SIX KEY ORGANIZING PRINCIPLES FOR A TYPOLOGY OF GENERAL COMPLEX ADAPTIVE SYSTEM FEATURES AND DYNAMICS.

Dr Rika Preiser

Researchers and practitioners are challenged to explore new avenues for studying and engaging with complex systems in ways that respond authentically to the pressing social-ecological challenges of our time. Given that best-practice manuals that contain rule-based formulas for dealing with complexity are not possible, the encounter with complex adaptive systems leaves us in a space where we are beckoned to respond and act in ways that allow for rigorous and novel conceptual framings, as well as develop practical tools that can deepen our understanding of the rapidly changing and intertwined social-ecological dynamics of the Anthropocene.

RECONSTRUCTABILITY ANALYSIS: A SYSTEMS SCIENCE DATA MODELING METHODOLOGY

Prof. Martin Zwick

This talk will introduce Reconstructability Analysis (RA), a data modeling methodology deriving from the 1960s work of Ross Ashby and developed in the systems community in the 1980s and afterward. RA, based on information theory and graph theory, is a member of the family of methods known as 'graphical models,' which also include Bayesian networks and log-linear techniques. It is designed for exploratory modeling, although it can also be used for confirmatory hypothesis testing. RA can discover high ordinality and nonlinear interactions that are not hypothesized in advance. Its conceptual framework illuminates the relationships between wholes and parts, a subject that is central to systems science.

DESIGNING SUSTAINABLY AGILE AND RESILIENT ORGANISATIONS

Dr Linda Holbeche

In today's complex times it is increasingly recognised that enduring business success will be achieved by those organisations that are agile, innovative and customer-driven. As Professor Ed Lawler puts it, superior performance is only possible when there is a high degree of fit between the requirements of the environment and the capabilities of the firm. In today's increasingly turbulent environments, this fit is temporary at best. To remain successful, organisations must be able to change in a way that creates a new alignment when the environment changes; in other words, they must be agile.

REFLECTIONS OF A BIOLOGIST ON SOME INTERSECTIONS BETWEEN BIOLOGY, SYSTEMS SCIENCE, AND BIOMIMICRY/BIOMIMETICS/BIOINSPIRED DESIGN

Dr Peter Niewiarowski

The idea of looking to living systems as a way of inspiring solutions to problems in the human built environment (Biomimicry/Biomimetics/Bioinspired Design: BBBD for short) is clearly ancient, but a formally recognized field is still very much emerging. Disagreement, debate, negotiation, and dissonance among those engaged in BBBD arise for many reasons, reflecting different conduct and perspectives of the contributing disciplines. I will explore some features of disciplinary intersections in BBBD, especially where the understanding of participants might differ with respect to assumptions and definitions regarding concepts such as function, mechanism, control, and system.

List of Abstracts

2018 Abstracts

Session Abstracts

3271

ACTIONABLE KNOWLEDGE MAPPING TO ACCELERATE INTERDISCIPLINARY COLLABORATIONS FOR RESEARCH AND PRACTICE

Steven Wallis

With increasing calls for interdisciplinary collaboration to solve wicked complex problems there is also increasing clarity around barriers to collaboration such as differences in research methodologies and disciplinary terminologies. This paper uses a Science of Conceptual Systems (SOCS) perspective to show how theories from different disciplines may be synthesized (or integrated, depending on your preferred terminology). Brief case studies are presented to show how knowledge mapping may be used to accelerate actionable scientific understanding, interdisciplinary collaboration, student learning, and practical application leading to increasingly successful and sustainable change for improving the human condition.

Keywords: Interdisciplinarity, Integrative Propositional Analysis, Metatheory, Collaboration, Systems philosophy

3274

ADAPTATION OF PASSIVHAUS STANDARD FOR WARMER CLIMATES: PASSIVE-ON PROJECT

El Hadi Bouguerra

LTSM, Mechanical Department, Blida I University, Route de Soumaa, Blida Algeria, EhBouguerra@yahoo.fr

Actually, buildings account for 40% of the final energy consumption where about 70% of household energy demand is for ambient heating and cooling. The current issue is that energy consumption for cooling is increasing sharply; demand is expected to double by 2030 as air conditioning becomes more usual also in residential sector. However, correct design and construction can contribute to dramatically decrease energy consumption and CO2 emissions of dwellings. For example, at average, each German Passivhaus (low energy building) consumes 80% less energy for heating than standard house, which leads into annual avoided CO2 emissions of 2.4 ton/year for one house. The reasons for such a success are the codification by the standard precisely energy and quality requirements and then provides a relatively standard set of solutions by which these requirements can be met. Furthermore, the solutions are relatively cheap; a house built to the Passivhaus standard at most costs 10% more than a standard house.

The Passivhaus standard was born to respond to the requirements of relatively cold central Europe. Though homes in southern Europe and Mediterranean countries need to be warm in winter, this is accompanied by a need to ensure comfort in summer, which at times can be the predominate issue. The question is: could the Passivhaus standard be adapted to warmer southern Europe? The Passive-On project findings propose an update in the Passivhaus standard to be adapted to define Passivhaus in cooling climates as well, including cooling energy and summer comfort.

The adaptation of passivhaus standard needs a system approach because it involves many factors with complex interactions and requirements. Subsystems can be defined as: envelope insulation (including reduced thermal bridges), air tightness and ventilation system, domestic appliances etc. Each subsystem has its own verification and validity criterion and can be tested individually. Other interactions are local climatic conditions; local construction systems that are often related to users cultural and historic background, and off course cost. Acceptance for the whole system can be done by meeting comfort temperature performance.

Analysis has shown that some acceptance criterions for Passivhaus can be kept for Passiv-on. For example, the useful energy demand for space heating is the same and should not exceed 15 kWh per m² net habitable floor area per annum. The same for primary energy demand for all energy services, including heating, domestic hot water, auxiliary and household electricity, does not exceed 120 kWh per m². The operative room temperatures can be kept above 20 °C in winter, using the abovementioned amount of energy.

On the other hand, research shows that some of the requirements of the central European Passivhaus standard can represent over engineering in southern Europe. For example the Passivhaus standard makes an explicit requirement to limit the permeability of the building envelope (n50 ≤ 0.6 h-1) which makes an implicit need for an active air ventilation system. However, with a less stringent building envelope criterion, experience shows that an active ventilation system can be avoided. So, a pressurization test result of 1.0 h-1 for permeability is usually sufficient to achieve the heating criterion.

Others requirements like comfort temperature are related to users behavior. This is taken in account with the neutral Adaptive Comfort temperature that can be achieved by using passive cooling strategies, such as window shading and night time ventilation. However, in some locations guaranteeing the comfort temperatures requires some energy

especially where swings between diurnal and night time air temperatures are low. In this situation some form of active mechanical cooling system to reduce the peak temperatures is necessary to achieve summer's comfort. So, if an active cooling system is the major cooling device, the operative room temperature must be kept below 26 °C.

3283

SPECTRUM DISTRIBUTION FOR THE SATELLITE SYSTEM

Cirilo Gabino León Vega, Instituto Politécnico Nacional, ESIME Zacatenco, Ciudad de México, C.P. 07738, México

Erick Velázquez Lozada, Instituto Politécnico Nacional, ESIME Zacatenco, Ciudad de México, C.P. 07738, México

Miguel Patiño Ortiz, Instituto Politécnico Nacional, ESIME Zacatenco, Ciudad de México, C.P. 07738, México

Saturation spectrum for geostationary satellites of medium and low height, has caused other options to seek and provide telecommunications services and research, using new technologies. Among these options are the technological development of small satellites and to investigate the frequency bands that are not currently being used, such as some segments of the KA band, etc. This fact has opened a market with new possibilities for growth. The technological development of communications has had an impact on the advancement of space technology. This has had an impact on industrial and research environments, generating opportunities for greater productivity and efficiency. The availability of advanced electronic devices and lower costs has impulsed the participation of academic entities in the space environment seeking to develop and integrate systems. This situation has led universities and research centers in developing countries to contribute to the development of pico and nano-satellites. However, this has brought a series of challenges in the regulatory field such as the use of frequencies, space junk, registering objects thrown into space, etc. for the different administrations of the world.

3285

GOVERNANCE OF ORGANIZATIONAL PROJECT MANAGEMENT AND MEGAPROJECTS USING THE VIABLE GOVERNANCE MODEL

Ralf Müller, Nathalie Drouin, Shankar Sankaran

Recent developments in organization theory integrate the traditionally distinct management domains of projects, programs, and project portfolios in a corporation into the emerging concept of Organizational Project Management. Along with that comes a lack of understanding how the new and more complex concept shall be governed. A complementary development is the emergence of ever larger projects, called megaprojects, which in themselves create societal, governmental, and business-related issues of yet unknown magnitude. Again, the governance of this emerging phenomenon is largely under-researched.

Against this background appear existing governance systems as inadequate due to increasing complexity, uncertainty and ambiguity and do not consider emergence which is a characteristic of organizational systems. According to Jaradat (2015: 56) 'a "systemic" perspective leads to better thinking analysis, actions and corresponding development in governing complex systems'. From a systems science perspective, the viable systems model (VSM) proposed by eminent system theorist Sir Stafford Beer has been used in the literature as a way of understanding governance of organizations and systems and complex systems.

This presentation will address this knowledge gap by applying the Viable Governance Model (VGM) to these two emerging organizational phenomena. The presentation is organized as follows: Descxription of the VGM concept and its recursive nature.; VGM's application in the context of a) Organizational Project Management, and b) megaprojects; A comparison of the two governance approaches; and conclusions by outlining some of the context related contingencies for governance approaches, theories, and underlying governance principles.

Megaprojects provide a context where several types of governance exist: administrative governance from the government during their conception, project governance during implementation and corporate governance during benefit realization when they move into operations. Thus, applying a governance model from a VSM perspective to a megaproject context will contribute to an understanding of principles of governance to management and organizations from a systemic perspective.

Reference:

Jaradat, R. M. (2015). Complex system governance requires systems thinking - how to find systems thinkers. International Journal of System of Systems Engineering, 6(1/2), 53. https://doi.org/10.1504/IJSSE.2015.068813.

3286

SEISMIC LENS-TYPE SHEAR PANEL DAMPER FOR BRIDGES AND BUILDINGS: INNOVATION AND OPTIMIZATION IN NATURE AND DESIGN TO ENGINEERING FIELDS

Tatsumasa TAKAKU

JSCE fellow, Executive Professional Civil Engineer(JSCE), Dr. of Engineer, 1-13-1 Nishikamakura Kamakura Kanagawa Japan 248-0035, takakut@jcom.zaq.ne.jp

Seismic Lens-type shear panel damper has been newly developed for highway bridge and buildings against the large scale earthquakes. It utilizes low yield steel LY100 and concave lens shape panel. Both properties yield low strength and high ductility which are major requirements for damping devices. Both responses by static and dynamic tests show rectangular shape of load-displacement hysteric curves with high quality damping. Damage and life cycles can be estimated by Miner's rule. Prediction matches well with testing results. Large deformation of steel with high speed strain rate generates great heat of temperature 300~450° C. Earthquake energy is converted both to strain and heat, which results in large energy dissipation. Miner's rule which was popularized by M. A. Miner in 1945, is one of the most widely used cumulative models for failures caused by fatigue. Miner's rule is probably the simplest cumulative model and the foundational discoveries about nature of complex systems.

The presentation briefly explains followings; Seismic lens-type shear panel damper and half size model (fundamental/principle); Shape/connection/low yield steel LY-100; Static and dynamic testing results, optimization of lens (shape /steel grade):

Fundamental behaviors: concave depth and failure modes(strength/ductility); Miner's rule and tests results(theory/practice); Application to bridges (large scale, heavy/long); Fundamental requirements for seismic motion and expansion due to temperature; Performance for safety/serviceability 3) Details of bearing/stopper /damper; Application to architectures (small scale, light/high); Fundamental requirements for seismic motion(drift/resistance); Shear walls for tall buildings(~10F) 3) Lateral bracing for residential house(~2F).

Based upon the nature laws, optimization in design are simply and easily planned and accommodated by scaling the lens size to be large /small and strong/weak, in quality and quantity. In design and optimization of complex systems, scale factors are crucial to be consistent and available for overall sizes. In usual, system complexity and combination of different members fall in irregularity. The member connections cause irregular transmission due to loadings. Theory seldom matches well with practices. Simplicity of lens panel damper results in good agreement with design theory of nature laws. Engineering matches well with science when the complex system is simple. Law of similarity is neatly summarized by the Gestalt psychologist Kurt Koffka theory that "The whole is other than the sum of the parts". The little word carries much importance, especially for us as designers in the engineering matters. The macro (e.g., global economy) is not the sum of the micro (local economy).

Keywords: lens-type shear panel damper, Miner's rule, law of similarity, theory/practice.

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USING INTERACTIVE MANAGEMENT TO EXPLORE THE FACTORS CAUSING DELAY OF MODIFICATION PROJECT IN A SOUTH AFRICAN POWER STATION

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Project delays are common problems in construction industry. The modification and shutdown (outage) projects in South African power stations are faced with project delays as well. The project delays have detrimental effects to the supply of electricity and impacts the advancement of the South African economy. This paper explores the major determinants that influence untimely delivery of modification projects in a South African power station. Through the use of Interactive Management (IM) methodology, 21 principal project delay factors were identified and used for structuring a delay model. The model generated through the IM session is a digraph, on the basis of relevant stakeholders' consensus, showing the 'aggravate' relationship between the identified delay factors. The digraph reveals that the main determinant of modification project delays in a South African power station is the 'proficiency of a project manager'. Proficiency of a project manager relates to the ability of a project manager to accomplish the required project tasks based on his or her skills, competency, and experience within the project management field. The model developed through Interactive Management session demonstrated that proficiency of a project manager in that South African power station is the driver of other project delay factors, such as the factors in a large circular loop lying in the second stage of the model, including 'poor leadership', 'poor communication', 'poor planning', 'insufficient risk management',

'scope creep' and so forth. The model serves as a starting point to revisit the power station's strategy in dealing with the project delays.

Keywords: Interactive Management, Systemic Thinking, Project Delay

3290

HUMAN CAPITAL MANAGEMENT INNOVATION FOR MEXICAN LODGING THROUGH AUTOPOIESIS AND SELF-ORGANISATION

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In the context of the Mexican hospitality sector, Small and Medium Enterprises (SMEs) are considered important agents given their participation in the generation of jobs and new business relations, nevertheless their closure rate in the first two years of operation is high. In addition, these organizations face structural problems that limit their capabilities to attenuate the variety of the environment and, simultaneously, improve their operations. This paper, presents a proposal through the complementarity between the Soft Systems Methodology and the Viable System Model to innovate in the design of a structure that allows the human capital management to influence a state of self-organisation based on precepts of the Autopoiesis Theory. As a result, a model that integrates self-regulation, autonomy and learning to support self-management of human capital was obtained to adapt continuously to its current context.

Keywords: Autopoiesis, Self-organisation, SMEs, Human Capital Management, SSM, VSM.

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DEVELOPING CRITICAL REFLEXIVITY TO IMPROVE OUR UNDERSTANDING OF COMPLEX SYSTEMS

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Several authors have offered alternatives to understand the nature of complex systems as well as tools for solving complex problems. Concepts such as boundaries, perspectives, holism, and interrelationships have been considered critical for dealing with complex systems. In this paper we will show how shedding new light on three main themes of critical systems thinking can help us to better understand and deal with complex systems. These three themes are: improvement, critical reflexivity, and pluralism. To explore them in a new way we draw upon the ideas of Emmanuel Levinas, Michel Foucault, and other thinkers. We begin the paper by drawing upon Levinas' ideas. We claim that critique should avoid reducing the Other to the Same, but rather challenge the exercise of the Same. The Other is not just another myself. She involves an irreducible alterity. Critique should aim at uncovering and challenging the reduction of the Other to the Same that results from the will to control and possess the Other, from seeing the Other as no more than a reflection of myself, or from attributing no significance to the Other. Challenging the reduction of the Other to the Same is important to preserve perspectives, to prevent the imposition of boundaries and distinctions, as well as to avoid inconvenient reductions of the complexity of the world that result from imposing my categories upon what should remain absolutely irreducible. This involves calling into question the exercise of the Same. A distinction between reflection and reflexivity is developed in the paper. While reflection makes reference to a mirror image and is based on the notion that there is an outside reality that we can identify and explain, reflexivity questions and investigates how we might contribute to the construction of social realities, how we construct our actions and being in the world, and how the I approaches the Other. We develop the notion of reflexivity, which involves thinking about different possible boundaries, questioning taken-for-granted assumptions, and examining the boundaries of knowledge as well as the boundaries of the self. These ideas are related to the study that Foucault carries out of the notion of 'epimeleia heautou' ('care of oneself'). This notion implies being eager to examine and transform the boundaries of our own self, our perspectives, our mental constructs, and the ways of discovering and building systemic relationships. It is related to a diversity of forms of reflexivity that imply a modification of the subject and its relationships to the world. We carry out a critical exploration of diverse forms of reflexivity because they can constitute the subjects as such. We explore three broad forms of reflexivity identified by Foucault (memory, meditation, and method) and we discuss their implications for systemic practice. This exploration is enriched by examining other forms of reflexivity, particularly forms of reflexivity developed in the Eastern world. We will discuss these forms of reflexivity by making reference to concepts developed by Eastern philosophers, and also by discussing ideas present in several arts. This includes forms of reflexivity that involve mind, body and spirit. It implies self-transformation and therefore constitutes a form of critical reflexivity insofar as it not only uncovers and questions the boundaries of the self, but also has the potential to transform these

boundaries. At the end of our paper, we will show how the aforementioned ideas can improve our options for understanding and dealing with complex systems.

3305

SYSTEMS CONCEPTS IN THE FOURTH GENERATION EVALUATION METHODOLOGY

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In the past years, the desire to use systems concepts in other fields of studies has increased particularly for the benefits that doing so would produce. One of such fields corresponds to evaluation, particularly that of program evaluation. Concepts such as relationships, perspectives, boundaries, and the system itself have been recognized as useful for conducting evaluations. However, most of the efforts have been directed towards using such concepts as well as systems tools in the practice of evaluation and not by incorporating them at a theoretical level. For this reason, this paper shows how systems concepts and particularly those related to boundary critique can be incorporated in reframing the Fourth generation evaluation methodology in a way in which it acquires a more systemic character. The paper argues that boundary critique was already implicitly present in some of the methodological steps of the aforementioned evaluation approach. However, including boundary critique explicitly brings several benefits not only for the evaluator but also for the client and the participant stakeholders in the way in which the evaluation is conducted, as well as in supporting relevant decision making processes regarding who will be part of the evaluation and what will be addressed by it. We will approach the reframing of this methodology by first presenting the original methodological design proposed by Guba & Lincoln. Thereafter, we will present the reframed methodological design step by step as well as a case study in which it was applied. Boundary critique becomes relevant for the specific steps of the methodology as well as the participants of the evaluation as by these means it makes more explicit the rationale over which decision making processes are based. Given that evaluation is grounded on a series of decision making processes involving different stakeholders between the client, the evaluator and other stakeholders, it is also worth exploring how power issues are understood and tackled in the methodology. In order to do, we approach power and power issues by means of Michel Foucault´s conception of power.

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COMMUNITIES-OF-PRACTICE AND SYSTEMS THEORY: A CASE STUDY

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This case study examines the development of a self-organized Federal Government Action Learning Community-of-Practice (FALCOP) through the lens of systems theory as an open human activity system. The FALCOP is an unsponsored Community-of-Practice (CoP) devoted to the practice of Action Learning within the United States federal government. The FALCOP's emerging membership comprises federal employees who are Action Learning coach practitioners and other federal employees who are interested in Action Learning as a problem-solving and leadership development method. CoPs embody systems theory in that they may be characterized as open systems with core members and peripheral members that introduce disruption to the system that both challenges and strengthens the CoP. Boundary crossings between the FALCOP and other peripheral federal communities, including leadership and learning communities as well as the federal government, resulted in upsetting the equilibrium operating within the CoP's practitioners. These environmental factors have played a significant role in defining the FALCOP's evolving membership and redefining its initial mission and vision. System disruptions have created both challenges to identity and professional growth opportunities for its core and peripheral members. In addition to defining the FALCOP as an open system, the case will investigate the role of the FALCOP as an agent for organizational change in its advocacy of Action Learning, both within agencies with employees who are currently participating in the FALCOP and for the federal government as a whole.

3310

THE MIND AS AN ARTIFACT

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This paper aims at proposing a model of understanding the mind as an artifact. This model is based on Simon's arguments in his seminal book the Sciences of the artificial. Moreover, this paper rejects a certain "substance thinking" which portrays the mind as an ethereal entity which can only be understood 'negatively" as lacking physical extension. For Simon (1996:xi), certain phenomena are "artificial" in a very specific sense: they are as they are only because of a

system's being moulded by goals or purposes, to the environment in which it lives. If natural phenomena has an air of "necessity" about them in their subservience to natural law, artificial phenomena have an air of "contingency" in their malleability by environment. For Simon (1996:xi) artifacts, in addition to being distinguished by contingency, have four main characteristics.

Artificial things are synthetized (though not always or usually with forethought) by human beings.

Artificial things may imitate appearance in natural things while lacking, in one or many respects, the reality of the latter.

Artificial things can be characterized in terms of functions, goals, adaptation.

Artificial things are often discussed, particularly when they are being designed, in terms of imperatives as well as descriptives.

This paper upholds that the mind fulfills all these characteristics and suggests that instead of defining the mind by opposing it to matter or negatively as lacking spatial extension (res extensa vs. res cogitans), there is a possibility of defining the mind as a problem of information. On the one hand information has been defined by Norbert Wiener (1961) as "negative entropy" i.e. "negative disorder" and hence "positive order" or the measurement of a certain "degree of organization." On the other hand, information processing has been presented as enriching immediate data of experience with meaning and value for the purpose of decision-making and problem-solving (Schultheis and Sumnar, 1998). Although these two notions of information seem to be remote from each other, they still conform to a cybernetic model that views "things social as interacting processing systems" (Beniger, 1996) and "appreciate[s] the importance of communication and control in all such systems" (Beniger, 1996). This paper conclusion that the mind can be defined a human control system. This argument is based on Cooney (1996) denunciation of Cartesian reductionism paving a way to a cybernetic model that does not reduce natural processes to their mechanical dimensions (matter in motion) but adds order and purpose as part and parcel of natural processes and systems. In other words, when dealing with natural processes and systems using a cybernetic model, we are not dealing with "dead" matter, ever static and immutable. Even the concept of motion itself is not restricted to change in spatial location. It can portray as originally used by Aristotle any change including not only material objects and particles in motion i.e. changing spatial location, but also, different patterns and processes of organisation that confer to natural and material complex systems and processes a certain level of order or negative entropy or amount of information. A cybernetic model is open for a possibility of adding structure, behaviour and function (purpose) as significant aspects of reality. Reality therefore, is not reduced to its mechanical aspects but as material elements organise themselves into structures, systems and processes with a certain degree of order i.e. negative entropy or amount of information, they are both significant (yield some meaning) and useful (have some value) in a way that they can serve various purposes pertaining to the intelligent life we associate with the mind.

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A MAPPING OF THE CONCEPTUAL MODELS OF SYSTEMS TO ITS ARCHITECTURE

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Systems are multi-dimensional, complex and have multiple ideals. One of the biggest problems with systems is the uncertainty on where do they begin and where do they end; what is inside and what is outside. This is because what is perceived to be the system is an approximation as the understanding of the system evolves over a period of time based on observation and feedback. Creating this understanding involves successively spanning many dimensions of the system and adopting a holistic attitude with regard to it. Traditionally, a set of system models (such as Stock and Flow model, Influence model, Descriptive model, Analytical model, Domain-specific model, Integrated model and so on), are identified, with each capturing different levels of detail and synthesized to arrive at a holistic understanding of the system.

Man-made systems have become large, complex and sophisticated. The ability to engineer these systems has posed challenges which are often driven by factors of organization, integration, communication, change, size and scale. Over the last few decades, Architecture as a discipline has served as the backbone for addressing these challenges. In practice, Architecture is considered as the fundamental concepts or properties of a system and governing principles for the realization and evolution of this system and its related life cycle processes [1]. Traditionally, an Architecture is expressed as a set of architecture descriptions comprising a set of architecture views and models (such as Component model, Process model, Function Model, Features Model, Operations view, Services view, Capability view and so on).

While in theory, the system specification and architecture descriptions should correlate with each other, in practice it is not the case. The system specification is in terms of the systems vocabulary of a concrete system while the architecture descriptions are in terms of the architecture vocabulary of an abstract system. System models focus on a description and understanding of concrete systems and their behaviour while the architecture models conceptualize

an abstract system based on the concrete system(s) under consideration, including future evolution of these concrete systems. These differences in focus result in systems and architecture each having their own worldview and conceptual model. As a result, there is always a gap between what the system should be versus what the system is.

In order to align architectural understanding with system understanding, it would be useful to have a mapping between the conceptual models of each space. This paper proposes utilizing a common vocabulary and ontology for understanding, synthesizing, analysing and evolving systems and its architectures. The authors believe that such an ontology will aid in aligning the viewpoints of systems stakeholders and architects, particularly for architectural activities pertaining to existing systems, which stakeholders tend to understand more from the systems viewpoint.

Keywords: Systems, System models, Holism, Architecture, Architecture models, System specification, Architecture description, Conceptual models, Model mapping

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PERFECT TECHNOLOGY OF THE HUMAN BEING

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The most perfect technology we can manage, for free, without any needs of an external tools is the "human being´s technology". The Human Being's System is perfect. If we knew where it comes from and how does it really works we would realise that we are much more than "human beings". In other words, the human being's properties, capacities and abilities are much more powerful and unlimited of those what we generally think. Very complex issues to show in only one paper. But, anyway, if we know more about our own technology, apply it, people can be healthier and happy.

The true nature of the human being is ENERGY. Absolutely everything that exists, as well as the potential of existence and plasma, is energy. Quantum Physics, Quantum Mechanics, String Theory, Mathematics, Geometry, Metaphysics, Philosophy in fact all disciplines in the end shows us the scientific evidence about where we come from, what we are made of and the relationship of how do principals of universe behave.

All subsystems that integrate the system of the human being are energy too. Whatever we input into it is also energy. There is no matter. "What we think of matter are tiny particles. Only waves of potencial. All is Quantum Reality."

The 7 Hermetic Principles of the Kybalion: Mentalism, Correspondence, Vibration, Polarity, Rhythm, Cause & Effect and Gender, give us the clear evidence of how the universe works and how the other subsystems interact with the same systemic principals in an holographic universe. And in the Universe, The subsystem of the Human Being behaves exactly in the same systemic way. Because of this, "AWARENESS" is very important. To manage the energy of thoughts, sensations, emotions and feelings is the key for creating what we want as REALITY. This technology is essential to improve welfare and happiness of people.

3315

CONSEQUENCES OF MODERNITY', POTENTIAL OF THE DOUBLE HERMENEUTIC AND IMPLICATIONS FOR HUMAN SECURITY

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Giddens stressed in the 'Consequences of Modernity' that trust is contingent and that risks escalate when transfers are disembedded from local contexts. This paper concentrates on the need to develop policy and praxis to protect the commons. A critical and systemic approach explores Inglehart's (1997) notion of culture shift. Gidden's (1990) essay on the 'consequences of modernity' informs the analysis.

The aim of the paper is to explore the cascading interconnected challenges associated with energy and water security. By exploring the case study of transformation in water useage in Cape Town, the paper adds to the literature on that culture shifts by providing an in depth example of the cross cutting social, cultural, political and economic dimensions of changed behavior associated with water conservation. It provides an example of the lack of mitigation foreward planning offset by a rapid adaptation made at a household level to changed water availability.

The paper focuses on the impact of urbanisation in a context of climate change in Cape Town, South Africa where little preparation has been made for accommodating the higher population. This is partly due to the higher cost of a desalination plant as a result of a corrupt energy sector (Bond, 2012). It uses a case study approach to explore water insecurity in Cape Town in the context of a neoliberal economy where class and race add additional layers to life chances. using range of primary and secondary sources.

Rapid adapation to conserve water in Cape Town has been achieved through a combination of fear for the future and a desire not to be shamed through a transparent water management mapping system and also through generous donations of water by farmers within the region and by NGOs across South Africa.

By exploring the case study of transformation in water useage in Cape Town, the paper adds to the literature on that culture shifts by providing an in depth example of the cross cutting social, cultural, political and economic dimensions of changed behavior associated with water conservation. It provides an example of the lack of mitigation foreward planning offset by a rapid adaptation made at a household level to changed water availability.

The paper is based on an analysis of everyday lived experience in Cape Town and news 'from the margins'. It explores a case study of rapid adaptation in Cape Town to water shortages that are a result of increased migration to the Cape and lack of forward planning to address the affects of climate change. Forward planning to introduce a desalination plant stalled as a result of the high costs associated with an unreliable energy system. Rapid adaptation to conserving water has been achieved through a combination of farmers and NGOs donating water, residents of Cape Town saving water as a result of fear for the future and a desire not to be shamed through a transparent water management mapping system.

The paper contributes to a new area: namely the commons as a process and a sense of connection to living systems, rather than as a resource 'held in common', to cite Bollier (2011). The paper underlines the importance of research across boundaries and so-called Mode 2 knowledge production (Gibbons et al 1994) based on critical systemic approaches that span conceptual boundaries and support working across disciplines and sectors.

To sum up the paper addresses the cascading consequences of the lack of integrated governance across regions and advocates the potential of so-called regional 'cascade economics' (Pauli et al 2010) and non-anthropocentric development that supports rural-urban balance. Since the Stern Review on Climate Change (2006), little has been achieved in addressing the warnings concerning high carbon emissions globally and the cascading effects on food, energy and water security. It explores the impact of urbanisation in a context of climate change in Cape Town, South Africa where little preparation has been made for accommodating the higher population. In this paper a case is made for a way forward to address the cascading effects of climate change in the Western Cape region of South Africa by redressing the rural-urban imbalance in development opportunities.

Rapid adapation to conserve water in Cape Town has been achieved through a combination of fear for the future and a desire not to be shamed through a transparent water management mapping system and also through donations of water.

Keywords: consequences of modernity, cascading, risk, connections, double hermeneutic, trust, re-generation

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ADVANCES IN SCHEMA THEORY AS WELL AS SPECIAL SYSTEMS THEORY

Special Systems Theory has been developed over the last 20 some years starting in the early 1990s. Several collections of papers and summaries have been dedicated to describing it[1]. Much of the work over the years has been looking for precursors to the theory in other traditions such as Buddhism, Islamic Sufism, and Taoism that has been successful. However recently a major advance has been made which calls for a reassessment of the theory. In this paper we will discuss the theory as it stands and the advances that have been made in understanding it recently.

Keywords: Special Systems Theory, Schemas Theory, Systems Theory, Meta-systems Theory, Worlds Theory

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FOUNDATIONAL CONCEPTS UNDERLYING A FORMAL MATHEMATICAL BASIS FOR SYSTEMS SCIENCE

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Science is a Formal System for Developing Valid Knowledge. We propose Category Theory as the formal, mathematical language and theory for studying systems. But, to understand the applicability of Category Theory to Systems Science certain prior foundational concepts must be clearly elucidated. This presentation is not about Category Theory, per se. It is about related concepts that extend beyond our mental notions of concepts – extending into increasingly more abstract domains – worlds – including a Platonic World of Forms (Penrosian) and a supremely abstract Conceptual World (Popper and Lloyd). Refinement, verification and validation of concepts obviates the insufficiency and

[1] See Autopoietic Reflexive Systems Theory, Reflexive Autopoietic Dissipative Special Systems Theory, Special Systems Theory, https://osf.io/tw37d/

incompleteness of human belief as a foundational concept. These contextual worlds form three sub-systems of science: The Philosophical, the Mathematical, and the Empirical Sub-Systems – which are individually contrasted. It is from the mutual interaction between these coupled systems when not at equilibrium that valid knowledge emerges. We develop (abstract) concepts of: Objects, Functions, Functional Objects, Morphism, Categories (highly misunderstood), Functors, Domains (domains of validity).

In developing Axioms, Theorems, Models, Parameters and Data.

Theories, by understanding these priors, shorter inferential distances allow the Platonic and Mathematical concepts of Category Theory to become reachable, and the practicality of that strategy to be better understood.

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INNOVATION IN SERVICES: A VIABLE SYSTEM MODEL DESIGN FOR TOURIST MSMES INTEGRATION IN MEXICO

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In the context of micro, small and medium-sized tourism enterprises (MSMEs), flexibility and heterogeneity can be characteristics that add value to them. However, the lack of integration to treat, both its operation as the environment, makes it difficult to understand the various problems to which they are exposed. The previous, stresses the need for these human activity systems to coexist in a changing environment, an organization that seeks to their operation and maintenance. In this regard, this work takes up the concept of complementarity from the perspective of Systems Science. In this sense, complementarity refers to the beneficial adaptation of the heterogeneous capacities of tourism companies and to contribute to the innovation of their services to achieve the basic objective of a living system, that is to say, to survive and evolve with its environment. The Soft Systems Methodology and the Viable System Model were used, obtaining, as a result, a construct that proposes to order and amplify the internal variety, allowing to counteract the external variety.

Keywords: Tourist MSMEs, Services Innovation, SSM, VSM, Complementarity.

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DIGITAL DISRUPTION IN THE CONTEXT OF SOCIAL WELFARE

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In most countries, the population at the bottom of the pyramid has very less access to economic, education, food, water, housing, healthcare and other essential opportunities. This population is continuously exploited and basic human rights like education, health care, food and housing are not fulfilled for them. Protection for this population, in case of income shocks, illness in family, man-made disruptions, natural disasters, and loss of employment is not available either. Government subsidies like social security transfers do not reach this population as they don't have access to banking services and the presence of middle men reduce the benefits that are earmarked to them. Stringent profiling by organizations to prevent money laundering and financial thefts and the associated scrutiny of supporting documents prevent access to welfare services for this population.

While studying the various welfare schemes of different countries, it can be seen that the situation is considered as predominantly economic in nature; while social concerns (how will the community improve), business concerns (what kind of entrepreneurship can be systematically introduced), production concerns (what are they going to produce), employment concerns (how can the population sustain its income), quality of life concerns (how does financial inclusion contribute to quality of life), educational concerns (how can the community get the desired education), healthcare concerns (what healthcare tie-ups are possible), work product concerns (how work done by this population can be consumed) and so on are not taken into consideration. The underlying line of thought seems to be bringing the masses inside welfare schemes.

However, the authors differ from this line of thought. The authors believe that the focus should be human civilization centric rather than being human institutions centric which is currently the case. The authors believe that currently, the human population (irrespective of its economic status) is looking at surviving and sustaining itself within the current environmental, political, economic, ecological, cultural and social conditions. With the global networking and connectivity and the various innovations in product-services and business models that has become possible because of

the revolution in knowledge, technology and services, it is necessary to look further and identify means for the human civilization to thrive and enhance the conditions for the overall quality of life.

To support this line of thought, the authors propose the adoption of digital in the context of social welfare to create a digital disruption that goes further than what has been achieved presently. Globally, digital has enabled the conception and realization of complex human-made systems that are geographically spread, globally interconnected, multi-player oriented, multiple products and services linked, addressing multiple stakeholder concerns across multiple disciplines and utilizing emerging technologies in innovative ways, in a dynamic, challenging, evolving environment. The corner stone is the creation, manipulation, and enhancement of meaningful information which can significantly change the way information is exploited to provide meaningful interventions for social welfare. In this paper, the authors discuss about a digital disruption cycle and how it can aid in disrupting the bottom of the pyramid eco-system in the context of social welfare. Further, the authors discuss about a systematic approach for enabling digital disruption.

Keywords: Bottom of the Pyramid, Eco-System, Social Welfare, Transformation, Reimagination, Digital, Digital Disruption

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THE CHALLENGE OF COMPLEXITY IN SOCIETY: MEANING MAKING AT THE EDGE OF CHAOS

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The pressing social problems we have are demanding that we build our capacity for meaning making to address them effectively. Meaning making at the edge of chaos is the type of meaning making we engage in when our current worldview is profoundly challenged by new information and experiences and, when the world is complex and chaotic, we are continually challenged and disoriented. This paper introduces the concept of meaning making at the edge of chaos and its theoretical basis in transformative learning theory, logotherapy, constructive developmental theory, complexity theory, chaos theory, and complex adaptive systems. In particular, it focuses on the concepts of disorienting dilemma, critical reflection, and the components of a meaning system derived from transformative learning theory. From logotherapy, it draws on the notions of will-to-meaning, meaning of life, and freedom of will. This paper includes the theory of the socialized, self-authoring, and self-transforming minds from constructive developmental theory. Finally, the concepts of nonlinearity, self-organization, emergence, learning, adaption, the butterfly effect, dissipative structures, and far-from-equilibrium are some key aspects from the world of complexity. These theories are integrated and form the basis for a model of meaning making at the edge of chaos.

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SUSTAINABILITY OF SOCIO-ECOLOGICAL SYSTEMS AND SOFT SYSTEMIC APPROACH

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The currently generally accepted practice of sustainable development is based on human-centered, linear and simple world model. It is assumed that the uncertainty of the real world can be controlled and predicted by entirely rationality of human beings, and hereby design the social sustainable development schemes and evaluation criteria. However, the practice of sustainable development is facing challenges due to the complexity of socio-ecological systems. Therefore, we need new theoretical assumptions and methodologies based on ecological-centered, nonlinear and complex model.

The issues of sustainable development is the sustainability issue of socio-ecological systems. Socio-ecological systems is a complex adaptive system composed of social system, economic system and natural system. The three subsystems are a kind of semi-autonomous agents, and only through the nonlinear interactions of competition and cooperation can they form a dynamic and stable structure and make the whole socio-ecological systems emerge to be orderly and sustainability. The sustainability of socio-ecological systems are self-adaptive, self-stable and self-organization, which are the holistic properties and systemic value of "social-economic-natural" system to realize co-evolution. It is the criteria for judging the state and process of sustainable development of socio-ecological systems.

System dynamics is an important system approach to study the causal relations between structures and behaviors of complex systems. In particular, the World model constructed by system dynamics has become a classical method to study sustainable development. System dynamics provides an effective method for us to understand the complex causal relations and co-evolutionary behaviors between human social system, economic system and natural system through structural analysis and computer modeling. However, socio-ecological systems is a complex adaptive system, its sustainability involves some unstructured problems. Therefore, there is a need for quantitative analysis of social, economic and natural causal relations in the systematic analysis of sustainable development. There is also a need for a soft systemic approach, that is, to analyze and coordinate the uncertainty of sustainable development scenarios of

socio-ecological systems and the value conflicts between subsystems. As a result, the system design of sustainable development of socio-ecological systems should be the combination of system dynamics and soft systemic approach. China's green development reflects this approach.

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RECONSTRUCTABILITY AND DYNAMICS OF ELEMENTARY CELLULAR AUTOMATA

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Reconstructability analysis is a method to determine whether a multivariate relation, defined set- or information-theoretically, is decomposable with or without loss (reduction in constraint) into lower ordinality relations. Set-theoretic reconstructability analysis (SRA) is used to characterize the mappings of elementary cellular automata. The extent of decomposition possible for each mapping without loss is more effective than the λ parameter (Walker & Ashby, Langton) as a predictor of chaotic dynamics, and non-decomposable mappings tend to produce chaos. SRA yields not only the simplest lossless structure but also a vector of losses for all decomposed structures, indexed by parameter τ. This vector subsumes λ, Wuensche's Z parameter, and Walker & Ashby's fluency, memory, and hesitancy parameters within a single framework, and is a strong but still imperfect predictor of the dynamics. The set-theoretic constraint losses are analogous to information distances in information-theoretic reconstructability analysis (IRA). IRA captures the same information as SRA, but allows the Walker-Ashby measures to be explicitly defined within a more encompassing framework. Of the parameters tested, fluency is the best scalar predictor of chaos.

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TOWARDS FRACTAL PROPERTIES OF COGNITIVE PROCESSES IN THE HUMAN BRAIN UNDER THE COMPLEXITY SCIENCE APPROACH

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The systems movement experienced four waves in 20th century: the first wave stemmed from the debate on the nature of life between vitalism and mechanicalism. The second was the interdisciplinary research arising after the World War II, with General System Theory and Cybernetics, with the help of Information Theory, Operational Research, and Systems Analysis. The third one was the establishment and development of the Theory of Self-Organization. And the fourth wave of systems movement was the rise of Complex Systems Science, which mainly referred to the systems research movement in 1980s with the Chaos Theory and Complexity Science, including some new concepts such as emergence and chaos, appeared with the accompaniment of some new methods of mathematics and computation such physical theories of nonlinear dynamics (e.g. Fractal geometry) and multi-agent-based computer simulation.

The human brain has been the subject of study among different branches of knowledge, describing their physiological and cognitive processes from data treated with qualitative tools and linear quantitative variables, seeking to obtain a determined average behaviour and the causality of the same. However, living systems do not obey linear issues. The actions that emerge from them have complex characteristics, which explanations or understanding is far from being able to be represented from their components and their individual behaviour, reason why their study and understanding requires the application of Chaos Theory and Complexity Science.

Cognitive processes are the ones that allowed human beings to differentiate them from other animals in ways that give them the opportunity to own, modify and live in any environment on the planet. This research focuses on the nonlinear quantitative characterization of cognitive processes. In order to do this, it was applied fractal geometry as an alternative tool for the characterization of cognitive (non-linear) processes that emerge from human brain. With this quantitative tool it was studied data signals of EEG (voltage generated by the interrelation among neurons as a function of time) from cognitive processes.

Fractal geometry could allow to eliminate the biases and tendencies in the signals of the cognitive processes to increase the visualization and suggestion of the real dynamics of these processes, in order to complement the experts opinion in a discipline or medical field that interpret the results.

In this research it was applied fractal geometry to study the fluctuations dynamics of stochastic time series (EEG) of a patient with reading and spelling disorders, which can be a reflection of difficulties in some of the cognitive processes such as language, learning, memory, intelligence, perception sensation or attention. Data were taken from 19-channel EEG (electrodes), which were treated as time series: voltage vs. time, each time series was 6453 data length. For each channel it was constructed 198 time series of fluctuations (standard deviation), for different time lags (τ). From each fluctuation time series, there were constructed other 198 time series (fluctuation of deviation fluctuation), also for

different τ. Based on all-time series of generated fluctuations (39,204), there were determined two scaling exponents: the roughness exponent (H) and the fluctuation growth, for each of the 19 channels.

By applying fractal geometry, it would be possible to establish (from statistical point of view) the probable future states of cognitive processes, that help to discovering new forms of treatment, therapies and contribute with ideas about the dynamics of cognitive processes.

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COMMENTS ON THE MODEL-BUILDING PHASE OF SOFT SYSTEMS METHODOLOGY IN THE NEW MILLENNIUM: A REVIEW OF PUBLICATIONS 2000-2017

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Substantial attention has been given to Soft Systems Methodology (SSM). A systematic review was implemented in 1999 to provide a complete summary of existing SSM studies, but there is no systematic exploration of model-building phase publications for this millennium. The aim of this paper is to systematically retrieve and review theoretical and empirical studies on the optimization of model-building phase of SSM from 2000 to 2017. This paper has found a wide variety of rich picture construction, conceptual design and systems mapping methods and this paper discussed model-building quality from these three aspects. We also suggest that some problems in CATWOE may be ameliorated by employing Whitehead's process philosophy:(1)there has been a new change to icons that are renowned as being synonymous within previous rich picture construction;(2)a concept called qualifying function,which has the potential to help people to view problem situation from new perspectives, is introduced as a conceptual tool for modelling and design;(3)participatory systems mapping is a new type of participatory technique which focuses on the methods that participants jointly devise diagrams on a topical issue and develop policy recommendations, and this technique has some significant features that can enrich the model-building phase of SSM. Limitations and conclusions of the study were articulated in this paper.

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TIME HAS GONE TODAY

Frank Piontek

Past thinking dismissed physics or astronomy as irrelevant to metaphysics or theology. This eventually paved the way for science to dismiss philosophy as meaningless, mandating philosophy take into account physics or astronomy. Laszlo contends the theoretical edifice of theology is not radically different from that of science. Carr illustrates that cosmology relates to philosophy and theology and develops in Time. Contemporary outlooks in science and mathematics shed little understanding on those views.

Little is empirically understood about the origin of the universe. The predominant cosmological singularity, "Big Bang" model states that the universe was started instanteously; in the shortest fraction of a second from a miniscule point where all matter, energy, time, space and existence emerged. An obvious question to associate relevance between physics and metaphysics is: what came before the Big Bang?

Hawking contended we cannot empirically determine what happened prior to the Big Bang, (T=0); so prior events (T-0) have no meaning. Paradoxically; empirical meaning (T=0) proceeds from the Meaninglessness (T-0). If meaninglessness produces meaning; has Astrophysics has reached its epistemological limit.

Also regarding the Big Bang, mathematicians indicate interplay between mathematics and astrophysics is necessitated. Yet mathematics (and therefore astrophysics), have been shown by Gödel to lack final systemization and are not free from internal contradiction. Consequently such Noncontradiction, or Truth of a system, cannot be formalized within that particular system. Given this Gödelian view, how can any science of phenomena be free from noncontradiction? Bertalanffy notes that any observational statements already presuppose an accepted conceptual universe and that perceptual cognition is not a reflection of real things nor is knowledge an approximation to truth or reality.

Mathematics also engages us into a current issue regarding numbers. Are they abstract objects (Whitehead and Gödel) or do they even exist at all (Nominalism)? Since it is alleged that there was no time prior to the Big Bang, what about Time?

Generally, from Boethius onward, time is viewed from the present into the past and projected into the future. Many disagree including; Hegel, Heidegger and Einstein. That Number is Time was a tenet of Greek philosophy from Plato & Aristotle onwards. McTaggart adds Spinoza, Schopenhauer, Bradley and almost all mysticism to an unreality of time school. Bergson contended the problem of Time is the central crux of philosophy and excepting the problem of evil; it is the hardest in all of philosophy.

By accepting the predominant linear view of Time we obfuscate our understanding of evil. Time unfolds and flows backwards not forwards. Plato argued learning is recollection and the being of anything can be known only through recollection; which comes from anamnesis. Schelling argued that the ruling dimension is the future that is the time in time. Bertalanffy portrays a philosophy of Nicolas of Cusa, which relates that whatever we do or think has already been in us, i.e., latency. Plotinus, not Heidegger, first maintained the primacy of future in the understanding of time. Both Whitehead and Merleau-Ponty accept nature as an unfurling.

Time is anamnesis. We recollect and discover our currently forgotten; but simultaneously created free-self. We are complete yet we forgot how we did it. We live, remember and recall. Time is the record of our moment; what we had volitionally done; the logical consequences from our now. That now is unfurled from anamnesis.

Omniscience knows this; we forgot and now live that forgetfulness. Time is the rewinding of the Divine "VCR/DVD" as we are shown ourselves. Our soul making and the evil we created is complete, yet we forgot how we did it.

A Book of Life is written, we don't recall our page number.

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A VISION FOR KNOWLEDGE-CENTRIC INTEGRATED SYSTEMS MODELLING AND ENGINEERING

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Systems modelling practice today builds models to support various systems life cycle activities: architecture and design, analysis, simulation, project and configuration management and so on. These models span a range of world-views and knowledge domains, and it is challenging to integrate them all to form a single system model. Our work on the INCOSE SSWG SE Conceptual Model project has outlined how various knowledge domains come together to form a system, and how these knowledge domains relate to each other. This paper builds on those ideas to propose an approach that enables integrated modelling of large, complex systems such as enterprises, including the associated knowledge and behavioral information with inbuilt internal and external consistency relationships.

The proposed systems modelling approach is based on the following principles:

Model systems as a hierarchical multi-dimensional network of wholes: The SE Conceptual Model work establishes the idea that an entity can be modelled as a whole by expressing its assumptions about the environment in the form of a collection of context roles with role profiles. These context roles span multiple dimensions: behavioral dimension (input providers and output consumers), resource dependencies, peer service exchange, control and life cycle management, structural relationships (parent, child), process-product relationships, abstraction-technological realization relationships, usage and business value etc. Other wholes bind to each of these roles recursively until the selected modelling boundaries are reached, resulting in an integrated model of arbitrarily large and complex systems as hierarchical multi-dimensional networks of wholes. Role relationships also enable linkages with consistency relationships between the system of interest and associated engineering life cycle systems such as network of life cycle processes, management systems and business systems.

Linkage to knowledge ontologies: The SE Conceptual Model work established the idea that knowledge domains can be categorized into "wholes" knowledge domains and aspect knowledge domains (e.g. knowledge about network routers vs. network routing). Knowledge about a whole includes a list of relevant aspects, and how the whole may be mapped to these aspects. When building a system model, it is desirable link each model element (entities, attributes, relationships, operations, processes etc.) to the corresponding wholes knowledge domain concepts using an ontological model (which in turn has mappings to the corresponding aspects). This adds semantics to the model, and allows all the relevant domain knowledge to be brought to bear for model synthesis and analysis.

Linkage to behavioral information: The functioning of the system described a system model has associated behavioral information that should also be linked to the model. We can link different types of behavioral information: desired behavior (i.e. requirements), expected/predicted behavior (from analysis) and observed behavior, a time series of values. Gaps between them lead to refinement either of the system model or of the underlying knowledge itself, enabling closed-loop system understanding and engineering.

Support for abstraction: Abstraction is a fundamental operation in systems understanding and engineering: constructing an abstract view of an entity that focuses on a subset of its information, involving acceptable approximations to the actual entity description. Modelling needs to support abstraction as a consistency relationship between models and views.

Reasoning completeness: This paper proposes an approach to ensuring the informational completeness and integrity of a system model, relative to applicable knowledge and the collection of concerns that the model aims to address.

The result of this approach is a modular network of models, such that each node in the network represents a whole, and is self-contained with respect to reasoning: each whole has the associated model information, knowledge and behavioral data required to check both internal and external consistency of its model, as well as consistency with models of other wholes.

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SYSTEMS THEORY AND THE METAPHYSICS OF COMPOSITION

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Ideas from systems theory – recursive unity and emergent attributes – are applied to the metaphysical and meta-metaphysical debates about the ontological status of composites. These ideas suggest the rejection of both extremes of universalism and nihilism, favoring instead the intermediate position that some composites exist in a non-trivial sense – those having unity and emergent novelty – while others do not. Systems theory is egalitarian: it posits that what exist are systems, equal in their ontological status. Some systems are fundamental, but what exists is not merely the fundamental, and the fundamental is not merely the foundational. The status of composites raises non-trivial issues, but mereology – and metaphysics in general – would benefit from substantive interaction with scientifically interesting questions.

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ATTEMPTS IN CO-RELATING THE THEORY OF TREE OF LIFE, TAICHI YIN-YANG FIVE ELEMENTS TRINITY I±1 SYSTEM, TRADITIONAL CHINESE MEDICINE DIFFERENTIAL DIAGNOSIS-CURE PROCESS, SCHEMAS THEORY, RELATIONAL SCIENCE, DSRP THEORY, FIVE AGGREGATES OF HUMAN MIND SYSTEM BY BUDDHA, AND COGNITIVE PROCESS OF CONSCIOUSNESS

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General systems theories have been developing with the aim of understanding the general fundamental components and relationships of knowledge across different disciplines. After 60 years of hard work and academic exchanges, many modern Western systems theories have developed with a variety of terminologies, illustrating the relationships between observers and decision makers, between systems and environment, and between the organizational forces of systems (decreases entropy with emerging effect) and the chaotic forces of the 2nd law of thermodynamics (increases entropy with de-emerging effect). In order to enrich and enlighten further development of the theories, ancient Eastern wisdoms from Confucianism, Buddhism, Taoism, and Traditional Chinese Medicine (儒釋道醫) have been analyzed with modern systems terminologies for the "Integral East-West Systems Thinking" project by the Ancient Balance Medicine Research Institute.

"Tree of Life" is a term and concept that appeared in different ancient cultures. The one that is being investigated is the Hermetic version of Tree of Life, Qabalah, as illustrated by SpiritScienceCentral.com with 10 spheres or "planes" of creation which are individually called Sephira. Other versions have more relationships between the spheres, for example, the Jewish and the Christian version. The research challenge lies in how to co-relate these 10 spheres with the numbers 2 in Ying-Yang by Taoism, 3 in Heaven-Earth-Human Trinity by Confucianism, 4 in Distictions-Systems-Relationships-Perspectives theory of analysis by Derek Cabrera, 5 in Five Elements Differential Diagnosis-Cure Process by Traditional Chinese Medicine, Five Aggregates Human Mind Systems by Buddha, Five Virtues by Confucianism, Five components in R-theory of Relational Sciences by John Kineman, 13 in the 5+3+5 levels in Emergent Meta-system in Schemas Thoery by Kent Palmer, and 15 in the 3x5 levels in the Taichi Yin-Yang Five Elements Trinity i±1 System by Ancient Balance Medicine Research Institute. All theories seem to attempt to release the boundary of duality between the physical world with precise engineering and the world of consciousness with fuzzy cognitive processes, and eventually develop different united non-dual systems thinkings. The research in this paper has found a possible set of co-relations among these different systems thinkings, by analyzing in a systemic manner, the structure of the components and relationships, and their corresponding properties and transformations.

It is believed that the bridging of these Ancient-Modern East-West （古今中西）systems thinkings would inspire more research and academic exchanges, leading to a more holistic worldview for understanding ourselves and the world around us.

Keywords: Confucianism, Buddhism, Taoism, and Tsraditional Chinese Medicine 儒釋道醫, Tree of Life 生命樹, Taichi Yin-Yang Five Elements Trinity i±1 System 太極陰陽五行天地人系統, Traditional Chinese Medicine Differential Diagnosis-Cure Process 中醫辨證論治, Schemas Theory 基模論, Relational Science, DSRP Theory, Five Aggregates of Human Mind System by Buddha 佛陀五蘊系統, Cognitive Process 認知過程, Consciousness 意識, Fuzziness vs Precision 精密與模糊, Five Virtues by Confucianism 儒家五常, Health and system thinking Special Integration Groups SIG 健康與系統思維特別整合分組, organizational force組織力, entropy熵, second law of thermodynamics熱力學第二定律, Integral East-West Systems Thinking 融合東西方系統思維, Ancient-Modern East-West systems thinkings 古今中西系統思維, Unification of Nature and Man 天人合一

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A STUDY ON THE LEARNING MODE OF TOURISM EXPERIENCES

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Travel experiences while learning where the traveler goes and what different things they see from everyday life. This brings pleasant, meaningful, and valuable experiences. Dewey's (1938) theory of experiential learning emphasizes “learning by doing ”. He learns and gains by reflecting on the insights. His personal observation and actions reflect certain behaviors. The process of experiential learning in tourism is an extremely important elements which complement each other.

The purpose of this paper is to construct a “travel experience learning model” based on the “empirical learning theory”. The general mode of discussion includes topics i.e. the motives of the travel process, decision-making, project implementation, and reflection. However, there have been a few studies on motives, choices, decisions, and implementation plans for research on tourism. In the past, research on tourism related areas was primarily in motivation, choice decision-making, and implementation plans. There was little discussion about an individual's experience promoting the growth process. Therefore, the tourism experience learning model was the subject of inquiry. Based the qualitative content literature analysis, the relevant conceptions of the travel experiences of “knapsack tourism” and “self-help tourism” findings, the framework of the “travel experience learning model” was extracted as the goal. Finally the tourism experience learning Management implications discussion.

Keywords: Action Learning, Travel Experience Learning Model

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ESTABLISHING AN UMBRELLA PHILOSOPHY - REQUIRED TO UNDERPIN GENERAL SYSTEMS UNIFICATION IN A SINGULAR ENCOMPASSING PARADIGM

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As Strickland & Reveal (John Wiley, 1995) reminded us in “Understanding the Nature of System Change: An Interdisciplinary Approach”, von Bertalanffy in “General System Theory” (Brazillier, 1968) stated that the original aim of GST was ‘to investigate the isomorphy of concepts, laws, and models in various fields, and to help in useful transfers from one field to another.’ From its inception GST/ISSS has advanced that “embracing and ambitious” noble objective of the founders, through conversations, conferences, forums and publications.

The encyclopaedic diversity of systems, complexities, organizations and levels of behavioral existence is daunting. Physicists first hinted at the potential for discovering a grand isomorphism, by focusing on the fundamental forces as first place for ‘unification’. That has yet to be accomplished. In the meantime, Sarton, von Bertalanffy, Whorf, Boulding, Miller, Beer, Rapoport, Rosen et al, opened the spectrum of conversations to include biology, ecology, economics, sociology and more, in a grander sensibility.

And though there have been great investigations, innovative detailings of specific models and math-described ideas, such as H. Odum “emergy”, R. Rosen “entailments”, D.Hebb “systems of systems”, J Rose “integrity paradigm”, among others, conceptual goals have drifted from trying to identify a single isomorphism, to coping with local comparisons and similarities. A grand convergence seemingly is no longer the centerpiece of the conversation roundtable.

The author proposes that it might be beneficial, in order to refresh the vision of GST/ISSS founders, to do a deeper analysis of the philosophy of General System Theory as originally conceived. Such philosophy was not whole-born, but

itself had to be a product of how the universe is organized – was encountered – was recognized – and eventually became appreciated – by human minds.

There is no intention of replacing the diverse wellspring of prior philosophical ideas and mindsets, but rather to hold true to the goal of identifying a shared seminal behavioral rule of performances among systems, to recognize an improved philosophical embracing frame of reference, as a requisite for isomorphism. An improved essential notion among essentials … rules of performance being the tangible practical aspects, but by better defining the intangible qualities … such as a re-worded 21st century framing of Aristotelian causes, might enable a quantum leap across the impasse chasm that General System (singular) Theory faces. Potential correlation~calibration resting on a seminal principle of requisitely defined association~communication. The author looks to re-open that conversation, in hopefully a new way.

Keywords: Integrity Paradigm ; communication ; general theory of entropy~negentropy ; systems philosophy ; information access

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A THEORY OF SYSTEMS

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This paper fills a gap in our understanding of the interaction between physical objects and formation of systems. In a general sense, systems theory can be described as the study of corporeal objects as they interact within an ontological framework of objects and processes. A theory of systems unifies myriad definitions into a single definition of a system under the premise that a system must satisfy four conditions—demonstrate process metastability, show external adaptability, reveal internal agility, and manifest non-reciprocal / irreversible emergence. We define a theory of systems based on three fundamental observations: 1) All systems consume, conserve, and lose energy, 2) All systems are dynamically stable, and 3) All systems have a fundamental lifecycle determined by their metastability mechanism. We analyze the flow of energy, matter, material wealth, and information between physical objects to determine their integrative actions. Thus, a theory of systems reveals the origin and sustainment of functions; shows that interactions between all objects result in emergence; and infers an ontological framework which structures systems knowledge into recognizable patterns. Applying a model-based systemic approach, we show the relations between systems and their ontological framework as constituent systems within systems of systems.

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RESEARCH FOR LIVING: FORUM THEATRE AS SECOND-ORDER CYBERNETIC ACTION RESEARCH

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Inspired by the critical pedagogy of Paulo Freire (1996), “Forum Theatre” was originally developed by Brazilian director, activist and, later, city councilor, Augusto Boal as part of his program of the “Theatre of the Oppressed.” It has been developed further by, among others, Vancouver’s David Diamond, whose Theatre for Living has “moved away from the binary language and model of "oppressor/oppressed" and now “approaches community-based cultural work from a systems-based perspective; understanding that a community is a complexly integrated, living organism.” (theatreforliving.com). The Theatre for Living website describes the Forum Theatre component of their work as follows:

In Forum Theatre, we show the audience the play all the way through once – the play builds to a crisis, and stops, offering no solutions. The play is then performed a second time, where audience members can then stop the action and enter the stage themselves, by replacing characters with whom they identify and try to solve problems or issues inside the story. The rest of the cast stays in character and improvises. […] The theatre becomes a creative laboratory where we can try ways to transform ourselves, our communities, and the world. (theatreforliving.com)

In addition to fully produced “main-stage” shows developed over several weeks, involving paid casts and professional designers and, often, performed in “soft seat” theatres, Diamond has evolved his one-week “Power Play” process through which he will take members of a community into which he has been invited to explore a particular issue of concern through an intensive workshop process culminating in the creation of a short Forum piece to be performed before other community members in school gymnasiums, community centers and other “non-professional” spaces. A substantial percentage of his work takes place within indigenous communities across western Canada and has tackled such “wicked problems” as homelessness, addiction, and family violence.

Even in the more “professional” Theatre for Living main-stage shows, deep personal engagement with, and knowledge of, the issue at hand is a far more important qualification for a cast-member than extensive acting experience. As an example, the cast for 2015’s maladjusted, a Forum Theatre piece about the mental health care system in the province

of British Columbia, was composed of a retired psychologist, an active mental health and addictions nurse, as well as a number of past and present recipients of mental health services.

The parallels between the process described above and the description of Action Research within the call for papers of this SIG are not difficult to discern. And, indeed, Forum Theatre performances often provide, in the spirit of more traditional forms of Action Research, penetrating empirical insights into the systemic structures that perpetuate "wicked" problems and that, in the spirit of the "Legislative Theatre" employed by Augusto Boal during his tenure as city councilor, often find their way into policy recommendations via project reports that the company presents to the provincial government. There are, however, further facets of the Forum Theatre creation process and audience experience that, through the embodied role-playing it demands, further fulfills the reflexive promise of Action Research in a particularly second-order cybernetic fashion.

Larry Richards characterizes the second-order cybernetician, not as a scientist or engineer, but as "a potential craftsperson in and with time" who explores the role varying dynamics can play in "the reconfiguration of constraints (resources) in order to make possible what was not previously possible, including the avoidance of what was previously inevitable." He goes on to make a further distinction of the second-order cybernetician's craft that resonates with the art of Forum Theatre actors and the particular kind of audience learning enabled by their work.

Being a craftsperson in and with time is different from being an artisan, where one works with physical media –[…] Time is not a medium in the way that sound and paint are. Knowing when to say or do something in an intervention, how loudly or softly to speak, how fast or slowly to move, what rhythm to use, how to turn a flow into an event, when to emphasize or not – all of these involve a kind of craftsmanship in and with time.

These are, indeed, the kinds of self-observational distinctions brought into greater relief by Forum Theatre as it provides a studio experience in which all participants can sharpen their ability to make such distinctions and identify the new kinds of opportunities for action they afford. This transformation can be understood as a shifr from "first-order" to "second-order" observation as articulated by Niklas Luhmann.

The first-order observer lives in a world that seems both probable and true. By contrast, the second-order observer notices the improbability of first-order observation […] But as second-order observation it can at least thematize the improbability of first-order observation (including its own). It can comprehend more extended realms of selectivity and identify contingencies where the first-order observer believes he is following a necessary path or is acting entirely naturally.

This element of the Forum Theatre work to be discussed in this paper has been greatly enhanced by an engagement with the second-order cybernetic Enactive Management program of Osvaldo Garcia de la Cerda and Maria Saavedra Ulloa. (de la Cerda, 2009) centred around the use of their ontological tool, CLEHES, and its observational schema of six criss-crossing elements (Cuerpo [body], Language, Emotion, History, Eros, and Silence) rendering previously invisible distinctions visible to observers who can then go on to respond with the kind of dynamic sensitivity and craftsmanship identified by Richards.

Drawing on my own experience as a member of the mixed indigenous/non-indigenous cast of Theatre for Living's šxʷʔaṁət (home) exploring the difficult path to reconciliation between Canada's settler and indigenous populations and as director of Conflict Theatre @ UBC co-creating plays with a diverse group of employees at the University of British Columbia exploring blockages to authentic and productive communication in situations of workplace conflict, this paper will explicate the procedures of Forum Theatre as a form of Action Research featuring video clips of audience interventions at Forum performances and supported by empirical evidence of its efficacy in, not only, facilitating the co-creation of knowledge around particular systemic issues, but also, heightening such reflexive competencies as self-awareness, other awareness, self-regulation and relationship management in the midst of the challenging interactions resulting from the systemic structures at work. For, as Diamond insists, "[b]ecause Theatre for Living approaches the community as a organism [...] when plays are created, they are made to help us investigate ways to change the behaviours that create the structure, not just the structure itself." "(Diamond, 2007 p, 38)

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FROM MOSAIC TO SYSTEMATIC: OUTLINING A SYSTEMS APPROACH TO WATER RESOURCE MANAGEMENT

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Effective Water Resource Management (WRM) is a complex undertaking that requires a variety of solutions; including economic ones. Both supply-side and demand-side management approaches have been implemented with the goal of meeting the demands of multiple stakeholders while being constrained by challenges such as infrastructure inefficiencies, water source access issues, and short-termism/political expedience. While successes have been made on both the supply and demand side, there is doubt that either approach is sufficient on its own to promote effective, sustainable water resource management over the long-term. In light of this, it is natural to propose an amalgamation of the two. However, combining the approaches without considering 1) which variant is most appropriate or, importantly, 2) potential interaction effects between the two means the hybrid will be merely mosaic in nature. While such mosaic approaches do reflect a much needed diversity in solutions, they run the risk of being suboptimal at best. At worst, they can be counterproductive. Instead, a systems-based approach to effective management is necessary.

A complete systems approach includes an understanding of the goals and assumptions underwriting WRM. An important place to begin in this regard is with the concept of resilience. Water managers want their systems to be resilient to stress and the recent crisis in Cape Town illustrates the perils of failing to meet such a goal. Furthermore, the economic strategies highlighted above are intended to make water systems more resilient. Given this role, it is critical to be clear about the definition of resilience, who the stakeholders in a resilient system are, and over what time scale resilience is measured. A systems-based approach to WRM should begin by banishing some any conceptual uncertainty. In Part I of this paper, the authors canvas several key resilience concepts and highlight some of the philosophical contentions that lie behind them. In Part II, the authors review economic theory for both supply and demand-side approaches. In Part III, then, the authors consider how these two strategies can be applied to WRM specifically; leveraging Ludwig von Bertalanffy's concept of Isomorphology to clarify the connection between general economic theory and its application to the management of water resources. Finally, in Part IV the authors sketch out a research program intended to develop the framework initialized in this paper. This will include a brief discussion of future empirical research. It is not uncommon for experts to proclaim that a systems-level approach is necessary for the effective and sustained management of water resources. However, details can be sparse on what such an approach looks like. This paper is intended to help address this paucity of specifics.

Keywords: water resource management, isomorphology, resilience, supply and demand-side economics

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A REQUISITE VARIETY BASED FRAMEWORK TO INCREASE SYSTEM RESILIENCE TO EMERGENT PERTURBATIONS

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Ashby's Law of Requisite Variety has provided several decades of explanation concerning the regulatory capacity necessary to effectively adapt to changes in the environment to ensure survivability. The purpose of this exploration, based in Ashby's Law of Requisite Variety, is to provide an explanatory framework that relates system design, execution, and development of regulatory capacity necessary to ensure continued viability (existence) of a system. In this exploration we pursue four primary objectives. First, we explore the historical development and use of Ashby's Law of Requisite Variety. This provides a review of literature which synthesizes major themes, provides a scholarly critique of the development, and examines the utility, realized and unrealized, provided by Ashby's Law. Second, a Systems Theory and Management Cybernetics based framework for variety absorption is developed. This framework provides the basis for a new and novel use of Ashby's Law to provide enhanced system resilience [ability to recover to a previous state following a disturbance] through purposeful design, execution, and development of a system. The essence of the framework suggests that system design inability to match emergent perturbations (variety) is: (1) a source of 'unabsorbed variety' which accumulates in a system and creates system uncertainty [instability], (2) unabsorbed variety can be indirectly measured through the existence of system pathologies, which represent violations of underlying systems principles, (3) the design-execution coupled dyad must sufficiently absorb variety such that a system can be suitably resilient to emergent perturbations to permit variety absorption at a level that supports continued viability, and (4) long term system sustainability is dependent upon development which enhances system design-execution capacity for variety absorption. Third, the implications of this Requisite Variety based framework are examined in relationship to purposeful design, execution, and development of systems. Following early work of Stafford Beer's management cybernetics, complex system governance is introduced as an emerging field to provide more purposefully designed, executed, and developed systems to provide requisite variety essential to maintain stability for increasingly complex systems. Fourth, several amplifications and utility for Ashby's Law are suggested. Among these amplifications we include: (1) the intersection of Systems Theory and Management Cybernetics to articulate sources of 'unabsorbed variety' as pathologies in complex systems functions of communications, control, coordination, and integration, (2) introduction of a meaningful set of measures for 'unabsorbed variety' as pathologies in complex systems, (3) suggest enhancement of regulatory capacity of a system targeted to purposeful modification of design, execution, and

development in response to the level of 'unabsorbed variety' that exist in the system. The exploration closes with implications for further development and application of the framework in operational settings. Among these further developments, we suggest an extension to Simon's almost five-decade old conclusion that although we consume information, 'information consumes attention' which we extend to include 'attention consumes [absorbs] variety'.

3359

KILLING THE MODERN THEATRE: A NEW MEDIUM TO AUGMENT STAGE PERFORMANCES

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Paul Simon, in "The Dangling Conversation," asked "Is the theatre really dead?" Yes, traditional theatre of the literary, mechanistic age is. Consequently, the play script and its format are dead because we have moved to the electrical, electronic, digital (EED) age and theatre is no longer just humans on a stage delivering dialogue, action and possibly song with realistic or even impressionistic sets. This paper shows how Electronic Digital Displayed Script With Embedded Multi-Media (EDDSWEMM), in a way, acts as a "Bridge Over Troubled Waters" from the new EDD age to the old literary age.

In fact, the whole of society has changed, and theatre needs to follow. Marshal McLuhan, the Toronto philosopher, stated that the societal impact of a new medium is far greater than its content. And, that a new media requires a new form; this paper--in part--is formatted to accommodate EDDSWEMM. It opens doors for new content that includes the content of the old print media. A crisis is that changing a play script format for any reason is tantamount to professional suicide.

This paper follows up on my 2017 presentation at ISSS in Vienna, Austria, of "MS Windows Applied to Theatre"--a peer reviewed paper that lays a scientific foundation for projecting an electronic, digital script with embedded multimedia. It showed how the construct "Viewability," that I named, applies to theatre and script projection. Projection is a form of display of information. Drama displays, by human dialogue and action, the information in a script. Microsoft Word is used to write a script, and by means of Object Linking and Embedding (OLE), visual multimedia--represented by icons--may be embedded in the script. Display may be initiated by double clicking on icons in the text. Similarly, sound may be embedded and "played" by double clicking on music icons. In the interest of increased Viewability, non executable production cues may add additional information to the script. Stage drama is synchronized with the projected script.

The resulting script, displayed on a monitor, also acts as a new digital-literary genre for the individual reader or actor rehearsing at home. Its presentation lies somewhere between the old, formatted as for a typewriter, literary based paper script and a traditional full production augmented by EDDSWEMM.

This paper shows that there are many reasons for EDDSWEEM forecast by McLuhan's follow up and popularization of Understanding Media ... in a subsequent book, The Medium is the Massage. I identify additional reasons such as the obvious advantage to the deaf. McLuhan did not extensively treat theatre as a medium for communication.

I review the Dramatists Guild modern play script format and show that it is part and parcel of the old literary/mechanical age. My proposed new EDDSWEMM format includes the content of the old (sacred) script format. The possibilities of additional content using EDDSWEMM are wide open. Risk aversive producers and theatres often look for tried and true literary works to ensure a gate, but if they want something new and are to survive, they will have to provide material that bridges EED to the old age. Directors, playwrights and audiences are always looking for new material but are locked into the old format; projection at least provides a reason to begin delivering dramatic material in new ways.

Visualization, a hot word currently vogue in the systems science community, is by projection of this paper.

EDDSWEMM requires technical resources that exceed those that Microsoft currently provides for document production. Hopefully, this problem will be resolved as part of future research and can be reported in the next ISSS conference.

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MICE TOURISM NETWORK TOPOLOGY AS AN INNOVATION IN THE COMPLEMENTARITY OF A SSM APPLICATION

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Socio-Technical systems are characterized by complexity, turbulence, and the diversity of points of view on how to deal with problem situations. However they can be explored by the observer as learning systems.

This research establishes the problem situations that have affected the viability of MICE Tourism in Mexico, such as legacy aspects, the missing relationships with the academia, and the lack of benefits for society. This was done by using the first three stages of Soft System Methodology (qualitative approach) and the Network Science tools (network analysis). The argument to use these tools is that they were developed to study, characterize and modelling the dynamic of complex systems. The approaches complement each other to enrich the diagnosis of the system.

The conception of the MICE tourism network is based on the relationships (links) between the elements (nodes) that interact in the system. This MICE tourism network is composed by 43 nodes and, at least, every node has six links with its neighbors, yielding 406 links. It means that the communication throughout the network is spreading, so that if more nodes are added to this networks, the number of links will grow faster.

Keywords: MICE tourism, SSM, network science, complex system

3362

METHODOLOGY FOR THE DEVELOPMENT OF AN AGENT BASED MODEL TO SUPPORT LOGISTICAL PROBLEMS OF REFUGEES IN THE NETHERLANDS

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The unfavourable situation in Syria motivated many people to flee the country. Not only did these people take unimaginable risk but they chose to embark on a journey with an unknown destination. Like many European countries, the Netherlands also became a destination or route for many refugees.

This paper reports on a government funded study to improve logistics for refugees, through development of agent based model. Since emancipation of the refugees in terms of logistics management is a key success factor, the study is done from a critical social theory perspective. A seminal paper on principles for critical social theory in information systems research is applicable and guides the process. We selected action research from a critical social theory perspective for this research project. In addition to the critical social theory character of the study, it has a strong design focus. Design science research has gained popularity in the field of information systems. Recently, key scholars in design science research in information systems expressed interest in combining design science research with action research. However the current literature does not emphasise the critical social character of action research. Current literature combining these methodologies does not focus on the emancipative capabilities of the artefact.

From the perspective of the refugees, the emancipative purpose of the proposed artefact is all important. As proposed by the principles for critical social theory in information systems, we take the following explicit value position: We want to develop an artefact that improves the logistical situation of the refugees in support of basic human values. We value the refugees as people who made extreme decisions to take unimaginable risks and want to support them on their logistical and procedural journey in refugee hosting nations. We do have a responsibility to the government to assist the governmental processes. This position guided us to use critical social heuristics as methodology to gain a better understanding of the perspectives of the stakeholders (such as governmental organizations, NGO's, lawyers, refugees, etcetera) involved. Since our focus is on a holistic understanding based on values, we chose the multi-aspectual framework of the philosopher Dooyeweerd to guide the analysis of interview data from the diagnosis phase of the project.

The purpose of the diagnosis phase is to gain an understanding of the logistical problems experienced by the refugees. The assumption is that problems occur when values are endangered or when the value of one stakeholder clashes with the value of another stakeholder. We conducted interviews with 14 refugees. We then listed all the steps that a refugee takes during the refugee procedure in the Netherlands and mapped the problems to the steps in the refugee process. We asked 14 stakeholders to supplement the problems that were identified in the interviews and asked the stakeholders to 'translate' the problems to underlying values. We use aspectual analysis to interpret the results in order to develop objectives for an artefact. In this paper we show how the analysis of the data from a Dooyeweerdian perspective enriched our own understanding of the required intervention. By focusing on the values formulated by the stakeholders (such as respect, autonomy and cultural sensitivity) we provide an innovative strategy for thinking about information systems.

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CLARIFYING AND SUPPORTING ROOT CAUSES IN ORGANIZATION BEHAVIOUR: TOWARD A SCIENCE OF SOCIAL SYSTEMS

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The aim of this paper is to identify root causes in human social system behaviour then discuss implications of these causes for understanding, designing, and managing large organizations. The need for clarifying root causes is clear. Science offers useful laws for how things behave, or the hard sciences, such as chemistry, physics, math and engineering. In contrast, science offers few and conflicting models for how people behave. Thus, there are the soft sciences, such as psychology, management, education, sociology, and economics. And there are the soft social systems such as schools and workplaces. Our current knowledge of soft social systems lies in many disciplines, and the knowledge within each discipline resides in silos, resulting in Tower-of-Babel communication across disciplines. Unintended, undesired, even harmful outcomes are frequent, especially in large organizations. The approach used in this investigation is narrative path analysis. Beginning with large social system outcomes as the unit of focus and dependent variable, a systems science explanatory lens is developed, and the path lands at the individual human system member as root cause, unit of focus and independent variable. The narrative path then proceeds back up to the large social system, with implications at multiple levels/sizes of system-- the pair, the room, small building, and then the multisite organization. The investigation gathers details via key concepts, literature, and evidence from relevant disciplines, including management, control systems engineering, psychology, adult learning theory, plus examples from large urban schools and workplaces. Metaphors and images are included to clarify the narrative with the goal of making sense to a wide diverse audience—including leaders, learners, workers, theorists, researchers, engineers, and policy-makers. Updated theory is that cause/agency of organization behaviour is not solely in the leader, nor the worker, but in both. Each system member, from janitor to CEO, from student to superintendent, learns and performs according to his/her own willingness and ability, resulting in almost infinite variability. A new provide-pickup relationship emerges. That is: The leader's role is to provide input, resources and tasks; the learner/worker role is pickup of input, each at his/her own rate. In spite of infinite variability, there is predictability. We can predict, with certainty, that each system member will pick up, learn and complete tasks, as he/she is willing and able. The nature of pickup described, a new issue emerges, span of pickup, at the level of the large social system-- adding an important new dimension to the concept of span of control. Namely, in large social systems, important input is beyond the pickup span of individuals. For example, it is easier for CEOs to care more about their children's college tuition than their employees' salaries. And, it is easier for front-line employees to care more about their weekly paycheck than the big picture goals of the organization, or for a cattle herder to care about the profit gained by adding a new animal to his herd than the big picture of overgrazing. Ideal-based user-designed automated social control systems (IBUDASCS) are proposed to allow organizations and system members to flourish. The cumulative meaning of IBUDASCS is constructed using the following examples: Control Systems-- When the temperature turns 65, the heater turns on; plus Social—When an employee is late, he/she makes up the time (Honor system, or superviser controlled); plus Automated – When an emploee is late, the information automatically goes to the time clock and payroll; plus User-designed-- People at each system level decide together their automated consequences (in alignment with suprasystem policy); plus Ideal-based-- The consequence is automated not to berate or punish, but to free up everyone's time for more important matters.

Keywords: Management, Education, Control Systems Engineering, General Systems Theory, Social Systems Theory

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A SYSTEM DYNAMICS MODEL OF THE FIRE SUPPRESSION "TIPPING POINT"

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In recent years, the fire science and management communities have turned to systems thinking principles to better address the challenges of managing wildfire in an ever-changing and increasingly complex world. A key theme is unraveling the "fire paradox," which is essentially a reinforcing feedback loop where aggressive fire suppression in fire-prone forests leads to an accumulation of hazardous fuels such that future fires burn with higher intensity and resistance to control, ultimately leading to greater demand for suppression. By instead capitalizing on opportunities for expanded use of fire as a tool to restore forest conditions and reduce hazards, managers can invert feedbacks wherein fire can act as more of a self-regulating mechanism. One barrier to such a change is uncertainty over questions of where, when, and how frequently fire response decisions can deviate from the status quo of aggressive suppression in order

to achieve more desirable fire outcomes. We propose a systems dynamics model of a coupled human and natural fire-prone system as a mechanism to address this question, focusing particularly on identifying the "tipping point," i.e., the rate and magnitude of change in suppression decisions at which the long-run trajectory of risk reaches an inflection point and begins to decrease. In this presentation we will first discuss model formulation, highlighting key concepts and variables such as forest conditions, fuel loads, fire regime, fire-on-fire encounters, and resistance to control. We will then present preliminary results and outline future research directions.

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HOW THE USE OF PATTERN RECOGNITION THROUGH HETERARCHIES CAN MINIMIZE TIME AND EFFORT IN CREATING PROTECTIVE AND RECOVERABLE GRID STRUCTURES

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System Engineers need to differentiate between engineering a system and doing System Engineering. Often, when dealing with large interconnected systems—which most collectives of things are these days, system engineering as practiced multiples complexity. Praxis today intensifies the misuse of personnel. It wastes their time as standing armies or divides their attention by having to work part time on several different programs. Program failures are masked off by the delay of test and evaluation. Tech manuals that remain out of date retard training. What this paper seeks to do is to stimulate the application of Model–Based System Engineering to infrastructure through more efficient techniques. These models can be based on graph theory using heterarchies, and reduce the time between product designs to amplify every user's satisfaction.

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FROM SURVIVABILITY TO FLOURISHING AND SUSTAINABILITY TO THRIVABILITY: AN EMERGING CONCEPTUAL FRAMEWORK

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This paper explores the ISSS conference theme of "Innovation and Optimization in Nature and Design" by employing philosopher Owen Flanagan's notions of fitness and flourishing, I extend these concepts to second-order frameworks, as sustainability, and the emergence of thrivability. The time has arrived to articulate how to respond to emerging questions regarding what designates media/technology, life/society, what is inevitable or good, and how they all have changed over time and continue to evolve.

I will outline a theoretical ethics for thriving culture. Firstly, we require fitness for survival, or simply "survivability." Expanding on the foundation of survivability, flourishing can be understood as growth and inter-cultural competency in the early to late-20th century. By establishing these normative structures a second-order notion of fitness for sustaining, or sustainability activated social movement growth in the late 20th century and continued into the early 21st century. In moving forward, this in turn must become a flourishing for thriving, meaning a new sense of openness, a transdisciplinary convergence with fitness-sustainability, enacting new notions of growth in the 21st to 22nd century, or in other words, simply put—thrivability.

This paper reboots environmental and ecological communication theory-practice with open, agile, commons-based approaches for setting forth an integrative conceptual frame for thriving in the 21st century. In order to "thrive," I posit a new meta-norm. This system acknowledges that values and forms of moral imagination cannot be dislocated from our implementations. More than merely utilizing sustainable memetics, brands, and/or practices (e.g. green-washing), we need to accentuate the emerging educational and scholarly trajectories of openness and ecological transparency in the forms of free/open access in journals, source code (both representation and physical), and the technologies of law and communication that can assist in transforming the dialogue and dialectic. Rather than remaining in a state of dog-paddling, or sustaining, we must move towards a 'post-sustainable' state. Moral imagination in the 21st century not only needs to acknowledge and utilize the convergence of human beings with emerging computational systems and infrastructures, but must ask how we can remediate the physical environmental damage we have incurred.

This metaperspective—noting meta- as "along with" not above or beyond—of second-order flourishing recognizes the practices and effects of sustainable frameworks that—for lack of a better way of putting it—actually work. We must contend with and repair (curate) what John Dewey calls the "superfluous products" of our own creation. We require an inventive regenerative aesthetics, not feeding back in endless loops, but a feedforward into the problematic situations that are only beginning to emerge by reimaging ways to engage in ecomedia literacies, biodesigns, and the ecoverse we inhabit. The chickens have come home to roost in the form of unsustainable environmental transformation. An emerging notion of an interconnected commons-based wisdom will move us into a new ethical foundation of thrivability.

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PREDICTING COST OF CARE IN TOTAL HIP AND KNEE REPLACEMENT SURGERY WITH RECONSTRUCTABILITY ANALYSIS

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Legislative reforms aimed at slowing growth of US healthcare costs are focused on achieving greater value per dollar. To increase value healthcare providers must not only provide high quality care, but deliver this care at a sustainable cost. Predicting risks that may lead to poor outcomes and higher costs enable providers to augment decision making for optimizing patient care and inform the risk stratification necessary in emerging reimbursement models. Healthcare delivery systems are looking at their high volume service lines and identifying variation in cost and outcomes in order to determine the factors that are driving this variation. Better understanding patient factors and the increased risk of increased cost.

One way to improve predictions is through enhanced modeling methods. Current modeling is predominantly done with logistic regression (LR). This project applied Reconstructability Analysis (RA) to data from hospital based hip and knee replacement surgery. RA is partially similar to LR, but has some unique features.

RA is a data mining method that searches for relations in data, especially non-linear and higher ordinality relations, by decomposing the frequency distribution of the data into projections, several of which taken together define a model, which is then assessed for statistical significance. The predictive power of the model is expressed as the percent reduction of uncertainty (Shannon entropy) of the dependent variable (the DV) gained by knowing the values of the predictive independent variables (the IVs)

RA predictive models were then generated for the total cost of the hospital episode. RA generated continuous predictions for cost by calculating expected values. Models included novel comorbidity variables, non-hypothesized interaction terms, and often resulted in substantial reductions in uncertainty.

Predictive variables consisted of both delivery system variables and binary patient comorbidity variables. Delivery system variables (surgeon, location, and surgeon volume) were found to be the predominant predictors of total cost rather than individual patient risk factors. Results suggest that provider practice patterns have a larger effect than previously considered. Improving hospital and provider efficiency may be more strategic than cherry picking low risk patients.

Risk ratios were generated as an additional measure of effect size. These risk ratios were used to classify the IV states of the models as indicating higher or lower risk of adverse outcomes. Some IV states showed nearly 25% of patients at increased risk, while other IV states showed over 75% of patients at decreased risk. In real time, such risk predictions could support clinical decision making and custom tailored utilization of services.

Future research might address the limitations of this project's data and employ additional RA techniques and training-test splits. Implementation of predictive models is also discussed, with considerations for data supply lines, maintenance of models, organizational buy-in, and the acceptance of model output by clinical teams for use in real time clinical practice.

If outcomes and risk are adequately predicted, areas for potential improvement become clearer, and focused changes can be made to drive improvements in patient care. Better predictions, such as those resulting from the RA methodology, can thus support improvement in value – better outcomes at a lower cost. As reimbursement increasingly evolves into value-based programs, understanding the outcomes achieved, and customizing patient care to reduce unnecessary costs while improving outcomes, will be an active area for clinicians, healthcare administrators, researchers, and data scientists for many years to come.

3376

VIOLENCE AND IMPASSE

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It is the contention of the author that the roots of violence do not stem from human nature or even animal nature, but that they are even more fundamental, being inherently and inextricably interwoven into the paradoxical nature of complex adaptive systems.

Violence can be defined as the invasion of a boundary or the disruption of a necessary flow across a boundary. In exploring how this might manifest in human interaction, the nature of humans as multileveled systems of systems is investigated. Because we all have different perspectives, priorities and perceptions, there will be times when perceived human needs feel unmet, and there is a risk that abuse or violence will be used as a response to try and meet those needs.

Often violence occurs because the two or more people involved in an interaction are unable to bridge the differences that have arisen between them in a way that allows them to have their perceived needs adequately met. A boundary

has been placed between those involved creating an impasse. The person who was previously seen to be operating within a shared boundary is deemed to have shifted to become the 'other', the cause of the problems, and even a hostile enemy. The point of impasse is often used to 'justify' an abusive or violent response. The dynamics of impasse are examined in the case of intimate partner relationships and international politics to demonstrate how the principles developed operate in practice at various levels through society. The final section looks at how systems thinking might help avoid reaching an impasse, or in some case bring a relationship back from impasse to where meaningful authentic dialogue might be resumed.

Keywords: Violence, impasse, boundary, systems theory, needs, threats

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TOWARD A TRANSDISCIPLINARY FRAMEWORK OF THE FIELD OF STUDY OF COMMUNICATION BASED ON THE CYBERSYSTEMIC APPROACH

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At the beginning of the twenty-first century, the academic field of study of communication has been related with "the expansion of understanding and observation of the processes of communication, cognition and information, not only with the synthesis or integration. The focus is to observe the differences and similarities between information, cognition, meaning, intelligence, mind and communication and proposing an integral synthesis for the communication phenomenon. The aim of this paper was to build a unified framework for understanding the concept of communication in the physical, biological and human domains, through their systemic interrelations.

The Cybersystemic approach helps to elucidate differences and similarities in the systems of knowledge that involve the communication phenomena. Systemic design research integrates and organizes existing knowledge through Systems Sciences principles. From an exploration review, this paper presents a systemic framework for the study of the communication phenomena under the outline of its holodynamic evolutionary process toward a higher level of complexity of an integrated communication phenomenon. Research provides a starting point toward a unified understanding of the communication phenomena, under a conceptual approach that describes and explains a broader definition. As a result, the cybersystemic framework allows an open dialogue through a multidisciplinary language of Systems Science and toward a better understanding the concept of communication.

Keywords: Cybersystemic, Communication Theory, Systems Science

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VISUALIZATION OF FOUR VARIABLE LATTICE OF RECONSTRUCTABILITY ANALYSIS AND BAYESIAN NETWORK STRUCTURES

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Reconstructability Analysis (RA) is an analytical approach developed in the systems community that combines graph theory and information theory. Graph theory provides the structure of relations (model of the data) between variables and information theory characterizes the strength and the nature of the relations. RA has three primary approaches to model data: variable based (VB) models without loops (acyclic graphs), VB models with loops (cyclic graphs) and state-based models (nearly always cyclic, individual states specifying model constraints). These models can either be directed or neutral. Directed models focus on a single response variable whereas neutral models focus on all relations between variables. Neutral system VB models with loops are the focus of this paper because of their comparability to Bayesian Networks.

The lattice of possible graph structures for an RA neutral system VB model with loops depends upon the number of variables in the data. With three variables there are nine possible specific structures, with six variables there are over seven million. The lattice of possible structures increases hyper-exponentially with the number of variables.

For a three variable RA neutral system VB model with loops, with variables A, B and C, A:B:C represents the independence model with probability distribution p(A)p(B)p(C). The colon represents independence between variables. Thus the A:B:C model represents independence among all variables. ABC with probability distribution p(ABC) represents the saturated model which is the same as the data. The lattice of all possible structures is constructed by adding a single new relation starting from the independence model A:B:C. For data with n number of variables, the lattice is constructed by adding all possible new single dependent relations to structures from the prior level until the saturated model ABC is achieved.

Bayesian networks (BNs) are a subset of chain graphs, also known as block recursive models, because they have directed edges only. For a three variable BN there are twenty five specific structures and for a four variable BN there are almost

thirty thousand. Like RA, the number of structures grows hyper-exponentially with the number of variables because of the possible combinations of variables and edge directions.

Like RA, the BN independence model for three variables can be represented by A:B:C and the saturated model by ABC. Unlike RA where edges are undirected, BN specific structures include the directions of edges between variables that are dependent.

Generally speaking, the BN lattice is developed in the same manner as that of RA, by adding a single new relation at each level with the additional step that all possible edge orientations are identified at each level. The lattice of neutral system RA structures and BN structures mostly overlap, however there are some RA structures that BNs cannot represent and some BN structures that RA cannot represent. For example the structure ABCA:C with probability distribution p(A)p(C)p(B|AC) is not found in the RA lattice but is common in the BN lattice. In contrast the RA neutral system structure AB:AC:BC, which contains a loop, is not found in the BN lattice.

In this paper we build a visualization of the lattice of general structures for a four variable RA neutral system with loops and a four variable BN system. The lattice of general structures for both BN and RA are organized by numbers of degrees freedom and thus provide a direct comparison of the similarities and differences between the two lattices of possible structures. This visualization and comparison of the two lattices in this way is new.

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LEADERSHIP AND SYSTEMIC INNOVATION: SOCIO-TECHNICAL SYSTEMS, ECOLOGICAL SYSTEMS, AND EVOLUTIONARY SYSTEMS DESIGN

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Innovation comprises an area of human activity that bridges disciplinary boundaries in epistemological domains as well as action frameworks in ontological domains. It involves a complex system composed of people, organizations, role structures, skills, and knowledge bases, in addition to the hardware produced in workshops and factories. This paper argues that Systemic Innovation, as an emerging field of praxis in its own right, provides an integral and actionable framework for the curation of human initiatives that span human, technological, environmental, and generational concerns with lifelong learning and creative design initiatives. To do this, the field draws on socio-technical systems theory (STS), the study of living systems and ecological system dynamics (including such areas of embodied action as permaculture), and evolutionary systems design (itself comprised of general evolution theory (GST), social systems design methodology (SSM), and lifelong and transformative learning praxes). How these frameworks are used to guide systemic innovation in service of life, increasingly robust and supportive living environments, and future-creating scenarios of systemic viability and thrivability is at the heart of the field of Systemic Innovation. This paper explores the principle outlines of this approach.

Keywords: Systemic innovation, thrivability, collective intelligence, design thinking, Socio-Technical Systems theory, innovation ecosystem, VUCA challenges, Evolutionary Systems Design, Human Ecology.

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SYSTEMIC INTEGRATION OF SPACE INTEGRATIONS IN MEXICO

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The construction of a space launch base in Mexico, has as its objective the spatial technological development through a systemic method which consists of three stages within which there are five phases and within them there are eight sub phases; This method allowed determining the following results: Detection of the problem; make the diagnosis; the solution proposal, and the planning to achieve the objective.

The limitation of this work is that it cannot be guaranteed that there will be technological spatial development since it is the responsibility of the Mexican State to implement the corresponding policies to thus achieve it. The originality of this article is that it is treated with a deductive approach, and we find that there is no technological development in the country and it is essential to have it for integral growth.

Keywords: technological development, systemic method, launch base, Mexico.

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PATTERNS AS CONNECTORS OF MULTIPLE REALITIES

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When dealing with complexity, we are confronted with a growing interdependence of factors, and intricacy of causes and effects. In particular, material, social and individual drivers and processes are increasingly entangled to produce the hidden patterns that underlie our socio-ecological and socio-technological systems at various levels, which may lock us into unethical and unsustainable systemic behavior. On the response side however, knowledge and forms of agency are ever more specialized and fragmented, locally influenced by a variety of paradigms, as well as conflicting forces.

More than ever, in order to make sense of our changing world and to respond to its challenges, we must be able to unpack the different dimensions of complexity across a variety of boundaries. To better achieve this, we must find ways to mobilize a plurality of forms of knowledge and action and to coalesce the 'good thinking' and 'good forces' for systemic change.

In this paper, I explore to what extend the development of a pattern literacy can serve the understanding, orientation and design of complex systems, while attempting to cross epistemological and ontological divides. In particular, I examine the role of patterns as decoding and encoding tools, and their potential to enable the breaking down and construction of architectures of meaning at various levels of granularity, starting from our perceptions of the world as we encounter and make sense of it, to the habits we take and behaviors we display as we interact with it, and finally to the more elaborate designs we unleash in the world intentionally or not, that may take a life of their own. I then examine how the versatility and 'plasticity' of the concept of pattern and forms that patterns take, can help recursively decode and encode different views and perspectives of knowledge and reality both in understanding and design, and reflect on how patterns can be used in interpretive methods of inquiry and creative thinking to respond to the challenges I described above.

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THE GENERAL THEORY OF DYNAMICS SYSTEMICITY: PART 7. THE SYSTEMICITY OF PERCEPTION GIVING SENSE TO ENDOGENOUS-EXOGENOUS EVENTS INDUCING TO SURVIVAL

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"The Bioethism paradigm" (acronym for Biology-Ethology, ecology - Humanism) fosters universal specificities relative to the complexity of Life's processing, which in form of open systems, appeared on Earth from biochemical components and survival proprieties within propitious physicochemical environmental forces (J.-J. Blanc 1996). For reference, the author's past proceedings were developed - part after part since 2004 - as the structure and chapters of a "General Theory of Metadynamics Systemicity". Its building blocks are being centered on the Universe diversity of x-dynamics: petadynamics teradynamics, gigadynamics', metadynamics', dynamics', microdynamics' and nanodynamics' systemicity. The set of X-dynamics are, in physics, multipliers defined in powers of 1015 to 10-6, proceeding in increments of three orders of magnitude (10' or 1`000), such as: peta, giga, meta, kilo, micro, nano... The publication of these works is meant to support the acquisition of a large transdisciplinary understanding of the "x-dynamics' systemicity world" that sustains the whole evolution of the Universe system's components as well as those of living entities (things, objects, individuals), while perceiving and experiencing sets of forces and fluxes. This is why the theory of Systemicity emerged from synergies as applying the principles of "The Bioethism Transdisciplinary Paradigm of Universal Systems" down to "Living systems" both having their specific temporal survival" that the author J.-J. Blanc developed since 1996.

"Systemicity" is a notion that surges from interrelation, interaction, intrication…within interdependent synergies. The systemicity of atomic and molecular cycles has made and sustains both cosmic systems and Life's cycles on planet Earth along differential time periods (trillion of light-years to less than hours) and their specific retroactivity. Intrication is the quantum entanglement of a physical phenomenon that occurs when pairs or groups of particles are generated or interact in ways such that the quantum state of each particle cannot be described independently — instead, a quantum state may be given for the system as a whole, in other ways its metabolism status. Measurements of physical properties such as position, momentum, spin, polarization, etc. performed on entangled particles are found to be appropriately correlated. The different parts of "X-dynamics Systemicity" are developed through a new "reading grid of natural structures and behaviors of entities, objects and things as adapting from "neighboring'" within "neighborhoods" (ecosystems) where they specifically cope with endogenous and exogenous events and forces inducing to the retroactive temporal restructuring of their structure and behavioral aptitudes (as in part 6).

Neighboring is "to associate in a neighborly way, to communicate with, to live side by side with, and to overlook and look out". Biological molecule sequences, while neighboring, are participating in the structuring and the evolution of "cosmobjects"(JJB), organism, species and entities along with their reproduction abilities. It infers nature and extent of selective forces, those driving the evolving shaping of atom sets and organism genes (mutations). In other words, as in this part 7, "survival means" possess diverse perception, memory and experience tools that empower their adaptability

to the permanency of all things to happen and change, i.e.: they possess means as how to "give sense to things around from the interpretation of what's they perceive. The choice of the sense given may be lethal or propitious to their surviving.

In order to exist, both objects and living creatures replicate and evolve thanks to their perception and feeling tools within global, glocal and local areas (ecosystems) and by their natural components which form their structures and behaviors. Resulting actions and gene mutations are permanently changing both the endogen milieu and external environmental ecosystems metabolism and components quality (e.g.: means used from vision giving out the formation of a move or a feeling driving to its systemicity result like fear; the gravity effect of two masses as sustaining a balanced equilibrium, flying away…).

Subsequently, through ecosystems' 3D multi-layers, from proto-organisms to humans, their individualities take on specific social traits and behavioral statuses that account for the diversity of species to get developed and/or to go extinct. For example, when the Earth became a "snowball" from a nearly total glaciation (-600 Mo/y), the survival of some neighboring bacteria and micro-organisms escaping the drastic extinction of most species, conversely perceiving ways of adaptation, boosted up an extraordinary explosion of marine species bearing quite new functions (- 545Mo/y), that then after volcanic holes progressively reheated areas of the planet and boosted some organisms population revivals from the systemicity of sets of interrelated metadynamics and their symbiotic outputs propitious with adaptation and evolution.

The Universe's global environment generates x-dynamics such as cosmic petadynamics (black holes? Black energy?), teradynamics, gigadynamics and metadynamics cycles... in form of systemic forces, fluxes and moves occur within immense gas and particles neighborhoods. Interrelated, they are some of the main physicochemical cosmic, galactic, stellar, planetary and terrestrial feedback synergies from which x-dynamics systemicity retroactions emerge (i.e. rock cycles). Sets of systemicity results make atoms and molecules to participate in the structuring of matter and cosmic objects (nebulae, baby stars, stars and planets, waters and rocks), within a molecular world that originated from and after the "Big Bang" a nd the role of aggregation.

Furthermore, the physicochemical neighboring conditions for planet Earth to stabilize within the "Sun's green belt" was a balanced thermodynamics and environmental state issued from the presence of the Moon's mass aggregation at the right distance so as to become propitious for Life to "hatch" (gravity and tidal forces). Such favorable position, sustaining the Earth and Life's evolution by the development of x- dynamic adaptive pathways, that are "perceiving, giving sense and experiencing things" is highly evolving on with universal objects survival cycles, forces, fluxes, moves and matter that are "perceiving, giving sense and experiencing" things in several synergetic manners, (e.g. cosmic objects feelings, plants natural emotional intelligence. . .). Perception tools are physicochemical and organic features treating signals- like neurons- or other microtubule as protein structures and links around brain networks. Microtubules are a component of the cytoskeleton 2, found throughout the cytoplasm. The microtubule can dynamically switch between growing and shrinking phases in this region ("search and capture model"), a matter of neighboring milieu. Life as a whole and living entities, while neighboring around, are confronted with gravitation, electromagnetism, chemical and physical phenomena, and particularly with temperature and the "thermodynamics of entropy". Filtering their milieu symptoms and their environmental events signals, living creatures develop means of perception in ways their inner systems and organs such as the immune one, emotional brain with amygdala and reptilian area or vision with eyes are well fit drivers for supporting their survival behaviors.

The neighboring areas (mille-feuille as 4D-networks) are diverse but concomitant producing forces and fluxes that are dynamical drivers within the diverse ecosystems. Their systemicity results from actions of coalescence, conjunction, co-evolution, convergence, symbiosis, percolation, phase transition or threshold output, neighborhood adaptation, etc. Universally, these actions and mechanisms concern atomic, molecular and physicochemical world's permanently provoking feedback that drives the evolution of systemicity cycles and perception means. Because of the development of similarities in unrelated matters or organisms present in similar environments, a balanced equilibrium is necessary to sustain the whole of things to survive temporally. The disappearance of a link along a food chain completely disorganizes the ecosystem's metabolism endangering its sustainability. Specific bonds and traits of structures and behaviors, as well as evolution trends for "surviving objects and living creatures" require a certain knowledge and a memory about actions-reactions (drivers) from ago-antagonistic signals and stimuli in order to give the propitious answer to an adaptation, then evolution of things. Issued from ecosystemic and socio-systemic metabolism and environmental statuses (geophysics, climate, predator preys networks of food chains…), these signals sustain things thanks to the x-dynamics systemic retroactivity results reigning about from the convergence of multi-symbiosis.

A Closer Look at Instincts

[2] - **Cytosqueleton: a** microscopic network of protein filaments and tubules in the cytoplasm of many living cells, giving them shape and coherence.

In animals, instinct has the inherent tendency to engage spontaneously into particular pattern of behaviors. Examples of this include a dog shaking after it gets wet, a sea turtle seeking out the ocean after hatching, or a bird migrating before the winter season. This part of the theory, the 7th one, describes the major dynamics that symbiotically pilot "key drivers" that represent the general act of "perception". This act, occurring at the cosmos and biological objects levels, is inducing to different physicochemical interactions and laws (gravity…), prolonged down to the Earth major dynamic drivers that induce to its survival as well as survival specifications, adaptations and an immense evolution n of bushy Life's species which hatched from water, oxygen, carbo dioxide, hydrogen and nitrogen…showing the four functions of such an happening: Proteins: Amino acids, protection of the body, Lipid: Fats, store energy and build up cell membrane, Carbohydrates: Sugar, provides physicochemical energy, Nucleic Acid: DNA, RNA, provide an organism the knowledge of basic functions and genetics functions.

One may easily understand here that human sociology shows such the diversity of neighboring comportments and effects issued from these basic perception outfits, both being endogenous and exogenous. Observing then, that the various effects of systemicity are universally giving sense to what happens, driving the dynamics systemicity results at survival tools to induce to with adaptation and evolution necessities. Thanks to perception capacities (instinct, intelligence,…) and a variety of memories (short, long term,,…) from which permanently emerge the symbiosis of differential qualities capable to give sense to things then to a survival timeline.

Keywords: bioethism, systemicity, survival, metadynamics, symbiosis, feedback, entropy, metabolism, synergy, convergence, coalescence, neighboring, perception, senses, organs.

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THE ∞2 INFLUENCE MODEL OF MULTIDIMENSIONAL INTELLIGENCES LINGUISTICS AS AN INNOVATION IN LINGUISTICS OF GENERAL SYSTEMS THEORY

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Verbal-linguistic smartness is one of "Multiple Intelligences". Theoretically, it is recognized as single-dimensional or linear thinking, manifesting in its syntagmatic relation, the sequential or linear arrangement of words in a language. Beyond the traditional linguistics, the diverse schools of linguistics of general systems theory are two-dimensional. For example, Lucien Tesnière's valence theory, Noam Chomsky's transformational linguistics, Kenneth Pike's tagmemics, Michael Halliday's systemic functional linguistics, Ronald Langacker's cognitive linguistics, Jef Verschueren's pragmatics as a theory of linguistic adaptation, Istvan Kecskes's intercultural pragmatics as the dynamic emergence of meaning and Jacob Mey's "Theory of Everything" in human communication. Moreover, they apply dynamic systems thinking to study syntax, semantics and pragmatics. Halliday contended that "language can be characterized as a complex dynamic system, one that persists through constant change in interaction with its (eco-social) environment. It belongs to the class of semiotic systems (systems of meaning), in contrast with systems of other kinds, physical, biological and social."

The author proposes an emerging multidimensional intelligence linguistics, integrating the divergent schools of linguistics. It is innovative represented in dynamic wholeness spirit and transdisciplinary nature. Its ∞2 influence Model is not only three to four dimensional and fractal, but also dynamic co-systems thinking by VR to break through three major limitations: one-dimensional linear word order, two-dimensional plane printing and ultra-high loading energy induced information anxiety. It aims at synthesizing an omnipresent ecological perspective on events, relations, patterns, elements, structures, functions, processes, influence and meanings in most language.

In terms of syntax, the ∞2 influence model of multidimensional intelligence linguistics could cover all possible syntactic patterns in the hidden valence connections. In regard with semantics, the ∞2 influence model of multidimensional intelligence linguistics constructs multidimensional semantic webs or encyclopedic knowledge (frames, scripts, scenarios, schemata) from the upper to the middle, and to the lower ontology, as a scale-free, multi-level networks of meaning. As to pragmatics, the ∞2 influence model of multidimensional intelligences linguistics represents the pragmatic universals or universals of multidimensional linguistic, of which interaction is within context, or frame, or point of view between utterer and interpreter.

In summary, the ∞2 influence model of multidimensional intelligences linguistics could visualize clouds (systems) of meanings as two seven-limbed aliens, with "heptapods" best revealed in the multidimensional time/space patterns and the written language of complicated circular symbols in movie Arrival, 2016.

Keywords: multidimensional intelligences linguistics, co-systems thinking, syntactic patterns, semantic webs, pragmatic universals

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GRANULARITY MEASURES ON THE LATTICE OF SYSTEM STRUCTURE MODELS

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Reconstrutability Analysis (RA) is a celebrated method in mathematical systems theory and systems science, with many applications. RA operates on a collection of data measured over a set of observables, and identifies good models of systems of those variables which might have produced those data. RA searches the space of possible models to identify the most parsimonious model relative to the data, as judged by two criteria:

Simplicity: Models are better when they are simpler; and

Faithfulness: Models are better when they best account for all, and only, the information present in the measured data.

These two criteria are naturally generally opposed: the simplest models generally account for too little information, but the most faithful models can be unnecessarily complicated. So RA approaches the technical problem of finding an optimal model.

RA is a method in mathematical systems theory, operating on a statistical collection D of data on a set X of n observables. It then models the data as a structure S (thus "reconstructability"): S is a particular set of groups of the n variables, so that the variables within a group are "connected to" (dependent on) each other. Mathematically, a structure S is an irredundant cover of the n variables X: a collection of subsets of X which span the n variables, but where no one subset is contained in another. Structures S live in a combinatorial object, the lattice of irredundant covers of a set, which we call the structure lattice, L. Structures S in L can range from the most fine at the bottom of L (all variables are completely mutually independent), to the most coarse at the top of L (all variables are mutually determined), with a complex range of intermediate granularities in between. The simplicity of a model S is then measured as its "level" in L, while its faithfulness is a statistical measure of the information content of S compared to that of the data D.

The structure lattice is a fascinating object, and arises in mathematical systems in ways other than RA, from measure theory to multidimensional graphs to computational topology. In some of our other work, we use L to characterize the "local sections" of a "description sheaf", a model of the relative tolerances amongst a collection X now of n sensors.

Our general interest in the properties of L is also motivated by our prior work on a smaller object contained within L: the lattice P of partitions of a set X, where a partition is a cover none of whose groups overlap. We have previously identified two canonical granularity measures characterizing a particular partition within P: dispersion is a rank-based, ``vertical'' measure of the number of partition blocks; while smoothness is ``horizontal'' measure of the evenness of the distribution of elements to blocks. These two measures are not strongly correlated, so that both are needed to fully characterize a particular partition. We have now identified granularity measures for the structure lattice L. In particular, the coarseness of a structure S in L is similar to dispersion, a rank-based, vertical measure, which exactly measures the coarseness of S. On the other hand, the overlap of S is largely independent of coarseness, and measures the extent to which the different groups intersect. While coarseness and overlap are canonical measures on L, and coarseness acts as a simplicity measure in RA, it is less evident that overlap can similarly play the role of faithfulness.

In this paper, we introduce these measures in the context of the structure lattice, discuss their properties, and their relation to and potential use for RA.

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MEASURING THE LEVEL OF POLITICAL SYSTEM LITERACY THROUGH THE ELECTION PLEDGES OF SOUTH KOREAN ELECTORAL CANDIDATES

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I analyze unfamiliar aspects of the political system in the Korean local elections held on June 13, 2018. In particular, an analysis of the election promises made by the mayoral candidates of Gwangju Metropolitan City and superintendent candidates of the Gwangju Metropolitan Office of Education suggest that they lack political system literacy, a concept that is defined in general and as a means of cultivating democracy in South Korea. The election promises promised to the voters are analyzed in terms of political system literacy in relation to current issues in city governance and to problems in public education. One conclusion from this analysis is that better efforts must be made to educate the future leaders of the Korean political system from an early age to improve their political system literacy.

Keywords: system literacy, political system literacy, election promises, Gwangju Metropolitan City

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SYSTEMS APPROACH: CONCEPT PROPOSAL TO DEVELOP SAUDI ARABIA LOW-COMPLEXITY -DEFENSE-SPARE-PARTS MANUFACTURING INDUSTRIES, UTILIZING TECHNOLOGY TRANSFERS AND BUSINESS INCUBATOR

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The overall goal of this projects is to adopt and build on three of the Saudi vision 2030 "thriving economy" theme third-level objectives that include (1) Localize military industry, (2) Nurture and support the innovation & entrepreneurship culture, and (3) Grow SME contribution to the economy.

One of the very important initiatives of the adopted "thriving economy theme to our area of concentration is planning to grow the economy by manufacturing half of the defense needs within the Kingdom, with the intention to offset the economy, keep more resources in Saudi Arabia and to create more job opportunities for its citizens". The main research question explores how to develop a conceptual model to demonstrate how innovative technological initiatives contribute to localized military equipment manufacturing technology. The research process includes creating a conceptual model meant to assist with the development of low-complexity-defense-spare-parts manufacturing industries, utilizing technology transfer and a business incubator. The model will include (1) adopting a Systems Approach to better understand the nature and the scope of the problem statement (2) developing a Conceptual Model for high volume, low mix, low complex spare parts manufacturing industries that will contribute to the national defense industrial sector, (3) investigating the adequacy and limitations of the Innovative Concept, (4) validating the model by analyzing the alignment of the concept with the systems methodological strategy.

This project utilizes an applied research (often called action research) as its methodology. This methodology applies a systems approach and related systems thinking to ensure a holistic understanding of the nature of the problem statement. The literature review bodies clustered beneath the category of "Technology and Innovation Management" and addresses classifications of the major approaches to the issue of localizing the defense manufacturing industry. Moreover, the literature review in the field of innovation, technology transfers and Systems Science have been analyzed. While this project is still ongoing, the hypothesis of this conceptual framework will address the need to develop a flexible model that contributes to the current and future challenges as there is a lack of an adequate model to guide Saudi government on how to develop the SME defence manufacturing industries in order to become aligned with their country's vision 2030.

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PROFESSIONAL IDENTITY AS A SYSTEM IN INTEGRATED HEALTHCARE: A PRELIMINARY REPORT

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Whole-health services are health care services that treat all aspects of a person's health as a complex and interactive system. In this context, issues traditionally viewed through restrictive silos of "physical health" and "behavioral health" are considered together. In the recent past, two professions have developed, each within their own silo. Physical health has nurtured the development of community health workers (CHW), while certified peer specialists (CPS) have taken root in the behavioral health arena. In 2017, The US federal Substance Abuse and Mental Health Services Administration (SAMHSA) convened a multi-region work group of 25 professionals from the policy, management, and service provision domains of both CHW and CPS-related spaces to consider the potential integration of the two professions. An early realization of this work group was that these two professions were operating with similar values and practices, despite having evolved in different regulatory and service environments. Over the course of two years, the group is to explore the potential costs and benefits of integrating these professions, and to build understanding of the practical considerations of such a process. That is, how (if at all) could this integration actually happen? This presentation describes the early stages of a participatory action research project focused on this project. The student researcher uses the PAR Holon systems framework posited by Kinneman (2015) as a tool to: identify relevant components of professional identity and perform a preliminary assessment of the current state of alignment between CHW and CPS professions. Surveys of a cross-stakeholder group were used to generate an influence matrix, which process informed the development of potential strategies to further develop any potential integration process.

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MODELLING HEALTH AS AN EMERGENT PROPERTY OF SOCIO-ECOLOGICAL SYSTEMS: AN AGENT-BASED APPROACH

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Human health and well-being fundamentally depend on the functional integrity and sustainable management of the ecosystemic contexts for our societies. Numerous complex and non-linear interactions between social and biophysical processes characterize socio-ecological systems whereby co-benefits for human and ecosystem health emerge as the result of prevailing virtuous feedback cycles between well-being and sustainability. Due to the inherent complexity of relationships between coupled social and biophysical processes, traditional approaches for environmental management and assessment (e.g. cost benefit analysis) have proven unsuitable for evaluating the benefits of ecosystem services. Reductionist assessment techniques emphasizing monetary valuation have resulted in an inability among environmental management and government organizations to articulate the critical relationship between the natural environment and human health. This leads to poor understanding within the general public and political resistance to conservation efforts. High levels of uncertainty - commensurate with the complexity of interactions between social and ecological systems – demand systems-based post-normal scientific methods characterized by multi-iterative, multi-criteria assessment techniques for scenario analysis. As part of the ongoing Managing Water and Watersheds for Co-benefits project at York University, our research team has partnered with the local Credit Valley Conservation Authority to develop a gamified agent based modelling approach for assessing and communicating the health benefits of sustainable land-use practices in watersheds.

Our methodology operationalizes Kay and Waltner-Toews' systems-informed Ecosystem Approach as a general set of principles and guidelines for participatory action research. We further draw from Potschin-Younge and Haines' cascade model of ecosystem services as an organizing framework for our modelling approach, in which changes to ecosystem "cascade" into implications for ecosystem function. In turn, changes to ecosystem function are inferred to have implications for the benefits derived from ecosystem services, which are then weighted according to social, monetary and ecological valuation techniques. Currently, our agent-based model (ABM) uses geographic information systems (GIS) data to estimate the average normalized difference vegetation index (NDVI) associated with different land-use types within the Credit Valley Watershed in Ontario, Canada. Using established scientific literature linking NDVI values to mortality rates, we simulate alternative land-use scenarios to estimate changes in the overall NDVI profile which allows us to estimate the impact to mortality across various demographics. The results are then compared against monetary valuations of land-use alternatives in the watershed to demonstrate the costs, in terms of human well-being, of economic development. The agent based approach allows for sensitivity analysis as users simulate the impacts of sustainable land-use alternatives over time. Ultimately, the model will be integrated with our existing web-based GIS to provide an interactive web-game that will allow users to simulate land-use alternatives that will impact their communities. This approach provides a useful tool for both public education and land-use planning, with the potential for future research into the impacts of game-models for promoting conservation interventions and human health.

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SPECULATIVE REALISTS QUESTION REALITY BEFORE HOMO SAPIENS AND AFTER EXTINCTION

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The term 'speculative realism' was first introduced in 2007 to describe the work of certain philosophers around Q. Meillassoux, of which many translations, introductions, and special issues have been published in Japanese. According to speculative realists, phenomenology, structuralism, analytic philosophy, and most subsequent schools of twentieth-century philosophy (L. Wittgenstein, M. Heidegger, and M. Foucault) assume the antirealist, Kantian claim that phenomena depend upon the mind to exist. That is, the speculative realists are united by their rejection of what Meillassoux calls correlationism. This is the doctrine according to which we never grasp an object in itself, in isolation from its relation to the subject. Now, when we call ancestral any reality anterior to the emergence of the human species, we can ask, how is correlationism liable to interpret these ancestral statements? We can also ask, how has matter emerged from a vacuum? How have living systems appeared out of lifeless matter? How has Homo sapiens come into existence out of living systems? Meillassoux himself asks how to pass through the correlationist circle. We should question the absolute, which is outside correlation. Our absolute, in effect, is nothing other than an extreme form of chaos. The world before human beings emerged is thereby contingent. There is a capacity-to-be-other, that is, there is the possibility of our own non-being. The posteriority of extinction should also be considered, in addition to ancestral anteriority. R. Brassier, one of the speculative realists, refers to the death of the sun. He has said that 'the death of the sun is nothing but a death of mind'. How does thought think the death of thinking? Important is the dialogue of the correlationism of modern philosophy with old and new realism, which question the reality outside of the correlation.

We have already emerged in this universe with mind. Although we can recognise something with this mind, something, in other words, is nothing but something which is recognised by our mind. Thus, correlationism is correct and cannot be escaped. From within correlation, however, we can recognise that there is an outside to the correlation. We can

recognise ancestral anteriority and posteriority of extinction through the correlation. We can think the reality through the working of negation of recognition. We can recognise Kantian thing-in-itself through the self-negation of recognition.

Again, we have already emerged in this universe with mind. What has already existed should be thought as necessary. Now, I can propose an ex post facto teleology. The fact is constituted by this after, by the belatedness of the subject. I also would like to propose a modest anthropocentrism. The emergence of human beings should be thought as necessary, while all things and living things potentially have minds. Thus, we can call this view a weak panpsychism. Furthermore, once we have minds with which to think, we think everything with these minds. The ability to think has something privileged. Nonetheless, at the same time, it is important to think everything as contingent. There is no reason for anything to be or to remain the way it is; everything must be able to be other than it is. We not might have emerged through a process of evolution. We might not exist in this universe. We could be extinct in the future.

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LEARNING WITH NATURE'S PATTERN LANGUAGE: A PEDAGOGICAL FRAMEWORK FOR DESIGNING LEARNING EXPERIENCES AS VIBRANT LIVING SYSTEMS

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During a time of heightened uncertainty and turbulence, what insights can nature's pattern language offer in the design of learning experiences for change-agents for a healthier world?

Living systems theory, as a scientific language based on navigating relational patterns and processes with self, other, and the world, is highly suited as a framework for learning experience design. Every ecological and social system is based on common organizing principles, such as networks, cycles, feedback loops, nested systems, flows, and the capacity to self-organize into something new. These "living systems principles" provide a language of relationships in natural, as well as social systems, and, as such, offer a pattern language for learning, as well.

In this presentation, the author will introduce her framework for designing learning experiences that feel alive, vibrant, and foster self-organizing, collective creativity, mimicking an ecological or "living" system congruently in learning content, process, and structure, for both classroom and online learning. The framework allows for intentional congruency on multiple levels: 1) ways to set up the visible and invisible learning space, 2) ways to pace learning components and allow for flow according to nature's rhythms, 3) ways to allow for creative expressions and encourage learners to give voice to their inner pattern wisdom and emotional landscapes, 4) ways to encourage the mind to utilize systems analysis across disciplines, and 5) ways to help learners integrate this awareness in their practice. If all these levels mimic living systems, learners are more motivated and equipped to co-create life-sustaining emergent ideas, designs, and structures for a more just and sustainable world – a much needed skill during turbulent times.

In this presentation, the author will introduce her framework for both online and face-to-face formats and offer a set of inquiry questions, design guidelines, and creative exercises based on living systems principles across these multiple levels of learning experience design. The author will then share testimonies and living-systems-inspired poetry from both face-to-face and online inner-city community college learners, who have experienced dramatic shifts participating in systems-inspired learning communities.

3411

SYSTEMS PHILOSOPHY AND ENGINEERING THERMODYNAMICS

Terry Bristol

Despite impressive contributions, the philosophical foundations of systems theory remain in flux. The proper understanding of the systems framework in relations to classical mechanics and quantum theory remains unresolved. I argue our understanding of systems theory is advanced by recognizing the crucial link to engineering thermodynamics. 'Real' engineering thermodynamics is more general than the historically dominant mechanical thermodynamics of Clausius, Boltzmann, the Entropy Cult (viz. Jaynes's MEP) and the recent information theory. That systems theory's philosophical foundations are in a philosophy of engineering and engineering worldview should be no surprise, given the origins in cybernetics and operations research. The extensions to ecology, from Odum to Morowitz and Ulanowicz support the thesis. The systems engineering thermodynamics paradigm (SETP), is more general, formally subsuming and superseding all possible scientific, mechanical frameworks. To subsume means to be able to explain all the successes of the prior paradigm. To supersede means to make sense of the limited mechanical theories within a new more comprehensive perspective. SETP allows us to clarify essential characteristics of systems. Systems are structurally and functionally dissymmetric, more general, subsuming mechanical frameworks defined by the symmetry and conservation. Systems naturally emerge qualitatively, are recursively self-enabling and historically cumulative. Quantum theory is properly understood in terms of the SETP. Dissymmetric, complementary structures and functions

are what make optimization and feedback unique characteristics of systems and systems engineering. The SETP entails a new understanding of our place in the universe as participant, agent engineers, as engineers in a world of engineering.

3416

EVALUATING THE EFFECTIVENESS OF REMOTE ALCOHOL MONITOR INTERVENTIONS IN REDUCING MOTOR VEHICLE CRASHES INVOLVING DRUNK DRIVING IN TRAFFIC SYSTEMS IN THE UNITED STATES, TEXAS, AND CALIFORNIA

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Each year, motor-vehicle crashes (MVCs) are responsible for more than 1.2 million fatalities and over 50 million injuries worldwide and are the leading cause of accidental deaths in the US. Despite the large contribution of alcohol-use to MVCs, little is known about how to maximize the effectiveness of interventions alone or in combination. This can result in wasted money and other resources and, worse, in lives lost. Our long-term goal is to estimate the cost and the effectiveness of policy-based interventions aimed to reduce MVC fatalities and injuries related to driving under the influence of alcohol (DUI), to address the gaps in our understanding of the mechanisms and processes through which these interventions reduce DUI-related MVC injuries and fatalities, and to create an optimal portfolio of interventions for preventing DUI-related accidents for use by state and local governments and other relevant stakeholders.

One intervention of interest for reducing drunk driving offenses being proposed for use by states involves using remote alcohol monitoring devices (RAMs), such as an ankle bracelet that conducts transdermal readings by sampling alcohol vapor just above the skin for insensible perspiration and provides continuous sobriety monitoring of the person wearing the device (24/7 monitoring).

Analysis. Funded through the Center for Transportation Safety at the Texas A&M Transportation Institute, we developed a System Dynamics (SD) array model to simulate the dynamics of DUI-related MVC injuries and fatalities in traffic systems in the United States, Texas, and California with the objective of identifying the causal mechanisms, potential leverage points, and effects of policy-based interventions mandating RAMs based on the previous studies:

RAM device effects on first-time and repeat offenders,

RAM offenders recidivated at higher rates (but not significantly),

RAM offenders who did recidivate, did so at a later time, and

Risk of a driver causing a DUI-related MVC based on prior offenses (“the offender lethality assumptions”).

The model examined the effects of these studies alone, in combination, and in various calibrations in each location and their implications for DUI-related morbidity and mortality and drunk driving rates. We verified and validated for the ability to reproduce historic trends using secondary data analysis, estimates, and relevant literature to calibrate/parameterize variables. The model started 2010-07-01 and ended 2031-07-01, using a daily time step and Census interval distribution years.

Different offender lethality assumptions were used to calibrate models testing intervention effects per location, running each assumptions set 250 times, for 1000 total realizations and then compared by total DUI deaths between scenarios. Sensitivity analysis involved applying normal distributions to calibrated variables with a mean base value of the variable

and standard deviation of 25% of the base value (Monte Carlo) and performed 1000 model runs with each of the offender lethality assumptions.

Results. Using the Shapiro-Wilk test for normality, the results were not normally distributed (W = 0.98713, p-value = 0.02428). Using the Wilcoxon signed-rank test to compare scenarios, the median difference between total DUI deaths with vs. without intervention was not significantly greater than zero in any scenario examined. Model results suggest RAM devices did not significantly decrease drunk driving mortality in any geographic location or scenarios.

Keywords: public health; system dynamics; traffic; transportation; alcohol; policy

3421

EXPLORING PRACTICAL AND ETHICAL IMPLICATIONS OF APPLYING SYSTEMS THINKING TO REAL-WORLD PROBLEMS

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The current and urgent global struggles that we face bear testimony to the need for careful strategies for dealing with these wicked problems. Acting responsibly in the face of these problems means confronting difficult choices, where no single option presents one with the 'correct' outcome. A measure of 'undecidability' will always accompany decision-making in complex situations. This is because we cannot calculate outcomes – we have to choose, knowing that things could be otherwise. Responsible decision-making, however, requires innovation in thought and action in order to move beyond our current governance strategies and to reframe governance issues in larger, more stratified contexts. However, challenging the status quo implies a measure of risk because we are negotiating – in part – with the unknown.

In this presentation I will argue that an acknowledgement of the complex nature of reality presents a call to proceed differently in this world.

The implications of systems thinking proposes a different way of 'being-in-the-world' that could help us tackle wicked problems in different ways by offering us some 'equipment' (heuristics) as to how to negotiate through the messiness of intractable problems. Systems thinking offers us a way with which to think together different paradigms without reducing them to one another or dismissing one for the other, so that we can be in a position to act and intervene differently by means of temporal coordinates from where to launch critical counter voices that could have some impact in shaping societal and political issues. It can be understood as a 'reasoning art' (mode of thinking) that does not conform to some substantive method or recipe, but a relentless double (or triple or multiple) thinking that enables innovative ways of negotiating our way through complex realities.

In this presentation I will offer some practical heuristics and normative imperatives that could guide action or decision-making based on a mode of thinking that derives its validation from the characteristics of complex adaptive systems.

3423

WHAT IT MEANS TO DO RESEARCH ON THE PSYCHOLOGY OF SYSTEMS FOR ISSS: BASIC PRINCIPLES

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Over the past 10 years few ISSS annual conferences have seen sufficient papers submitted to the Systems and Mental Health Special Integration Group to enable a dedicated session in our afternoon schedule. However, in every one of those years, a multitude of papers pertain explicitly to humans – which therefore, in most cases, pertain to human psychology. From a perspective of an ISSS SIG Chair, this presentation will describe basic research premises that are central to effective systems research involving human psychology. This will address three key pillars: (1) sound research principles that all researchers should consider, including the use of primary and secondary research sources and the demands that systems research places on the person of the researcher; (2) the need to examine the connection between the systems writer's topic of interest and existing bodies of psychology literature, both classic and cutting-edge; (3) and the basic tenets of general systems theory upon which the ISSS was founded. These three pillars are of equal importance. Research overlooking any of them will be lacking in the substantive contribution it could be making to our unique systems field, and the broader communities of academics and practitioners of which we are part.

3427

ORGANIZING, ACQUIRING, AND ARCHITECTING FOR STRATEGICALLY PROACTIVE OBSOLESCENCE MANAGEMENT OF MISSION CRITICAL AVIONICS AND ELECTRONIC CONTROL SYSTEMS

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Significant effort and research have been invested in addressing the issue of obsolescence. Most efforts and requirements presume the presence of a system then invest in the management of that system's eventual obsolescence issues. The thesis of the proposed research presumes obsolescence as an inevitability at the beginning of a program or other design effort, then assumes the program progresses under the influence of that presumption.

In other words, in addition to the well-established requirements driving implementation of preeminent obsolescence monitoring and management systems, large organizations and/or programs can define organizational, acquisition, and architectural approaches that, when presuming obsolescence, can preemptively inform decisions that reduce development, ownership, and acquisition costs. Employing adjusted organizational structures, utilizing modified acquisition strategies, and deliberately leveraging commonality and nimble architectures form the fundamental strategy for lowering development costs and producing long-lived systems that more economically accommodate change (i.e., the aforementioned presumed obsolescence). Commonality can be leveraged intra-program as well as across DoD sectors or the entire DoD enterprise. The multi-tiered effect includes a stronger reliability program, economies of scale in production, reduced development resulting from certified designs at the lowest levels, and proactively managed obsolescence of Electrical, Electronic, and Electromechanical (EEE) parts. The leverage can also be applied to software in a manner similar to the hardware approach, with reusable software building blocks being analogous with reusable hardware designs. Finally, deploying model-based systems engineering (MBSE) as the mechanism whereby the proposed approach is managed provides the connection between the abstract and each specific instantiation in a way that, itself, is more easily repeatable.

This presentation will describe a generic organizational structure approach, an abstracted acquisition strategy, and a set of design architecture characteristics, the optimized combination of which can minimize the fiscal and schedular impacts of obsolescence while providing other benefits such as controlled technology insertion. The presentation also will present ("sanitized") examples of successful instantiations of this approach while describing some challenges the approach presents.

3428

A PROPOSED METHODOLOGY FOR DEVELOPING SYSTEMS THINKING LESSONS BY AND FOR NON-EXPERTS

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Systems thinkers achieve expertise by learning from experts and reading existing systems thinking literature. This method is typically successful, if the learner is driven; however, this method does not work for everyone. This explains, in part, why systems thinking is not widely used. Many of today's complex problems are approached using a reductionist perspective which is often ineffective at understanding the whole problem. The alternative is the holistic approach of systems thinking. The first step to becoming a systems thinker is to acquire sensibility, or an awareness and appreciation for systems. However, there are not enough people in the world with even systemic sensibility, let alone enough systems thinkers to solve the complex problems of today or the unknown problems of tomorrow. Therefore, the need to propagate systems thinking education beyond the select few is critical if the current trajectories of many complex problems facing the world today are to be altered. Therein lies an opportunity to foster systemic sensibility among the next generation of thinkers and problem solvers during primary and secondary education (K-12). However, impeding this propagation are two challenges. First, the number of experts capable of teaching systems thinking is already small and the number with the ability to teach K-12 audiences is even smaller. Second, the amount of systems thinking curriculum suitable for K-12 audiences and capable of fostering systemic sensibility are lacking. To address these challenges, the authors propose a systemic methodology which will facilitate the development of systems thinking lessons for non-experts, by non-experts. This methodology is the result of a collaboration with two industrial engineering Capstone projects and the Science and Math Investigative Learning Experiences (SMILE) Program at Oregon State University.

Keywords: Systems Thinking, Systems Education, Systems Literacy, Systemic Sensibility, Human-Activity Systems

3430

MODELS OF SECOND-ORDER SOCIAL CHANGE

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If individual and social changes are interrelated, then models of how change happens should reflect these interrelationships. Often they don't. Defining key terms: I describe an awareness of one's systemic affiliations and entanglements within and amongst social situations as a second-order awareness; and I use the term model to mean a representation and abstraction that can be used in investigating and understanding how things work. In this broad sense, models are not necessarily mathematical, empirical, or predictive; rather, they are conceptual tools that may aid in developing insights, identifying questions, and guiding strategic practice. My methods are designerly: In order to consider the ways in which a second-order awareness might influence and be influenced by one's efforts at social change, I use a visual and appreciative patterning to examine change models centered on the individual, centered on the social, and connecting individual to social. I find that models of second-order awareness often omit "the how" of individual change — that is, how such an awareness might be developed and the role of social relationships in one's second-order development. Models of social change, on the other hand, often omit the ways in which such change might require an accompanying individual change. In each case, I propose a model that might better account for individual-social interrelationships.

3431

A SUCCESSFUL USE OF SYSTEMS APPROACHES IN CROSS-DISCIPLINARY HEALTHCARE IMPROVEMENT

Johnson, Julian; Beck, Fran; Smith, Gary; Harding, Alan

UK Healthcare is facing many different trends: a changing demographic of an ageing and 'frail' population; increasing numbers of the population living with at least two long term conditions; improvements in medical care and interventions which can treat a larger number of conditions; continued budget pressures and raising expectations. Healthcare is a complex socio-technical system, and to identify and devise interventions with clear net benefits is a challenge: we see a classic 'wicked problem'. The outcome from three INCOSE-facilitated multi-disciplinary workshops was a coherent prioritised work programme, with buy-in from all stakeholders, and traceable back to original issues and opportunities. This presentation will explain the context, the engagement from INCOSE, the nature of the workshops and techniques applied, and the outcomes. The developed programme supports the Shropshire and Telford NHS Sustainability and Transformation Plan (STP). Arguably the biggest ongoing challenge remains handling complexity and coherence across multiple stakeholder perspectives.

3433

PROCESS VIEW FOR ACTIVE AND HEALTHY AGING

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Active and Healthy Aging (AHA) is one of the growing concerns and aims of a sustainable society and thus a focus of the European Union. The adoption of a process view and the analysis of the processes to be performed has brought about numerous advantages to business organizations and industrial enterprizes. Advantages range from clarity, understandability, and teachability to increased efficiency due to assessment and measurements of quality and capability. The basic idea of the process view is to describe necessary activities on an abstract level (i.e. as activity types) and organize these abstracted activities (together with abstracted work products) in a process model. Individual processes are derived (instantiated) from the process model to be enacted.

In this paper we investigate, as a continuation of (Chroust, 2017) and (Chroust and Aumayr, 2017), the challenge of applying a process view to health support for elderly persons ("AHA", Active and Healthy Aging (univ.Torino, 2016)) and identify the differences from classical applications (software engineering, office automation, business intelligence, ...).

We will turn our special attention to activities which can be designed to be performed by a Senior himself/herself, by helpers from different professions, and by machines (computers) of varying capability and diversity. The variability of the capability of elderly people obviously has to be taken into account by the support system by providing alternative implementations of the same support activity task depending on the capability of an individual Senior. A discussion about the possibilities to assess the quality of AHA-processes and their support by a Model Interpreter closes the paper.

Keywords: aging, health, senior, process view, process model, process capability, AHA

3435

NARRATIVES OF INGENUITY: USING STORIES OF COWORKING SPACES TO SEE SYSTEMS CHANGE

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Organizational stories can be used to explore and shed light on different ways that social system change is expressed and enacted. In this study, I use a trans-disciplinary theoretical framework, drawing from narrative analysis, concepts from institutional theory, and systems thinking, to reconstruct and analyze the founding stories of coworking spaces for insights into how these emerging organizations narrate and enact social system change through narratives of ingenuity. Coworking spaces are a new way of organizing for work and a values-driven social change movement. Within this rapidly evolving and growing global phenomenon, some coworking spaces are using organizational ingenuity to challenge institutional barriers and organize for change in nontraditional ways. Some of these localized solutions are having systemic impacts. Organizational ingenuity is an adaptive capacity for unconventionally creative problem-solving in response to traditions and constraints (Lampel, Honig, & Drori, 2014). Narratives of ingenuity are defined for the first time in this study as stories and ideas about unconventional problem-solving under constraints that circumvent, overcome, or cross boundaries to create systems change.. The narratives of ingenuity identified in the theoretical sample of coworking spaces used in this study offer insights into how coworking founders and participants perceive, narrate, and enact social change, and how stories facilitate the boundary-crossing beliefs and activities that bring about that change. This study also demonstrates how digital stories about local organizations can be used to spotlight new perspectives on larger systemic problems and emergent change.

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A SYSTEMATIC WORLDVIEW MODEL AND ITS GENERALIZATION AS A GENERAL INQUIRY FRAMEWORK

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Systems science methodologies do not have a consistent way of working with worldviews, even though determining stakeholder perspectives is central to systems thinking. In this paper, we propose a comprehensive "Worldview Inquiry Framework" that can be used across methodologies to govern the process of eliciting, documenting and comparing the worldviews of stakeholders. We discuss the systemicity of worldviews, and explain how this can help practitioners to find the roots of stakeholder's disagreements about value judgements. We then generalize the structure of the Worldview Inquiry Framework to produce a "General Inquiry Framework" that can be used to govern an inquiry process in other contexts. We show that the presented Worldview Inquiry Framework is a special case of this General Inquiry Framework, and show how the General Inquiry Framework can be tailored for other contexts such as problem solving, product design and fundamental research.

Keywords: worldview; systems philosophy, Worldview Inquiry Framework, General Inquiry Framework

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SYSTEMS PROCESSES THEORY (SPT) AS A CANDIDATE GENERAL SYSTEMS THEORY, PROTOTYPE SYSTEMS SCIENCE, & KNOWLEDGE BASE OF WIDESPREAD UTILITY

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This paper begins with arguments supporting the need for criteria lists that enable our intended comparison and judgement of alternative approaches to systems theories whether particular or general. It argues that clear criteria, shared as a consensus, is the sine qua non for advancement of the field and may explain why there has been so little consensus and evolutionary progress in GST across its seventy-year history. It also describes a couple of other fields as exemplars in which professional "lists" have become necessary and widely used with what results.

There are advantages to attempts to establish a list of criteria for assessment. Criteria are a bit more neutral and less partisan-involved and so might enable focused, logical appraisal of what needs to be true in systems research as opposed to the current situation of pride, megalomania, special interest and partisan arguments.

The paper presents and defines five suggested lists of criteria. Individual lists are submitted for science in general, theory in general, sciences of systems, general theories of systems, and systems of systems. Debate can then begin on who agrees with these lists, what changes should be made to them, and how they should be applied in order to reach field-wide consensus. The role of consensus in fueling "strong inference and progress" in the natural sciences will be described. The author has found that the absence of such consensus is the root of sluggish development and evolution in systems theory, and much miscommunication across worldviews.

The paper continues with applying the criteria to some widely known alternative candidate GST's, and self-labelled systems sciences. A chart showing which features of the criteria list that Systems Processes Theory satisfies will be presented. Another chart showing which features of the criteria lists that GST* possesses and which it does not is included. A rationale for what is not included and what criteria are not mentioned in GST* will be discussed. The overall purpose of the paper is to improve pathways for synthesis, integration, and unification of the many diverse approaches to systems.

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NATURAL SYSTEMS PHENOMENA ARE ALREADY DEEP APPLICATIONS OF THE SYSTEMS PROCESSES THEORY (SPT)

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One of the most fundamental challenges facing highly abstract general theories is their practical application. Practitioners from a wide range of fields demand evidence that the general facts and observations of the theories provide substantial understanding of how best to design and sustain all kinds and types of human systems.

GST's like Systems Processes Theory (SPT) are frequently challenged by practitioners who want to know where it has been applied and with what outcome. This paper turns this argument or challenge on its head. It demonstrates that the SPT is literally built from the empirical experiments or evidence from the natural sciences but using their results to compare ACROSS disciplines instead of staying WITHIN the discipline. That the same Isomorphic Systems Process (ISP – such as e.g. Cycling) is found in >100 different systems-in-nature, at widely different scales, using widely different components and specific mechanisms indicates that it has already contributed to sustainability of real systems, sometimes for billions of years.

The paper will also argue that there is not that much difference between natural and human systems on the systemness level. The widespread assumption that physical systems are separated by a vast gap from living systems and living from human systems has not stood up well given much modern research. So the many ISP's and their interactions need to be used in human systems to give them the same longevity, stability, adaptability, and development/evolutionary capacity as natural systems. This is prescriptive. So our conclusion is that the many case studies of where the Isomorphic Systems Processes are found in natural phenomena should be recognized as "applications." Their presence literally causes the origin of that scale or type of system. Just because these are found in natural phenomena and not human artifacts is not a sound argument that they are NOT applications. They function to stabilize those systems dynamics. So they are "applied" in that context.

This paper also discusses whether or not theory can be Prescriptive as well as Descriptive and Generative (in the sense of Ontology) or not. In a very real way, this is the same challenge that every branch of theory has traditionally faced: theoretical physicists are always criticized by experimental physicists and theoretical biologists by experimental biologists. Unless GST and systems science can be seen as prescribing how we could better design human systems, it will not be appreciated or more widely applied to our human designs.

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LINKING LISTS OF REOCCURING HUMAN SYSTEMS PROBLEMS AND PRESCRIPTIVE SPT SOLUTIONS

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An earlier paper in this series attempted to show that systems thinking is NOT systems science and that the conflation of those terms needs to be reduced for the health, rigor and more extensive acceptance of the systems movement. Similarly, it needs to move from solely "descriptive" research to "prescriptive" and "generative" research for it to mature more deeply as well as benefit the human species. This paper addresses both of these goals and will define the meaning of descriptive, prescriptive, and generative as well as provide pathways to achieving those qualities.

It will present two detailed lists that may very well contribute much to the desperately needed unification of the efforts of systems thinkers and systems scientists across the spectrum of system awareness.

The first list collects very specific identification and description of reoccurring or archetypic human systems problems. The problems were found to be present in or across many different types of complex human systems and human design failures. These archetype problems are summarized from the research efforts of nine independent lifeworks (some from systems studies others from systems engineering). This list may be considered a representation of the growing awareness of systems thinking problems, their analysis for similarities, and finding commonalities, but it is still a "descriptive" list. The problems may be common to many different system types, but they are not accompanied by prescriptive solutions that clearly solve those problems.

The second list collects "mechanisms" or isomorphies common to a range of several natural sciences and their different phenomena. These are mechanisms that presumably cause stable systemness or the emergence of complex systems

that have significant longevity and stability. They would not be found common across to so many different systems; they would not be isomorphic, if they were not causal regularities or patterns. But it is necessary for (and this list derives from) comparative systems analysis of many phenomena from many different sciences. Since it is derived from comparing and linked to the published experimental results on many different phenomena, it may be considered a representation of a prototype systems science. As such, it is hypothesized to be both "prescriptive" and "generative" (meaning ontological at the most basic level). The purpose of this paper is to show linkages between these two lists that would both bring systems thinkers and systems scientists together and move the systems movement from its "descriptive" stage to the more useful and complete "prescriptive" and "generative" stages.

Several significant systems research questions arise from the central challenge of relating the first list to the second list. Which particular systems mechanisms that go awry might be the primary cause of which particular archetype human systems failures? Is there often only one systems mechanism cause, or are there several working together? How can we determine between both of these cases of pathological causality?

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STATUS REPORT ON INITIATING AN INTERNATIONAL SOCIETY FOR SYSTEMS PATHOLOGY (ISSP)

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This paper will present an up-to-date summary of accomplishments of the team dedicated to establishing a new professional society, the International Society for Systems Pathology (ISSP). It will explain the 14 goals/purposes/objectives of the society contained in its By-Laws and Articles of Incorporation, progress on incorporation and achieving non-profit status. It will present a Manifesto of Interdependence for Systems Pathology. It will explain the award of four grants from INCOSE and the Wilson Foundation. It will describe the International Business Office of the ISSP and its many systems resources including both the physical and digital Archives of the ISSS. It will give an overview of more than a dozen domains of pre-existing systems-level pathological study as source pools for members as well as report on current membership. It will describe a growing bibliography of >100 texts, 3,500 reprints, analyses and reports on many dozens of isomorphies for GST. It will report on plans for publications such as a biannual Bulletin, an annual Yearbook of best papers, an introductory text introducing the concept of unifying the dozens of domains of Systems Pathology, and planning of a Journal on Systems Pathology. It will demonstrate active websites, and describe a network of a dozen interconnected and cross-referenced websites on this topic. It will close with an appeal to attending participants to join and help with this exciting new endeavor.

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DEVELOPING A SYSTEMIC PROGRAM EVALUATION METHODOLOGY: A CRITICAL SYSTEMS PERSPECTIVE

Maria Alejandra Torres Cuello

In recent years there has been an increased interest within the program evaluation field for introducing systems thinking concepts in it. However, most of these attempts have been primarily directed towards supporting the practice of evaluation and not towards making theoretical advancements. This article is focused on introducing systems thinking concepts at a theoretical level, particularly those related to boundary critique in the program evaluation field by reframing the Fourth Generation evaluation methodology. I will introduce the general ideas for carrying out such reframing as well as describing the major changes produced in the methodology and how the introduction of these concepts may be beneficial for conducting an evaluative process.

Keywords: Systems thinking, program evaluation, boundary critique, Fourth Generation evaluation.

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OPPORTUNITIES AND LIMITS OF AN ECO-SYSTEMS VIEW BEYOND SOCIO-ECOLOGICAL SYSTEMS

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The presentation is an inquiry of the opportunities and limits of the application of eco-systems theory and epistemology beyond the domain of Socio-Ecological Systems and Human Ecology as a research field. It originates from the successful application of the eco-systems view in a two years policy consulting project "to Co-Create an Effective European Digital Multimodal Transport System" of the author in the role as Special Adviser to the European Commission and a follow up critical self-assessment of the epistemology applied and its achievable results.

The presentation includes an overview of the origin of the terminology and the historic development of the epistemology and concepts, the mutual influences of systems theory and eco-systems theory from biology to social science and engineering, and its current wide spread use in governance theory and innovation theory, as innovation

and governance have been the two phenomena addressed in the application of systems thinking to realize a complex socio-eco-techno-system.

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UNDERSTANDING HUMAN ACTIVITY SYSTEMS: A STUDY OF TEAM USING GENERAL SYSTEMS SCIENCE PRINCIPLES

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Teams are human activity systems that exist to fulfil a purpose. For a team to fulfil its purpose, it is crucial to understand the characteristics, development stages, and factors contributing to team performance. Team performance factors have been studied by different disciplines such as organizational science, education, and engineering management. However, there is a lack of consensus on what are the main characteristics, developmental stages, and factors that contribute to team performance. This can be attributed to differing perspectives used by researchers in each discipline. This lack of consistency results in multiple team models that lack common ground, making it difficult for practitioners to select appropriate models that suit their needs. This is particularly troublesome as the complexity of engineering systems that rely on the work of teams, increases. Furthermore, the heuristic nature of the team design and management methods limits the ability of systems and engineering managers to understand how teams emerge and therefore how to manage them. Therefore, there is a critical need for a synthesis of team theories to provide a foundation for team studies and achieve more effective team building across disciplines. In this research, relevant team theories are integrated using a systemic perspective, resulting in: 1) an operational definition of team and team characteristics, 2) definition of team factors, 3) team development stages, and 4) a conceptual model to assist engineering managers with effective team management and development.

3446

FRAMEWORK FOR GENERATING TRADE SPACES FOR COMPLEXITY ALLOCATION IN COMPLEX SYSTEMS

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According to the INCOSE Systems Engineering Vision 2025, better understanding of complex systems is one of the main value driven practices to be developed in Systems Engineering. Particularly, decision support methods to enable more rapid analysis of multiple alternative designs and optimization of complex systems with multiple variables and uncertainty has been identified as one of the top needs of the systems engineering practice. After requirements analysis, one of the major Systems Engineering activities in the product life cycle is the definition of the logical architecture. At this phase, the logical elements, system configuration, and complexity of the overall system architecture are defined. Generating trade spaces having the desired characteristics to analyse multiple alternative designs of the complex system is at the core of this activity. However, as systems get more complex as more functionality is added and more subsystems or modules are included, visualizing and assessing an ever-increasing complexity of the system is not an easy task during this phase. In this work, a framework is presented to quantify complexity, analyse the allocation of system structural complexity among subsystems, and generate effective trade spaces to facilitate trade space analysis.

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INTERPRETING RA MODELS OF NOTE-ONSET INTERACTIONS TO DISCERN AND EXPLAIN CLAVE DIRECTION

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Reconstructability Analysis (RA) was used to generate and evaluate models of sequences of musical note onsets. These sequences were classified into four classes in three musical contexts based on a musical grammar akin to “harmony” but concerning the timing of note events. (Having emerged only in certain societies and from the cultural interactions between Yorùbá, various Angolan peoples, Iberians, and the native peoples of the pre-Columbian Americas, this musical grammar is found only in some of the musics of South America and the Caribbean.)

A variety of search approaches and search criteria were used in the Occam3 modeling engine, including BIC, AIC, and information, to extract classification information from rhythmic sequences. (‘Rhythm’ here refers to the timing of note events, not necessarily to any steady pulse, repetition, or percussive instrumentation.) The models discovered reflect trade-offs between complexity (degrees of freedom) and simplicity in how they prioritize some note-event interactions over others.

These close to 10,800 randomly generated idealized patterns have a 16-dimensional input space and a four-dimensional output space (for a total of 20). By limiting the output classes to whether a certain clave direction was present or not, the search space dropped to 17 dimensions. Hence, it was paramount to develop search trade-offs. The approaches developed for traversing the search space efficiently are detailed in the paper. Interpretation of these models is compared with several criteria for clave-direction determination deduced from systematic observations of four master musicians (and from deep exposure to the underlying musical practice).

BIC was found to be the most beneficial modeling criterion, with information second, and AIC third. The models discovered through RA provide insight into how clave direction arises in all possible rhythm sequences in that they highlight certain rhythmic schemata known to be strong indicators of clave direction while leaving out others as well as highlighting other rhythmic relationships for discerning clave direction that have been discovered through musicological (qualitative) means.

In some cases, models considered in this study show trade-offs suggesting that sufficient musical insight may be gained by considering interactions of fewer note events. In other cases, the interpretation of clave through an analogue to algebraic elimination gains unexpected support through RA modeling.

We thus demonstrate the ability of RA to model an intricate and culturally specific (not broadly accessible) musical construct in terms of discrete note events and their interactions in such a way as to mirror a human understanding of the corresponding musical practice.

3448

TECHNOLOGICAL SURVEILLANCE COMPETENCES FOR ENTREPRENEURS: A KEY FACTOR TO BOOST THE NUMBER OF SCIENCE-BASED STARTUPS

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This article explores how the development of technological surveillance competences in entrepreneurs can foster the increase in number of startups based on hard sciences and disruptive technologies rather than internet-based applications in Argentina. This analysis was done from an empirical perspective, using secondary sources of information and interviews with experts of the Ministry of Science and Technology of Argentina, academic directors of entrepreneurial programs and entrepreneurs. The article is structured as follows: initially, a startup's database analysis was performed based on the report of Tecnolatinas Research and venture capital databases. As a result, emerged the low percentage of science- based startups in Argentina and Latin America compared with the internet-based ones. A list of the most relevant science-based startups from Argentina was developed.

Several factors emerged as possible contributors to the situation: i) level of interaction between Academia and entrepreneurs; ii) level of Technological Surveillance training of entrepreneurs; iii) level of Technology transference from Academia to entrepreneurial ecosystems and; iv) level of interdisciplinary inside Academia. Among all of the surveyed factors, the level of Technology Surveillance training of entrepreneurs was considered very relevant for being considered strategic. A research of the main programs and courses about entrepreneurship in Argentina was conducted, showing the absence of the technological surveillance subject in almost all of them. Finally, a set of findings are discussed and presented together with potential areas for further considerations and implementation.

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SEA AND LIFE

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"It is a curious situation that the sea, from which life first arose,

should now be threatened by the activities of one form of that life.

But the sea, though changed in a sinister way, will continue to exist;

the threat is rather to life itself."

Rachel Carson, The Sea around Us (1951)

The present situation of the sea needs to be considered in a systemic view, connecting not only the environmental aspects with each other, but also relating those with economic and political decisions. There is a need for a world model, and to create consciousness in the population about the importance of the sea; therefore, the importance of including these topics into the educational curriculum, starting from the youngest of the society.

The Grupo Mar (in English "Sea Group") is a research, development and action association, integrated by academics and professionals interested in a systemic approach to the topics related with the sea and its coasts.

It is composed by the following institutions:

- Instituto Tecnológico de Buenos Aires (ITBA)
- Grupo Argentino de Estudio de Sistemas Integrados (GESI)
- Colegio Atlántico del Sur de Mar del Plata (CADS)
- Fundación EcoConciencia
- Universidad Tecnológica Nacional, Regional La Plata (UTN-FRLP)
- Academia del Mar (ACMAR)
- Universidad Nacional de la Patagonia San Juan Bosco, Facultad de Ciencias Económicas (FCE-UNPSJB)

On June 8th, 2018 – World Oceans Day – the Grupo Mar presented a participatory project at the Puerto Madryn Regional Headquarters of the Universidad Nacional de la Patagonia, San Juan Bosco (UNPSJB), the host institution of the event.

With focus on the Patagonian coastal communities, the presentation was developed through an interdisciplinary panel and associated conferences. By using this approach, the presentation started showing several aspects of the sea issues, followed by a substantial exchange of ideas conducted to mobilize the interest and sensitivity of the participants, with the goal of reaching through them, a broader community. The purpose was achieved thanks to the participant's (mostly professionals, academics and students) involvement and their request to provide continuity to the discussions through a dialogue forum such as the one described in this paper.

Keywords: Sea, systemic, cooperation, biosphere, youth.

3450

MOTION SICKNESS AS METAPHOR

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Individuals experience motion sickness when their brains receive mixed signals from their eyes, inner ears and proprioceptive cells in their bodies. It is essentially an algedonic (pain/pleasure) signal that many believe is an evolutionary response to eating something poisonous. It doesn't do any good to know that isn't the case – witness many people's experience of virtual reality – but individuals can counter motion sickness with over-the- counter anti-nausea drugs and wristbands. And, of course, many become acclimated after multiple experiences.

Individuals in social situations are also subjected to inconsistent and conflicting messages about the state of their own lives and of the society we live in that have been amplified by internet communications and politicians and lobbyists who spread and exploit the confusion. What seems to have been steady progress toward more agreement on matters of fact is currently stalled, if not reversed. Tribalism, fear mongering, alternative realities and superstition seem to be on the rise and many seem to reach for simple answers to complex questions.

The Viable System Model enables insights into the management of organizations. What might we learn and what actions might we take if we looked at motion sickness as a metaphor, using the VSM template, for the turmoil in Western societies and politics today? We begin by assuming that information overload and conflicting statements about what is happening legitimately confuse people and that the implications of changes they do not understand unsettle their perceptions and decisions.

We might look in several directions for the equivalent of pills or wristbands for answers. First, people can relate most reliably to things in their direct experience. Local civil society can and should be strengthened as it gives people a sense of identity based in direct experience. Learning civics in school provides a foundation for understanding the institutions that provide social infrastructure and how governance has developed.

The ignorance of concepts from systems thinking is very damaging since without understanding the importance of context, of multiple observers seeing situations very differently and the need for regulations to have requisite variety people don't have a framework in which to anchor opinions. Systems models such as the Viable System Model with its recursive structure from the neighborhood to the nation can be such a framework.

The VSM's four main homeostats are between the present and the future, between horizontal autonomy and vertical control, between the system and its metasystem and between the system and its present and future environments. It suggests particular steps that can be taken to break down complex issues into manageable segments.

Its recursive structure enables us to examine social groups from the family to the nation and to trace common elements and relations with the environment.

3452

A SYSTEMS ANALYSIS OF COMMUNICATION: DEFINING THE NATURE OF AND PRINCIPLES FOR COMMUNICATION WITHIN HUMAN ACTIVITY SYSTEMS

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Communication within Human Activity Systems plays a critical role in organizational change. However, research on communication typically expresses communication as a tool to evaluate the current state of an organizational system, or as a vehicle to change the current state of the system to a more desired future state. It is rarely considered from a holistic viewpoint, being a complex system with an integrated effect on the organization as a whole. The holistic understanding of communication as an emergent system from the interaction of elements and activities within Human Activity Systems is required to better manage factors impacting effective communication. Presented in this article is an ontological framework characterizing the behavior of communication in Human Activity Systems as well as its role in organizational change, encompassing the nature of communication and its impact on Human Activity Systems. Furthermore, principles for communication, within the bounds of Human Activity Systems, are derived to provide researchers and practitioners a methodology for assessing the interaction of these two systems. These principles are expected to provide a change in perspectives of communication in Human Activity Systems and allow for a more optimal design of both systems and their interactions.

3453

MANAGEMENT-LED PARTICIPATIVE CONTINUOUS PROCESS IMPROVEMENT

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Continuous process improvement is one of the foundations for any Lean or Six-Sigma implementation. This typically requires to find and maintain solutions to problems and to achieve this, a precise understanding of the system state is required. Implementing solutions without assessing the system state, can risk the whole Lean or Six Sigma program. Continuous process improvement is exercised at every level of organization with the assist of a variety of tools. Jishuken one of such continuous process improvement tools, which uses cross-organizational and cross-functional teams to tackle a broad range of process improvements (from operational level to strategic level). Jishuken is adept at handling, according to the Cynefin framework, system states where the cause and effect relationship is evident (ordered) and within a unanimous team environment (unitary). However, Jishuken does not offer any guidance to handle system states wherein the cause and effect relationship may not be evident (unordered) and/or the team environment may not be unanimous (pluralistic). This research uses a complementary approach to enhance Jishuken's capabilities with Cynefin framework. As a result, six system states are proposed, and their accompanying operational definitions are provided. This results in a conceptual model that offers flexibility to Jishuken process practitioners to operate in different system states.

Keywords: Continuous Process Improvement, Lean Manufacturing, Cynefin Framework, Nominal Group Technique, System of System's Methodologies, Kaizen

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BEYOND SPATIAL AUTOCORRELATION: A NOVEL APPROACH USING RECONSTRUCTABILITY ANALYSIS

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Raster data are digital representations of spatial phenomena that are organized into rows and columns that typically have the same dimensions in each direction. They are used to represent image data at any scale. Common raster data are medical images, satellite data, and photos generated by modern smartphones.

Satellites capture reflectance data in specific bands of wavelength that correspond to red, green, blue, and often some infrared and thermal bands. These composite vectors can then be classified into actual land use categories such as forest or water using automated techniques. These classifications are verified on the ground using hand-held sensors.

Reconstructability analysis (RA) is a methodology for analyzing categorical data. There is an entire field of geostatistics for analyzing spatial data that are continuous and numeric, but tools for spatial analysis of categorical (non-numeric) data are limited. RA can bring new insight into such data. This study applies RA to a set of satellite data classified by National Land Cover Database into 15 land use classes. This analysis groups these classes into four types: Forest, Developed, Water, and Grasses.

A Von Neumann Neighborhood (VNN) kernel is passed over the data, coding the values in the North, South, East, and West directions into columns. These tuples of data now consist of rows in which the first column is the center cell of the VNN, the DV we are trying to predict, and the remaining four columns are the values of the VNN, the IV predictors.

The VNN was chosen over the Moore neighborhood, consisting of eight neighbors because the NW, NE, SW, and SE cells are further from the center cell than the N, S, E, and W cells. An even better reason— in this particular data analysis -- to prefer the VNN is that RA on the Moore neighborhood indicates that a model with all IVs in the VNN predicts the center cell with a fidelity as high as 84%. Further analysis shows that just the North and South cells together predict the center with 64% probability. We analyze this three-cell relationship for most of the remaining results.

We remove data rows for the trivial case in which all five cells are the same. Another trivial case is when the North and South cells have the same value. In this case the center cell will likely be the same, with a probability ranging from 88% to 98%, depending whether the neighbors are Developed, Grasses, Forest, or Developed.

When the North and South cells are different from each other, RA pulls out relations that are beyond classical autocorrelation. If either N or S is Grasses, there is a preference for the center cell being Grasses, regardless of what the N cell is. Similarly, if the S cell is Developed (and not Grasses) then the center cell has a higher probability of being Developed regardless of the N value. If both N and S are neither Grasses nor Developed, then we get the intriguing result that the preferred value for the center cell is whatever the S value is, whether it is Water or Forest. There are more subtle results when the East cell is added back into the analysis.

This initial foray into analysis of raster data using RA shows a great deal of promise compared to other textural analysis techniques, such as GLCM, or autocorrelation analyses, such as Moran's I or hotspot analysis.

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EVALUATING THE IMPACTS OF DROUGHT CONDITIONS IN CALIFORNIA WITH AN EMPHASIS ON SANITARY SEWER OVERFLOWS

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Various impacts of the California drought were investigated and considered for study. Only some infrastructure impacts due to drought conditions were able to be analyzed for study, because most considered impacts did not have enough data available. Impacts of the drought to California were then studied, and analyzed using Sanitary Sewer Overflows data statistics. These were compared to average temperatures and precipitation as proxies for drought conditions. Drought conditions have been hypothesized to reduce flow conditions in sewers, due to reduced Inflow and Infiltration into sewer pipes, and the increased water conservation measures needed. This statistical study of sanitary sewers was made possible by the extensive online data collection of the California State Water Resources Control Board's Sanitary Sewer Overflow Reduction Program. Using Excel's statistical analysis tools for these SSOs, their occurrences, volumes and major causes, we were able to correlate them with the proxies for drought conditions in California. Namely, we correlated SSOs to average monthly temperatures, MNTM, and precipitation, TPCP, in each of California's nine water board regions. Very weak to very strong correlations using Pearson's coefficient were found between dry, hotter months and lower numbers of SSOs. The best statewide correlations were found between MNTM and SSO occurrences. These correlations were found to be significant by triangulating our Pearson's Coefficients correlations with significance F, in Excel's ANOVA Regression Analysis tool, for all nine water board regions. The regression analysis was then used to make estimates of SSO occurrences directly associated with MNTM, or average monthly temperatures. Drought conditions caused a strain on the economy and water infrastructure needs of the state in terms of increased water supply needed, and possible capital improvements to the supply needed later. However, the drought conditions

measured in terms of MNTM and TPCP, actually reduced the occurrences og Sanitary Sewer Overflows consistently. Patterns of Pearson's Correlations and other statistics were further analyzed to hypothesize causes of SSOs. This also allowed us to compare California's SSO statistics to those of the United States Environmental Protection Agency for the year 2004.

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BRIDGING THE DISTANCE BETWEEN THE VIEW FROM THE BALCONY AND CLIENTS' PERSPECTIVES IN FRAMING ACTION RESEARCH DISSERTATION PROJECTS: SYSTEMIC WISDOM FROM THE SUFI STORY OF FIRE

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For the past five years, the University of Illinois at Chicago DrPH (doctorate in public health) in leadership program has focused on developing a curriculum that supports increasing the capacity of enrolled students, who are working professionals, to both more effectively address "wicked" complex problems they face in their professional positions as emerging leaders, or see others facing, as well as teach them systematic research skills that allow for building the capacity for practice-based research (Lenihan et al 2015). This requires producing evidence, created through collecting and analysing data, documenting lessons learned about the facilitators and barriers to solving these problems, in such a way they can be transferred to other contexts, beyond the narrow boundaries of the specific situation that may have generated the practitioner's initial awareness of the problem, or that has engaged other stakeholders' interests. Students are required to frame and develop a project through a problem statement that makes explicit broad leadership implications for the proposed research, of interest to a national or global public health practitioner audience.

The research questions generated from the 30,000 foot, "balcony" view of the problem, however, are sometimes not enough to create buy in from stakeholders in the problem who may function as gatekeepers to data that the student needs to access to order to do the proposed research. This can be true whether or not the student has chosen a problem situated in their own work environment. Furthermore, for lessons learned to be transferable to other contexts, they still need to be useful within the local environment in which they were generated. That is a goal of the research, as action research. Although not all UIC DrPH dissertations fit the classic action research model of multiple cycles of designing a study, collecting data, analysing data, communicating findings, and taking action (Stringer 2008), the dissertation projects can be considered "action research" in the broader sense of research that produces actionable, that is, useful and useable, knowledge. But given the human context of useable knowledge, the research questions and the evidence they generate need to resonate with the perceived needs and understandings of key stakeholders, who act as clients for the research products as well as, often, gatekeepers to the data the researcher needs. Documenting and understanding these stakeholder perceptions is a necessary part of the environmental scan we have found that the students need to do in the early stages of defining and framing their problem. However, the stakeholder perceptions aren't just synthesized into a "balcony level" view; divergences within them and between them and the "balcony" level view need to be continually kept in the researcher's mind as research questions are developed and research products planned, so that people who have the power to act on the research results see them as relevant and indeed useful for action. The wisdom required to bridge the gap between the systems analysts' "balcony" view and the needs of actors grounded in their daily reality isn't new: it was articulated in the 850 year old Sufi story about the uses and misuses of the knowledge of fire. The master teacher in the story tells his students:, "Although [most people]. . . imagine they are ready to learn, they are really concerned with learning what they imagine is to be learned, and not what they first need to learn. Understand this, and then you will find the proper way to teach." (Shah 1993). This story links research and social change to learning, and it is as true for our students, as learners and as teachers and leaders of change, as it is for us.

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CASE STUDY OF SOFT SYSTEMS METHODOLOGY APPLIED TO SMALL COMPANY SCALING UP

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The Soft Systems Methodology (SSM), created by Peter Checkland and his colleague, has been around for several decades. Join Daryl for a lively dialogue about an instance where SSM was applied end-to-end to a consulting firm to understand why the company was having problems scaling up. Employee attrition, team issues and unclear direction were coming up in several locations, but management was mystified. We explore how SSM was able to provide some guidance and a path forward for this consulting firm.

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DATA MINING AND ANALYSIS WITH THE OCCAM SOFTWARE SYSTEM

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The OCCAM software system comprises a specialized set of tools for mining, modeling, and understanding discrete multivariate data, based on the method of reconstructability analysis (RA). Though OCCAM has only two principal actions – Search, for model generation and comparison, and Fit, for deep investigation into a single model – each action has multiple subtypes with numerous options. To navigate these choices successfully, a researcher must have specific knowledge both of RA and of this particular software, as well as general experience with data analysis. These requirements are a barrier to increasing adoption of the RA method.

To lower that barrier, this paper demonstrates the effective use of OCCAM through an example analysis project, described in detail from start to finish. The project was designed to cover all of OCCAM's major features and options, and to highlight the characteristics of RA. The description also includes data cleaning and exploration, a framework for iterative hypothesis generation and testing, and integration with tools such as Excel, R, and Python for visualization of results. The analysis uses public data, and all supporting documents are being shared online as an open-source appendix.

Through the open publication of this exemplar project, this paper aims to make both RA and OCCAM more accessible to a greater variety of researchers. In doing so, this work draws upon decades of combined experience in research, development, and instruction with OCCAM, led by Dr. Martin Zwick of the Systems Science Program at Portland State University.

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BIOCYBERNETICS AND SUSTAINABILITY - RULES OF NATURE AS A MODEL FOR VIABILITY

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Regarding concepts that support the strengthening of natural rights, biologically and ecologically inspired approaches are of particular importance for obvious reasons. Biocybernetics, as developed and propagated by the German systemic scientist Frederic Vester (1925-2003) since the 1970s, is one such nature-inspired concept. The "Eight Basic Principles of Biocybernetics", in particular, provide a set of instruments for understanding and adequately dealing with complex systems, focusing on preserving and strengthening nature, while at the same time enabling the transfer of acquired insights to other problems.

The abstract provides a first understanding of the background and development of the eight biocybernetic principles as well as an overview of the different applications of this approach.

In all his works, Vester regarded these eight biocybernetic rules as the basic principle of viability, and especially the "viability and sustainability" of systems. They serve as guardrails for orientation in the design of viable and sustainable systems. This can be illustrated based on examples from nature, but also from business and society.

Based on his early research in Biochemistry, Vester had very early derived from the functioning of nature, "a set of rules which can be described as the basic laws for viable systems" (Vester 1976: 23). In analogy with the functions of single cell as a prototype, the smallest living system, these basic mechanisms can be used as a model for viability of larger human-made systems. Among them is first the importance of balancing, negative feedback cycles (rule #1) – and not a dominance of positive, enhanced feedback. This rule, for example, states that negative feedback in a system or subsystem has to take precedence over positive feedback with regard to correlations.

The next main basic principle for viability is the independency on quantitative growth. The recommendation to assure viability is therefore to avoid mere dependency on quantitative growth (rule #2), the system function has to be independent of growth. A postulation, which is fundamentally opposing most current economic approaches. In the meantime, our global worlds „real-live laboratories" have finally proven the destructive results of these conventional growth oriented approaches. Probably it might be the only possibility, in face of environmental destruction and of the interwoven damaging effects to find sustainable solutions for human ecology and health, for migration, and for the exponentially growing social, political and military crisis.

The other rules cover further basic principles that play an important role in the field of green economy. Independency of products and concentration on functions (rule #3) would be a useful orientation for many fields of production. One drastic example is the actual situation of the car industry, still selling mainly products instead of serving the needs of the function: mobility and transport.

A further aspect is the principle of Jiu-Jitsu - using existing forces (rule #4). The most economic mechanism for the utilization of energy in nature is this principle (like solar energy). Circular processes like multiple use of products and of

functions (rule #5) and of recycling (rule #6) and the principle of symbiosis (rule #7). The final and comprehensive law is the biological design (rule #8) – concerning itself with organizational cybernetics (Malik 2016) and with creative bionics.

A very important point here is the importance of biocybernetic principles for the strategic dimension of the sustainability discussion; this is evidenced by the typical strategic approaches of efficiency, consistency and sufficiency, all of which are systemic components of the eight principles. For Vester, it was clear that a solution to our civilizational problems cannot emanate from a single approach, but only from a skillful, systemically based nexus of different approaches.

From the implementation of these rules in the areas of planning and management, these steps were then implemented methodically and practically and developed over the years, leading e.g. to the development of the computer-aided biocybernetic planning and management tool "Sensitivity Model Prof. Vester®" (later „Malik Sensitivity Model). This allows the basic rules to be used e.g. in the development of a forward-looking strategy and innovations e.g. for the automotive industry or in the design of organic farming facilities.

In general, there is a major problem that needs to be taken into account both in systemic considerations and in the application of the basic rules of biocybernetics: As a result of our conventional training, we are accustomed to what is known as linear thinking; we believe that we can control the development of systems and obtain absolute security from them. The principle of biocybernetics, not only to see ourselves as cybernetes or gubernators, but as a part of the system and not just outsiders standing at the helm, would lead to a different interaction with nature as well as with man-made systems.

The authors would like to close these reflections with some further thoughts of Frederic Vester:

"While our politicians are still arguing about whether systemic and interconnected thinking is really necessary, in some circles of industry and even among insurance companies (which as we saw in the early chapters get to feel the effects financially), it has long since ceased to be a question of whether and become one of how interconnected thinking can best be applied. The examples given in the article and the mentioned literature will no doubt finally have underlined how greatly it will be to our advantage if we tackle future questions in the wider systemic context, whereas individual solutions (from the tax legislation to subsidy policy and from the labor market to emission controls), be they never so perfect, ultimately leas up blind alleys, even when they come from the ecological camp.

Indeed, I see the greatest risk in our continuing to view the world as an arena to be conquered with the aid of blinkered technological expertise, by tackling each project separately and concentrating only on getting the details exactly right, proceeding piecemeal without regard to overarching contexts. For this will place increasing stress on the world economy; its inevitable concomitant will be the progressive collapse of the vitally important interplay of all the many (and virtually free) regulatory and self-regulatory processes that make up our biosphere – on which, for better or worse, we are totally dependent, however sophisticated our technology." (Vester 2007: 337–338)

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Keywords: change of awareness and behavior, climate change, eight rules of biocybernetics, cybernetic simulation game, ecopolicy, interconnected thinking, sensitivity modeling, simulation, systemic criteria and levers, systemic education, systems thinking, transdisciplinary approach, transformation, viability.

3475

RECENT PROGRESS IN R-THEORY: AN INTEGRAL PHILOSOPHY OF NATURE

Dr. John J. Kineman, University of Colorado

R-Theory is a new view of life and the natural world that I am testing on many dimensions. I began its development in 1988 as a Gaia worldview, published it in ISSS first in 1999 as "Autevolution", and then formalized the theory in 2011 as a synthesis of Robert Rosen's work in Relational Biology. It is based on a mathematically 'whole' cycle of four essential causes thought to be general to all systems, even physical. R-theory restores causality that Modern science discarded in its quest for exactness, which proved generally unattainable. R-theory's assumption that nature is fundamentally complex is more parsimonious because it includes complex causality before reduction, thus avoiding the need for post-hoc additions to mechanistic theory that have characterized science since the Modern Era.

Significant progress has been made in testing and further developing the theory. I will review that progress from four different studies, each published in various books and journals in the past 2 years. These studies are summarized below:

R-theory was applied along with systems dynamics theory, to study causality in the socio-ecological cycle of the plant leaf. The theory was shown to yield a robust causal definition of sustainability. It showed the importance of contextual analysis and ecological niche modeling as an effective way to model final and formal cause.

The above study of a 'hosted' life form (the leaf), led to identifying a fourth organizational life type in the mathematical formalism of the R-theory holon. That type correlates with proto-biotic life, which is a necessary fourth Domain recommended by taxonomists. This completes the 2011 description of three 'organism' types, adding the missing 4th type implicated by the theory.

In collaborative research in India we found both cultural and archaeological evidence that ancient metaphysics and the cultural organization of civilizations in the Indus-Saraswati basin of South Asia between 600 and 3000 BC, conformed to an organizational concept of existence essentially the same as the R-theory Holon. Ancient ideas of whole systems were clearly described in the Vedas and Upanishads. Evidence suggests that a profound shift in human thinking occurred between 1900 and 600 BC, from highly sustainable holism to unsustainable, and thus disruptive, dualism. Systemic unity may be obtainable combining holistic and dualistic thinking.

The general implications of R-theory metaphysics has been tested in cosmology as first published in the ISSS in 2000. The theory implies a four-space scale-expanding view of the cosmos, which appears to be more accurate and parsimonious than the "standard" view of 3-space expansion. This work strongly supports the idea of context dependency at cosmological and quantum levels that may also help explain consciousness. Rosen's concepts of complexity and time reached deeply from biology to fundamental physics, and one of the issues in proposing R-theory is just such general implications at the foundation of existence, as we know it.

3476

AI: CREATING G.O.D. OR G.O.O.D.?

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An exploration of the current state of government, digital transformation, future intents and ethical positions in the development of Artificial Intelligence (A.I.) and Machine Learning (ML). Using a broad systems science approach to link the social systemic impacts of media, governance and digital transformation. While digital protagonists and futurists

such as Ray Kurzweil suggest that society is currently in the space of creating G.O.D. (Government of Design) and potentially achieving immortality, the same systems also pose an existential threat to humanity. Yet what is 'humanity' and what does 'being human' mean? Algorithms and mathematical formula utilise a 'value' system with data that is generated by human interactions to provide vital business information. In essence, humans being human. If 'Data' is the new technological 'Science', will the human spirit become a 'Dot' to be socially engineered by other Dots of the system? Could Critical Systems Thinking and systemic intervention be the cognitive approach to reveal the inherent personal value systems that drive and embed themselves within the technical systems we create and potentially avert the unintended consequences of Good intent?

Keywords: Critical Systems Thinking, AI, Artificial Intelligence, Big Data, Cybersocial Ethics, Spirituality, God, Good, Virtue, Social Systemics, Systemic Intervention

3477

ROBOT FUTURE VS CO-OPS IN NATURE: TRANSCENDING SINGULARITY: ROBOT FUTURE VERSUS LESS MACHINE DEPENDENT COMMUNITARIAN ECONOMICS

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John von Neumann first used the term "singularity" in the 1950s in the context of technological progress causing accelerating change: "The accelerating progress of technology and changes in the mode of human life, give the appearance of approaching some essential singularity in the history of the race beyond which human affairs, as we know them, cannot continue."

In 1970, during my 4th year at UC Davis, I wrote a paper for myself about the role of computers in the workplace. I correctly forecast the 1984 rollout of free-standing computers (MacIntosh Super Bowl introduction). In the paper, I forecast computers winning the civil war against humans in 2041. (Attached as "1970 Future of AI")

If there is a civil war between humans and computers, the computers will win. But it will be a fleeting victory, because nature is so much more sophisticated and complex than machines that nature will still win. Maybe humans' time is past tense like the dinosaurs, but other forms of natural consciousness will bother the computers so much that they will lose control. When the dinosaurs ruled, the only mammal, our common ancestor, was a mouse-sized rodent. Some species-that-can-evolve better than a computer-can-evolve will emerge.

I have been intrigued with those questions ever since. This paper is an update.

Poster Abstracts

3318

HEALTH AND SYSTEM THINKING SIG: FROM HEALTHCARE TO INTEGRAL ANCIENT-MODERN EAST-WEST SYSTEMS THINKING FOR GENERAL SYSTEMS THEORY

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The search for a set of basic components and their relationships to one another within a certain field has been the work for scientists. System thinkers try to find a basic set of components and relationships that can be applied to all fields of science. System thinking enables the view of a big picture in a holistic perspective, so that all components, relationships, and transformations can be clearly understood by the observer.

In any system, an observer is required in order for analysis occur. In physics, speed and time do not mean anything without the frame of reference of an observer. The frame of reference of the observer determines the perspective of the analysis of the system. An observer can try to analyze a system objectively, however, being objective only means that the analysis is agreeable by a certain population of observers. There will always be a larger population of observers and hence the analysis is always relatively subjective. Objective analysis with either "no perspective" or "all perspective" is impossible, any analysis will instead take on one of an infinite number of possible perspectives.

A general systems theory must include both the system and the observer decision maker. Therefore, it must include at least one particular perspective. Some of the existing fundamental theories in different fields are should have some similarities including set theory in mathematics, relativity in physics, differential diagnosis-cure process in Traditional Chinese Medicine, Taichi Yin-Yang theory in Taoism, and Five Aggregate Systems theory in the teaching of Buddha.

The systemic thinking of the correspondence between nature and human has been the fundamental concept in traditional Chinese culture since around 500BC. The concept is also embedded in the teaching of Confucianism, Buddhism, Taoism, and Traditional Chinese Medicine.

Taichi yin-yang system theory describes the relationship between any two entities (element/process) at any level of interest. It concerns the quantitative and qualitative changes between the entities.

The Five Aggregate system theory of the human mind is one of the importance concepts developed in the teaching of Buddha. The Five Aggregate are: observation, distinction, sensation, action and physical object. These five systems are able to describe the properties of the observer and the decision maker.

Heaven, earth, and human are the tripot of wholeness in Confucianism. Research reveals that the properties of heaven may have the key to the structures and functions of the environment.

How hard or how soft a system is depends mainly on the flexibility of perspectives distinction of the observer, but also on the flexibility of observation, reaction to information, and the flexibility of actions.

The traditional Chinese medicine differential diagnosis-cure process is a practical systemic process that has been used daily for more than 2000 years. It is believed that the whole macroscopic-microscopic spectrum of systems is suitable. The system state identification involves three pairs of direction-forming spectrums. The Superficial and Internal spectrum gathers information between the boundary and the system. The Cold and Hot spectrum gathers information between the form and function, or matter and energy within the system. The Deficient and Excess spectrum gathers information between the environment and the system. Strategy can then be formulated to regulate and maintain the system.

The Taichi Yin-Yang Five Elements Trinity i±1 systems has five elements structure at both i+1 level and i-1 level. When the i+1 five elements system emerges to become level i water element, the i-1 five elements system would emerge to form level i Earth element. Together with the other three level i elements which provide interactions between Earth i and Water i elements, another level i five elements system would be formed. Similar structure are found in other Ancient-modern East-West systems thinkings, for example, Confucianism, Buddhism, Daoism, Schemas Theory, DSRP systems, R-Theory system and even “Tree of Life” structure.

With this proposed GST, we are expected to find similarities with a variety of systemic theories and practices, where we can then learn the unity in diversity.

Keywords: General Systems Theory, Taichi Yin-Yang Five Elements Trinity i±1 systems, Integral Ancient-modern East-West systems thinkings, Confucianism, Buddhism, Daoism, Schemas Theory, DSRP systems, R-Theory system, Tree of Life, Traditional Chinese Medicine Systemic Healthcare Engineering.

3319

HEALTH AND SYSTEM THINKING SIG: PHYSICAL HEALTHCARE

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Ever since the success of the first antibiotics against TB, the battle of human against germs and virus falls into the favor of human. Just when human thought that we are in complete control, we are amazed by the growing difference between the speed of discovering new antibiotics and anti-viral drugs and the speed of the breakout of new germs and viurs like SARS and HxNx.

Traditional Chinese Medicine is based on the Taichi Yin-Yang theory that was published 2000 years ago, which has been thoroughly developed through time. TCM employs the Differential Diagnosis-Cure process to balance the five different sub-systems and the eight components of each system in human body. The remarkable results in the battle against SARS is supported by the guidance of this ancient theory, rather than a particular effective Chinese herb. The research of this success could only be understood through the viewpoint of system theory.

Reductionism was the major scientific view before world war II, its development leads to industrial revolution and modern medicine. Traditional medicine like Traditional Chinese Medicine, Ayurvedic Medicine, Homeopathy, Naturopathy, and Western Herbal Medicine was then considered as alternative medicine because they are seem incompatible with reductionism and allopathic medicine. However, reductionism was found to be an incomplete scientific view after world war II and a more holistic scientific view was developed namely system theory.

Systemic thinking is to consider both the system and the environment when analyzing or maintaining a system, or its environment. When analyzing a particular component within a system, all other components should be considered as well but different importance ratio is allowed. Traditional medicine has been analyzed with the incomplete scientific theory for logical explanations of its medical theory and practice, resulting in confusion and misunderstanding. This workshop will demonstrate the application of system theory to investigate the holistic nature of a particular traditional medicine namely Traditional Chinese Medicine. It is believed that all other traditional and alternative medicine could be better understood in this holistic scientific view of system theory.

The Taichi Yin-Yang system theory was developed when combining both the traditional Chinese thinking and the systemic thinking. Taichi is considered as the organizational force in the universe, and the Yin-Yang combo is considered as the information gathering process, the current state determination process, and the steady state regulation process. The system state identification involves three pairs of direction-forming spectrums. The Superficial and Internal spectrum gathers information between the boundary and the system. The Cold and Hot spectrum gathers information between the form and function, or matter and energy within the system. The Deficient and Excess spectrum gathers information between the environment and the system.

The Traditional Chinese Medicine Healthcare Protection Program composed of three components:

1.the TCM diet on how to choose food from the Cold-Hot food spectrum,

2.the Middle-way exercise therapy on how to regulate our body and Chi (Qi) from the fully Open-Close movement spectrum,

3.the TCM 24h healthcare lifestyle on how to use our health wisely for work and fun from the Human-Environment spectrum.

The systemic thinking of the correspondence between nature and human has been the fundamental concept in traditional Chinese culture since around 500BC. The concept is also embedded in the teaching of Confucianism, Buddhism, Taoism, and Traditional Chinese Medicine. It is hoped that the link between TCM healthcare and modern system thinking can be formed. And then the combination of the Ancient system theories could form a General System Theory that could be applied across boundaries into different modern system theories including Viable system model, system dynamics, cybernetics, measurement system, soft and hard systems, anticipatory systems, General Theory of Systems, system of system process, Spirituality and Systems, Health and system thinking, monetary systems.

Keywords: Middle-way exercise therapy, Healthcare Protection Program, Taichi Yin-Yang system theory, Traditional Chinese Medicine, Reductionism, System maintenance, Heath and System thinking, Buddhism, Confucianism, General System Theory, Health and system thinking, Taoism, Traditional Chinese medicine differential diagnosis-cure process, Unification of nature and man,

3320

HEALTH AND SYSTEM THINKING SIG: SPIRITUAL HEALTHCARE

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Spiritual Healthcare is about the improvement of our in-born characteristics, possibly hidden in our physical DNA or our energetic spirits fields (Aura). We now try to match this with the Observation Aggregate of the Five Aggregate Human Mind system in the teaching of Buddha. The Five systems are: observation, distinction, sensation, action and physical object. These five systems are able to describe the properties of the observer and the decision maker. Here we must put our foundation in the fundamental teaching of Buddha in the ?our Nobel Truth guided especially by the Right View and Right Thought in the Eight-Fold Nobel Path which is the fourth part of the Noble Truth.

Throughout our life we have been looking for satisfaction that brings happiness. Our government have been relying on economics to achieve this but 80% of the time we are dis-satisfied with the people and situations around us, bringing craving, aversion and ignorance into our minds and creating all sorts of problems in our society. This is called suffering in the teaching of Buddha, and he offered us with a three step solution for our mind. We investigate the systemic view of these three steps namely self protection, concentration and purification of our mind. We also investigate a 10 days Vipassana mental healthcare program for people of all religions including scientific communities. It is believed such a program could bring happiness, peacefulness and harmony for our community. Spiritual Healthcare could then be performed within the objective framework of our body.

Keywords: Vipassana mental healthcare, Buddha, Four Nobel Truth, Eight-Fold Nobel Path , Spiritual Healthcare, Spirituality and Systems Science

3348

INTEGRITY PARADIGM - UPDATED AND EXPANDED 2018

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The author presents a graphic display of his “Integrity Paradigm”, with additional mathematical and concept interpretation concerns, to better frame and explain the hypothesis of a General System Theory (per the GST founders) that have been added to the paradigm since his last presentation at an ISSS conference.

Conversation and questions are invited.

Keywords: Integrity Paradigm; communication; general theory of entropy~negentropy; systems philosophy; information access

3393

SYSTEMS APPROACH: CONCEPT PROPOSAL TO DEVELOP SAUDI ARABIA LOW-COMPLEXITY - DEFENSE-SPARE-PARTS MANUFACTURING INDUSTRIES, UTILIZING TECHNOLOGY TRANSFERS AND BUSINESS INCUBATOR

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The overall goal of this projects is to adopt and build on three of the Saudi vision 2030 “thriving economy” theme third-level objectives that include (1) Localize military industry, (2) Nurture and support the innovation & entrepreneurship culture, and (3) Grow SME contribution to the economy.

One of the very important initiatives of the adopted “thriving economy theme to our area of concentration is planning to grow the economy by manufacturing half of the defense needs within the Kingdom, with the intention to offset the economy, keep more resources in Saudi Arabia and to create more job opportunities for its citizens”.

The main research question explores how to develop a conceptual model to demonstrate how innovative technological initiatives contribute to localized military equipment manufacturing technology.

The research process includes creating a conceptual model meant to assist with the development of low-complexity-defense-spare-parts manufacturing industries, utilizing technology transfer and a business incubator. The model will include (1) adopting a Systems Approach to better understand the nature and the scope of the problem statement (2) developing a Conceptual Model for high volume, low mix, low complex spare parts manufacturing industries that will

contribute to the national defense industrial sector, (3) investigating the adequacy and limitations of the Innovative Concept, (4) validating the model by analyzing the alignment of the concept with the systems methodological strategy.

This project utilizes an applied research (often called action research) as its methodology. This methodology applies a systems approach and related systems thinking to ensure a holistic understanding of the nature of the problem statement. The literature review bodies clustered beneath the category of "Technology and Innovation Management" and addresses classifications of the major approaches to the issue of localizing the defense manufacturing industry. Moreover, the literature review in the field of innovation, technology transfers and Systems Science have been analyzed. While this project is still ongoing, the hypothesis of this conceptual framework will address the need to develop a flexible model that contributes to the current and future challenges as there is a lack of an adequate model to guide Saudi government on how to develop the SME defence manufacturing industries in order to become aligned with their country's vision 2030.

Workshop Abstracts

3281

ACTIVE AND HEALTHY AGING WORKSHOP

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The demographic changes, especially in the Developed World, make aging one of today's growing concerns that needs to be addressed systemically. The aim of this workshop is to discuss ways in which Active and Healthy Aging (AHA) can be achieved to ensure a sustainable and caring society. Support for AHA should compensate for more or less insufficient capabilities of older peoples. This is a highly interdisciplinary challenge which involves practically all domains of life: physiology, medicine, psychology, social sciences, society, technology, logistics, infrastructure, architecture, economics, etc.

In this team workshop we want participant to present, short presentations on any of the following topics: investigate the (positive and negative) impact of the various domains on the life of aging persons; analyze approaches to resolving negative impacts and strengthen positive impacts in the various domains; identify synergetic and conflicting developments across the domains, suggest strategies to at least mitigate and perhaps synergestically resolve current and future conflicts between potential strategies; identify strategies to strengthen the resilience (or even antifragility) of seniors; identify future research activities inside and outside of ISSS.

This workshop is a follow up of from IFSR Conversations being held in Linz in April chaired by Gerhard Chroust and Shankar Sankaran. A summary of the conclusions from the conversations will be presented at this workshop.

3292

MULTI-STAKEHOLDER DECISION-MAKING IN COMPLEX SCENARIOS – USING SYSTEMS THINKING

Professor Kambiz Maani

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Global challenges and local problems and can no longer be viewed and 'solved' with disciplinary sciences and the 17th century reductionist mind-sets. Leaders and decision makers need to understand complexity and how to deal with it in the multi-stakeholder multi-agency scenarios that predominate today. In today's exceedingly connected and dynamic world, most decisions are complex and require engaging with multiple stakeholders representing diverse sectors and competing interests, often under uncertain and adversarial conditions. Worse, systemic delays and feedback cycles embedded in complex systems muddle decisions and their anticipated outcomes, causing adverse and unintended consequences. According to the Australian Public Service Commissioner, "Tackling wicked problems requires thinking that is capable of grasping the big picture, including the interrelationships among the full range of causal factors underlying them. They often require broader, more collaborative, and innovative approaches." Yet, despite sophisticated technology and seasoned manager, business and government decisions – everywhere - are fraught with failures and adverse consequences. The impacts of these decisions undermine the economy, the environment, the society, and the communities - locally and globally.

In this workshop Professor Maani will discuss the hidden, yet commonplace, pitfalls of group and organizational decision-making and will introduce a simple and proven process for building consensus decisions in complex scenarios. Drawing from three decades of working with business and government leaders around the globe, Kambiz will share several international case stories, including sustainability projects in Asia-Pacific, to demonstrate this process. The workshop will be interactive with opportunities for the participants to share their own stories and challenges.

3300

KNOWLEDGE MAPPING FOR LITERATURE REVIEWS: A SCIENCE OF CONCEPTUAL SYSTEMS APPROACH

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Research for the purpose of understanding and explaining complex systems often includes a literature review. Regrettably, many students (and even some researchers) find literature reviews challenging for a number of reasons including the difficulty of synthesizing theoretical perspectives, maintaining the review's relevance to the topic, and providing clear justification of the research project.

This workshop is designed for professors, mentors, and managers who supervise literature reviews as well as the students and scholars who write them. In this workshop, participants will learn:

- How traditional approaches to literature reviews may lead to the confusion of students and the fragmentation of theory
- Knowledge mapping (KM) techniques supporting easier and more effective teaching, mentoring, managing, and conducting, of literature reviews
- A "science of conceptual systems" (SOCS) approach for demonstrating understanding, countering fragmentation, enabling more effective synthesis of theoretical perspectives, clarifying relevance to research project, and justifying research
- Ways for KM to dovetail with other approaches to managing and conducting literature reviews
- How this approach supports improvements in actionable understanding and accelerates advancement in any field of study.

Avoiding deep philosophical discussion in favour of focusing on the operational "nuts and bolts," this dynamic workshop includes individual and group exercises, short presentations, and conversations. Participants are encouraged to bring one or two theories which they find interesting or challenging. Due to the limited time available, those theories should be relatively concise – represented in a paragraph or two of text (a set of related propositions), or as a diagram (including concepts and connections). If you do not have a theory, one will be provided for you.

This workshop begins with the understanding that approaches to conducting literature reviews are often systematic (following a specific path), while the theoretical perspectives resulting from those reviews have been unavoidably fragmented because we have lacked an understanding of what it means to have a systemic theoretical perspective of our real world systems. Without highly systemic theories, we are unable to deeply understand our natural systems or to optimize our designed systems.

SOCS research shows that theories that are more systemic are more useful for creating and exchanging knowledge, understanding situations, making decisions, and reaching goals. Importantly, we can measure "how systemic" our theories are, thus providing a relatively objective path for improving the usefulness/effectiveness of our theories.

By representing knowledge graphically as a KM, we can more easily evaluate the systemic structure of that knowledge. That perspective enables students, professors, and dissertation supervisors/mentors to easily identify strengths and weaknesses of theoretical perspectives. We can use those insights, in turn, to focus conversations for improving literature reviews and research, thus supporting more rapid advancements in the field.

This approach has proved interesting to students and researchers, leading to a number of published papers. Additionally, this approach is especially useful for interdisciplinary projects as it supports the synthesis of theories within and between disciplines.

Finally, it is worth considering the place of this systems based approach in the broader context of systems thinking, cybernetics, and related fields. As each field advances, and our understanding of systems becomes more systemic, we can expect this kind of literature review will lead to improvements in the organization of our field's knowledge. That, in turn, may support improved accessibility of the systems literature, thus accelerating the advancement of our fields.

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SCIENTIFIC & PHILOSOPHICAL FOUNDATIONS FOR SYSTEMS ENGINEERING AND A POSSIBLE BASIS FOR THE UNIFICATION OF SYSTEMS SCIENCE

Kent D. Palmer

See https://sites.google.com/site/syssciwg2014is14/home/schemas-theory-workshop-2014

Agenda: http://www.mediafire.com/file/duv7d92e59ea92b/WorkshopISSSCorvalis2018-SchemasTheoryTutorial-20180705kdp04a.pdf

Overview:

This tutorial on Schemas Theory describes and proposes a unified framework for understanding the relationship between Systems Science and Systems Engineering that will lead to a higher level of Abstraction based on insights derived from Mathematical Category Theory. For more information on Schemas Theory, go here.

What will be learned

What are Schemas?

How are they expressed in Schemas Theory?

What is the relationship of Schemas Theory to Systems Theory?

What are the Philosophical Principles that govern Design Thought?

How do the Schemas set the constraints on Design possibilities?

What are the Foundational Mathematical Categories that are the basis for understanding Order in Designs?

What are the Order View Hierarchies that constrain the Product Essence and the Product Development Lifecycle?

How does Advanced Systems Engineering use these concepts to help understand the System Design in relation to the Product Essence?

TOPICS

Introduction

Philosophical Principles and Schemas Theory

Foundational Mathematical Categories

Emergent Meta-Schemas

Emergent Schemas Design

Integral Systems Engineering Methodology

This workshop has been given previously at INCOSE.org 2014 and ISSS.org 2014 conferences.

Synopsis:

One of the foundations of Systems Engineering is Systems Science. In the workshop we will consider how ideas from Mathematics and Philosophy of Science might be introduced into Systems Science and Systems Engineering. The goal is to find a way to introduce these abstract ideas into Systems Engineering in a way that is useful for practitioners as guidance in building systems, and to consider ways in which the Systems Engineering Body of Knowledge (SEBoK) might be improved based on these ideas from Systems Science, Philosophy of Science and higher Mathematics.

One of the foundations of Systems Engineering is Systems Science. And a way to unify Systems Science is to go up one level of abstraction to Schemas Theory as proposed by Umberto Eco in Kant and the Platypus which he discusses Mathematical and Geometrical Schemas in his recounting of the history of Schemas within the Western tradition. Schemas Theory is a concrete way of talking about the intelligibility of different scopes of Spacetime differentiation within experience. But it coincides with the level of Natural Transformations within Mathematical Category Theory while Systems corresponds to the level of Functors, and individual systems in disciplines appear as mappings. In the Workshop we will consider how these ideas from Mathematics and Philosophy of Science might be introduced into Systems Engineering. The goal is to find a way to introduce these abstract ideas into Systems Engineering in a way that is useful for practitioners as guidance in building systems and to consider ways in which the Systems Engineering Body of Knowledge might be improved based on these ideas from outside of Systems Engineering in Systems Science, Philosophy of Science including concepts from Ontology and Epistemology and recently developed higher Mathematics.

Description of Workshop

This workshop will use Schemas Theory to present some basic ideas about Systems Science. Schemas Theory is the next higher level of abstraction from Systems Theory. But Schemas deals with other Schemas than Systems like Pattern, Form, EcoSystem, Domain and World among others. Schemas theory is a context for understanding Systems Science by contrasting with other ways of looking at the organization of things. Moving to the next level of abstraction up from Systems Theory is a Paradigm shift for Systems Science and Systems Engineering. In this workshop we will explore the CS Peirce and B. Fuller idea of Philosophical Principles that are the basis of our understanding of phenomena in

experience. These will allow us to understand how the Schemas exemplify and are grounded in these principles which are expressed by the Schemas inwardly and outwardly at different levels. Then the nature of the Schemas as representations will be elucidated by their connection to the Foundational Mathematical Categories (FMCs) which are the possible foundations for Mathematics in general. Each Schema draws from the FMCs as needed to represent its contents at any given moment and we can use these categories to analyze the contents of a schema. Finally the Schemas are related to the Product Essence which appears as a set of hierarchies based on mathematical order that drives the structure of the Product Development Lifecycle and the relation between Schemas and Design of Technological Artifacts will be explained. Schemas give a framework for the unification and understanding of the results of Sixty Years of Systems Science and we will also touch on how the schemas help us to understand the results of Systems Science research. Part of the course will touch on the relation of Schemas Theory to Mathematical Category Theory and how schemas exemplify categorical relationships such as seen in Groupoid Theory which has recently been related to Type Theory the Homotopy Type Theory. Groupoid Theory is one of the few mathematical operations that produce synthesis, and systems are syntheses, and thus it will be explained how we can base much of our synthetic development work on this new theory of Types rooted in Groupoid Theory. The Workshop will be a combination of lecture with discussion to make the concept of schemas come alive for the participant so that these advanced ideas can be studied more effectively by the participant.

3317

SYSTEMS BASICS: LEARNING FROM THE PRINCIPLES EMBEDDED IN NATURE TO OPTIMIZE THE PRINCIPLES AFFECTING INSOMNIA AND CONSCIOUSNESS - THE SYSTEMS THINKING IN THE EASTERN TAICHI YIN-YANG FIVE ELEMENTS SYSTEM IN TRADITIONAL CHINESE MEDICINE

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Insomnia has become a modern city sickness. Learning from the principles embedded in Nature, attempts have been made and natural methodologies performed to treat insomnia problems. In the process our understanding of human consciousness will be also enriched. Research reveals that no simple methods can completely solve the problems, but applying a combination of a set of principles can achieve the requisite balance. Hence optimizing the balancing points of these principles to produce a feasible solution seem to be the logical direction. The cause of insomnia may come from one or more of the Five Elements system, including the Wood mental system, the Fire emotional system, the Metal behavioural system, the Water spiritual system, and the Earth physical system (with one or more of its five sub-systems). These Five systems could be the principles that need to be balanced out for the time, location and individual.

From this analysis we will try to find the common structure and relationship that can be generalized using systems thinking which could be applied to treat different sickness and promote healthcare. Research has shown that this systems thinking is rooted in the fundamental concept in traditional Chinese culture since around 500BC. The concept is also embedded in the teaching of Confucianism, Buddhism, Taoism, and Traditional Chinese Medicine. The traditional Chinese system theories under investigation include the Taichi yin-yang system theory, the Five systems theory of the human mind, and the Traditional Chinese Medicine differential diagnosis-cure process. These theories are found to be related to different modern system theories including Viable System Model.

Taichi yin-yang system theory describes the relationship between any two entities (element/process) at any level of interest. It concerns the quantitative and qualitative changes between the entities. This is related to causal loop diagram (CLD) in system dynamics which uses reinforcing loop and balancing loop. The observer is not specified in the theories, but the perspectives of the observer actually determine the entities, the unit of quantitative changes, and the ratio of qualitative changes. The Five systems theory of the human mind is one of the important concepts developed in the teaching of Buddha. The Five systems are: observation, perspective, sensation, action and physical object. These five systems can be used to describe the properties of the observer and the decision maker.

The Traditional Chinese Medicine differential diagnosis-cure process is a practical systemic process that has been used daily for more than 2000 years. It is believed that the whole macroscopic-microscopic spectrum of systems can be suitably accommodated. The system state identification involves three pairs of direction-forming spectrums. The Superficial and Internal spectrum gathers information between the boundary and the system. The Cold and Hot spectrum gathers information between the form and function, or matter and energy within the system. The Deficient and Excess spectrum gathers information between the environment and the system. Strategy can then be formulated to regulate and maintain the system. These three spectrums could be another set of principles that need to be balanced out depending on the time, location and individual.

Keywords: Traditional Chinese Medicine, Confucius Golden Mean, Taoism, Unification of Nature and Man, Health and system thinking Special Integration Groups SIG, Yin-Yang Five Elements i ± 1 System, Traditional Chinese medicine differential diagnosis-cure process, Physical Healthcare, Integral East-West Systems Thinking, optimization

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WORKSHOP: INNOVATION AND OPTIMIZATION: EFFECTIVE PAPER PRESENTATIONS

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In a world, with volatile, uncertain, chaotic and ambiguous scenarios, which is changing at a very fast rate, communications are vital. In this paradigm, what is not communicated does not exist. And that is what happens with the result of our research, to gain visibility it has to be communicated. Presentations are a great chance to do it. The problem is that sometimes presentations are not as effective as one may think. It is not all about the presenter — you —, indeed, it is about the audience — them— who need to get the message as clear as possible and be able to use the information you provide. Sometimes members of the audience cannot connect with the presenter and as a result of that they lose attention. The message is not delivered successfully. What went wrong? What can be done to grow audience engagement? It does not matter whether you are a seasoned presenter or a first timer, there are some tools that can help you make your presentations memorable.

The goal of this workshop is to provide attendees with practical tools to enhance their presentations to make them more effective. During the first part, several exercises will be carried out to explore the different types of presentations according to the timeframe and audience, presentation structure, timing, visual thinking using for presentations, body language and presenters personal style. During the second part, the idea is to build presentations as teams, working with the tools presented during the first part, evaluating them in the role of the stakeholders and making the necessary arrangements to enhance them. During the last part of the workshop, each team pitches their presentations and the learnings.

3332

TANTRA: THE MOST POWERFUL HUMAN TECHNOLOGY

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Tantra is the “Science of the Energy”. When we know ourselves and how the system of the human being works, we can use the energy in our favor to give us positive feedback and achieve anything we want.

We will see some basic concepts to enter the universe of self-knowledge and the "7 Principles of Kybalion" that govern it. Then, we will do some experiential exercises that give us an approximate idea of how to work Tantra -energy- with ourselves. We will install a positive energy feedback system in our body as well, to heal, empower, and if possible, create, individually, a desired project.

The objectives of this workshop are:

-To know “energy” in our body and how to detect it.

-Our thoughts are energy. Be careful on what you think. How to think in a positive way taking into account the “7 Principals of the Kybalion”.

-How to be conscious about our own energy. Our emotions and feelings are energy. How to deal with emotions and feelings.

-How to use energy in a positive way. Three positive uses of energy: storage, healing and investment it in a project. How to develop and redirect vital energy in an easy way. How to create a human positive feedback system for good health. Redirect energy to manage and use it in whatever you want.

-Cellular memory and how to clean it with energy.

“I surrender to the force -energy- of life that is flowing through my body and my mind”.

“Where the attention goes follows the energy”

Human beings are rediscovering ¨energy¨ within themselves, the most powerful tool human beings have to heal themselves and create the reality they want.

-Q’s & A’s and share experiences.

3335

LINKING A SYSTEMS SCIENCE FRAMEWORK TO SYSTEMIC PRACTICE AND SYSTEMS ENGINEERING

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A great deal of systems science knowledge has been generated over the past 70+ years, including models, principles, concepts, frameworks, catalogues of isomorphies, methods and tools. However, it has been challenging not only for practitioners but also systems scientists to view and understand the field as a coherent whole, especially given that today it has fragmented into multiple sub-disciplines such as cybernetics, system dynamics, complexity science and so on.

An INCOSE Panel was organized in IS 2017 to explore why Systems Engineering is struggling to find its own foundation in Systems Science. The panel explored the questions that must be addressed to establish a firmer scientific foundation for SE practices. It highlighted the significant roadblocks on the path to a better understanding of how systems work and how systems can deliver value to its stakeholders. The objective of the panel was to identify areas where Systems Science can contribute to better SE practices and define the way forward in achieving a better scientific foundation for the SE discipline.

Further, an IFSR 2018 Conversation was organized to address the question of "What is systems science". This Conversation examined the current bodies of knowledge in systems science, how knowledge is structured in science domains and the nature of formation of knowledge about systems. These thought experiments eventually resulted in a draft framework aimed at organizing and bringing coherence to the systems science body of knowledge. This framework proposes that the systems science body of knowledge addresses the nature of systems as well as how people engage with systems, and provides a guide to the formation of knowledge (in sciences and other knowledge domains). The framework includes a suggested categorization of systems science concepts, as well as criteria to test whether a concept belongs in a given category. An initial list of systems science concepts and isomorphies was classified using these criteria to test the framework.

The purpose of the workshop is to continue developing the framework and use it to capture systems science knowledge. Specific objectives include socializing the framework with the systems science community and obtaining buy-in, refining the framework and populating it with systems science concepts, and working through its linkages to systemic practice and to systems engineering.

3340

NURTURING LIVING SYSTEMS AWARENESS THROUGH MOVEMENT, MUSIC, CREATIVITY, AND PLAY

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As agents in a turbulent world, how can we infuse our actions with more vitality and nurture our capacity as co-creative change agents? We invite you to a playful workshop of experiencing the ISSS community as a vibrant living system and to carry that felt sense into the conference and our lives.

This workshop is inspired by an experiential approach called Biodanza, which is grounded in living systems theory and was particularly inspired by system scholars Maturana, Varela, and Capra. Biodanza, which means Dance of Life, integrates music, movement, play, and authentic interactions to evoke a felt sense of being fully alive in the here-and-now. This modality originated over 40 years ago in Chile and Brazil under the wings of psychologist and anthropologist Rolando Toro and has spread since then to five continents. Biodanza sessions are designed to help participants develop capacities for adaptability and fluidity in their lives and to become more attuned to life's pattern language and self-organizing possibilities.

An organizational development approach Biocentric Systems in Organizations, based on the Biodanza system, is being utilized internationally to help organizations become more fully aligned with their inherent potential as living-learning systems and vibrant communities of practice. In addition, Biodanza has influenced education in many countries, most notably Italy and Brazil, where "biocentric education" is practiced in several K-12 schools.

In this workshop, we will first review the organizing principles of nature as a pattern language for learning and connection. Participants will then be guided through nature-inspired poetry and playful movement exercises with music. No dance experience needed!

Keywords: living systems awareness, autopoiesis, pattern language, embodied ways of knowing, movement, music, multiple ways of knowing, ecological consciousness.

3359

HANDBOOK OF SYSTEMS SCIENCE

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This workshop will allow for a discussion about the Handbook of Systems Science, currently in progress, to be published by Springer, Tokyo in 2019. Interested authors and contributors are welcome to participate, as are those who would like to use the handbook after publication.

3380

CO-EXPLORING THE ROLE OF PATTERNS IN ADAPTING THE ORIGINAL SPIRIT OF GENERAL SYSTEMS THEORY TO THE NEEDS OF OUR TIME, TOWARDS SYSTEMS LITERACY

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In this workshop, we will Invite participants to express what they have on their minds when they think of crossing the boundaries between disciplines and of the spirit of General Systems Theory in the 21st century in a context of technologically rich global environment (cyber) , and increasingly important realization of the importance of understanding the relation of humans, human nature, and the nature of the planet and cosmos (bio), with a simultaneous fragmentation of knowledge, and polarized positions on the nature of knowledge and reality.

We will also invite participants who have been working on General Systems / unity of science and more generally on patterns and language in the context of systems to talk about their work.

Part of the workshop goal is to help shape the work leading to the 2019 ISSS conference that will focus on exploring descriptions and content of systems literacy and building bridges trans, cross, and inter-disciplines.

3418

BATESONIAN AND ROSENNEAN BRAINWAVES

Judith Rosen and Nora Bateson

An evening immersed in the scientific work of Robert Rosen and Gregory Bateson, via Judith Rosen and Nora Bateson. Judith Rosen will run a primer on Anticipatory Systems, Robert Rosen's model of living organisms, which helps us understand certain peculiarities about ourselves (and our interactions as human beings), about ecosystems, and about science in general-- via the modeling relation. Then, after a short intermission, Nora Bateson will run a Warm Data Lab, which is a hands-on process of discovery, regarding just how important the enlarged perspective of systems thinking is in science-- and pretty much everything else as well.

The Warm Data Lab designed to illustrate the critical importance of relations in the causal stream and to help us find ways to "see" them so that they may be studied, scientifically. As described on the International Bateson Institute website: ""Warm Data" is information about the interrelationships that integrate elements of a complex system. It has found the qualitative dynamics and offers another dimension of understanding to what is learned through quantitative data, (cold data). Warm Data will provide leverage in our analysis of other streams of information." Of her Warm Data Lab, Nora has said "I maintain that developing an understanding of the patterns and processes of interdependency in complexity is the single most practical capacity that we can support in ourselves and each other." It will be an interesting, intriguing, and fun exploration of ideas and the power of the human mind to create what we need to solve complex problems without generating terrible side effects in the process.

All together, expect to spend about 2 hours (with a break in the middle). We look forward to seeing you!

3438

RELATIONS OF SPT TO SYSTEMS & PATTERNS LITERACY: ODUM MODELS OF OCEAN, FRESHWATERS, AND FOREST

Dr. Len Troncale, Emeritus Professor, and Past Chair, Biology Dept.; Past Director, Institute for Advanced Systems Studies; Lecturer, IME Dept., College of Engineering, California State Polytechnic University, lrtroncale@cpp.edu

One of the most fundamental challenges facing highly abstract general theories is their practical application. As usual, those working in the trenches demand that theoretical constructs prove that they can be usefully applied. Theoretical types often have a high level of faith and belief in their constructs and organizations like ISSS feel they are capable of saving the world; but their confidence is challenged by the lack of exemplars showing that mere basic systems awareness can deliver solutions.

The field trips planned for the end of ISSS'18, and as previews for planning of ISSS'19, directly take on this key challenge. Our Thursday and Friday field trips will be to real places of current crisis, that is, nearby, forests, oceans, and freshwater

streams and lakes in Oregon. Our focus will be on addressing those complex systems with two general systems theories, a concept of patterns, and both pattern and systems literacy of the general population as potential sources for solutions. The talk and paper will also suggest how to judge whether or not a lifework reaches the level of a GST or systems science.

This particular talk and paper will give a brief introduction to the Systems Processes Theory. SPT is an assemblage of from 55 to 110 ISP's (isomorphic systems processes) and their presumed and proven interactions as a detailed specification of how long-surviving and sustainable systems work. SPT is a candidate general systems theory and a prototype systems science. It will begin with an evaluation of how the SPT relates specifically to "patterns" in general, and then assess how it relates to both "pattern literacy" and "systems literacy." A draft "Field Manual" will be distributed that gives a precis of several of the most important isomorphies and how they might be applied to pathologies in the architecture and dynamics of forests, oceans, and freshwater.

The talk and paper will also re-introduce the ISSS to the general systems work of Howard T. Odum, Craford Prize Winner and the 30th President of the ISSS. His lifework is also a candidate general systems theory and prototype systems science. Several mini-models or simulations of forests, oceans, and freshwater ecologies that Odum, his students and ecological colleagues have produced and tested will be shown. Odum's work is being continued by his followers in the ISAER (Int'l Society for the Advancement of Emergy Research). A list of collaborative projects between ISSS, INCOSE, the Naval Postgraduate School, and ISAER, to produce more mini-simulations and models, will be briefly described and later used to understand difficulties faced in the above cited ecologies visited on the field trips.

3466

DEFINITIONS AND CHARACTERISTICS OF VARIOUS SAFETY AND SECURITY SYSTEM DOMAINS

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Safety and security operate as distinct professional realms. With respect to underlying concerns about risk, though, the distinctions are neither clear nor absolute. Across applicable system domains, overlaps can create considerable confusion. In an age of increasing threats, many of which are terroristic, improving security and safety has become a global priority. Practical initiatives and research projects, however, have run into obstacles. In many languages the words "safety" and "security" are translated as the same word, further obscuring distinction and adding to the challenge of improvement.

Domains are vast and can include safety and security issues within systems such as food, water, and energy. Specific programs such as nuclear security and nuclear safety have distinct organizations responsible for the development of regulations and protective measures. Less tangible concepts such as social safety and security and increasingly complex issues surrounding cybersecurity and cyber safety call for increased attention to appropriate definitions and classifications of safety and security problems. Complexity within and across these safety and security systemic domains challenges these definitions. This paper is a presentation of the concepts of safety and security using systems dynamics tools exploring common characteristics of each concept.

This paper will also serve as a presentation of the various safety and security domains, key characteristics, and stakeholders. The hope is that cross-disciplinary dialogue and coordinated clarification of language around these topics will be helpful for practitioners and researchers.

3478

SYSTEMS ENGINEERING OF THE FUTURE

William (Bill) Miller

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This workshop will reflect on the impact on systems engineering from future technology advances as we continue to see accelerated adoption of these new technologies. Many of the recent technology advances are driving systems into a more dynamic, non-deterministic, stochastic and evolutionary environment. This workshop will consider at the challenges, impacts and changes needed for systems engineering to be relevant, effective and impactful in the future.

3481

THE SYSTEM OF ACCOUNTS FOR GLOBAL ENTROPY PRODUCTION, (SAGE-P): A THERMODYNAMIC MEASURE OF SUSTAINABILITY

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SAGE-P posits three independent value-algorithms of production, consumption and capital in the topological domain spaces of the Econosphere, (i.e., values are conserved-in-exchange or prices), the Sociosphere, (i.e., values are

conserved-in-use or participation) and the Ecosphere, (i.e., values are conserved-in-itself or intrinsic), (Friend, 2016). We take the position that human values per se are abstract objects, like prices, but can be logically discerned from the analytical discourse on ethics, loosely referred to as 'cultural values.' Values can also be extracted empirically from economic, social and environmental statistics, either directly as commodity prices or inferred from choices, either individually (e.g., revealed preferences) or cooperatively and/or institutionally, (e.g., implementation of policies). Joan Robinson, applying the analytical method, believed that the concept of value, while necessary, could not be objectified in the economic project, to wit:

One of the great metaphysical ideas in economics is expressed by the word 'value.' What is value and where does it come from? It does not mean usefulness -the good that goods to us...It does not mean market prices...it is something which will explain how prices come to be what they are. Like all metaphysical concepts, when you try to pin it down it turns out to be just a word, (Robinson, 1962:29).

The object of the paper is to: (a) pin down 'pluralism of values' assumed under a set-theoretic Venn Diagram of three overlapping circles representing distinct categories of economic, social and ecological objects/functions, (b) apply the G-R Flow-Fund Model of the entropic process to construct, with sufficient formalism, the value-algorithm necessary for the three-way correspondence mapping of values on some well-defined, hierarchical-structured, database in the form: Ecosphere [Sociosphere (Econosphere)], and (c) measure sustainability in terms of the entropy-efficiency criterium, (i.e., the minimum rate of entropy production per unit of consumption, and its inverse, the optimum rate of entropy-efficiency per unit of production). While exchange and use value poses little, if any, unsurmountable problem for constructing the entropy efficiency value-algorithms for human-produced goods and services, the corresponding intrinsic-value algorithm for nature-produced goods and services remains elusive. For instance, the value-algorithm proposed for TEEB* assumes an imagined equivalent value of the human-produced and nature-produced goods and services, either conserved-in-exchange (i.e., instant in space-time), or conserved-in-use (i.e., over a period in space-time). Georgescu-Roegen noted the absurdity of the equivalence notion, to wit:

Economists do speak occasionally of natural resources. Yet the fact remains that, search as one may, in none of the numerous economic models in existence is there a variable standing for nature's perennial contribution. The contact some of these models have with the natural environment is confined to Ricardian land, which is expressly defined as a factor immune to any qualitative change. We could very well refer to it simply as 'space'.(Georgescu-Roegen, 1971:2). Karl Polanyi echoed the same sentiment when he wrote: What we call land is an element of nature inextricably interwoven with man's institutions. To isolate it and form a market out of it was perhaps the weirdest of all undertaking of our ancestors. (Polanyi, 1957:178).

We shall propose, and indeed demonstrate, that 'intrinsic-value' of material objects and/or functions can be expressed in two types of interactive value-algorithms. The first, and indeed extremely challenging, is written in the language of metaphysics, where intrinsic value are derivatives of ethical principles of obligation and of accountability, (Schopenhauer, 2010). The second, and the one we shall expand in this paper, is written in the language of thermodynamics, (i.e., entropic process), where intrinsic values are redefined as values conserved-in-existence, or existential. The UN Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) felt compelled to value 'nature's contribution to people' and applied, perhaps erroneously, the value-algorithm of TEEB. This Paper presents an alternative, perhaps more robust, value-algorithm of entropy accounting formalised in the net-valued Low Entropy Fund (LEF) available for human consumption (Georgescu-Roegen, 1971: Chapter IX: The Analytical Representation of Process and the Economics of Production).

* The Economics of Ecosystems and Biodiversity Project

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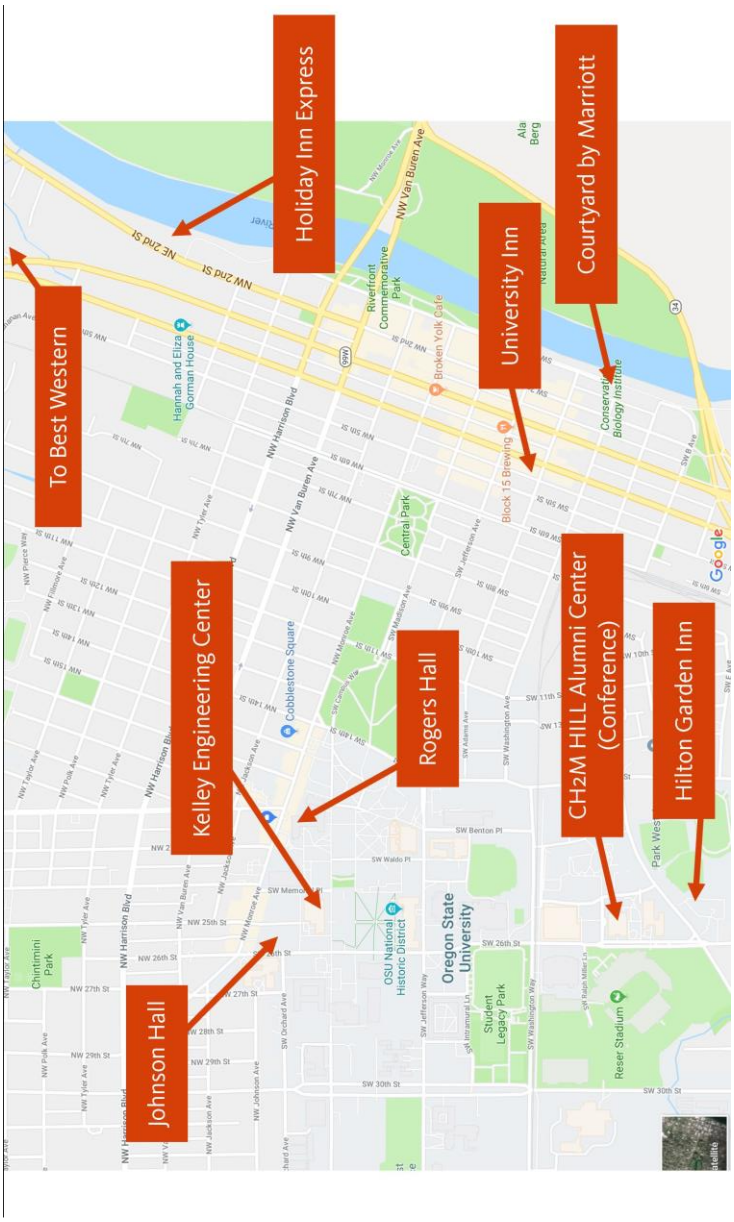
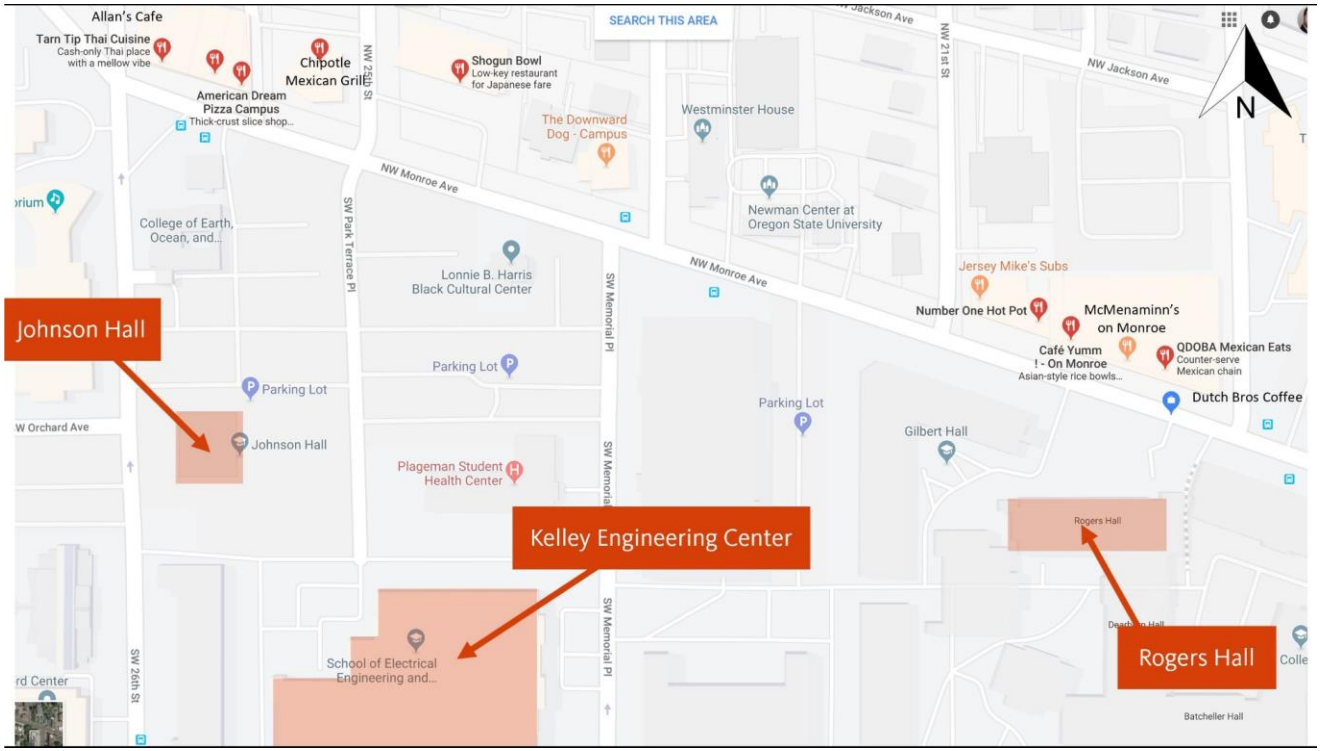
Conference Location Maps




Johnson Hall
Kelley Engineering Center
Rogers Hall
SEARCH THIS AREA
N
Allan's Cafe
Tarn Tip Thai Cuisine
Cash-only Thai place with a mellow vibe
Chipotle Mexican Grill
American Dream Pizza Campus
Thick-crust slice shop...
Shogun Bowl
Low-key restaurant for Japanese fare
The Downward Dog - Campus
Westminster House
Newman Center at Oregon State University
College of Earth, Ocean, and...
Lonnie B. Harris Black Cultural Center
Jersey Mike's Subs
Number One Hot Pot
McMenaminn's on Monroe
Café Yumm ! - On Monroe
Asian-style rice bowls...
QDOBA Mexican Eats
Counter-serve Mexican chain
Dutch Bros Coffee
Parking Lot
Johnson Hall
Plageman Student Health Center
Gilbert Hall
Rogers Hall
School of Electrical Engineering and...
Batcheller Hall
NW Monroe Ave
NW Jackson Ave
NW 21st St
SW Park Terrace Pl
SW Memorial Pl
SW 26th St
W Orchard Ave