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MENTI CODES FOR PLENARY SESSIONS

Friday	
Plenary/Speaker	MENTI Code
Mike Jackson	537542
Peter Tuddenham	652634
Saturday	
Sarah Schoedinger	19068
Gail Scowcroft	182491
Catherine Cramer and Steve Uzzo (joint together)	986386
Sunday	
Len Troncale	276340
Michael Mehaffy	488620
Peter Corning	732338
Monday	
Bob Cavana	153291
Frank Niepold	548025
Martin Storksdieck	278361
William Smith (in Plenaries slot as a way to summarize plenaries)	733703
Tuesday	
Pille Bunnell	361455
Workshops/PhD	999088
Shankar Sankaran	514793
AGM & Conclusion	317125

Welcome to ISSS 2019

Dear Colleagues,

Welcome to Oregon State University for the 2019 Annual Meeting and Conference. We have a varied yet focused program entitled **Nature's Enduring Patterns: A Path to Systems Literacy**

Nature offers us all kinds of clues to the patterns that exist throughout the cosmos to the smallest identifiable entity in the world. Science searches for answers to the mysteries that confront us as living beings. For over 60 years, the work of ISSS in the 'general systems' field has been to encourage the development of theoretical systems which are applicable to more than one of the traditional departments of knowledge.

Recognizing our embeddedness in nature provides ways to investigate the common patterns or 'isomorphies' of concepts, laws, and models in various fields, and to help in useful transfers from one field to another.

Understanding and appreciating these patterns is key to the development of systems-literate people able to make robust decisions and act in complex situations, considering relationships and effects of systems of all kinds and at all levels.

ISSS has the opportunity to reflect on its past, recognize the rapidly changing complex environments, cultures and contexts, and make worthwhile and significant contributions to understanding and managing the complex problems and issues we face today.

We will be learning from systems thinkers, system scientists, and ocean literacy, earth science literacy, data and network literacy and climate literacy among many others as we explore creating a systems literacy initiative.

We look forward to sharing scientific results and engaging in conversations across disciplines regarding nature's enduring patterns. We will explore how to educate for, and what it means to create, a systems-literate society.

Peter D. Tuddenham
ISSS President
Corvallis, OR USA
June, 2019

A Brief Introduction to our Memorial Lectures

The Bertalanffy Lecture

Ludwig von Bertalanffy is regarded as one of the founders of General Systems Theory. The ISSS recognizes his initiative and contributions by inviting someone who has made significant contributions to General Systems Theory to give a plenary talk in his honor at its annual meeting.

Bertalanffy lived from 19 September 1901 – 12 June 1972. He was an Austrian biologist. He introduced the idea of General Systems Theory in 1950, *An Outline of General System Theory*, published in the British Journal for the Philosophy of Science. He stressed the importance of considering “wholeness” and he went on to observe: “we find also formally identical or isomorphic laws in completely different fields.” And further on in the same paper “what is the origin of these isomorphisms?”

These observations and questions are among the basis for the founding the General Systems Research Society, now known as the International Society for the Systems Sciences.

The 2019 Bertalanffy lecture will be given by Dr. Len Troncale.

The Ranulph Glanville Memorial Lecture

Ranulph Glanville was a Professor of Andragogy at the University of Amsterdam, and taught Architecture in Portsmouth and London, England. He was professor of research in Innovation Design Engineering at the Royal College of Art, London, professor of research design in the Faculty of Architecture Catholic University of Leuven, Belgium, and adjunct professor of design research at Royal Melbourne Institute of Technology University, Melbourne

He received his PhD in Cybernetics from the Brunel University under Gordon Pask. He viewed cybernetics as the dynamic complement to systems.

Glanville lived from 13 June 1946 – 20 December 2014. As President of the American Society for Cybernetics (ASC) he worked to build connections between the ISSS and ASC. He made contributions to the systems and cybernetic community and to our understandings of our worlds in conversation through art, music, performance and design.

The 2019 Ranulph Glanville lecture will be given by Pille Bunnell.

**Conference Program and Schedule
ISSS 2019**

Thursday: June 27, 2019 – Pre-Conference Activities

REGISTRATION DESK OPEN 14:00 – 18:00 (Foyer – LaSells Conference Center, 875 SW 26th Street, Corvallis, OR 97331)
Conference Phone: 408 221 6521

<p>14:00 – 18:00</p>	<p>Workshop 3308 Peter Tuddenham, Gary Smith</p>	<p>Room: Ag Production Room LaSells Conference Center 875 SW 26th Street, Corvallis, OR 97331 There is a growing appreciation within the ISSS that we need the capability to rapidly adapt to the changing environments. We must do this if ISSS is to survive and thrive. Over the past few years several actions have occurred that are contributing to a richer picture of actions that can be helpful for our society. We need your input and participation. In the spirit of idealized design described by Russ Ackoff we have the opportunity to design the future ISSS that we all desire, and that would all appreciate if we had it tomorrow. This afternoon workshop will share the recent survey results, the experiences of ISSS SIGs meeting online every Saturday, research on systems and systems sciences as presented in journals and other systems organizations around the world, recent work by INCOSE and Conversations at IFSR and other sources. The workshop will begin to formalize what we need to create and map out a plan for developing a renewed ISSS shared vision, mission, objectives, goals and actions and behaviors for the 21st century.</p>
<p>18:00 – 21:00</p>	<p>Evening Opening Reception GUISTINA GALLERY, LaSells Conference Center 875 SW 26th Street, Corvallis, OR 97331 Tickets available at registration desk (\$15).</p>	

Friday: June 28, 2019

ALL MORNING SESSIONS LOCATED IN CH2M HILL ALUMNI CENTER, CASCADE BALLROOM

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: ELLE ROOM).

08:00 to 08:45 Open Café, Open for Conversations before the plenaries each morning. (CH2M Hill, Cascade Ballroom)

WHOLE SYSTEMS, NATIVE SYSTEMS, SYSTEMS LITERACY, NEXT GENERATION SCIENCE STANDARDS, SYSTEMS SCIENCES THEORIES AND APPLICATIONS

09:00 Welcome and Announcements – **Javier Calvo-Amodio**, ISSS VP Conferences, Oregon State University

09:15 – 09:30 Introduction to Conference – **Jennifer Wilby**, ISSS VP Administration

09:30 – 10:15 **Michael C. Jackson**, University of Hull, UK, President ISSS 2001: *Systems Thinking in an Age of Complexity*

10:15 – 10:30 Coffee Break

10:30 – 11:15 **Peter D Tuddenham**, College of Exploration, ISSS President: *Natures Enduring Patterns as a Path to Systems Literacy*

11:15 – 12:30 Questions and Plenary Participative Workshop, Facilitated by **Peter D Tuddenham**

12:30 – 13:30 Lunch in Side Foyer

13:30 to 15:30 Parallel Sessions – CH2M Hill Center

1	2	3	4	5
<p>Willamette 115A</p> <p>WORKSHOP 3498 Embracing Emergence: Essential Roles For Birthing New Systems <i>Marty Jacobs</i></p>	<p>Willamette 115B</p> <p>SIG: Systems Pathology Chair: Len Troncale</p> <p>3547 A Computational Model For Recovery From Traumatic Brain Injury <i>Wakeland, Wayne; Kenzie, Erin</i></p> <p>3550 Systems Pathology: Review of Conflicts Within Historically Unquestioned Concepts <i>Rose, James N.</i></p> <p>3570 Clinical Systemics: Towards An Integrated Framework and Methodology For Alleviating Pathologies In Complex Systems <i>Roolf, Peter L</i></p>	<p>Trysting Tree</p> <p>SIG: Socio-Ecological Systems and Design Chair: Angelika Schanda</p> <p>3583 Goal 14: The Cinderella of The Millennium Goals <i>Barrera, Ricardo</i></p> <p>3584 Communicating For Sustainability <i>Leonard, Allenna</i></p>	<p>Burlingham</p> <p>SIG: Organisational Transformation and Social Change Chair:</p> <p>3545 Human Agency In Social System Behavior: Implications For Understanding, Designing and Managing Organizations <i>Gabriele, Susan Farr</i></p> <p>3569 Designing Enduring Human Activity Systems <i>Jacobsen, Malaia; Calvo-Amodio, Javier; Riney, Heather</i></p> <p>3611 A Systems-Oriented Approach to Planning and Evaluating A Public Health Lab Capacity Building Intervention using a Social Network Perspective to Highlight Patterns of Interaction in Organizational Relationships <i>Reed, Eva; Lapoff, Maura</i></p> <p>3537 Skype Presentation A Systems Analysis of The Conflict Culminating In The Wairau Affray of 1843 <i>MacGill, Victor Ronald David</i></p>	<p>Elle IFSR Workshop</p> <p>IFSR: A Peak Body to Raise our Collective Profile and Status in the International Science, Education and Practice communities Session led by Ray Ison, President of IFSR As outlined at the General Assembly meeting in Linz in 2018 when elected president, it is my firm belief that only by building on what we have in common can we build a more robust voice for Systems Science and Systems Practice (with cybernetics) within international fora and the like. Building solidarity is not a negation of difference; difference builds insight, opens new lines of inquiry and fosters enthusiasm, but solidarity institutionalized through a platform open to celebrating difference and what the many lineages of Cyber-Systems have to offer, is surely something IFSR and its members seek? This session will explore interactively the functions that a Peak Body could/should take, ways to articulate a shared purpose and opportunities for investment and organization for the flourishing of cyber-systemic understandings and practices.</p>

15:45 – 17:45 Parallel Sessions – Parallel Sessions – CH2M Hill Center

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<p>Willamette 115A</p> <p>SIG: Systems Engineering and Systems Modeling Chair: Javier Calvo-Amodio</p> <p>3615 The Purposeful Human Activity System Defined Through Principles <i>Calvo-Amodio, Javier; Rousseau, David</i></p> <p>3574 (3573) Assessing The Behavior of Human Activity Systems Through The Observation and Interpretation of Sociotechnical Signs <i>Kittelman, Sage McKenzie</i></p> <p>3616 Engineering Enduring Systemic Change in Organizations: Using Principles as Activity Drivers <i>Calvo-Amodio, Javier</i></p> <p>3636 Proposed Team Concept Network: A Systemic Approach <i>Wang, Siqi; Calvo-Amodio, Javier</i></p>	<p>Willamette 115B</p> <p>SIG: Systems Pathology Chair: Len Troncale</p> <p>3608 Recurring Dysfunctions in Complex Systems <i>LR Troncale</i></p> <p>3607 Diagnosing Failures in Complex Engineered Systems <i>Griepy, J. and L. Dale Thomas (delivered by Dr. Pamela Buckle)</i></p> <p>3609 From SPT-Isomorphic Systems Processes to Specific Diseases in a Class of Systems-Level Pathologies: Update on ISSP Foundation <i>LR Troncale</i></p> <p>Additional Discussion of Ongoing Work in Systems Pathology</p>	<p>Trysting Tree</p> <p>SIG: Viable Systems Model (VSM) Chair: Allenna Leonard</p> <p>3553 (3593) A Viable System Model For Management of The Economic Growth <i>García-Barríos, Francisco Jaime; Badillo-Piña, Isaías; Tejeida-Padilla, Ricardo</i></p> <p>3592 Innovativeness of The Judiciary Power. A Case Study Using The Viable System Model (VSM) <i>Castiglioni, Sara Noemi</i></p> <p>3618 Brazil's Path To A Healthier Global Future: Community Clinic Health Systems <i>de Castro Lobo, Maria Stella; Li, Jon</i></p>	<p>Burlingham</p> <p>WORKSHOP 3588 Mapping Systemic Change <i>Silverman, Howard</i></p>	<p>Elle</p> <p>SIG: Hierarchy Theory Chair: Peter Tuddenham</p> <p>3513 Ontogenesis and Major Transitions In Evolution: What Comes Next? <i>Mobus, George</i></p> <p>3567 Appreciating The Whole Person and Their Approach To Managing Complexity and Communicating (Speaking, Listening, Conversing) In Life and Work: A Conversation To Explore Possible Implications and Relationships of and Between William Smith, Aô's Appreciation, Influence, Control Model (AIC); Stafford Beer's Viable System Model (VSM); and Elliott Jacques Stratified Systems Theory (SST). <i>Tuddenham, Peter David</i></p>

Evening Workshop, Willamette 115A 19:00 – 21:00

3544
Integrated Science General Education (ISGE): "Stealth" Systems Science Course For GE
Troncale, Len Raphael

Saturday: June 29, 2019

ALL MORNING SESSIONS LOCATED IN CH2M HILL ALUMNI CENTER, CASCADE BALLROOM

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: ELLE ROOM).

08:00 to 08:45 Open Café, Open for Conversations before the plenaries each morning. (CH2M Hill, Cascade Ballroom)

WAYS OF DEVELOPING LITERACIES -- INSPIRATION: SUCCESSES OF LITERACY PROJECTS

09:00 – 09:15 Welcome and Announcements – **Javier Calvo-Amodio**

09:15 – 10:00 **Sarah Schoedinger**, Senior Education Program Manager, NOAA Office of Education, Past President of the National Marine Educators Association: *Ocean Literacy: How the Concept of what Everyone should know about the Ocean Changed the World*

10:00 – 10:15 Coffee Break

10:15 – 11:00 **Gail Scowcroft**, Associate Director, Inner Space Center, Graduate School of Oceanography, University of Rhode Island; Executive Director, COSEE: *Global Ocean Science Education For The Human/Ocean System*

11:00 – 11:45 **Steve Uzzo**, Chief Scientist, New York Hall of Science - Data Literacy and Catherine Cramer; Co-Lead, Data Science for All; Northeast Big Data Innovation Hub; *Data Literacy: Networks And Data: Adventures In Literacy And Learning*

11:45 – 12:30 Questions and Plenary Participative Workshop, Facilitated by **Peter D Tuddenham**

12:30 – 13:30 Lunch in Side Foyer

13:30 to 15:30 Parallel Sessions – CH2M Hill Center

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<p>Willamette 115A</p> <p>WORKSHOP 3499 Workshop: Innovation and Optimization: Effective Paper Presentations <i>Castiglioni, Sara Noemi; Rosencrans, Kendra</i></p>	<p>Willamette 115B</p> <p>SIG: Digital Product-Service Systems Chair: Anand Kumar</p> <p>3506 Architecture Literacy <i>Kumar, Anand; Sikharam, Durga Bhavani; Goruganthula, Edwin Anand; Lokku, Doji Samson</i></p> <p>3526 (3635) Facilitating Organization and Control of Multi-Media Presentations By Generalizing A New Digital Medium (EDDSWEMM) <i>Buckner, Richard Lee</i></p> <p>3515 An Exploration of The Viability and Living Characteristics of Architectures <i>Kumar, Anand; Lokku, Doji Samson; Nori, Kesav Vithal; Natarajan, Swaminathan</i></p>	<p>Trysting Tree</p> <p>SIG: Critical Systems Thinking Chair: Janet McIntyre</p> <p>3521 Social Engagement To Redress The Banality of Evil and The Limitations of The Social Contract To Protect Habitat <i>McIntyre, Janet Judy</i></p> <p>3500 Project Governance: A Systems Approach Towards Simpler, Better and Faster <i>Venter, Carin</i></p> <p>3502 Negotiations In Systemic Interventions: A Critical Systems Perspective <i>Pinzon-Salcedo, Luis Arturo</i></p>	<p>Burlingham</p> <p>WORKSHOP 3551 Our GSTs Founders' Goal: A Single Grand Encompassing Theory Embracing All Systems. The First Proposal On The Table: James N Rose <i>'Integrity Paradigm'</i> <i>Rose, James</i></p>	<p>Elle</p> <p>WORKSHOP 3541 (3541) Solidarian Paradigm For Systemic Economic Model <i>Crespo, Fabiana</i></p>

15:45 – 17:45 Parallel Sessions – Parallel Sessions – CH2M Hill Center

1	2	3	4	5
<p>Willamette 115A</p> <p>WORKSHOP</p> <p>3536 Knowledge Mapping For Literature Reviews: A Science of Conceptual Systems Approach <i>Wallis, Steven E.</i></p>	<p>Willamette 115B</p> <p>SIG: Research Toward a General Theory of Systems Chair: David Rousseau</p> <p>3572 A Discipline Devoted To Nature's Patterns? Exploring The "Field" Question <i>Silverman, Howard</i></p> <p>3579 Towards Pattern Literacy: The Bio-Semiotic Underpinnings of 'Patterning' and 'Languaging' <i>Finidori, Helene</i></p> <p>3580 Advances In The Prospects For Realizing A Scientific General Systems Theory <i>Rousseau, David</i></p>	<p>Trysting Tree</p> <p>SIG: Critical Systems Thinking Chair: Janet McIntyre</p> <p>3546 The Potential of Eco-Facturing To Re-Generate Rural-Urban Balance Through Eco-Villages and City Hubs: Promoting Social and Environmental Justice Through Vocational Education and Training Hubs <i>McIntyre, Janet Judy</i></p> <p>3599 Systems Processes For Individual Consciousness and Social Revolution <i>Rasmussen, Lynn M</i></p>	<p>Burlingham</p> <p>SIG: Relational Science Chair: John Kineman</p> <p>3597 On Constructing Structure From Finite Discrete Time Series <i>Cretu, Andrei</i></p> <p>3542 (3542) Science of A Living Universe <i>Kineman, John J.</i></p>	<p>Elle</p>

Dinner available at nearby local restaurants

18:00 Council Meeting (Board, SIG chairs, Trustees)

Sunday: June 30, 2019

ALL MORNING SESSIONS LOCATED IN CH2M HILL ALUMNI CENTER, CASCADE BALLROOM

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: ELLE ROOM).

08:00 to 08:45 Open Café, Open for Conversations before the plenaries each morning. (CH2M Hill, Cascade Ballroom)

NATURES ENDURING PATTERNS: NATURE, PATTERNS, LANGUAGES, INSPIRATION AND IDEAS

09:00 – 09:15 Welcome and Announcements – **Javier Calvo-Amodio**

09:15 – 10:00 **Len R. Troncale**, Bertalanffy Lecture, President ISSS 1990, Professor Emeritus, Past Chair, Dept. Biology, Founding Director Emeritus, Inst. for Advanced Systems Studies, Lecturer, Systems Engineering Grad Program, California State Polytechnic University: *2019 Bertalanffy Lecture: A Candidate GST: Systems Processes Theory (SPT)*

10:00 – 10:15 Coffee Break

10:15 – 11:00 **Michael Mehaffy**, Senior Research Affiliate, KTH University, Stockholm, Executive Director, Sustasis Foundation: *From Systems to Patterns: Toward Curated Web-networks of Shareable Knowledge in the Age of Clickbait and Fake News*

11:00 – 11:45 **Peter Corning**, President ISSS 1999, Institute for the Study of Complex Systems. *Building A Global Superorganism: A New Paradigm for the Era of Climate Change*

11:45 – 12:30 Questions and Plenary Participative Workshop, Facilitated by **Peter Tuddenham**

12:30 – 13:30 Lunch in Side Foyer

13:30 to 15:30 Parallel Sessions – CH2M Hill Center

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<p>Willamette 115A</p> <p>WORKSHOP</p> <p>3596 Open Learning Commons and The Digital Life Collective <i>Best, Robert; Ing, David</i></p>	<p>Willamette 115B</p> <p>SIG: Systems Philosophy Chair: David Rousseau</p> <p>3586 Towards A Philosophy of Language and Machine Learning <i>Swartz, Jeremy David</i></p> <p>3581 Systemic Virtues In Natural and Engineered Designs <i>Rousseau, David; Calvo-Amodio, Javier; Billingham, Julie</i></p> <p>3552 (3568) Nonlinear Systemic Thinking: Synergic Epistemology <i>Shim(Sim), Yeon-soo(Youn-soo)</i></p> <p>3554 How Economic Systems Grow/Evolve <i>Bristol, Terry</i></p>	<p>Trysting Tree</p> <p>ASC WORKSHOP</p> <p>Part 1 This will be an interactive session set up as a short systemic inquiry into the lineages and traditions that inform cybernetics, systems and complexity. Similarities, differences, foundation stories and myths will all be explored. The inquiry will be informed by three short presentations based around interpretive frameworks or experiences. Thereafter the experiences and interpretive frameworks of those present will be explored and discussed. Those presenting and facilitating the ASC session will be Jocelyn Chapman, guest editor of a recent special issue of World Futures entitled 'For the love of cybernetics'; Stuart Umpleby, current president of the International Academy for Systems and Cybernetic Sciences (www.iascys.org); and Ray Ison, from the Open University in the UK and President of IFSR (http://www.open.ac.uk/people/rli2#tab1).</p> <p>Please come and join in.</p>	<p>Burlingham</p> <p>WORKSHOP</p> <p>3522 Nurturing Natural Pattern Awareness through Movement, Music, Creativity and Play. <i>Widhalm, Barbara</i></p>	<p>Elle</p> <p>WORKSHOP</p> <p>3523 Systemic Governance In The Complexity of Authentic Democracy <i>Jones. Peter McIntyre, Janet</i></p>

15:45 – 17:45 Parallel Sessions – Parallel Sessions – CH2M Hill Center

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<p>Willamette 115A</p> <p>WORKSHOP 3529 Federated Wiki and Pattern Language <i>Ing, David; Cunningham, Ward; Best, Robert</i></p> <p>BRING YOUR LAPTOP</p>	<p>Burlingham</p> <p>SIG: Designing Educational Systems Chair: Barbara Widhalm</p> <p>3591 Defining and Measuring The Systems Thinking Learning Process For Non-Experts <i>Taylor, Seth; Calvo-Amodio, Javier; Well, Jay</i></p> <p>3582 Teaching Pattern Literacy Through Creative and Expressive Ways of Knowing <i>Widhalm, Barbara</i></p> <p>3555 A Study On The Correlation of Cross Cutting System Through The Analysis of Subject Competency In Korea Science Inquiry Experimental Textbooks. <i>Shim, Min-hu</i></p> <p>3563 (3563) New Insights of Horizontal Gene Transfer of Microbial Rhodopsins In Ocean <i>Shim, JinGon</i></p>	<p>Trysting Tree</p> <p>ASC WORKSHOP Part 2 This will be an interactive session set up as a short systemic inquiry into the lineages and traditions that inform cybernetics, systems and complexity. Similarities, differences, foundation stories and myths will all be explored. The inquiry will be informed by three short presentations based around interpretive frameworks or experiences. Thereafter the experiences and interpretive frameworks of those present will be explored and discussed. Those presenting and facilitating the ASC session will be Jocelyn Chapman, guest editor of a recent special issue of World Futures entitled 'For the love of cybernetics'; Stuart Umpleby, current president of the International Academy for Systems and Cybernetic Sciences (www.iascys.org); and Ray Ison, from the Open University in the UK and President of IFSR (http://www.open.ac.uk/people/rli2#tab1).</p> <p>Please come and join in.</p>	<p>Burlingham</p> <p>SIG: Systems Applications to Business and Industry (SABI) Chair: Andreas Hieronymi</p> <p>3575 Rapid Problem Structuring With The Bigpicturecanvas – A Simple and Efficient Way To Improve Shared Views of Complex Challenges <i>Hieronymi, Andreas</i></p> <p>3548 Supply Chain Risk Management and An Emerging Emphasis On Third Party Externalities <i>Udbye, Andreas</i></p> <p>3516 Purposeful Failure In Organizational Life <i>Pembrey Macnamara, Delia; Buckle, Pamela</i></p>	<p>Elle</p> <p>Post Workshop Discussion</p> <p>3523 Systemic Governance In The Complexity of Authentic Democracy <i>Jones. Peter McIntyre, Janet</i></p>

Evening Workshop, Willamette 115A 19:00 – 21:00

**WORKSHOP
3543**

Unbroken Sequence of Systems Origins (USSO): A Systems-Based Theory of Emergence
Troncale, Len Raphael

Monday: July 1, 2019

ALL MORNING SESSIONS LOCATED IN CH2M HILL ALUMNI CENTER, CASCADE BALLROOM

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: ELLE ROOM).

08:00 to 08:45 Open Café, Open for Conversations before the plenaries each morning. (CH2M Hill, Cascade Ballroom)

EDUCATION AND OUTREACH: OPPORTUNITIES FOR ENGAGEMENT AND PARTICIPATION

Recognizing Canada Day

09:00 – 09:15 Welcome and Announcements – **Javier Calvo-Amodio**

09:15 – 10:00 **Bob Cavana** - School of Management, Victoria University of Wellington, New Zealand: *Establishing a ‘Systems Identity’ for Management and the Social Sciences Equivalent to ‘Systems Engineering’ in the Engineering World*

10:00 – 10:15 Coffee Break

10:15 – 11:00 **Martin Storksdieck**, Director, Center for Lifelong STEM Learning, Oregon State University: *Integrating Systems Science Perspective across Various STEM Literacies*

11:00 – 11:45 **Frank Niepold**, US Climate Literacy Program Manager - NOAA: *Developing a Systems Thinking Approach when it Comes to Developing Possible Solutions to Climate Change*

11:45 – 12:30 Questions and Plenary Participative Workshop, Facilitated by **Peter Tuddenham** and **William Smith**, ODII.

12:30 – 13:30 Lunch in Side Foyer

13:30 to 15:30 Parallel Sessions – CH2M Hill Center

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<p>Willamette 115A</p> <p>WORKSHOP 3530 Exploratory Group Workshop: Systems Changes Research Program <i>Ing, David; Eng, Dan; Khan, Zaid</i></p>	<p>Willamette 115B</p> <p>WORKSHOP 3566 Systems Literacy Workshop <i>Tuddenham, Peter David</i></p>	<p>Trysting Tree</p> <p>SIG: Systems Ethics Chair: John Vodonick</p> <p>3576 A Recursive Ethics For Systemic Complexity <i>Sweeting, Ben</i></p> <p>3503 Governance of Organizational Project Management <i>Sankaran, Shankar; Müller, Ralf; Nathalie, Drouin</i></p> <p>3520 Holoicon, The General Semiotic Archetype Hidden Behind The ∞2 Co-Influences Model <i>Lin, Kingkong</i></p>	<p>Burlingham</p> <p>SIG: Health and Systems Thinking Chair: Thomas Wong</p> <p>3557 Systems Sciences Is Lifting Off In China: Report of The 3rd Chinese Systems Sciences Conference 2019 On Health, Human Body and Others <i>Wong, Thomas S L</i></p> <p>3531 (3531) Perfect Health System Technology of The Human Being <i>Crespo, Fabiana</i></p> <p>3558 Our Journey From Traditional Chinese Medicine To General Systems Theories – The Development of Integral Ancient-Modern East-West Systems Thinking <i>Wong, Thomas S L; Burtleson, Deeanna L.</i></p>	<p>Elle</p> <p>SIG: Action Research Chair: Roelien Goede</p> <p>3590 Using Information To Empower Refugees: Popular Maslow vs Proper Maslow <i>Goede, Roelien</i></p> <p>3525 (3562) System Risk Visualization and Mitigation Methodology and Its Application To ICT System Failures <i>Nakamura, Takafumi</i></p> <p>SKYPE PRESENTATION 3527 Project Systemic: A Systems-Thinking Approach To STEM Ecosystem Development In Chicago <i>Smith-Walker, Natasha; Sydelko, Pamela; Jafri, Jameela; Lehman, Elizabeth</i></p>

15:45 – 17:45 Parallel Sessions – Parallel Sessions – CH2M Hill Center

1	2	3	4	5
<p>Willamette 115A</p> <p>WORKSHOP</p> <p>3505 Co-Creating Conditions To Thrive In Education: A Systems Informed Positive Psychology Workshop <i>Colla, Rachel; Downie, Andrea</i></p>	<p>Willamette 115B</p> <p>WORKSHOP</p> <p>3566 Systems Literacy Workshop <i>Tuddenham, Peter David</i></p>	<p>Trysting Tree</p> <p>SIG: Systems Engineering and Systems Modelling Chair: Javier Calvo-Amodio</p> <p>SKYPE PRESENTATION</p> <p>3565 (3565) Including Generative Mechanisms In Project Scheduling Using Hybrid Simulation <i>Scales, Jeff</i></p> <p>3606 Imagining ‘Do No Harm’ Malpractice Avoidance in Future Systems Engineering <i>Singer, Janet; Ring, Jack; Singer, Michael</i></p> <p>3507 Trends In Small Satellite System In Mexico <i>León-Vega, Cirilo Gabino; Iturri-Hinojosa, Alejandro; León-Puertos, Cuauhtémoc</i></p>	<p>Burlingham</p> <p>SIG: Health and Systems Thinking Chair Thomas Wong</p> <p>WORKSHOP</p> <p>3587 Exploring Traditional Chinese Medicine and Western Medicine Through the Lens of Systems Sciences: General Systems Theory, Relational Theory, DSRP theory, Schemas Theory, Viable System Model <i>Burleson, Deeanna; Wong, Thomas S L</i></p>	<p>Elle</p>

<p>18:30 – 21:00</p>	<p>ISSS Conference Dinner Best Western OMAHA ROOM, GOSS STADIUM Tickets available at the Registration Desk until Monday evening (\$35).</p>
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Tuesday: July 2, 2019

ALL MORNING SESSIONS LOCATED IN CH2M HILL ALUMNI CENTER, CASCADE BALLROOM

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: ELLE ROOM).

08:00 to 08:45 Open Café, Open for Conversations before the plenaries each morning. (CH2M Hill, Cascade Ballroom)

CYBERNETICS, DIRECTIONS, REFLECTIONS

09:00 – 09:15 Welcome and Announcements – **Javier Calvo-Amodio**

09:15 – 09:30 **Stuart Umpleby** - Professor Emeritus in the Department of Management at the George Washington University in Washington, DC. International Academy for Systems and Cybernetic Sciences:

09:30 – 10:15 **Pille Bunnell**: *Recursive Reflections on Friendship and Conversation*

10:15 – 10:30 Report from Graduate Training Program

10:30 – 10:45 Coffee Break

10:45 – 11:00 **Peter D Tuddenham**, College of Exploration, ISSS President, *ISSS Wrap Up Summary*

11:00 – 11:30 ISSS Annual General Meeting: Peter Tuddenham, Chair

11:30 – 12:00 **Shankar Sankaran**, *Incoming President Presentation 2020: Sustainability Sublime – A Networked Approach*

12:00 – 12:30 Questions

12:30 – 13:30 Lunch in Side Foyer

Plenary Speakers

FRIDAY



Michael C. Jackson OBE

Michael C. Jackson is Emeritus Professor at the University of Hull, editor-in-chief of *Systems Research and Behavioral Science*, and MD of Systems Research Ltd. He graduated from Oxford University, gained an MA from Lancaster University and a PhD from Hull, and has worked in the civil service, in academia and as a consultant. Between 1999 and 2011, Mike was Dean of Hull University Business School, leading it to triple-crown accreditation. Mike has been President of the International Federation for Systems Research and the International Society for the Systems Sciences.

He is a Companion of the Association of Business Schools, a Chartered IT Professional, and a Fellow of the British Computer Society, the Cybernetics Society, the Chartered Management Institute, the Operational Research Society and the International Academy for Systems and Cybernetic Sciences. Mike has received many awards, two honorary degrees, and has been a visiting professor at numerous international universities. In 2011 he was awarded an OBE for services to higher education and business. In 2017 he received the Beale Medal of the UK Operational Research Society for 'a sustained contribution over many years to the theory, practice, and philosophy of Operational Research'. Mike is known as a key figure in the development of 'critical systems thinking' - a topic on which he has published ten books and over 100 articles. His latest book 'Critical Systems Thinking and the Management of Complexity' was published by Wiley in March 2019.

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.

SATURDAY

Sarah Schoedinger



Senior Program Manager
National Oceanic & Atmospheric Administration (NOAA)
Contact info: sarah.schoedinger@noaa.gov, 240-676-3538

Sarah Schoedinger is Senior Program Manager for NOAA's Office of Education where she co-manages the agency's [Environmental Literacy Program](#) and serves as a liaison to organizations whose educational missions and programs complement those of NOAA. The Environmental Literacy Program has invested over \$36M since 2009 in projects that build climate literacy and community resilience to the impacts of climate change through formal K-12 and informal education. Since 2004 Sarah has been one of the leaders of a campaign to increase ocean literacy, beginning with a workshop to define ocean literacy and identify the essential principles and fundamental concepts for grades K-12 to the promotion of these concepts at the national and international levels for use within both formal K-12 and informal education. Sarah is a past president of the National Marine Educators Association (NMEA) and served on its board from 2002-2007. Prior to coming to NOAA, Sarah was the Education Director of the Consortium for Oceanographic Research and Education (now the Consortium for Ocean Leadership). Ms. Schoedinger is a 1992 graduate of St. John's College in Annapolis and holds a Master of Science degree in marine studies from the University of Delaware.

Gail Scowcroft



Gail Scowcroft, an ocean scientist and education professional, is the Associate Director of the Inner Space Center at the University of Rhode Island Graduate School of Oceanography, a national facility for ocean science research and education. She is the Executive Director of the *Consortium for Ocean Science Exploration and Engagement (COSEE)*, an independent global network of ocean science research and education institutions. Gail is also Director of the National Science Foundation's Alliance Office for the *Climate Change Education Partnership*, a network of U.S. climate change education programs. For the first 18 years of her career, Gail conducted ocean science research focused on climate reconstruction and global climate change. For the last 20 years, she has also directed ocean and climate science education programs. Gail is an international leader in ocean and climate science education, lecturing across the globe on related issues. Under President Obama, she served a four-year term on the U.S. Ocean Research Advisory Panel, the federal advisory committee established to provide independent advice and guidance about ocean related issues. Recently, she has worked with the United Nation's Intergovernmental Oceanographic Commission to develop international collaborations related to ocean literacy and workforce development for the blue economy.

Stephen Uzzo



As Chief Scientist for the New York Hall of Science, Stephen Uzzo develops and leads large-scale initiatives to research and integrate cutting edge science into teaching and learning. He currently leads initiatives to build communities of practice in complexity, data-driven science, and engineering, and improve science, technology, engineering and math (STEM) literacy of the public. His background includes over twenty years experience in the research of teaching and

learning in STEM, and prior to that, ten years in video and computer graphics systems engineering. Dr. Uzzo's research interests include complex networks, smart cities, and the impact of big data on communities of need. He holds a terminal degree in network theory and environmental studies and serves on a number of institutional and advisory boards related to his interests. His work includes developing, studying and teaching graduate programs in STEM learning. Having never lived very far from the ocean in New York, Massachusetts and California, Dr. Uzzo has also been a lifelong advocate for marine conservation.

Catherine Belle Cramer



Catherine Cramer works at the intersection of data-driven science and learning, specifically as it pertains to the understanding of complexity and its application to data and network sciences, with a focus on underrepresented communities. For over 20 years she has developed tools and programs for the teaching and learning of complex network and data science, centering on identifying, creating, sustaining and growing productive and innovative collaborations and partnerships between research, industry and academia. She worked with the centers for Ocean Science Education Excellence (COSEE) and the Ocean Literacy initiative from 2004-2014 and was one of the founders of the Network Literacy and Network Science in Education movements. She remains active in both, most recently organizing the 8th annual Network Science in Education symposium at the University of Vermont as part of the 2019 International School and Conference on Network Science and is on the Board of the Network Science Society. She is co-editor and co-author of the Springer volume *Network Science in Education*, published in October 2018. She is currently co-leading the data literacy efforts at the Northeast Big Data Innovation Hub, located at the Columbia University Data Science Institute, as well as a Social Network Analysis of the Hub itself.

SUNDAY

Len Raphael Troncale



Dr. Len Troncale is Professor Emeritus of Cell and Molecular Biology, and past Chairman of the Biology Department at California State Polytechnic University. He is also Director of the Institute for Advanced Systems Studies, and Coordinator of its NSF-supported Systems Integrated Science General Education Program. He has served as VP and Managing Director of the International Society for General Systems Research (SGSR), and President of the International Society for the Systems Sciences (ISSS). Dr. Troncale has published 87 articles, abstracts, editorials and reports, served as Editor on 11 projects, delivered 115 invited and computerized presentations and demonstrations in 23 countries and served as P.I. on 52 grants and contracts for \$5.3M from a variety of federal, state, and private organizations such as the NSF, DOE, ONR, HUD, the HHMI and the Keck Foundation, as well as the CSU System.

Michael Mehaffy



Michael offers strategic consulting for walkable mixed-use projects, with an international practice based in Portland, Oregon. He consults on projects for private developers, NGOs and governments in North America, South America, Europe and Asia. Michael is also a noted researcher, author, speaker and educator in urban planning and architectural design. He has held teaching and/or research appointments at six graduate institutions in five countries, and he is currently on the editorial boards of two international journals of urban design. He is also on the boards of four NGOs in sustainable development and livability, including the Portland-based Sustasis Foundation, where he is Executive Director. He is also a regular author for noted research and professional publications

including *Urban Land*, *Metropolis*, *The Atlantic's CityLab*, and *Planetizen*, and he is a frequent interviewee by media outlets as diverse as *The Wall Street Journal*, *Voice of America*, *Newsweek*, and *The Guardian*. He holds a Ph.D. in architecture from Delft University of Technology (NL), and he did graduate work in business, public affairs, philosophy of design, planning and architecture, at The University of California at Berkeley and The University of Texas at Austin.

Reflecting his real-world expertise, Michael has also personally managed and/or co-designed projects up to \$100 million, performed on-site construction management, owned a development and construction business, served as development executive for a major pension fund partnership, secured financing, structured deals, assembled and managed large teams, prepared and secured entitlements, conducted or assisted marketing, sales and leasing, designed and/or personally built over 20 houses up to \$2 million, supervised up to 25 employees, and designed and built gardens, furniture, signage, and individual building details.

Peter A. Corning



Dr. Peter Corning is currently director of the Institute for the Study of Complex Systems in Seattle, Washington. He was a one-time science writer at *Newsweek* and a professor for many years in the Human Biology Program at Stanford University, along with holding a research appointment in Stanford's Behavior Genetics Laboratory. In addition to some 200 professional papers and media articles, he has published seven previous books, including *Holistic Darwinism: Synergy, Cybernetics and the Bioeconomics of Evolution* (University of Chicago Press, 2005), *The Fair Society: The Science of Human Nature and the Pursuit of Social Justice* (University of Chicago Press, 2011), and *Synergistic Selection: How*

Cooperation Has Shaped Evolution and the Rise of Humankind (World Scientific 2018). He is also a former President of the International Society for the Systems Sciences. A press kit with more details can be found at <https://www.prforpeople.com/peter-corning>. His website link is www.complexsystems.org

MONDAY

Robert Cavana



Robert Y. Cavana, MCom (Econ), PhD (System Dynamics), is a Reader in Systems Science with the Victoria Business School, Victoria University of Wellington, New Zealand. Previously he was the Corporate Economist with NZ Railways Corporation. Bob is a past President of the NZ Operational Research Society, a past Vice-President of the International System Dynamics Society and a former Managing Editor of *System Dynamics Review*. He was a NZ representative and Company Secretary on the Executive Board of Australia & New Zealand Academy of Management and is

currently a Fellow of ANZAM. He received the Hellenic Society for Systemic Studies Honorary Award as “Distinguished Scientist in the Scientific area of Systems Approach” in 2009. He has published in a wide range of international journals, and is a co-author of *Systems Thinking, System Dynamics: Managing Change and Complexity* 2nd ed (Pearson Education, Auckland, 2007) and *Applied Business Research: Qualitative and Quantitative Methods* (Wiley, Brisbane, 2001; Chinese edition 2004). He recently co-edited the MDPI ‘Systems’ online special issue and book on ‘Systems Education for a Sustainable Planet’.

Martin Storksdieck



Martin Storksdieck is the director of Oregon State University’s Center for Research on Lifelong STEM Learning, and a professor in OSU’s College of Education. Martin works in the intersection of research, practice and policy, focused on STEM learning and science communication across settings and time, and on the role of science-based professionals and science hobbyists in engaging a broader public. Martin serves on the Science Advisory Boards for the National Oceanic and Atmospheric Administration (NOAA) and the Leibniz Institute for Science and Mathematics Education at the University of Kiel (Germany). He is the Chair of Trustees for TERC, a nonprofit R&D organization in Cambridge, MA and is a board member of the Tree Media Foundation.

Frank Niepold



Frank Niepold is the Climate Education Coordinator at NOAA’s Climate Program Office in Silver Spring Maryland, Climate.gov Education section lead, a co-chair of the U.S. Global Change Research Program’s Education Interagency Working Group, the U.S. Climate Action Report Education, Training, and Outreach chapter lead for the U.N. Framework Convention on Climate Change (UNFCCC), Education and Youth delegate for the United States at the 2015 Conference of Parties (COP21), and a member of the Federal Steering Committee for the Fourth National Climate Assessment (NCA4). At NOAA, he develops and implements NOAA’s Climate goal education and outreach efforts that specifically relate to NOAA’s Climate goal and literacy

objective. Frank is the “Teaching Climate” lead for NOAA’s Climate.gov web portal that offers learning activities and curriculum materials, multi-media resources, and professional development opportunities for formal and informal educators who want to incorporate climate science into their work. Additionally, he is the managing lead of the U.S. Global Change Research Program (GCRP) document, Climate Literacy: The Essential Principles of Climate Science. NOAA, NSF, NASA, AAAS Project 2061, CIRES, American Meteorological Society, and various members from both the science and education community worked to define climate literacy in the United States.

TUESDAY

Pille Bunnell



I have a background in ecology and ethology. After finishing grad studies nearly a half century ago, I worked for decades as a systems ecologist who specialized in the integration and explanation of complex concerns for domain specialists, policy makers, students, and the public. As a consultant I conducted projects in the framework of Adaptive Environmental Management. Since retiring from the consultancy I shifted my focus to cybernetics, investigating the relation between complex systems, human understanding, and human activities. I currently teach these ideas in various graduate level programs. In the last few years I have also been working for the SelfDesign Learning Foundation in various capacities.

Shankar Sankaran – ISSS President 2020

Dr. **Shankar Sankaran** is the Professor of Organizational Project Management at the School of the Built Environment, Faculty of Design Architecture and Building, University of Technology Sydney (UTS), in Australia. At UTS he is a Member of the Centre for Informatics Research and Innovation (CiRI), Centre for Business and Social Innovation (CBSI) and UTS Megaproject Research Team. He teaches advanced level subjects in the UTS Master of project Management Course including aspects of organizational project management (governance, portfolio and program management) and systems thinking and supervises doctoral students. Shankar’s research mainly focuses on organizational project management, megaprojects, project leadership, systems thinking and action research. The results of his research have appeared in more than 130 publications. He is a co-editor of the the first book on systems research titled Guide to Systems Research published by Springer and is the section editor of the Management and Organisation Section of the forthcoming Springer Handbook of Systems Science. Shankar is a vice chair of the board of the Global Accreditations Centre of the Project Management Institute since 2018. He is the current President Elect of the International Society for the Systems Sciences and founded its Action Research SIG.



Plenary Abstracts

FRIDAY

3603

Session: PLENARY

SYSTEMS THINKING IN AN AGE OF COMPLEXITY

Jackson, Michael

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The world has become increasingly networked and unpredictable. Decision-makers at all levels are required to manage the consequences of complexity every day. Simple solutions to complex issues are usually inadequate and risk exacerbating the very problems they are designed to solve. Leaders of international bodies such as the UN, OECD, UNESCO and WHO – and of major business, public sector, charitable, and professional organizations – have all declared systems thinking an essential leadership skill for managing the complexity of the economic, social and environmental issues they face.

This presentation explains the need for a systems approach and charts the development of systems thinking as it has sought to come to terms with different aspects of complexity. It shows how different systems approaches have to be used in informed combinations to manage the interconnected problems that decision-makers currently face – an approach known as ‘critical systems thinking’.

Keywords: complexity, WHO, decision making

3633

Session: PLENARY

NATURES ENDURING PATTERNS AND SYSTEMS LITERACY

Tuddenham, Peter

peter@coexploration.net

Background and Year in Review Overview

This conference marks the end of my time as president of ISSS. It has been a busy and interesting year. Time to review and look forward.

Unfortunately, I was unable to be at the 2018 annual meeting at the beginning of my year as president as I had a minor stroke. However as fall began I recovered well and launched into my time as president with energy and enthusiasm. I began to implement a plan to explore Systems Literacy with ISSS members, to explore contributions of the ISSS Special Integration Groups (SIGs) by holding weekly video conferences online, applying digital technologies and to exploring the purpose and practices of the Society.

Connections with ISSS Partners

Turning to the organization of ISSS I will review the year and the actions I have taken on behalf of the organization. We renewed and reinforced our relationship with the American Association for the Advancement of Science (AAAS) and attended the Annual meeting in Washington DC in February 2019. I will report on our connections with International Council for Systems Engineering (INCOSE) and the several presentations ISSS members made at INCOSE in California in January 2019.

ISSS Members Management, Communications, Organization Development and Members Website

Implementation of a membership management system and website called myiss.org will be described. The SIG Sessions on Saturday have produced many new initiatives. By creating a program of meetings every Saturday online on a video conferencing system Bluejeans we have begun to develop resources and understanding about each of the SIGs. The presentation will review the many surveys of members that have been completed including on the vision for system science, a request for suggestions for five-year action ideas for this society, opinions about annual conference location and developing models of relation between the SIGs and the relevance to ISSS society mission and purpose.

As a result of my stroke I began to explore natural patterns and pathologies concerned with the role of the brain in human experience. I will explore these biological models and their relevance for organizations, and touch on developments and personal experience in brain training.

Member education and learning through Saturday SIG Sessions

I was curious to learn more about the nature and happenings of the Special Integration Groups and I developed a plan to showcase each SIG. Each Saturday morning and sometimes later in the evening to reach members in India, Australia and New Zealand. Over 74 members at one time or another joined the video conversation with a core group of about 20 participating every week. Each SIG Chair was offered the opportunity to summarize the activities of the SIG. A different SIG was featured each week. Recordings of the sessions are viewable by members at myisss.org

This Year's Conference Theme

Turning to the theme of the conference natures enduring patterns as a path to system literacy I will outline the work to date on systems literacy and identify the opportunities to develop systems literacy in the future.

Finally the presentation will give an outline of the conference in Corvallis in 2019 and introduce our plenary speakers and their relationship to systems approaches, natures enduring patterns, the ocean and to science education, and to the intent of this 2019 meeting to further develop approaches to systems literacy. I will also outline the hopes for the one hour workshop plenary session each day at the end of the morning and introduce the work of William Smith PhD who will assist me with these collaborative sessions to explore the relation between ISSS and Systems Literacy.

Next steps towards Systems Literacy

Reflecting on my journey though life with an awareness of cybernetics and systems ideas I will encourage the continued co-development and research in both areas of inquiry and coordination between ISSS and the American Society for Cybernetics, INCOSE, IFSR, AAAS and Systems Dynamics Society.

SATURDAY

3601

Session: PLENARY

OCEAN LITERACY: HOW THE CONCEPT OF WHAT EVERYONE SHOULD KNOW ABOUT THE OCEAN CHANGED THE WORLD

Schoedinger, Sarah E.

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Ocean literacy is an understanding the ocean's influence on you and your influence on the ocean. Building public understanding and acknowledgement of the importance of the ocean to our daily lives was a motivating factor for a geographically distributed group of US-based scientists, formal and informal educators, and policy influencers coming together in the early 2000s to address the absence of ocean science content in US science education standards and our elementary and secondary classrooms. This convening and several others that came after it became the cornerstone of the Ocean Literacy Campaign, resulting in a definition of ocean literacy and the articulation of seven essential principles and 45 fundamental concepts that an "ocean literate" person would know. The definition, essential principles and fundamental concepts became the foundational pieces of the Ocean Literacy Framework, which now also comprises a scope and sequence for grades K-12 and an alignment to Next Generation Science Standards.

Despite the initial focus on K-12 education in the United States, this framework has been influential in ways never imagined by the initial leaders and participants of the campaign. In this presentation, Sarah Schoedinger will discuss a brief history of the Ocean Literacy Campaign, focusing both on how the framework was developed as well as the intended and unintended consequences that resulted as it became a model for the development of numerous other literacy frameworks (some of which will be discussed later in this conference) and has influenced both formal and informal education within the United States and abroad.

Keywords: ocean literacy; model

3598

Session: PLENARY

GLOBAL OCEAN SCIENCE EDUCATION FOR THE HUMAN/OCEAN SYSTEM

Scowcroft, Gail

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Most global citizens are not aware of how the state of the ocean and its resources affect their daily lives. They are also not aware of the extent of the services that the ocean provides, which are related to environmental, human health, economic, social, and geo-political factors. The importance of ocean science research in support of these services is critical to society, yet the arena of ocean science and related marine enterprises remain a mystery for a large portion of the global population. The global ocean system can't be extracted from the Earth's complex intertwined Earth systems nor can it be separated from human health, social, or cultural systems.

The pressures of a growing human population, increased development and demand on natural resources, and climatic warming necessitate decision making in support of national, regional, and international goals. It is more important than ever for all citizens to be knowledgeable and aware of their relationship with the ocean, how it affects them, and the scientific research that is addressing pressing ocean-related concerns. This is the essence of ocean literacy (OL) - an understanding of the ocean's influence on people and people's influence on the ocean. The U.S. ocean science research and education community has worked together for over 25 years to expand and enhance ocean science education efforts. These efforts have included the national OL initiative, a collaborative undertaking of several U.S. organizations and institutions, which developed the Ocean Literacy Essential Principles and Fundamental Concepts (OLPFC) for primary and secondary schools.

Recent collaborative efforts by COSEE (Consortium for Ocean Science Exploration and Engagement) and the College of Exploration have striven to move beyond a single sector/single nation approach to ocean education and literacy through the engagement of multiple sectors connected to the human/ocean system, specifically the research, education, business, and policy sectors. This work, initiated in 2015 via the Global Ocean Science Education (GOSE) Workshops, is intended to move the dialog beyond the knowledge requirements of the OLPFC toward an understanding of anthropogenic impacts on the ocean and attitudes toward important ocean-related activities and behaviors. Systems thinking across nations, sectors, and natural systems is critical if the global citizenry is to become ocean literate. In addition, an understanding of the complex relationships in the ocean/human system is imperative in achieving the goals of the United Nations Decade of Ocean Science for Sustainable Development (Decade; 2021-2030). The 2019 GOSE Workshop will provide a forum for the international, cross-sector ocean science community to plan for the upcoming Decade and explore connections between ocean and systems literacy.

Keywords: ocean literacy, human ocean system

3604

Session: PLENARY

NETWORKS AND DATA: ADVENTURES IN LITERACY AND LEARNING

Uzzo, Stephen Miles; Cramer, Catherine Belle

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As the understanding of science increasingly requires thinking about complex interconnected systems and data-driven ideas (such as ocean science, genomics, ecosystems ecology and social, political and economic networks), there is a need for basic literacy in data and network science for all people. This talk will cover efforts to build consensus between the network and data science interdisciplinary communities of practice for developing essential concepts and core ideas related to both network and data literacy. The speakers will discuss the processes with which these literacies were developed and distributed, and important factors that contributed to their success.

Based on the success of the Ocean Literacy Principals, a series of workshops were held at UC Berkeley, Boston University and the New York Hall of Science with groups of network scientists, learning researchers, teaching and curriculum specialists and students, in order to devise a draft set of Network Literacy essential concepts that were then reviewed and edited by the global network science community of practice. This year-long process resulted in a published set of 7 Network Literacy Essential Concepts and Core Ideas. These have since been translated into over 20 languages and have been used for instruction across all grade bands and throughout the world.

This led to a similar movement in data science, which is still in process. The New York Hall of Science, in collaboration with the Northeast Big Data Innovation Hub of the Columbia University Data Science Institute, are collaborating with academia, researchers, non-profits, libraries and industry to develop a set of essential

concepts needed to achieve data literacy for all people. Issues of equity and interdisciplinarity will be discussed along with barriers and opportunities in data science across sectors.

Keywords: data literacy; network literacy

SUNDAY

3549

Session: PLENARY

2019 BERTALANFFY LECTURE: A CANDIDATE GST: SYSTEMS PROCESSES THEORY (SPT)

Troncale, Len Raphael

lrtroncale@cpp.ed

This talk begins with a concise overview of Ludwig von Bertalanffy as Founder of GST and the ISGSR, forerunner of the ISSS. His main contribution may have been his focus and emphasis on how systems work, the mechanics of systems dynamics, the isomorphies true of many different systems. The talk will begin with a citation of the original objectives of the SGSR as formulated by Founders like Bertalanffy and will cover as many of the following additional topics as possible within the allotted time (although all of the slides and handouts will be available whether delivered or not):

(1) The extent of Isomorphies developed by Bertalanffy; (2) Other Founders and their often-forgotten cross-disciplinary contributions; (3) Overview of >100 GST Sources; (4) Dispersion or Fragmentation of Theories: Half Century Need for Unification; (5) Desirability of debating Criteria for a GST and for a Science of Systemness to increase rigor and acceptance of our approaches;

(6) My LifeWork in ISSS: Origin of & Intention for SIGS & Change of Name to ISSS; (7) Conflating Systems Thinking [ST] & Systems Science [SS]; (8) Need for A Science of Systems; (9) Odum, Miller, Haken as Prototype Sciences of Systems & benefits; (10) Brief Analysis of Current SIGs in ISSS; (11) Need to Know Systems Mechanisms to Fix or Better Design Systems;

(12) Shortest Intro Possible to Troncale SPT as a GST & SS; (13) What Is An Isomorphy in SPT; (14) Alternative Lists of Isomorphies in SPT; (15) Sample of Extent of Natural Science Literature on Isomorphies, Utility of Harvesting or Incorporating into GST attempts; (16) Linkage Proposition Advance of SPT; (17) TEN SPT Spin-Off's;

(18) Systems Archival Resources at new Claremont Office; (19) Current Modeling Attempts; Odum to NPS to ?; (21) SPT as Model of Models; Library of Models for each Isomorphy; (20) Exemplar Applications of SPT to Engineering, Industries, Natural Systems; (21) SPT as Descriptive, Prescriptive, AND Normative; (22) Science-Based Values for Tech Era from SPT: From Tao of Systems Science to Emergence of Meta-Humans; (23) Announcement of the newly forming International Society for Systems Pathology (ISSP), ISGE & USSO Workshops.

Keywords: Bertalanffy; systems processes theory; GST; systems science; SPT; Isomorphies

3629

Session: Plenary

FROM SYSTEMS TO PATTERNS: TOWARD CURATED WEB-NETWORKS OF SHAREABLE KNOWLEDGE IN THE AGE OF CLICKBAIT AND FAKE NEWS

Mehaffy, Michael

michael.mehaffy@gmail.com

One of the most urgent issues today is the need — too often unmet — to develop and apply useful shareable knowledge to work effectively to meet our growing challenges. This issue is especially urgent in light of the rise of social media, information “bubbles”, clickbait, and other disturbing trends on the World Wide Web. Yet Wikipedia and related resources offer intriguing counter-examples. They begin to show ways that knowledge can be gathered, curated and shared effectively within a larger community, in much the same way that scientific knowledge is curated through an open-source process of peer review. Wiki was actually a direct outgrowth of the work of the architect Christopher Alexander, who developed “pattern languages” to capture actionable knowledge in relational, flexible, language-like forms. This talk will explore the close relationship between systems science and pattern languages, and the remarkably fruitful output that is now converging in interesting and hopeful ways. The presenter is a long-time colleague of Alexander, and a scholar on his work and its implications.

3602

Session: PLENARY

BUILDING A GLOBAL SUPERORGANISM: A NEW PARADIGM FOR THE ERA OF CLIMATE CHANGE

Corning, Peter Andrew

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The growth-oriented economic strategy that has largely prevailed in Western societies over the past two centuries is literally a dead-end. Nor is our global system of independent, deeply competitive nation states a viable strategy for the future, despite the current trend toward increased nationalism. As I argue at length in my forthcoming new book, we are facing a collective choice like none other in our long, multi-million-year history (and pre-history) as a ground-dwelling bipedal ape. We have only two paths going forward. We must either create a more integrated and cooperative global society and political order or else our species will very likely be consumed by lethal conflict and perhaps even devolve and go extinct. Only an organized process of cooperative social, economic, and political change on a global scale offers us genuine reason for hope. Many biologists use the analogy of a “superorganism” as a way of characterizing a socially organized group in the natural world. In my book (titled *Superorganism*), I provide an outline and a roadmap for how to achieve a new, more legitimate and sustainable economic and political order on a global scale -- a global “superorganism.” A key element of this roadmap is a proposal for a new “social contract” designed to create a legitimate and fair global society, along with increased global governance. Among other things, this would include a “universal basic needs guarantee.” If we follow the proven pathway in humankind of cooperation, innovation, and creating new synergies, there is every reason to hope that we can make the necessary changes and build a sustainable global society for the long term. But this will require bold leadership and broad public support, a very tall order. The supreme question before us, as the great Walter Lippmann put it 50 years ago, is “how men will be able to make themselves willing and able to save themselves.” The jury is still out.

MONDAY

3628

Session: PLENARY

**ESTABLISHING A ‘SYSTEMS IDENTITY’ FOR MANAGEMENT AND THE SOCIAL SCIENCES
EQUIVALENT TO ‘SYSTEMS ENGINEERING’ IN THE ENGINEERING WORLD**

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This presentation will involve a discussion of some of the issues facing ‘systems scientists’ in the academic world in trying to better establish their ‘systems identity’ in commerce, business & social science faculties at universities or polytechnics (ie in tertiary sector educational institutions). The talk will draw on the author’s own experiences at Victoria University of Wellington, New Zealand over a nearly 30-year period, and his recent co-edited MDPI Systems journal special issue and book on ‘systems education for a sustainable planet (with Prof Ockie Bosch). The book contains contributions from Australia, UK, Europe, USA et al, and these will be briefly discussed. In addition, the author will try and draw on lessons learned from his co-authored paper recently published in System Dynamics Review on ‘a ‘power and influence’ political archetype: the dynamics of public support’. In that paper the focus is on how ‘communities for purpose’ build and lose power over time depending on a multitude of factors, some within control of the community and others outside the control of that community. If we consider the ISSS and systems thinking community at large as the ‘community for purpose’ we could begin to use the political archetype and concept model to help our community grow and build up momentum and influence over time helping to bring systems thinking knowledge and skills into the wider public arena over a reasonable timeframe (or before it is too late – eg from the adverse effects of climate change!). It is hoped that this approach will also add to the current ‘systems literacy’ projects being undertaken around the globe, including, for example, the theme of this conference and the project currently being curated by Peter Tuddenham at <http://www.systemsliteracy.com>.

3595

Session: PLENARY

INTEGRATING SYSTEMS SCIENCE PERSPECTIVE ACROSS VARIOUS STEM LITERACIES

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Over the last decade various science literacy frameworks have been developed, including the Ocean Literacy Framework, The Essential Principles of Climate Literacy, or Energy Literacy: Essential Principles and Fundamental Concepts for Energy Education. Common amongst these frameworks is an implicit or explicit focus on systems; conversely, without a systems perspective, the complex issues around ocean health, or the linked technology, society, nature issues that underlie climate change or energy use cannot be understood fully. Yet, systems thinking per se is difficult to convey, teach or communicate, and while included in new US science education standards, there is little indication that student indeed learn systems thinking as a cross-cutting practice. Complicating the matter is the issue of what reasonably can or should be expected of children around systems literacy, and in extension, what expectation we ought to have about appropriate systems literacy in adults. Martin Storksdieck will reflect on opportunities and challenges in creating a systems literacy framework that might serve as guide to formal and informal education.

Keywords: literacy; education; systems thinking

3600

Session: PLENARY

DEVELOPING A SYSTEMS THINKING APPROACH WHEN IT COMES TO DEVELOPING POSSIBLE SOLUTIONS TO CLIMATE CHANGE

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Few issues facing society are more urgent than reducing our vulnerability to climate impacts, preparing for the staggering transition to a low-carbon economy, and building resilient communities. Yet K-12 schools, higher education, and free-choice learning institutions are often not prepared or focused on building awareness and inspiring action to care for our communities and our planet. Through activation of nations and communities extensive education systems with comprehensive climate change education, communities can more quickly embrace a low-carbon future, inspire future leaders, showcase their cities' adaptability, and create stronger communities.

The need for comprehensive, interdisciplinary climate change education is more important now than ever before. Since 1988, the Intergovernmental Panel on Climate Change (IPCC), an intergovernmental body of the United Nations, has provided the world with an objective, scientific view of climate change and its political and economic impacts. On October 8, 2018, the IPCC released the most important climate report to date. This IPCC special report, *Global Warming of 1.5° C*, provides insight into the collective global greenhouse gas emission choices that led to a warming of 1.5° C or higher above pre-industrial levels and serves as an urgent call to rapidly transition our global communities to low-carbon economies. It is also the first international climate report to provide a viable way to reach the goals set forth in the landmark Paris Climate Agreement to combat climate change, and accelerate and intensify the actions and investments needed for a sustainable low-carbon future.

The Climate Science and Education stated in the 2009 "Climate Literacy: The Essential Principles of Climate Science guide for Individuals and Communities" (USGCRP, 2009) why climate is key scientific issue that students need to address in their learning;

"To protect fragile ecosystems and to build sustainable communities that are resilient to climate change—including extreme weather and climate events—a climate-literate citizenry is essential. This climate science literacy guide identifies the essential principles and fundamental concepts that individuals and communities should understand about Earth's climate system. Such understanding improves our ability to make decisions about activities that increase vulnerability to the impacts of climate change and to take precautionary steps in our lives and livelihoods that would reduce those vulnerabilities."

The Climate Literacy Guide was used to create the climate related standards supporting the learning of more than three-quarters (84%) of U.S. students live in states that have education standards influenced by the Framework for K-12 Science Education and/or the Next Generation Science Standards.

To strengthen the learning related to climate change, we need to recognize and identify learning pathways that involves the complex, dynamic systems that demand a systems thinking approach when it comes to developing possible solutions. A systems thinking approach is increasingly recognized as a critical approach for education to address climate change. Climate change epitomizes a problem that demands a systems thinking and system dynamics approach: it is dynamic, complex, and crosses disciplines and societal

sectors. Addressing the impacts and societal problems resulting from climate change requires an unprecedented level of integration and education across scientific, social science, civic/government, and humanities fields. Systems thinking offers an opportunity to integrate knowledge across disciplines and move society's capabilities to rapidly transition to a low-carbon economy and address the impacts of climate change.

Keywords: climate change; literacy; systems thinking; solutions; education; climate change education

TUESDAY

3632

Session: PLENARY

THE RANULPH GLANVILLE MEMORIAL LECTURE

RECURSIVE REFLECTIONS ON FRIENDSHIP AND CONVERSATION

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As Ranulph was a friend, an with whom I had many conversations on reflection and recursion it behoves me to choose this occasion to reflect further on these topics. The experience of friendship feels delicious and meaningful. How is this so? I turn to a fundamental of all living systems, that is living in a constant of structural coupling which maintains our systemic relational embeddedness wherein we change coherently with our niche which changes along with us. Our medium as a whole appears to change slower than we do, its apparent inertia resulting from its complexity of other connections. In a conversation our immediate niche of the other, in whatever domain, changes at the same pace as we ourselves. In friendship we have the experience of an intimate flow of these changes.

In this talk I consider the implications of "chunking" and "betweens" in language, the fluid flow of entailments in meaning and emotioning, and the role of the current situation as well as the accumulation of co-epigenic coherences. Even as we reflect on these notions in a conversation, or engage in reflexive conversation on friendship in conversation, the lived experience of conversation in friendship remains retains an aspect of mystery. The experience of friendship happens both in our reflections and in our living; as a kind of multilayered awareness.

3634

Session: PLENARY

INCOMING PRESIDENT

SUSTAINABILITY SUBLIME: A NETWORKED APPROACH

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Several major cities in the world will face major issues, such as a shortage of clean water, due to unsustainable development, poor planning and political decision making. As a society supporting the United Nation's sustainable development goals we need to act to promote both environmental and societal sustainability that can help to address these crises. However, we cannot do this alone due to our limited capacity and resources. We need to work with like-minded societies who are also supporting the UN's SDG's. But working together as a network is not easy even if we have good intentions. To do this effectively we need to find a way to govern the activities of the network to work towards a common goal. Work being done in network governance by organizational and project management scholars can guide us to manage a network-based approach to sustainable development. This plenary will discuss some of these issues and then introduce the theme proposed for the 64th ISSS meeting. If we start collaborating with other organizations now with an aim to achieve some progress by the time we meet in 2020 we can carry this forward to contribute meaningfully to the society we live in.

Session Abstracts

3500 (3610)

Session: Critical Systems Theory and Practice

PROJECT GOVERNANCE: A SYSTEMS APPROACH TOWARDS SIMPLER, BETTER and FASTER

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This paper describes an empirical study that analysed and improved project governance, in terms of project health monitoring and reporting, and ultimately decision making capabilities relating to large capital (mega) projects. The researcher applied boundary critique to analyse monitoring, reporting and decision making mechanisms embedded in the governance process and systems—she applied Werner Ulrich's critical systems heuristics (CSH) to identify shortcomings. These were improved upon, and the process and associated system were streamlined.

This study is significant because megaprojects continue to grow in magnitude, regardless of the state of world economies. Proper governance is crucial to ensure maximum return on investment. A well-defined and appropriately executed project governance process, with supporting and enabling systems, ensures that projects are continuously delivered efficaciously and sustainably. Project management and governance is a dynamic field and research in this field has been expanding. Yet, limited effort have been made to address project governance, especially in African countries. Improper governance is a main cause of project failure and abandonment. So, more empirical research is needed to refine and optimise governance processes.

In this study, the researcher analysed and improved the project governance process and systems in a large South African based organisation with an international footprint. Their portfolio of projects aim to sustain, improve and grow the company's asset base, i.e. to ensure that the company remains competitive in its industry. The projects are resource intensive in terms of time, capital and human resources; for example, completion costs range between \$5billion and \$15billion. So, management was very concerned when a benchmarking company confirmed that project-related investment decisions, which stem from the applied project governance process and associated software/information systems, were suboptimal. For example, re-work during execution phases led to an estimated loss of 6.3% internal rate of return (IRR) and, on average, schedule overruns of 23% across this company's portfolio of projects. Management became increasingly uncomfortable with the quality of information that stemmed from the governance process, and requested that the process be analysed and improved.

So, to ascertain shortcomings, the researcher applied Ulrich's CSH to analyse the monitoring, reporting and decision making mechanisms. It was applied to determine actual (as-is) vs desired (to-be) dimensions of the project governance process and systems, i.e. what makes (vs what should make) it purposeful and measurable for clients; who controls (vs who should control) resources; who are (vs who should be) relevant experts, including what is (vs what should be) regarded as relevant expertise to guarantee successful design, development, implementation and continued use; and who/what emancipates (should emancipate) affected, yet not involved, stakeholders. Insight gained from the application of the boundary questions was used to improve (through targeted simplification) the governance process and system applied to assess and monitor the health of the organisation's project portfolio, so as to inform investment decisions.

Boundary critique of the process and system indicated that the core process was too complicated; also, serious shortfalls were identified in the system. For example, embedded metrics applied to transform input data into decision support information were inherently flawed; they did not serve the decision support process, and failed to provide credible decision support information. Metrics were, over time, adjusted by data capturers manipulate (positive) results, and did not reflect true statuses of projects. Relevant experts and expertise were not involved in the design and maintenance of the system. And, the system was unnecessarily complicated. After correcting said shortcomings, the outcome was a simplified system that provided credible decision support information—project governance was made simpler, better and faster.

Keywords: project governance, critical systems heuristics, systems approach

3502

Session: Critical Systems Theory and Practice

NEGOTIATIONS IN SYSTEMIC INTERVENTIONS: A CRITICAL SYSTEMS PERSPECTIVE

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Negotiations are an important element of systems practice. Churchman argues that if a problem solver wants to succeed in systemic interventions, he/she needs to participate in negotiations in which all sides should have the possibility of defending their positions. He claims that this is the case because in practical interventions problem solvers could never encompass the wider systems. Negotiations are pervasive in systems practice, and while some of these negotiations are formal, others are informal. They are frequently part of systemic methodologies. For instance, they are part of problem structuring methods (e.g., soft systems methodology, interactive planning, viable system diagnosis) as well as of other systemic methodologies (e.g., systems engineering, team synteegrity, systems dynamics). The pervasiveness of negotiations in systems practice goes unnoticed because we are guided by our belief that negotiation is only about making concessions. However, negotiations may take place in many different ways. They occur when we interact with others in order to understand what their interests and needs are, and when we try to persuade them. For instance, people negotiate when they try to agree on actions to accommodate different interests while they employ soft systems thinking, or when they seek participatory group agreements when using team synteegrity. In this paper we first show how systemic methodologies involve different forms of negotiation. Thereafter, we explore the role of moral frameworks in negotiations. We show how moral frameworks give an overall logic to individuals' behaviors in negotiations, even though these frameworks are frequently neglected in systemic interventions. We take advantage of boundary critique to study the structure of moral frameworks in negotiations, and we show how a transformation of moral frameworks can modify not only the logic of negotiations, but also the effects of the systemic interventions in which negotiations are embedded. We illustrate this by studying some real world systemic interventions. Although moral frameworks involving a consequentialist normative logic prevail in negotiation practice, this does not have to be always the case. We explore how two alternative types of normative ethics (deontological ethics and virtue ethics) may guide reason in different ways in negotiations. The context as well as the specific methods that are used by a systemic intervention, may affect the moral frameworks that are used in the negotiations that are carried out during the intervention. Given the strong link between people's moral frameworks and negotiations that are part of systemic methodologies, it is worth examining how people can make ethical choices in these negotiations in a holistic, informed and reflective way, so that these choices are consistent with their moral beliefs and their systemic methodological underpinnings.

3503

Session: SABI: Systems Applications in Business and Industry

GOVERNANCE of ORGANIZATIONAL PROJECT MANAGEMENT

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'Existential risk' continues to escalate and the crime of 'ecocide' is not yet recognised as part of international law even though it poses a new form of 'genocide'. Politically fragmentation and populism have become the new order driven by capitalism, anthropocentrism, speciesism, nationalism and racism. The case is made that liberalism has progressed too far in undermining collective (cosmopolitan) responsibility. The result is a form of state control and governance that is more closely linked with the nation state and the market than with protecting habitat or the needs of all those who fall outside the mantel of the social contract, such as young people, asylums seekers , the disabled and other sentient beings.

Key considerations are whether new forms of engagement could encourage people to think carefully through their options, rather than making rash decisions . Does discursive democracy and more engagement inevitably lead to populist decisions, polarization or narcissism? The need for democracy to re-engage with critical thinking is vital. Is it possible for groups to be held responsible in the same way that an individual can be held responsible? Arendt's notion that collective responsibility is upheld when each individual engages critically with their everyday decisions. Could balancing individual and collective needs be achieved through new processes and structures to help transform values and 'the banality of evil'? Some researchers argue it is indeed possible to engage in large groups that foster collective decision making for the common good.

This paper makes the case that critical engagement could be assisted through enabling people to think through the implications of their everyday choices and that this could help to foster an 'ecological mindset' to protect living systems. Balancing individual rights and collective responsibility to this generation of life and the next requires governance to protect the common good. This requires considering the consequences of

decisions whilst preserving the right to voice and agency – to the extent that it does not undermine the rights of the majority in this generation and the next.

The minimum requirement is re-balancing society to address political barriers but also to ensure that rights of the minority do not override the interests of the majority of living systems in this generation and the next. This requires a collective effort to re-create social and economic processes and structures to protect habitat. The three patterns of engagement that could foster the human stewardship of habitat are: 1. Recognition of the interdependency of living systems, 2. Making (ongoing) policy adjustments in context. In policy terms this requires new forms of organizational relationships that redress power imbalances that result in social, economic and environmental injustice and 'existential risk'. 3. Appreciation of cycles for re-generation in designs that sustain living systems. This requires rural-urban balance to protect habitat for domestic, farm and wild life based on the requisite variety for multiple species and their diverse habitats. The barriers to achieving these three pattern goals include power imbalances within and across species which requires an intersectional understanding of the way in which species membership, gender, race, culture and abilities shape the power dynamics that underpin social and environmental injustice.

A way forward is perhaps to focus on what matters within and across many species, namely a safe, inclusive environment, water to drink, food to eat, being able to keep cool or warm enough to sustain life and a sense of fulfilled purpose.

Keywords: values, multispecies representation, accountability, re-generation, living systems

3506

Session: Digital Product-Service Systems

ARCHITECTURE LITERACY

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The notion of architecture is heavily influenced by ISO/IEC/IEEE 420x0 series of standards, which provides an implicit view of architecture as different from design. These standards espouse a view that Architecture is the fundamental concepts or properties of an entity and governing principles for the realization and evolution of this entity and its related life cycle processes [1][2]. Over the years, architecture frameworks like ToGAF, DoDAF, NAF, IndEA and UAF have been developed, adapted and found to be useful by communities of practitioners in different architectural engagements. Architects often adapt and tailor one or more of these architecture frameworks while pursuing an architecture endeavour. These frameworks establish the conventions, principles and practices for use by architecture-related activities performed by architects within a specific domain of application or community of stakeholders.

The ability to engineer large, complex and sophisticated human made entities 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 such cases, architecture serves as the plan based on which the entity is designed, developed, improved, utilized, analysed and decommissioned. As a result, understanding the architecture of the entity and how it is synthesized is essential to the success of the entity. The entity as well as the environment in which the entity is situated in, evolves over time. This evolution could be due to the introduction of new concepts, properties, frameworks, reference models, patterns, styles, viewpoints, views, principles and other architecture related concepts that helps deal with the increasing complexity, size and scale of the entity being architected.

In such a situation, for any practicing architect, learning the trade of architecture becomes a life-long endeavour. Further, any new architect entering the world of architecture, feels overwhelmed by the sheer volume of things that they need to learn, understand, adopt, practice and analyse. The work product of architecting is an architecture description which is an expression of an architecture catering to the desires of one or more stakeholders of the architected entity. Often, many of these stakeholders find it difficult to understand the underlying architectural concepts, properties and principles even though they are aware of the context of use while they have to make decisions without understanding the consequences of their actions. To address these issues, in this paper, a few fundamental concepts, essential principles and properties that provides an outline of the influences between the stakeholders, architectures, architected entities and the environment in which the architected entity is situated in are presented.

The expectation is that an architecture literate person will understand the fundamental concepts, properties and principles of the architecture and the architected entity, communicate the architecture by appropriate ways and means, make informed decisions about the architecture and the architected entity as and when necessary so as to addresses the challenges that they face.

Keywords: Architecture; Architecture literacy; Fundamental concepts; Essential principles; Properties

3507

Session: Systems Engineering and Systems Modelling

TRENDS IN SMALL SATELLITE SYSTEM IN MEXICO

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A technological development of space in Mexico is proposed. Up to date, satellites are design, build and launch to the space by other countries. Satellites worked at an academic level to achieve this objective, a State policy is necessary to integrate basic and applied scientific research carried out by the country's institutions in the productive sector.

Small satellites for education institutions and research centers are currently being designed and built because of the relatively low cost compared to the geostationary ones that cover the American Continent. However, there was a lack of regulatory management, permits, launching bases, and systemic integration in companies.

Therefore, in order to obtain a Systemic Model was the production of a situation diagnosis with the corresponding planning.

Keywords: Small satellites, scientific research, State policy

3513

Session: Hierarchy Theory

ONTOGENESIS and MAJOR TRANSITIONS IN EVOLUTION: WHAT COMES NEXT?

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Over the last several decades a number of researchers and writers have turned their attention to an obvious fact in the structure of matter and energy as found on the Earth, and now thought to exist on other planets in other solar systems. The living world, and particularly the world including the human social system (HSS), is extraordinarily complex (defined in the paper). Yet at the origin of the Universe the organization of matter and energy was 'extraordinarily' simple. The deep history of the Universe, insofar as mankind's local experience is concerned, demonstrates an evolution of organization toward increasing complexity and hierarchical levels. Human societies today are more complex than those of a thousand years ago, which were more complex than social systems ten thousand years ago. Biological evolution has been a history of development from single celled organisms to primates with incredibly complex brains and life histories. How do we explain this clear trajectory from simplicity to organized complexity without invoking the concept of teleology? Moreover, how do we reconcile it with the 2nd Law of Thermodynamics? This paper reviews the development of the concept of ontogenesis as a totally natural, non-teleological process that is implemented in a recurrent ontogenetic cycle composed of auto-organization (combining) of more elemental components, followed by selection for stability of some of the new structures, followed by emergence of new properties, functions, and interaction potentials in the new composite entities. A subsequent period of selection by competition between emergent entities establishes a new level of organization in the complexity hierarchy. and then the process repeats giving rise to yet a higher level. Importantly, this cycle applies more universally than just in the realm of biological evolution. It started at the origin of the Universe, with physical and later chemical processes, continued through the origin of life on Earth, through Darwinian evolution, and into the development of human minds and the noosphere. It accounts for all structure observed today by human minds.

The ontogenetic cycle and the process of ontogenesis gives rise to what are recognized as major transitions in this universal evolution, or also called emergent organization. The overall pattern of increasing complexity and organization is described by several authors in a number of models of universal evolution. In this paper it is argued that all of these models can be reconciled such that our systems understanding of complexity, hierarchy, and dynamics are advanced.

At present the Earth system is comprised of the major geospheres: lithosphere, hydrosphere, atmosphere, biosphere, and the noosphere. The latter two are generally recognized as contributing the most to the complexity and organization of the planet, however, they could not exist without the others so the whole should be considered when considering the nature of an evolutionary trajectory.

After reviewing the subject, I will consider the implication of the process continuing to generate new more complex organized systems. With respect to the noosphere, the current situation on Earth, with a population in excess of seven billion people, is marked by a plethora of nations and cultures but interacting with one another in sometimes cooperative and sometimes competitive ways. It is the noosphere that is yet open and subject to dynamical reorganization. Is ontogenesis at work on the HSS such that the Earth may reach a yet higher level of organization? Can we use prior ontogenetic outcomes to predict or anticipate what that might

look like? Are there actions and social engineering tasks that the systems community should be involved in to bring about an integrated global society?

Keywords: ontogenesis; complexity hierarchy; human social system; evolution; noosphere

3515

Session: Digital Product-Service Systems

AN EXPLORATION of THE VIABILITY and LIVING CHARACTERISTICS of ARCHITECTURES

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The ability to engineer large, complex and sophisticated human made entities 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. Architecting is a search through a complex maze of uncertainties for solving a complex problem by synthesizing an unknown and original entity whose fundamental concepts and properties must be well understood and established upfront. The entire journey involves lots of trials and errors, in establishing different problem boundaries and proposing multiple solution alternatives for these problem areas from which some are selected and pursued further till the final architectural formulation is achieved. This architectural formulation serves as the foundation for the design, development, improvement, utilization, analysis and decommissioning of the human made entities.

Architecting human-made entities involves both reductionist and holistic thinking as architects deal with problems that are neither precisely stated nor understood. The architectures of these entities can be considered as abstract human-made entities by themselves. They exhibit characteristics which are often considered as essential ingredients of architectures. Such characteristics determine the extent to which the architecture can deliver value to the different stakeholders. Typically, architecting determines the characteristics of entities as well as that of the architectures themselves, engineering imbibes these characteristics into the entities and operations allows experiencing of these characteristics when used in different situations. Such characteristics are a perceptual, conditional, and somewhat subjective attribute and may be understood differently by different people.

In practice, architecture characteristics affect the behaviour, structure, design and experience of architectures. They represent stakeholder concerns and requirements that impacts the way the human made entity's value is perceived and delivered. It is often the case that an architect needs to deal with multiple architecture characteristics to assert the success of the architecting effort. Not only that, the architect also has to deal with the effect of these characteristics on the architecture, the architected human-made entity and the possible value that the stakeholders can experience. This means that there should be ways and means available to reason about the architecture characteristics. This paper explores two critical architectural characteristics that are essential in determining the success of an architecture endeavour. The first exploration is to examine whether Stafford Beer's VSM can be utilized to reason about the viability of any architecture. The second exploration is to determine whether Miller's LSM can be utilized to reason about the living nature of any architecture. The results of this exploration is discussed in this paper.

Keywords: Architecture; Architecture Characteristics; Viability; Living; Human-made entities; Architecture life-cycle

3516

Session: SABI: Systems Applications in Business and Industry

PURPOSEFUL FAILURE IN ORGANIZATIONAL LIFE

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Failure in business is verboten, to be avoided at all costs. After all, the Oxford Dictionary tells us to fail is "to disappoint expectation". Much preferred is success, because to succeed is "to bring one's labours to a happy issue". But failure and success have deeper meanings than just these. The word "succeed" was originally intended to mean "to go under, hence to follow" (Partridge 1958), which presents us with a different perspective. Alongside today's heroic assumption that success is a hard-won leadership achievement is the far earlier human observation that to succeed means merely to guide human activity toward a previously-existing expectation. Notwithstanding the contemporary enthusiasm for 'change', 'creative destruction', and other forms of 'disruption' in organizations, much of organizational life flows in streams running relatively unimpeded – inertial motion that seldom tends to veer much off course.

Rarely does management scholarship consider the value of failure – or, indeed, the great potential that might exist in purposefully failing. Systems science and cybernetics have much to offer in considering the

importance of purposeful failure in organizational success. This paper will examine their contributions, and the role of boundary judgments in human decision makers' perceptions of both failure and success. In a digitally networked world, combined with machine learning, rules about failure and success have scalable and systemic impacts in the world of artificial intelligence, ethics, and public policy.

Keywords: failure; success; organizations; decision makers

3520

Session: Research Toward a General Theory of Systems

HOLOICON, THE GENERAL SEMIOTIC ARCHETYPE HIDDEN BEHIND THE ∞² CO-INFLUENCES MODEL

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In the end of the 20th century, the surface problem in global network society is data smog, surviving the information glut, but the deep problems are human fragmental memory, language SVO structure, human linear thinking, small 2D display media, silo syndrome and "seeing is believing", etc. At that time, AI was gradually rising and AI at present emerges as new electricity. While quite a few experts try to apply AI to resolve those problems, the author chooses general systems theory to encounter those fundamental challenges. By undertaking the general semiotics approach and creating the general semiotic archetype, Holoicon (a 3D diagram) which could dissolve these problems.

Mathematics is the ultimately formal sign, and the most powerful patterns in nature and society. In Eastern wisdom, "Xiang/Image" is an alternative natural/formal sign of returning to primordially creative thinking on the general patterns in nature and society. The general semiotic archetype, Holoicon is the product of whole four layers Xiang/Image thinking to unite the microcosm with the macrocosm: firstly, wakeful consciousness Xiang/Image (from de Saussure, Peirce, etc.); secondly, dream sub-consciousness Xiang/Image (from Freud, Lacan, etc.); thirdly, deep collective unconsciousness Xiang/Image (from Jung, Pearson, etc.) and lastly, transcendental Xiang/Image unknown thinking (from Laozi, Zhuangzi, etc.). To the incredible state, Holoicon represents every Xiang/Image in the world.

Holoicon is the transcendental rheomode of Bohm's Holomovement. It is one (like OM) but it is all (like Tao). As above so below, as within so without, as the universe so the soul (principle quoted from Hermes Trismegistus). It deduces about three realms (triadic form) transformation out of the void-space as Joseph Campbell says "Life is a departure/initiation/return Journey." Its fourfold genetic schema include southern relational path (Africa ubuntu model, South America "Mother earth" model), eastern path of renewal (Chinese circle model, Buddha wheel model), northern path of reason (Celtic, Germanic matrix model) and western path of realization (Hellenic column model). By bridging self and world, there are emerging evolutionary ultimate infinity in the universal timeline. This is the epistemological base of the ∞² co-influences model proposed by the author in 2007 and then introduced the ∞² co-influences model in ISSS since 2010.

The complex environments of the 21st Century contain VUCA (Volatility, Uncertainty, Complexity, and Ambiguity), largely increasing the conflicts between human and AI more than 20 years ago. In the Tao of co-evolution between human and AI, Holoicon represents human's potential in developing multidimensional intelligences synchronously.

Keywords: Holoicon, general semiotic archetype, ∞² co-influences model, Holomovement, multidimensional intelligences

3521

Session: Balancing Individualism and Collectivism

SOCIAL ENGAGEMENT TO REDRESS THE BANALITY of EVIL and THE LIMITATIONS of THE SOCIAL CONTRACT TO PROTECT HABITAT

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'Existential risk' continues to escalate and the crime of 'ecocide' is not yet recognised as part of international law even though it poses a new form of 'genocide'. Politically fragmentation and populism have become the new order driven by capitalism, anthropocentrism, speciesism, nationalism and racism. The case is made that liberalism has progressed too far in undermining collective (cosmopolitan) responsibility. The result is a form of state control and governance that is more closely linked with the nation state and the market than with protecting habitat or the needs of all those who fall outside the mantle of the social contract, such as young people, asylum seekers, the disabled and other sentient beings.

Key considerations are whether new forms of engagement could encourage people to think carefully through their options, rather than making rash decisions. Does discursive democracy and more engagement inevitably lead to populist decisions, polarization or narcissism? The need for democracy to re-engage with critical thinking is vital. Is it possible for groups to be held responsible in the same way that an individual can be held responsible? Arendt's notion that collective responsibility is upheld when each individual engages critically with their everyday decisions. Could balancing individual and collective needs be achieved through new processes and structures to help transform values and 'the banality of evil'? Some researchers argue it is indeed possible to engage in large groups that foster collective decision making for the common good.

This paper makes the case that critical engagement could be assisted through enabling people to think through the implications of their everyday choices and that this could help to foster an 'ecological mindset' to protect living systems. Balancing individual rights and collective responsibility to this generation of life and the next requires governance to protect the common good. This requires considering the consequences of decisions whilst preserving the right to voice and agency – to the extent that it does not undermine the rights of the majority in this generation and the next.

The minimum requirement is re-balancing society to address political barriers but also to ensure that rights of the minority do not override the interests of the majority of living systems in this generation and the next. This requires a collective effort to re-create social and economic processes and structures to protect habitat. The three patterns of engagement that could foster the human stewardship of habitat are: 1. Recognition of the interdependency of living systems, 2. Making (ongoing) policy adjustments in context. In policy terms this requires new forms of organizational relationships that redress power imbalances that result in social, economic and environmental injustice and 'existential risk'. 3. Appreciation of cycles for re-generation in designs that sustain living systems. This requires rural-urban balance to protect habitat for domestic, farm and wild life based on the requisite variety for multiple species and their diverse habitats. The barriers to achieving these three pattern goals include power imbalances within and across species which requires an intersectional understanding of the way in which species membership, gender, race, culture and abilities shape the power dynamics that underpin social and environmental injustice.

A way forward is perhaps to focus on what matters within and across many species, namely a safe, inclusive environment, water to drink, food to eat, being able to keep cool or warm enough to sustain life and a sense of fulfilled purpose.

Keywords: values, multispecies representation, accountability, re-generation, living systems

3525 (3562)

Session: Action Research

SYSTEM RISK VISUALIZATION and MITIGATION METHODOLOGY and ITS APPLICATION TO ICT SYSTEM FAILURES

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A method is presented for mitigating system failures. Current state-of-the-art methodologies and frameworks have strength as a common language to understand system failures holistically with various stakeholders. On the other hand there is a shortcoming in quantitative aspects. This is major obstacle to assess effectiveness of various measures to mitigate system risk. In order to overcome this shortcoming, this paper express system risk numerically through a coupling and an interaction factors between system configuration elements as well as system failures frequency rate, this three numerical number (i.e. coupling, interaction and frequency) create three dimensional space, and measuring its trajectory through time visualize system risk trends which are the targets to create an effective preventative measures to system failures. A root cause of a system failure is discovered by using a System Dynamics technique to a trajectory of a system risk location, then based upon the root cause, the effective counter measures are extracted. Lastly this methodology is applied to the system failures cases with various ICT systems and counter measures are extracted. An application example of ICT system failures exhibits the effectiveness of this methodology.

Keywords: Risk management; Crisis management; Normal Accident Theory (NAT); High Reliability Organization (HRO); Information and Communication Technology (ICT); System Dynamics

3526 (3635)

Session: Digital Product-Service Systems

FACILITATING ORGANIZATION and CONTROL of MULTI-MEDIA PRESENTATIONS BY GENERALIZING A NEW DIGITAL MEDIUM (EDDSWEEM)

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This paper shows how a new, green, paperless, digital medium, EDDSWEEM (Electronic Digital Display With Embedded Multi-Media), may be generalized to facilitate organization and control of multimedia and avoid difficulties observed in a human speaker and multi-media presentation recently. At an Easter program this year, multi-media were used in a presentation of oral, musical, lighting and large screen digital displays where there were problems getting a video to work. A presenter used a remote clicker and read from a digital screen when progressing through his talk with some periods of difficulty because of the distractions of using those means of control. EDDSWEEM was recently described at a presentation at the 2018 annual conference of the International Society for the Systems Sciences in Corvallis, Oregon, as applied to literature and the theatre.

The new medium uses the Microsoft Windows operating system and Microsoft Office Word--standard on many PC based computers--as a display medium. As pointed out in 2018, many media may be embedded in Word document and controlled and displayed by continuous scrolling of the Word file without page boundaries and with appropriate clicking of icons or links. Such media may include other MS Office APPs. Testing of such "scripts" before a presentation/performance ensures freedom from the difficulties noted above; this principle may be applied more generally--limited only by imagination of the script author. The action of using the new medium and the varied content provides increased stimulation of the audience central nervous system (cool-ness). With it there are also productivity gains, and increased information communicated in the same amount of time by paralleling oral presentation with the digital display. Obviously this format is deaf inclusive.

This paper includes a cursory review of past media and asserts that, generally, they are subsumed by a new medium--at least over time--a new addition to media theory.

As shown in the 2018 paper, a new medium requires a new format, and the new format spurs creation of new content. As applied to augmentation of contemporary theatre and a new, standalone literary genre, this new content may move away from storytelling only, and move more toward delivery of information about ideas. As an example (but in no way example-limited), the idea of an emotional situation may be dramatized in theatre or displayed for a single "reader" on a computer monitor. This idea orientation is generalized in a simple idea oriented play production model augmented by EDDSWEEM--an addition to theatre theory. That model is then generalized for any live speaking presentation augmented by multi-media. This subject affords opportunities for new research in the fields of Information Science, Media Studies, Communication, English, Cultural Change, Deaf Education, Drama and presentations.

Keywords: New digital medium generalization; theatre theory; media theory; presentation organization and control; EDDSWEEM update

3527

Session: Action Research

PROJECT SYSTEMIC: A SYSTEMS-THINKING APPROACH TO STEM ECOSYSTEM DEVELOPMENT IN CHICAGO

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Project SYSTEMIC is an action research project that is applying a systemic intervention approach to broadening participation of African American youth in Science, Technology, Engineering and Math (STEM) education in Chicago's largest neighborhood, Austin. The project is funded by the National Science Foundation's INCLUDES initiative and is led by Project Exploration, a science education organization that provides out-of-school time STEM programming for Chicago youth, particularly students of color and girls. The premise for the Project SYSTEMIC approach is that before investing in the development and implementation of new STEM education programs, the STEM ecosystem should be understood systemically and from the whole-community perspective. This presentation will summarize the first stage of the project: engaging a number of community stakeholder groups in the Austin neighborhood of Chicago through participatory problem structuring and boundary critique to generate a community common systemic perspective of the entire STEM ecosystem. Once this common systemic perspective is developed, a

community-wide organizational strategy, using the Viable Systems Model (VSM) can be developed to create an systemic and adaptive approach to generating improvement.

Keywords: systemic intervention, problem structuring, stakeholder participation, community engagement, STEM education

3528

Session: Critical Systems Theory and Practice

GOD'S POINT of VIEW: THE PEAK of POLYMORPHISM

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This paper aims at introducing a metaphysical polymorphism based on the notion of information. Modern science emphasizes universality and objectivity as criteria for genuine knowledge and truth. Although the concept of polymorphism which is popular in natural sciences has been used by Walmsley (2008) emphasizing the polymorphism of consciousness in Lonergan (1972)'s sense, there is a possibility of introducing a polymorph model of reality based on the notion of information. Going back to Wiener (1948)'s definition of information and "negative entropy" i.e. "negative disorder" or "degree of organization", there is a possibility of defining information as patterns of (self)-organising matter and energy. In this way, reality is no longer conceptualized as material particles in motion as Newton's mechanics postulated. This metaphysical polymorphism shows that self-organising matter and energy at the micromolecular, neural, cultural, bureaucratic levels and in artifacts such farms, social and economic systems, corporations and software, creates an ecological continuity between the inorganic, the organic, and the artificial.

From the point of view of this ecological continuity, reality (metaphysics), knowledge (epistemology) and behavior (ethics) can be approached as problems of information because they still conform to a cybernetic model that views "things social as interacting processing systems" (Beniger, 1986) and "appreciate[s] the importance of communication and control in all such systems." (Beniger, 1986). A parallelism can be established between levels of control (Beniger, 1986) and levels of consciousness (Fuchs-Kittowski, 1991) in a way modern science's idea of a universe (one world) may be replaced by a "pluriverse." This implies that although as humans we may be living on the same planet earth we may live "worlds apart" because we operate at different "levels of reality" (different levels of (self)-organisation of matter and energy) and "different levels of consciousness" (Lonergan, 1972).

Metaphysical polymorphism invites a dynamic and integrative epistemology based on Lonergan's work in philosophy, theology and economics. This dynamic and integrative epistemology implies that knowing is first and most of all an activity of the knower. Secondly, when we are knowing we are not always doing the same thing e.g. thinking because knowing occurs in Lonergan's terms at four levels of consciousness, namely, the emotional (pathos), the intellectual (logos), evaluative (ethos) and the active (praxis). Thirdly, there is a bridge between metaphysical, epistemological and ethical issues through putting various levels of consciousness in succession rather than in opposition. Instead of opposing emotion to reason, reality to appearance, rationalism to empiricism, phenomenology to positivism, principles to facts, ideas (concepts) to objects, theory to practice, dynamic and integrated epistemology postulates a fourfold process of experiencing, understanding, judging (evaluating) and acting. Four integrated but differentiated activities in the process of human knowing imply four different outcomes of the process of human knowing: experiencing generates data or representations, understanding generates meaning, evaluating creates value while acting leads to achievement of practical goals. These activities also consume four types of resources namely attention, intelligence, reasonableness, and responsibility.

The knower then is not a passive spectator of the world but an active creator of value and meaning through information processing i.e. enriching the immediate data of experience with meaning and value for the purpose of decision-making. In this context, knowledge does not aim at certainty (clear and distinct ideas) but to wisdom i.e. dynamically integrating emotional, intellectual, ethical and practical skills in way that responds to the demands of the context while abiding to principles and values which one uses as yardsticks to guide one's conduct by integrating substantive (subject matters and their representation or data), semantic (meaning), behavioural (procedures) and teleological (or functional) processes.

Keywords: polymorphism, information theory, dynamic and integrative epistemology, systems dynamics

3531 (3531)

Session: Health and Systems Thinking

PERFECT HEALTH SYSTEM TECHNOLOGY of THE HUMAN BEING

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The Perfect Technology of the Human Being is the most powerful, more than IT and the atomic bomb, it is governed by "life power", but we don't know how it works. Is a must to take the challenge to know ourselves and find out how does it works. When you begin this path, most of the time you do not feel comfortable, because culture and ideologies make us have prejudices and beliefs that limit ourselves. Try to read this paper in a state of pure "equanimity". Nothing is good, nothing is wrong, it is what it is. Do not make judgments or assumptions of any kind, just experience my experiences by yourselves with good results. I hope you resonate with these ideas that are not mine, they have to do with the human being's nature, since it exists, this ancient wisdom, now available to everybody. "Except traumatism and structural defects, all other diseases can be cured by oneself", wrote John W. Armstrong in 1944, in his book "The water of life". How is that, nowadays, there are many studies that confirm that Chemotherapy is extremely harmful, and yet is still being providing by orthodox oncologists. Why medicine researchers do not speak about Naturopathy alternative methods? Why for over so many years doctors are occupying on the symptoms but not on the real causes of the diseases? Many people should ask themselves why doctors can't suggest nothing better than knife and radium X rays for cancer? Why when people already have cancer they are told that meat is not good for health? Would just be ignorance for so many years? What have to do with economic interests, laboratories profits. Health is not a business, is a right. Human beings are not clients of the health care systems, they are patients, and who doesn't understand it like this is not acting with human good values. The question is why Naturopathy does not go further being the most practical and cheapest way to self-heal. of course, it doesn't mean that the health care system is not useful at all. Diseases can be successfully treated and prevented, by self healing, without the use of drugs and surgery. Using methodologies such as control of diet, proper fast, exercise, massage, natural and non invasive alternatives.

Keywords: Health; Human Technology; Therapies

3532

Session: SABI: Systems Applications in Business and Industry

POLYMORPHISM: WHAT CAN BUSINESSES SYSTEMS LEARN FROM LIVING SYSTEMS?

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The concept of polymorphism which is popular in natural sciences has been used by Walmsley (2008) emphasizing the polymorphism of consciousness in Lonergan (1972)'s sense. There is a possibility of introducing a polymorph model of reality based on the notion of information. Going back to Wiener (1948)'s definition of information as "negative entropy" i.e. "negative disorder" or "degree of organization", information is defined as patterns of (self)-organising matter and energy at the micromolecular, neural, cultural, bureaucratic levels and in artifacts such farms, social and economic systems, corporations and software. Information creates an ecological continuity between the inorganic, the organic, and the artificial through a parallelism between levels of control (Beniger, 1986) and levels of consciousness (Fuchs-Kittowski, 1991). This ecological continuity implies that reality (metaphysics), knowledge (epistemology) and behavior (ethics) are problems of information because they conform to a cybernetic model that views "things social as interacting processing systems" (Beniger, 1986) and "appreciate[s] the importance of communication and control in all such systems." (Beniger, 1986) Polymorphism implies integrating substantive (subject matters and their representation or data), semantic (meaning), behavioural (procedures) and teleological (or goal-oriented, functional) aspects in both organisational structures and business processes. This can be done through information processing i.e. enriching the immediate data of experience with meaning and value for the purpose of decision-making. In the context of polymorphism, business systems can learn from important features of living systems:

- (1) Businesses as holographic systems i.e. favoring integration over fragmentation through embedding vision, systems and structures and corporate culture in each component of the organisation through the Stafford Beer's principle of recurrence.
- (2) Focusing on throughputs rather than outputs: designing businesses as value networks rather than value chains and ensuring flawless processes at each level of value creation through Total Quality Management (TQM).
- (3) From universality to transversality: traditional business models imply top-down linear bureaucratic models which implies a "command and control" management style and standardization for the sake of mass

production. Polymorphism implies that each customer is unique and a “sense and respond” (to customer needs) approach is better than a “make and sell” strategy;

(4) From hierarchies to heterarchies: This implies basing decision-making and problem-solving not on power and ownership but on knowledge. This change leads to different patterns of empowerment and sharing of rewards. The distinction between management and staff becomes irrelevant because power is no more at the top of a pyramid but at different nodes of complex networks where different members of a team share resources and information. This creates a flat, networked model of organisation that is ruled by equality rather than domination.

(5) From Cutting Edges to Cutting Across: This implies shifting from designing organisations as stable closed entities to dynamic open systems through disruptive innovations, outsourcing and establishing organisational structures which go beyond the boundaries of one single organisation such as joint-ventures, consortia, conglomerates and strategic alliances;

(6) From competition to collaboration: When value creation is based on knowledge rather than ownership or power there is a different understanding of the relationships between different players. The crude individualistic understanding of competitions is replaced by vertical integration (the suppression of hierarchical barriers) and horizontal integration (the formation of cross-functional teams). This new way of doing business has been called by Burn et al. (2002:xv) “coopetition”.

From warfare to trust: The marketplace is no longer conceived as a battleground or a dangerous place, where one must be very careful in order to brave the fury of the enemy and unveil the enemy’s traps. Polymorphism implies inter-organisational systems that link organisations to their customers and suppliers.

Keywords: polymorphism, Business Systems, Networked Organisations, Intelligent Organisations, Inter-organisational Systems

3535

Session: SABI: Systems Applications in Business and Industry

REDUCING and REMOVING HIERARCHIES IN SMALL BUSINESS: THEORETICAL BENEFITS and PRACTICAL PROBLEMS

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Graham Talley and Ashkahn Jahromi run a floatation tank center in Portland, Oregon that has been in operation since 2010. They also design software, organize events, and publish books. In addition, they consult with businesses around the world and are passionate about applying systems thinking to common problems that are faced in the small business world.

In this presentation, they will be discussing attempts to reduce and remove hierarchical structures in business. They will cover current research on the topic, as well as case studies into the effects of removing or limiting hierarchy. They will also share their own practical takeaways from attempting to reduce hierarchies in their own business over the last decade.

There are many benefits that companies have seen moving towards a more “flat” structure, and it is the opinion of the presenters that more companies, especially larger enterprises, should take steps in this direction. Benefits range from lower employee turnover and higher job satisfaction rates to more efficient operations with less bloat.

However, there are also practical downsides and logistical difficulties that arise when attempting to incorporate non-hierarchical models into a pre-existing business. These can include general disorganization, unproductive & bloated meetings, and hurdles with tragedy-of-the-commons responsibility issues.

Keywords: hierarchy, business, system design

3537

Session: Organisational Transformation and Social Change

A SYSTEMS ANALYSIS of THE CONFLICT CULMINATING IN THE WAIRAU AFFRAY of 1843

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The Wairau incident is an historical event that occurred in 1843 only 115 kilometres from my home in Nelson, New Zealand. At that time, the New Zealand Company was under pressure to acquire more land from the indigenous Maori to satisfy the growing number of immigrants from England seeking land. The New Zealand Company believed it had bought the land from another settler, however, the Maori denied that this part of the land was a part of the land agreement. Arthur Wakefield sent surveyors onto the land. When Maori burned down the surveyors’ huts, made from materials from their own land, the Maori resisted. This

impasse between both resulted in an affray between both parties leaving 22 Europeans and four Maori dead.

This paper investigates this incident through the lens of systems theory looking at the European settler and the Maori tribes as complex adaptive systems engaged in recursive interactions culminating in an impasse where differences in worldview meant boundaries could no longer be shared and dialogue within the relational space became fruitless. A small event proved to bifurcate the situation into a cascade of violent actions.

The implications of the theoretical understandings developed are then discussed to see how they might be useful in the wider context of conflict resolution.

Keywords: conflict, systems theory, impasse, Maori history, self-organized criticality

3541 (3541)

Session: Organisational Transformation and Social Change **SOLIDARIAN PARADIGM FOR SYSTEMIC ECONOMIC MODEL**

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Most of us dream of living in a better world. We would like the economy of the planet to be more just, kind and equitable. We are always looking to be secure in all areas of our lives. As a matter of fact, we usually waste a fortune on insurance. Health insurance, life insurance, home insurance, financial insurance..... insurance for everything! That is the equitable transfer of a risk of loss from one entity to another in exchange for payment. It is a means of protection, used to hedge against the risk of a contingent uncertain loss. But, what if instead of thinking we can control everything, also with insurance, we learn how to deal with uncertainty. What if we learn a different systemic way of using the "human being energetic technology": that embraces our body, mind and spirit, to lead the universal energy in order to favor our purposes, projects and desires in life, whatever they are. This abstract shows how a Systemic Abundant Economic Model helps to grow not only in an economic way but also in a spiritual one.

Keywords: Economy; Solidarity; Commitment; System

3542 (3542)

Session: Relational Science **SCIENCE of A LIVING UNIVERSE**

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According to R-theory, a new meta-theory of whole systems based on the work of mathematical biologist Robert Rosen, the "Gaia hypothesis" may be better understood as a holistic worldview than a mechanistic hypothesis. The new perspective on nature provides a framework for studying closed systems, which has already yielded a definition of life itself, four organizational types of life, and sustainability as a systemic property of causal closure typical of organisms. These results raise the possibility of "Systemic Gaia", the possibility of ecosystem sustainability and aut evolution (influence of a system on its own evolution). This paper asks if the Earth as a whole can be modeled as a self-sustaining and self-evolving system. R-theory's concept of causal closure in modeling relations ('holons'), as a meta-model of natural organization, may be the key to answering such questions. Extension of this model to the global level addresses many of the criticisms on both sides of the Gaia debate. Rather than challenging the dominant mechanistic understanding of nature, it preserves that established territory and gives it a relational foundation capable of adding new factors of organization. With such new factors, the theory addresses many concerns that led to spiritual or theological speculations such as "intelligent design" and pre-destination, instead placing creative process inside natural systems rather than forcing external origins. Consequently, the theory supports causal explanations for stasis and punctuated novelty (punctuated evolution), apparent gaps and emergence in the evolutionary record that would be of concern from a gradualist perspective, and the impression of end-directed evolutionary processes (teleology) as implied by Gaia. Modeling relations are claimed to be a fundamental law of nature involving cyclical causality that had been known since Vedic times, but re-interpreted, for example by Aristotle, as a hierarchy of causes. A cycle of these four causes naturally requires that form and function co-evolve, as do mind and body, as unified dual aspects of holistic self-defining systems. The theory supports convergence of Western and Eastern science within a Vedic ontology of "cosmic order" (Rta).

Keywords: R-theory, Rosen, Complexity, Evolution, Life

3545

Session: Organisational Transformation and Social Change

HUMAN AGENCY IN SOCIAL SYSTEM BEHAVIOR: IMPLICATIONS FOR UNDERSTANDING, DESIGNING and MANAGING ORGANIZATIONS

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The aim of this paper is to pinpoint human agency as the root cause in social system behavior then discuss implications for understanding, designing, and managing large organizations. The need for clarifying human agency 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 softsciences, 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 theoretical framework in this investigation is informed by Kenneth Boulding's general system theory and transdisciplinarity. The approach 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 and key concepts, literature, and evidence from multiple disciplines, including management, control systems engineering, psychology, adult learning theory, plus examples from large urban schools and workplaces. Updated theory is that agency of organization behavior is not in the leader, nor the worker, but in both. Each system member learns and performs according to his/her own willingness and ability, resulting in almost infinite variability. Thus, a new provide/pickup relationship is proposed to explain the roles of leaders with their learners/employees. It builds on the stimulus-response model in biology. It replaces and subsumes the command-control and laissez-faire assumptions in management theory and practice. The cause-effect, stimulus-response processes are identified in humans as pickup-interpretation-result. The result in humans is learning and/or behavior. Thus, 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 large social systems, important input is beyond the pickup range of individuals. User-designed ideal-based automated social control systems are proposed to allow organizations and system members to flourish.

Keywords: management; education; control systems engineering; general systems theory

3546

Session: Designing Educational Systems

THE POTENTIAL of ECO-FACTURING TO RE-GENERATE RURAL-URBAN BALANCE THROUGH ECO-VILLAGES and CITY HUBS : PROMOTING SOCIAL and ENVIRONMENTAL JUSTICE THROUGH VOCATIONAL EDUCATION and TRAINING HUBS

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The paper proposes an alternative cyclical economy based on eco-villages supporting urban hubs to regenerate rural-urban balance based on eco-facturing, to use Gunter Pauli's concept. Africa and Asia are two of the fastest urbanising areas globally.

The development of eco-villages supporting the 'one village many enterprises' concept currently applied in Indonesia relies on responsive design informed by the principle of subsidiarity and Ashby's rule, namely that policy decisions need to be made at the lowest level possible and the complexity of design decisions need to match the complexity of the local residents who act as caretakers for local living systems. The paper maps out design principles and makes the case that all living systems are in constant motion and design needs to respond in ways that generate energy, rather than extracting energy at the expense of this generation and the next.

Profit is nothing less than energy extracted at the expense of people and the planet. Alternative forms of organisation are possible, in the form of 'wellbeing stocks' to cite Joseph Stiglitz.

The development of eco-facturing using local products such as cassava for bioplastics, bamboo for biochar and fair trade, fair range luwark coffee are discussed as three examples of ecofacturing that are currently being developed in Indonesia.

The potential for eco-facturing to be applied in Southern Africa and Ghana is currently being explored using bamboo and cassava in appropriate areas and exploring a suitable cash crop. Coffee is one option, but many others such as red bush tea, aloes as well as a host of local herbs could be explored with Indigenous holders of wisdom. Some core design principles are suggested outlined by Christakis and members of Global Agoras community of practice and affiliates.

These principles are discussed in the paper together with the importance of 'being the change' through expanding pragmatism to support Systemic Ethics. These need to be guided by decisions that honour 'freedom and diversity' to the extent that freedom and diversity are not undermined by power imbalances. The short paper reflects on the key themes of two forthcoming Springer volumes, namely: 'Mixed Methods and Cross Disciplinary Research: Towards Cultivating Ecosystemic Living' and 'Democracy and Governance for Resourcing the Commons: Theory and Practice on Rural-Urban Balance'.

Keywords: design principles, vocational education and training, eco-villages and hubs, cyclical economy, cycles in nature, food webs, water flows

3547

Session: Systems Pathology

A COMPUTATIONAL MODEL FOR RECOVERY FROM TRAUMATIC BRAIN INJURY

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A computational simulation model calculates estimated recovery trajectories following traumatic brain injury (TBI). Prior publications include a multi-scale conceptual framework for studying concussion, a systems-level causal loop diagram (CLD) and an analysis of key feedback processes. A set of first order ordinary differential equations and their associated parameters determines recovery trajectories. The model contains 15 state variables, 73 auxiliary variables, and 50 parameters describing TBI pathology in an aggregate fashion at the cellular, network, cognitive and social levels. There are 1200 feedback loops, which give rise to a variety of behavior modes, many of which are highly nonlinear. Exogenous parameters include patient and injury characteristics, treatments, and time constants for recovery processes. Model testing has focused on reviewing the causal diagram with subject matter experts and determining sensitivity of model results to injury severity and patient characteristics, especially the time constants associated with healing/recovery processes. The model produces outcome trajectories that represent quick or slow recovery with no deficits, partial recovery, and the patient remaining indefinitely in a pathological state. While highly speculative, the model serves to demonstrate the potential utility of computational models in this context and to further discussion about the complex dynamics involved in recovery from TBI. Much more research will be needed to create a properly supported research model that could be used for precision medicine.

Keywords: computational model, concussion, brain injury, recovery trajectory

3548

Session: SABI: Systems Applications in Business and Industry

SUPPLY CHAIN RISK MANAGEMENT and AN EMERGING EMPHASIS ON THIRD PARTY EXTERNALITIES

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Whether negative externalities are characterized as market failures or as inevitable byproducts of commercial activities, they are increasingly under scrutiny by people affected by them. This paper looks at modern supply chains and how they should deal with potential negative impacts on non-stakeholders. While it is debatable whether contractual or transactional supply chain insiders – or second parties – are subject to negative externalities, it is evident that supply chain outsiders – third parties – are frequently saddled with them. This paper is concerned with managerial clarity as firms go about their daily operations and as firms experience unexpected disruptions. Both supply chain insiders and outsiders can be subjected to harmful effects of a firm's daily operations and any supply chain disasters, but management will be well served by determining the nature of the harm and who it actually harms. Risk management policies and methods will depend on who the potential victims are. Not being mindful of and minimizing the harm done to third parties, firms subject themselves to various types of pushback and sanctions, causing financial and reputational damage. of major concern is also the impact on outsiders, like society at large and the natural environment, which often find themselves bearing the brunt of the operations and the mishaps of supply chains. The management of corporate social responsibility needs to include systems for internalizing such damaging externalities and reducing the social disutility of sourcing, manufacturing and transportation activities.

The paper studies a database of close to 6,000 global supply chain disruptions over a 4-year period. By studying the events with high disruption potential, we are able to look for some commonalities in the externalities cast upon third parties. We urge supply chain professionals to broaden their definitions and practice of supply chain risk management to include and protect the interests of third parties, such as society at large and the environment. The rapid ascent of IT-based technologies will make it a lot easier to identify exactly who is to blame for any externalities, and might even simplify payments of compensation from offending firms to victims.

Keywords: Supply chain management; Externalities; Social welfare; Corporate Social Responsibility; Risk Management; Disruptions

3550

Session: Systems Pathology

SYSTEMS PATHOLOGY: REVIEW of CONFLICTS WITHIN HISTORICALLY UNQUESTIONED CONCEPTS

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Historically revered concepts could be the focal problems preventing developing a successful single General Theory of Systems. Certain previously accepted ideas need to be re-analyzed for possible logical incompleteness, for harboring errors based on limited information, or containing logically or relationally based conflicting principles. Conflicting math axioms and hypotheses, conflicted philosophical premises, dysfunctional interpretations of historically accepted models of what was observed and devised using ancient limited knowledge – require re-analysis, reconsideration and correction, based on expanded logic and coordination, in consideration of later knowledge improvements and scientific developments.

The author discusses problematic logic conflicts he identifies in - and between - the systems relations models of Plato, Descartes, Gödel, Mandelbrot, and Prigogine. He also describes previously unconsidered relations that exist in certain conventional statistics models that are based on too-narrowly defined real physical systems (including previously omitted important constraint conditions), putting into question the mathematics, which math any viable General Theory of Systems must include to be considered valid.

The thesis of this analysis is an extension of the Biological Systems Pathology SIG premise that imperfect mechanisms and irregular systems relations also have to be considered, in expansion from modeling only “healthy functioning” (organic) systems. Logic irregularities and concept deductions based on incomplete information sets are also issues that need to be addressed when composing/achieving a General Theory of Systems, and need to be explicitly considered.

Keywords: Integrity Paradigm; information transforms; open systems; closed systems; incomplete data bases; theory consistencies and coherence.

3552 (3568)

Session: Systems Philosophy

NONLINEAR SYSTEMIC THINKING: SYNERGIC EPISTEMOLOGY

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In the quantum physics that has been studying the essence of existence, the phenomenon of connection between subatomic particle's constituent quarks and gluons is found. However, the interconnected synergistic recognition of rationality, sensibility, understanding, intuition, and imagination, which are components of the human mind, has not been scientifically proven. The environment in which humans are located is a kind of nonlinear system. It is believed that humans can grasp even non - linear systems. In a nonlinear system, the human pure spirit makes the human mind consciousness and makes it comprehensively aware of the objects to know.

Keywords: nonlinear systemic thinking, synergy, epistemology, mind, components of mind

3553 (3593)

Session: Viable System Modelling (VSM)

A VIABLE SYSTEM MODEL FOR MANAGEMENT of THE ECONOMIC GROWTH

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In this paper we present a Viable System Model (VSM) approach in the field of Economics with the purpose of bettering the understanding of this macroeconomic phenomenon. Economic growth has been modelled to test main inputs that explain it, and to understand its behaviour. Most countries seek to increase economic growth because other economic variables improve, for example, the number of jobs increases, wages increase, or poverty decreases. The research first reviews the state-of-the-art, secondly it explains the methodology and the process followed, and finally it presents results. An alternative model to manage and understand economic growth is obtained, contributing to the economic theory.

Keywords: VSM, Soft System Methodology, Economic Growth

3554

Session: Systems Philosophy

HOW ECONOMIC SYSTEMS GROW/EVOLVE

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Paul Romer received the 2018 Nobel Prize in Economics for solving a problem in modern economics. The problem was growth. It was because modern economics is – or at least wanted to be – a science that growth was problematic. Ideally supply and demand were always in a dynamic equilibrium and conservative – a zero-sum game. Minor, unpredictable fluctuations around the equilibrium point due to external (exogenous) factors was considered scientifically respectable. A hurricane might temporarily lower the equilibrium point. An unexpectedly good growing season might temporarily raise the equilibrium point.

However, in the 1800s the equilibrium point was observed to be steadily rising, indicating 'net' economic growth. The measured growth increasingly exceeded what could be accounted for by the classical inputs of land, labor and capital. What could be the cause? Schumpeter identified what became apparent to everyone: "It's the technology." The industrial revolution had launched an acceleration of technological inventions. and yet, since inventions are, by their very nature, unpredictable, they had to be treated, like the weather, as exogenous factors. By the mid-20th century eighty-five percent of growth was attributed to exogenous inventions arriving unpredictably like 'manna from heaven'. The theoretical crisis for scientific economics was that 'net growth' violated the conservative presuppositions defining the scientific framework.

In order to solve the scientific problem of growth Romer made a paradigm shift to a post-scientific understanding of economics. Romer's new framework doesn't reject scientific economics. Rather it subsumes and supersedes the scientific models, understanding them as limited special cases, based on 'useful' idealizations. Romer 1990 ("Endogenous Technological Change") made invention and innovation internal. Non-rival ideas are cumulative, recursively enabling, natural products in Romer's more complete systemic representation of economic activity. Technologies are understood as embodied inventive ideas. Accelerating economic growth results from the discovery of such ideas, from the qualitative emergence of systems engineering knowledge.

Romer's paradigm shift leads to a pragmatist-like participatory Systems Theory of Economics. The economist and the new economic theory itself are now natural products and recursive participants in the learning system. Romer embraces post-scientific uncertainty and bounded indeterminacy. The 'existential' economic actor is both producer-consumer and inquirer – learning-by-doing. Inventions are discoveries requiring genuine empirical exploration and experimentation.

Keywords: economic growth, evolution as growth, Paul Romer, New Growth Economics

3555

Session: Designing Educational Systems

A STUDY ON THE CORRELATION of CROSS CUTTING SYSTEM THROUGH THE ANALYSIS of SUBJECT COMPETENCY IN KOREA SCIENCE INQUIRY EXPERIMENTAL TEXTBOOKS.

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The purpose of this study, in support of the introduction of the Science Inquiry Experiment Course for the first year of high school in accordance with the 2015 revised curriculum for the Republic of Korea, is to

examine the importance of learner-centered experience learning and the significance of experiment, practice, and inquiry in the era of the 4th Industrial Revolution.

To achieve this goal, the present researcher examines how the competencies of each textbook in the science inquiry experiment are distributed. Through this, I will explore the pursuit of the revised curriculum and present materials that will support Korea's science education policy through the overseas science education policy trends as promulgated by UNESCO and the NRC.

The study classifies and analyzes the presentation of seven kinds of scientific inquiry experiment in textbooks in Korea in the context of science education policy and key concepts and contents extracted from prior research papers, statements from governmental agencies and public institutions, notices from academic institutions, and various official and draft documents and reports. In addition, we have analyzed the core goals of the seven crosscutting concepts proposed by the Next Generation Science Standards (NGSS) of the United States by each inquiry activity in each textbook. The underlying purpose throughout has been to help students achieve a deeper understanding of scientific subjects and to more effectively exploit core competencies. The study reaches the following conclusions.

First, in addition to core competencies, Korea's curriculum competency emphasized adequacy of acquaintance with content rather than classroom innovation by learning for capacity building. The number of subject competencies in each textbook is higher than the number of textbook competencies presented in teaching and learning materials.

Second, it shows that the top three subjects of science competency according to seven kinds of science inquiry experiment textbooks in Korea are, in order of their contribution to scientific inquiry, solving ability, thinking ability, and communication ability, emphasizing the element of inquiry ability.

Third, it is the result of analyzing the inquiry activities of each science textbook experiment that incorporates the 'big idea' encompassing several concepts together with the subject competence. In addition, it is the result of analysis of crosscutting between concepts and crosscutting concept connecting boundaries. Among the seven concepts of cross-cutting, we can see that 'measuring the phenomenon of scale, proportion and quantity directly observed' is included in all textbooks only to a large extent. In other words, learners understand the need for variables other than length, size, weight, time, and temperature. In addition, learners themselves explore the importance of the inquiry learning experience on their own thinking about numerical results.

Fourth, as the number of inquiry activities by each textbook in the science inquiry experiment increased, the number of cross cutting concepts increased. These findings suggest the necessity of transforming the system of various inquiry experiment into a coherent connected organizational system rather than simply showing numerical comparison.

In this way learners can, by participating in various experiments and inquiries through the inquiry learning experience fostering a systematic, integrated conceptualization of science that goes beyond the seven traditional fields (physics, chemistry, biology, earth science, etc.), deepen their understanding of natural phenomena in nature and their implementations in technology.

Furthermore, in order to activate classroom teaching of inquiry or experiment, a more coherent science education policy about learner experience is needed that will help policy formulation in the era of the forth industrial revolution.

Keywords: science education, educational policies, crosscutting

3557

Session: Health and Systems Thinking

SYSTEMS SCIENCES IS LIFTING OFF IN CHINA: REPORT of THE 3RD CHINESE SYSTEMS SCIENCES CONFERENCE 2019 ON HEALTH, HUMAN BODY and OTHERS

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The 3rd Chinese Systems Sciences Conference (CSSC) was held in ChangSha, China in 2019. There were more than 1000 participants, 700 papers in 2 days with 18 streams of presentation in the afternoon sessions, including areas of Health, Human body, Traditional Chinese Medicine, Finance, Economics, social networks as complex networks, cybernetics, specific systems theories etc.

Prof QIAN XueSen 錢學森 was the founder of systems sciences in China. He was involved in rocket engine in the US and rocket engine and satellite in China. He strongly believed that the future belongs to systems sciences especially in the field of human body, and the traditional Chinese sciences would play an important part in the development. As a result, the founding of systems sciences faculty was from top-down, starting from the establishment of the Academy of Mathematics and Systems Sciences by the Chinese Academy of Sciences 20 years ago. It followed that other major universities and TCM universities also established or

planning to establish the School of Systems Sciences. Tremendous research initiatives are being carried out all over China and during the CSSC2019, it seemed that almost half of the participants were undergraduates and PhD students reporting their research findings.

Systems Sciences is lifting off in China. While the passion for systems sciences and the effort to obtain beneficial good results for different fields of sciences were obvious, it seemed that their average understanding of systems sciences and systems thinkings are still behind the ISSS. Therefore it provides a great opportunity for experts of ISSS to collaborate with them in research, since CSSC has the financial and human resources (Yin) and ISSS has all the expertise (Yang). By presenting this report, it is hoped that ideas and opinions could be gathered to build bridges (relationships) for this collaboration to happen. As a start, it is good to note that almost 1/3 of the presentations were in the form of papers and presentation slides in English.

Keywords: Chinese Systems Sciences Conference (CSSC)中國系統論大會; Prof QIAN XueSen 錢學森;

3558

Session: Health and Systems Thinking

OUR JOURNEY FROM TRADITIONAL CHINESE MEDICINE TO GENERAL SYSTEMS THEORIES: THE DEVELOPMENT OF INTEGRAL ANCIENT-MODERN EAST-WEST SYSTEMS THINKING

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Traditional Chinese Medicine (TCM) has experienced extreme impact from modern western medicine (WM) in the past 100 years and significant research projects have been carried out in the past few decades. The objective is to rationalize the clinical effectiveness and theoretical soundness and consistency, through the viewpoints and techniques of modern western medicine such as laboratory testing, double-blind experiments, animal experiments, evident-based medicine etc. The positive results have enabled TCM to barely survive in modern society. However, the academic succession of the essence of the original theory, and the subtle experience of aging TCM practitioners, are in danger of decline. Tremendous resources have been deployed into developing a new trend of TCM, but they are mainly in the areas of TCM university training for the acquisition of modern education methods, including compliance standard and tools, TCM students acquiring WM knowledge and research methods, TCM hospitals acquiring new WM diagnosis machines and surgical equipment, operational structure and functions of modern WM hospitals, and TCM practitioners acquiring new WM practice and surgical skills. However, resources deployed into the development of the essence of TCM theory have been extremely small in comparison. The difficulties of development lies not only in the lack of funding and human resources, but also in the incompatibility of the theories between TCM and WM. In ancient times, the theories of TCM were trans-disciplinary, that is, all the ancient fields of science such as philosophy, economics, social science, religion, engineering etc were all based on similar theories. However the replacement by modern western science in China has led to a separation of all these ancient fields of science from one and another, and TCM is one of the few traditional fields that still retains the essence of traditional theories in their daily effective practice.

The attention of TCM practitioners has been drawn to Systems Sciences due to the latter's multi-disciplinary and trans-disciplinary properties. My own information technology engineering background and clinical experience in the healing of my sinusitis and skin allergy, guided me into the study and clinical practice of TCM. Researching TCM from the modern Engineering perspective helped my understanding of TCM in a modern scientific way. However it was not until my fortunate encounter 12 years ago with experts in the International Society for Systems Sciences, and thanks to their enlightenment, that my TCM research has leapt into a new stage. The past few decades of research of TCM has been diverging into different fields reductionistically but the research of modern science has been emerging into similar fields systemically. We feel that it is our responsibility to steer TCM into the field of trans-disciplinary again.

Under the guidance of ISSS, we were able to refine our TCM model in the direction of examining the way the human system works, and also how to diagnose and tune the human body for stability and efficiency. In the process of trying to understand more on the methodology, we have received personal tuitions from professionals of ISSS in understanding Systems of Systems processes, Duality theory, Relational-Theory, Viable Systems Model, DSRP systems, Schemas Theory, and other General Systems Theories. In the research and learning process, we have discovered that all these modern GST are similar to the theories of TCM and other ancient Chinese general theories, in structure and function, as embedded in the teaching of Confucianism, Buddhism, and Taoism. Lately we have even discovered that these similarities also exist in an ancient western theory, namely the Tree of Life theory.

In the research of TCM and WM, we came across the properties and pitfalls of reductionistic thinking. The reductionistic approach to problems is to go far into the left side of the spectrum and employ the findings to represent the whole spectrum. However, spectrum has two sides and any point on it exists only on a relative

basis, but reductionists treat the left side of the findings to be absolute. On the other hand, systems scientists have found that going into the right side of the spectrum would produce many layers of additional emergence effect, which makes the situation more and more complex. Our research has discovered the following spectrums:

microscopic <====> macroscopic
accuracy <====> approximation
white box <====> black box
objective <====> subjective
control/replacement <====> tuning (natural equilibrium)
closed systems <====> open systems

However it would be equally disadvantaged if the findings on the right side of the spectrum is to be employed to represent the whole spectrum or any specific point of the spectrum. The old Chinese saying for such situation is “using the periphery to represent the whole” (以偏概全). That is, when we go to the extreme end of either side, we will reach a dead end where things do not perform as we expected in “our” domain of the real world. For example, quantum mechanics vs general relativity and the light boundary of the universe, or fractals vs fuzzy logic, or the uncertainty principle vs chaos theory.

Our understanding of the properties of General Systems Theory should suffice in describing the building blocks (structure 體) and the formation and operation (function用) of these spectrums, so that problems at any point of these spectrums could be understood and resolved within a range including the same point of the problem. To achieve these properties, we discovered that ancient Chinese employed the theory of Taichi Yin-Yang Five-elements Heaven-Earth-Human theory, Five Aggregates Human-Mind system, while modern GSTs would employ Relational-Theory, DSRP theory, and Schemas Theory that are top-down, and Systems of Systems Process that is bottom-up. Ancient Western systems would employ Tree of Life theory.

The other property of GST should be the applications in the maintenance of existing systems, and the design of new systems. TCM employed the Eight-principles of state diagnosis for human complex system, namely the Yin-Yang, Superficial-Internal, Cold-Hot, and Deficient-Excess spectrums. It also employed the tuning theory to re-balance the human body according to the theory of Confucianism Golden Mean (中庸). This Yin-Yang balancing method seems to have common properties with PID (proportional–integral–derivative) controller. Modern GSTs for systems maintenance would include Viable Systems Model. The GSTs for design would include Schemas Theory, while traditional Chinese employed GuiJu (規矩) of circles and right angles, and FengShui (風水) for architectural constructions of buildings and gardens.

In this paper we would like to share our findings of the integral Ancient-Modern East-West systems thinking, obtained during our learning journey from TCM to GST, hoping to provide a bridge for different GSTs to communicate and exchange ideas in order to enhance understanding between each other. Future work could lead to the discovery of the GST of GSTs.

Keywords: Confucianism Buddhism Taoism and Traditional Chinese Medicine 儒釋道醫; Tree of Life 生命樹; Taichi Yin-Yang Five Elements Trinity 太極陰陽五行天地人系統; TCM Differential Diagnosis-Cure Process 中醫辨證論治; Schemas Theory 基模論; Integral Ancient-Modern East-West Systems Think

3563 (3563)

Session: Designing Educational Systems

NEW INSIGHTS of HORIZONTAL GENE TRANSFER of MICROBIAL RHODOPSINS IN OCEAN

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The genetic evolution of living things studied as a vertical evolution. The creatures that have evolved as pyramids from evolutionary sub-object unit to evolutionary parent entity can now focus on horizontal line evolution. It is a process of adapting and evolving rapidly changing natural environment by introducing an external genome to other genomes through virus as a horizontal gene transfer. This systematic evolution is not merely a flow of vertical evolution, but a more complex system through systematic horizontal evolution, but it is that this complex system evolves one step further.

We investigated this horizontal evolution through the membrane protein microbial rhodopsin. It confirmed with microbial rhodopsin through natural virus transduction through viruses in the ocean, which confirmed through viral genomic DNA extracted from viruses. This study approached the evolutionary system approach through horizontal gene transfer of the virus in the ocean. The results of this study confirmed the genes acquired from other microorganisms in marine viruses, suggesting that they could be introduced into other microorganisms in the future.

Keywords: transmembrane protein, horizontal gene transfer, evolution

3565 (3565)

Session: Systems Engineering and Systems Modelling

INCLUDING GENERATIVE MECHANISMS IN PROJECT SCHEDULING USING HYBRID SIMULATION

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Scheduling is central to the practice of project management and a topic of significant interest for the operations research and management science academic communities. However, a rigour-relevance gap has developed between the research and practice of scheduling that mirrors similar concerns current in management science. Closing this gap requires a more accommodative philosophy that can integrate both hard and soft factors in the construction of project schedules. This paper outlines one interpretation of how this can be achieved through the combination of discrete event simulation for schedule construction and system dynamics for variable resource productivity. An implementation was built in a readily available modelling environment and its scheduling capabilities tested. They compare well with published results for commercial project scheduling packages. The use of system dynamics in schedule construction allows for the inclusion of generative mechanisms, models that describe the process by which some observed phenomenon is produced. They are powerful tools for answering questions about why things happen the way they do, a type of question very relevant to practice

Keywords: project scheduling; hybrid simulation; system dynamics; discrete event simulation; multi-method modelling

3567

Session: Hierarchy Theory

APPRECIATING THE WHOLE PERSON and THEIR APPROACH TO MANAGING COMPLEXITY and COMMUNICATING (SPEAKING, LISTENING, CONVERSING) IN LIFE and WORK: A CONVERSATION TO EXPLORE POSSIBLE IMPLICATIONS and RELATIONSHIPS of and BETWEEN WILLIAM SMITH, APPRECIATION, INFLUENCE, CONTROL MODEL (AIC); STAFFORD BEER, VIABLE SYSTEM MODEL (VSM); and ELLIOTT JACQUES STRATIFIED SYSTEMS THEORY (SST).

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We learn in conversations. This paper invites conversation on, and appreciation of three models of structuring relationships that have been influential frames of reference in my life. By appreciating the whole person we will explore the nature of conversation types that each model implies or represents. The structures we create, or we find ourselves in are discussed as possible boundaries and controls on the way we communicate in life and work.

The possible contribution of these three models and others to the process and content of systems literacy in different contexts will be examined.

Keywords: systems; VSM; SST; AIC; Conversation; whole-person; hierarchy; appreciation; influence; control;

3569

Session: Organisational Transformation and Social Change

DESIGNING ENDURING HUMAN ACTIVITY SYSTEMS

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In the face of rapid technological advancements and changing environments, organizations must seek innovative ways to adapt to such environments. From a systems perspective, organizational change is the transformation of a human activity system within an organization from its current system to an idealized system. This transformation is conditioned by the organization's ability to balance the needs of the conceptual and concrete parts of its systems. In this research, the authors present a proposed methodology that uses the general theory of human activity systems to guide the design of organizational change through the purposeful consideration of an organization's conceptual and concrete parts. This principled application of systems theory facilitates the objective creation and evolution of human activity systems which can be applied broadly to organizations in diverse industries. The application of the proposed methodology is illustrated through a case study with the Division of Finance and Administration at Oregon State University. The case study illustrates how, through the implementation of the methodology, the Division of Finance and Administration at Oregon State University is transforming its social and technical systems to create a more enduring human activity system.

Keywords: Enduring organizations, organizational adaptiveness, process improvement, human activity systems

3570 (3630)

Session: Systems Pathology

CLINICAL SYSTEMICS: TOWARDS AN INTEGRATED FRAMEWORK and METHODOLOGY FOR ALLEVIATING PATHOLOGIES IN COMPLEX SYSTEMS

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Clinical systemics is a framework and methodology induced from Western medicine for the purpose of identifying and treating pathologies in complex living systems. Motivated by climate change and other significant trends in the 21st century, clinical systemics is envisioned as a means of science-based, multidisciplinary collaboration and practice not only in social-ecological systems, but in other natural and artificial living systems as well. This paper will outline the philosophical underpinnings of such a framework and methodology, provide a contextual overview of the systems and complexity science project, and will describe the features of complex living systems, health, pathology, and healing. Building on these ideas, a vision for a clinical systemic framework and methodology will be articulated by drawing on examples from the history of Western medicine. and lastly, benefits and challenges of such a framework and methodology will be identified, followed by a suggested sequence of development and implementation.

Keywords: Climate Change; Clinical Systemics; Interdisciplinary Collaboration; Medicine; Policy Methods; Resilience; Sustainability; Systems Engineering; Systems Isopathology; Systems Literacy; Systems Pathology; Systems Practice; Systems Science

3572

Session: Research Toward a General Theory of Systems

A DISCIPLINE DEVOTED TO NATURE'S PATTERNS? EXPLORING THE "FIELD" QUESTION

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In recent years, rigorous attention has focused on developing a disciplinary activity-knowledge-guidance framework that might enable progress toward a General Systems Theory, i.e., a general theory of systems (GST*). I follow this work in utilizing a unique descriptor (e.g., cybersystemics, systemology) to encompass the field's spectrum: from cybernetics and systems engineering to soft/critical systems and complexity, resilience, and network science. Through a closer examination of the disciplinary field itself, I seek to contribute to this theoretical progress.

Exploring the field requires "describing the subject matter in its natural context." That is, if the disciplinary field is to be characterized as the study of nature's patterns, then the nature of such patterns, the nature of their study, and interrelationships between the two are all critical areas of focus.

I begin by proposing a set of criteria for describing the field of systemology. These include: this description must serve as a standard for evaluating claims of systemic theory and practice, regardless of temporal or cultural context; and it must account for the emergence of schools with widely diverging worldviews: from realism to holism and radical constructivism.

I hope to elicit insights and/or questions about: what we talk about when we talk about systemic patterns, and how we come to draw distinctions among such patterns, across domains of evolutionary existence. This talk revisits my ISSS 2016 (Boulder) offering, "Dynamics as demarcation" (unpublished).

Keywords: patterns; periodic table of dynamics; second-order; realism-constructivism

3574 (3573)

Session: Systems Engineering and Systems Modelling

ASSESSING THE BEHAVIOR of HUMAN ACTIVITY SYSTEMS THROUGH THE OBSERVATION and INTERPRETATION of SOCIOTECHNICAL SIGNS

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The study of communication as a system is largely unexplored in both literature and empirical research, however its role in human activity systems is critical for understanding and adapting organizational behavior. Currently most literature on organizational indicators or signs do not make a connection back to a system of communication or delve into the theoretical virtues of signs as they pertain to the human activity system;

building a message that can be understood by and between analysts of the system under observation. Signs are the most basic elements of communication, indicating properties about the system from which the signs emerge. Signs can be conceptual or concrete in form and provide the means for assessing system behavior. When combined with context, signs become information about the system and the information is used to develop a message and transmit from a sender to one or more receivers regarding the necessity for change. This research shall focus on signs and how they can contribute to change initiatives through their relationship to system behavior. Furthermore, a case study on organizational change will be employed to illustrate the use of signs to indicate whether management is balancing organizational intelligence (thinking) and organizational practices (doing), as indicated by Sir Geoffrey Vickers concept of appreciative systems, in change management initiatives. This research will lay the foundations for system analysts to assess how a perspective system is doing, from the observation and interpretation of its signs, and what needs to change in order for a system to reach its intended goal.

Keywords: Signs; human activity systems; organizational change; communication system; thinking and doing

3575

Session: SABI: Systems Applications in Business and Industry

RAPID PROBLEM STRUCTURING WITH THE BIGPICTURECANVAS – A SIMPLE and EFFICIENT WAY TO IMPROVE SHARED VIEWS of COMPLEX CHALLENGES

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Decision-makers in a VUCA world (an environment of volatility, uncertainty, complexity and ambiguity) face questions such as: Are we addressing the right problem? Do we agree on the relevant parameters and perspectives to address the problem? How can we avoid neglecting critical problem features in times of change? "Problem structuring" has been promoted, among others, by Rosenhead and Mingers (2001), and its value is widely acknowledged in academia. However, the transition to practice involves some challenges, such as how to embed these activities within the busy schedules of companies and governmental settings. Problem structuring must be time-efficient and easy to communicate in order to gain wider adoption across different fields and levels. To achieve this efficiency and ease of communication, a new framework is proposed, called BigPictureCanvas. It is a structured map that provides an overview of critical aspects of a problem space. The framework involves 36 aspects in six large categories, relevant for systemic and interdisciplinary problem-solving. While a traditional and linear approach would be possible, a more agile and iterative approach is suggested. A first iteration of the BigPictureCanvas takes less time than a typical business meeting. Further iterations and elaborations can be done when new events and changes occur. Additional training equips a group to select specific methods that best fit their problems and projects. The BigPictureCanvas has a broad scope, but is still user-friendly; it allows people to look at a problem from many different angles, without being overwhelmed by too much information. It further reduces the risk of blind spots before turning towards solutions. Additionally, it simplifies the comparison of different perspectives of problems and communicating complex projects to a wider audience. The proposed framework is in an early research and development stage and will undergo further improvement. Feedback and critique are welcome.

Keywords: systems thinking, problem solving, problem structuring, visual thinking

3576

Session: Systems Ethics

A RECURSIVE ETHICS FOR SYSTEMIC COMPLEXITY

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Conventional approaches to normative ethics are ill-equipped to cope with systemic complexity. There are various reasons for this, notably the challenges presented by the incommensurable criteria and uncertain boundary conditions that typify systemic contexts. In this paper, I focus on one particular difficulty, the entanglement of the processes of ethical discourse with the situations that it looks to address. In contrast to the way that normative ethics has tended to assume a position outside of the events it considers, a systemic perspective suggests we see ethical deliberation about a situation as also being a part of it. It follows that the manner in which ethics is invoked and debated is itself something to which ethical considerations apply. Consider, for instance, the tendency for contemporary ethical debates to descend into the assertion and counter-assertion of incommensurable first principles, and the conflict and moralization that can follow from this.

It is difficult to address these second-order ethical questions from within conventional frameworks. As normative ethical theories and moral codes are put forward on the basis that they give definitive guidance as to ethically good actions, it is easy to assume that the question of how they are enacted should be thought of primarily in terms of effectiveness. This assumption is undercut by the difficulty of resolving conflicts between ethical frameworks, which is especially the case in systemic contexts.

In response, I put forward a way in which to understand ethics as being recursively applicable to itself. As a starting point, I draw on cybernetics, a field concerned with both ethics and recursive processes. Cybernetics is notable for its recognition of ethical considerations within epistemology. Our claims to knowledge are intertwined with the purposes that we pursue and with our relationships with others and the world. In this paper, I locate this argument within ethical discourse itself, applying it to the epistemological questions that arise within meta-ethics, such as between ethical realism and subjectivism. In this way, cybernetics may help formulate ethical considerations nested within ethical discourse itself.

Keywords: Cybernetics, Ethics, Recursion

3579

Session: Research Toward a General Theory of Systems

TOWARDS PATTERN LITERACY: THE BIO-SEMIOTIC UNDERPINNINGS of 'PATTERNING' and 'LANGUAGING'

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In this paper I examine the biological and bio-semiotic underpinnings of "Patterning" and "Languaging", to explore the nature and "timeless properties" of patterns as signs and their role in the emergence of human cognition and language from an evolutionary perspective.

In particular I examine the process of 'habit taking' and the involvement of patterns in the coordination of unself-conscious action and creative processes, as well as their role in how we represent time-space relations and the 'order' and 'becoming' of things from a systems perspective.

I finally discuss how the development of pattern literacy can help the study of socio-ecological systems and provide a framework for understanding the complexities of the world, while bridging the different ways of perceiving and representing them, in view of designing sustainable socio-technological systems.

This paper is part of my broader research on pattern literacy in support of systems literacy, which is meant to provide insights into patterns and their potential role as mediators across ontological and epistemological divides.

Keywords: complex systems; patterns; pattern language; language; cognition; semiotics; biosemiotics; pattern literacy; systems literacy; systems thinking; systems design; systems inquiry; adaptive modeling

3580

Session: Research Toward a General Theory of Systems

ADVANCES IN THE PROSPECTS FOR REALIZING A SCIENTIFIC GENERAL SYSTEMS THEORY

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During the past few years significant progress has been made towards realizing a scientific general theory of systems that could unify the systems sciences and provide a distinct theoretical foundation of systems engineering. In this presentation, I will review the main elements of these advances and connections between them and related work, and report on efforts to accelerate these developments, integrate them, and leverage the outcomes. In the period since the founding of the ISSS much progress was made in the specialized systems sciences (e.g. complexity theory, fractal theory, game theory, hierarchy theory, automata theory, network theory etc.) but the search for a general theory has mostly produced heuristic principles for what is today called "systems thinking". However, in recent years four significant initiatives have brought specific focus to the challenge of advancing a scientific GST. These keystone projects are:

The INCOSE "Fellows' Initiative on SE and System Definitions" project

The INCOSE "Principles Action Team" project

The ISSS-inspired "General Theory of Design Elegance" project

The INCOSE-inspired "Foundations for Systems Engineering" (F4SE) Project

In this paper I will outline these projects and the advances they delivered or inspired so far, and discuss their plans and promise for future progress.

Keywords: general systems theory, GST, GT*

3581

Session: Systems Philosophy

SYSTEMIC VIRTUES IN NATURAL and ENGINEERED DESIGNS

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Building on the theme of the ISSS 2018 conference, the present authors have been pursuing a project to discover scientific general systems laws, as part of an effort to develop a scientific general theory able to (a) explain the processes driving innovation and optimization in natural systems and (b) support innovation and optimization in complex system design, governance or intervention. The need for such a scientific theory has greatly increased in recent years, because current methods for designing or intervening in complex systems are largely based on heuristics, and these are increasingly inadequate as rising functional, technological and mission complexity take us beyond experience-based best practice scenarios.

Our project was founded on the premise that we might discover scientific general systems laws if we could discover (a) the kinds of qualities that all viable systems have in common and (b) the nature of the causal interdependencies between these qualities. We took as a central hypothesis that (a) what those general systems qualities might be is suggested in the factors that engineers ascribe to designs that are 'good' or 'elegant', e.g. qualities such as robustness, efficiency, effectiveness and minimizing unintended consequences, (b) that the interdependencies between these qualities might be complex but nevertheless subject to discoverable governing trade-off principles, and (c) that viable and sustainable systems are ones that achieve an optimal balance between sets of these qualities while delivering adequate functionality.

Analogously to the notions of moral virtues as qualities good people have (e.g. honesty and kindness) and the theoretical virtues as qualities good theories have (e.g. coherence and predictive power), we introduce the new concept of "systemic virtues" as qualities "good systems" have (e.g. robustness and resilience). Our investigation suggested that (as for other kinds of virtues) the 'systemic virtues' do not form a hierarchy but have complex interdependencies. Our investigation of the nature and interdependencies of the systemic virtues is still ongoing, but we can already foresee opportunities for discovering general systems laws from this. In our presentation we will discuss our progress to date, outline our strategy for future work and indicate how the envisaged laws and theory might yield value.

Keywords: design elegance, GST

3582

Session: Designing Educational Systems

TEACHING PATTERN LITERACY THROUGH CREATIVE and EXPRESSIVE WAYS of KNOWING

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"The earth which is spread out like a map around me is but the lining of my inmost soul exposed."

(Henry David Thoreau)

Creative and expressive ways of knowing can help deepen learners' whole-person understanding of pattern literacy.

Transformative Learning research conducted over the last 50 years has confirmed that engaging learners of all ages in creative and expressive ways of knowing can deepen their capacity for cognitive-rational meaning-making of complex issues. Expressive ways of knowing include a wide range of modalities, including storytelling, poetry, performance arts, visual arts, creative movement, as well as reflective and mindfulness practices that deepen participants' relationships with nature's relational patterns.

Drawing on John Heron's pyramid of multiple ways of knowing, Fritjof Capra's summary of principles of living systems, as well as other contemporary transformative learning and living systems scholars, the author has developed a framework for designing learning content, process, and structures in ways that mimic nature's patterns throughout the learning experience.

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 expression, 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 nature's pattern language, the author proposes that 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.

During this presentation, the author will introduce her integrative pattern literacy framework and then offer specific experiential ways of teaching pattern literacy (for both face-to-face and online formats) and share experiences from students who have participated in the author's pattern literacy coursework. Conference participants will then be invited to briefly try out an experiential pattern literacy exercise during the session.

Keywords: pattern literacy; educational systems design; multiple ways of knowing; expressive ways of knowing; living systems principles; sustainability education

3583

Session: Socio-Ecological Systems and Design

GOAL 14: THE CINDERELLA of THE MILLENNIUM GOALS

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In September 2015 the Member States of the United Nations adopted a new universal agenda for sustainable development. The 17th Development Sustainable Goal (SDGs) is about how to strengthen global partnerships to support and achieve the ambitious targets of the 2030 Agenda, bringing together national governments, the international community, civil society, the private sector, and other actors. So, the other SDGs can see as an integrated, systemic net as their basic framework. There are studies of interrelationships among targets, and it possible to observe that the SDG 14 ("Conserve and sustainably use the oceans, seas and marine resources for sustainable development") appears that their realization will be impacted by many factors, both within and outside the "ocean sphere".

The ocean is the largest ecosystem on this planet, regulating change and variability in the climate system and supporting the global economy, nutrition, health and wellbeing, water supply and energy. Most of the world population live in the coastal zone; dependency on the ecosystem services provided by the ocean is likely to increase with population growth. The ocean is not a vast and indefinitely resilient compartment of the Earth system, able to absorb practically all pressures of the human population, from resource exploitation to fisheries and aquaculture development to marine transport. The human civilization is running out of time to avoid the detrimental cycle of decline in ocean health that will have dramatic repercussions on the ability of the ocean to keep providing the support all of us need.

To achieve global sustainability and adequate stewardship of the ocean, ocean science is crucial to understand and monitor the ocean, predict its health status and support decision-making, but is not enough. We need a systemic view, integrating the "other" sciences, and other dimensions of our knowledge and feelings. Taking these factors into account is going to be critical in devising strategies to progress on all these targets and on SDG 14 more generally.

In the last three years, some of the Member States submitted its voluntary national review (VNR) reports to the United Nations, on an annual basis. This year, 51 countries will present their VNRs, ten of whom will present their second VNR. The purpose of that is to promote accountability to citizens, support effective international cooperation and foster exchange of best practice and mutual learning. Especially for Small Island Developing States, coping with climate change impacts, exacerbated because of their small geographic area, isolation, and exposure. The associated development challenges from sea-level rise, altered rainfall patterns, and storm-surges threaten to reverse progress made towards the Millennium Development Goals now and in the future. But when we read the VNRs, the SDG 14 don't appear as we expected

Keywords: ocean, Sustainable Development Goals, Voluntary National Reviews

3584

Session: Socio-Ecological Systems and Design

COMMUNICATING FOR SUSTAINABILITY

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Planet earth is a whole system but human beings are finding it difficult to see how their collective activity is changing their environment in ways that will threaten their way of life and perhaps their survival. The current situation is characterized by vicious circles (runaway positive feedback loops) that make short term financial incentives take precedence over the long-term viability of the whole system which includes many non-financial parameters. Many people are confused by both the complexity of the situation and by deliberate misinformation campaigns to protect the status quo.

One set of cybernetic concepts has to do with communication including the relationship between information and noise, the channel capacity of both senders and receivers and the filters and transducers through which messages must pass. Communicating effectively with the public requires understanding and using these

concepts. Even without deliberate deception, which certainly is a factor, too much information, too tentative conclusions, too technical arguments and too little context make it likely that the information, even if correct, will be perceived as noise. Information travelling across a boundary from one perspective to another requires translation (or transduction) so that what is received is what the sender wants to say. Translating from one natural language to another is well understood but translating from one audience or discipline to another is often as difficult.

Another set of concepts has to do with scale. It is often not easy to see incremental change, action happening at the macro or micro level and effects at a distance in time or space. One natural example of this is when a species migratory time scale or temperature changes result in a mismatch with its usual food source.

The concept of homeostasis is about balance and keeping essential variables within acceptable limits. Much of what passes for public debate does not take into account balance as a standard to be adhered to rather than a battle for supremacy and one factor dominating all the. "Checks and balances" should lead to collaboration and compromise not gridlock and obstruction but that seems to be the case today.

Many models and descriptions of environmental issues do not take into account that different observers with different perspectives and priorities will see very different choices. While avoiding an 'anything goes' position is not helpful, it is also unhelpful to dismiss the viewpoints of others – especially if those viewpoints come from a different worldview or culture.

What many of these concepts come down to is the notion of requisite variety. No model of a system can exert control over it unless it can command at least as much variety as the system can deploy. That includes means to take note of red flags, emerging threats and opportunities for adaptation to evolving situations.

Human beings are embedded in social systems from the family and workplace to the nation or region. Their concerns about the wider world may be constrained by immediate threats to the security of their person, their property or their livelihood. It should be noted that the traditional relationship between employee and employer often does not apply leading to high levels of uncertainty and instability. Addressing environmental concerns without regard to social justice or our common stake in a livable planet will be an almost impossible task.

Keywords: cybernetics, sustainability

3586

Session: Systems Philosophy

TOWARDS A PHILOSOPHY of LANGUAGE and MACHINE LEARNING

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This paper explores philosophical precedents for categorization, and the need for continuing to develop next generation philosophic inquiry attuned to machine learning. By initially focusing on the development of late 20th century philosophy of language, I engage precursors that can be understood to act as core frameworks for the information society.

To begin, I bring forward the work of Mark Johnson and George Lakoff in cognitive linguistics and natural language categorization. By focusing on language, an outline of these development lays a solid groundwork including: conceptual metaphor, prototype theory, conceptual blending, and mental space. Specifically, the concept of radial category analysis as employed as a methodology in the philosophy of language is interrogated. This is where a central member category is created and spokes off of the center to elucidate various meaning structures of the central category (or "prototype," which then provides capacities for categorization of terms). These are then put into relationship with other categories as conceptual blends (including single, double, and multiple scope blends). Gilles Fauconnier and Mark Turner elaborated that

In Single-Scopes, the organizing frames of the inputs are different, and the blend inherits only one of those frames. In Double-Scopes, essential frame and identity properties are brought in from both inputs. Double-Scope Blending can resolve clashes between inputs that differ fundamentally in content and topology. ...

The main types of networks just mentioned are actually prototypes along a continuum ...

These components of are also part of second-generation cognitive sciences and have significant implications for not only for an embodied philosophy of language, but also for the emerging paradigm of machine learning.

Now consider network theory through a similar lens, where "nodes" and "edges" (links) of the (network) graph help to visualize the (possible) outputs of data-based techniques of machine learning. From methods of data processing, formatting, statistical, network analysis and clustering, there are now ever-increasing possibilities for applying "prediction" to networks of all kinds.

In surprisingly similar ways as radial category analysis, these new cluster classification methods are increasing the capacity, speed, and access of categorization. The implications of these emerging solutions from clustering techniques driven by ever-increasing data repositories, networks, and streams are also retrieving age-old problematics. These approaches are implemented through computational technologies that sort, recognize, and learn patterns in “big data.” These can include concept creation (blending), gene expression analysis (bioinformatics), social media network analysis, fraud-detection, and revealing relationships between economic and environmental dynamics (ecology).

Selmer Bringsjord and Naveen Sundar Govindarajulu note “[P]hilosophy is the place to turn to for robust formalisms to model human propositional attitudes in machine terms.” Similarly, philosophy requires (epistemological) inquiry that can account for extensions to the philosophy of language by machine learning. In conclusion, the methods of cognitive linguistics and its precedents for categorization may give greater context to the scope and scale of these endeavours, possibilities for (embodied) just-in-time pattern recognition, and acknowledging the importance of (experientialist) ethics, aesthetics, and meaning-making in the 21st century.

Keywords: philosophy, systems philosophy, embodied metaphor, philosophy of language, machine learning

3590

Session: Action Research

USING INFORMATION TO EMPOWER REFUGEES: POPULAR MASLOW VS PROPER MASLOW

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Most academics know the popular version of the needs hierarchy developed by Maslow in 1943. The hierarchy is part of many courses at universities. However, when the popular account of this work is compared with the original work, from a critical systems perspective, it is clear that the popular account provides only one perspective to the work of Maslow. Maslow starts his paper with assumptions developed from previous work. After an explanation of the needs hierarchy, which is the basis of the popular account, he delves deeper into the motivation of different individuals for need satisfaction. Amongst others, he describes freedom as a precondition for need satisfaction in a discussion on the relationship between “means” and “ends”. He also discusses the relationship between information and meaning in relation to our motivation for action.

This original work of Maslow is most helpful in understanding the position of the refugees from Syria in the Netherlands. Not only does the hierarchy of needs follow the progression of the refugees from a state of emergency to residents in the Netherlands, but the original commentary provided by Maslow is useful to guide intervention. In this paper, reflection is provided on the situation of the refugees based on data collected using interviews and focus groups with refugees and other stakeholders. The aim of the empirical work is to provide insights in the logistical situation of the refugees. This intervention is part of a project funded by the Netherlands Society for Scientific Research into modelling logistical solutions for the refugee environment.

Maslow is reviewed in this paper from a critical systems perspective. The assumptions made by his model are stated and his work is compared with the popular account thereof. It is shown how insights are developed from the unknown section of the work. These insights would not have developed from the popular version, and when implemented may have a significant impact on our understanding of the life world of the refugees.

Keywords: Maslow's theory of needs, critical systems, refugee crisis, action research

3591

Session: Designing Educational Systems

DEFINING and MEASURING THE SYSTEMS THINKING LEARNING PROCESS FOR NON-EXPERTS

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The integration of systems thinking concepts into general educational contexts, let alone the greater society, is a grand challenge for the systems thinking community. The value of systems thinking as a powerful holistic approach to thinking about and solving problems is unquestionable. Thus, it is imperative for the systems thinking community to find ways to expand the use of systems thinking beyond select educational settings. In doing so, this will equip every person with, at least the basic, systems thinking skills necessary to understand and manage the ever-changing and complex world around us. This is the systems literacy vision held by many in this community. However, the reality is that those who routinely make complex and critical decisions rely on reductionist problem-solving approaches, often leading to unintended and undesirable

outcomes. This all-to-common approach to thinking about and solving problems can be enhanced if the systems thinking community helps foster the use of holistic approaches among all thinkers, problem-solvers, and decision-makers. However, the barrier to entry for systems education across society is too steep. Lowering this barrier for all people is critical if systems education is to have any chance of permeating beyond the select few experts and their immediate sphere of influence. Thus, the need to increase the number of people (non-experts) who possess at least systemic sensibility (a general awareness of systems), and who can teach other people about systems thinking, is paramount when designing educational systems. To address this need, three teams of industrial engineering undergraduate students at Oregon State University (OSU) have developed eight educational lessons on different systems thinking concepts for a Capstone senior design course project over the last three years. The lessons have been developed in collaboration with the Science and Math Investigative Learning Experiences (SMILE) Program at OSU. SMILE engages underrepresented and underserved middle and high school students in rural communities across the state of Oregon with STEM curriculum in after-school clubs. A lesson development framework composed of systemic methodologies (to ensure the lessons yield a learning process) and systemic perspectives (to focus that learning process) created by the authors, conceptualizes the lesson development methodology employed by these teams. Although this methodology has been successful for developing systems thinking lessons by and for non-experts, current work is focused on defining and measuring the systems thinking learning process. Understanding this learning process is critical to ensure that each lesson meets the intended systemic sensibility outcomes and creates the necessary foundation for systems literacy to grow. The authors hypothesize that teaching students about distinctions, relationships, and perspectives (three basic systems thinking concepts, or skills) will achieve those systemic sensibility outcomes. Data was collected from an experiment with almost 150 middle and high school students participating in a SMILE Program activity. During the activity, students were asked to draw elements (for distinctions), interactions (for relationships), and roles/purposes (for perspectives) present in a fish tank system. After teaching students about the three concepts, students were asked to re-draw their fish tank system in order to determine whether learning these concepts made any difference in the quality and quantity of elements, interactions, and roles/purposes that students drew. The ongoing analysis and results from this experiment, and how those results will be used to define and measure the systems thinking learning process, will be presented to inform future work by the systems thinking community that strives toward building a systems-literate society.

Keywords: Systems Thinking; Systems Literacy; Systems Education; Human-Activity Systems

3592

Session: Viable System Modelling (VSM)

INNOVATIVENESS of THE JUDICIARY POWER. A CASE STUDY USING THE VIABLE SYSTEM MODEL (VSM)

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For several years, the use of technology, open data and customer focus as innovation engines has been imposed worldwide. and the Judiciary Power as a key player in the system of administration of justice of the Argentine Republic do not escape this tendency. As a consequence of this, it has implemented innovative processes in order to reduce their management times, improve the user-citizen experience and bring transparency to the process. Never the less, in Argentina these innovations are rare exceptions. In this paper the case of the "Judiciary Power of Tucumán Province" will be use as a leading case for its high level of innovativeness during the last ten years. The main objective of this paper is to model using Beer's Viable System Model approach the system in which this case is embedded, discuss and determine whether the system is a viable one or not, and compare the findings with the theoretical framework associated with the "new public management".

Keywords: VSM, judiciary power, systems, innovativeness

3597

Session: Relational Science

ON CONSTRUCTING STRUCTURE FROM FINITE DISCRETE TIME SERIES

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Context: An interesting and heretofore insufficiently explored system theoretic problem relates to the modeling and characterization of discrete time processes whose states take values in a finite set of unknown structure and size. In black-box settings, the generation of dynamical hypotheses depends crucially on the

observer's ability to draw distinctions among the states of the process by defining (in the most general case) equivalence relations on the observable part of the process state space. In the absence of a priori defined structures (such as measure theoretic or topological) on the state space, the construction of equivalence classes can only be done based on the distributional properties of the time series generated by the process (of which only a finite subset is assumed to be available to the observer).

Problem: The basic problem considered in this paper is that of identifying and quantifying the parameters of a finite discrete time series that enable an observer to draw distinctions and construct algebraic structures over the set of states, where none are given in advance.

Approach: In a black-box setting, it is possible to reframe questions about structure as questions about the relative importance of order in the time domain, which can be addressed by examining how automorphisms of the time domain act on the time series. Of particular interest in this regard is the subgroup of time domain permutations which preserve the equivalence relation induced on the time domain by the time series itself.

Result: State variety as measured by the index of the subgroup of state-preserving permutations of the time domain (a quantity which is closely related to information-theoretic entropy) cannot function as a measure of potentially constructible structure in a black box environment. On the other hand, a useful but not entirely satisfactory measure can be defined based on the index of the subgroup of permutations of the time domain which preserve the equivalence relation induced by the time series. This measure peaks for distributions that generate the greatest number of equivalence relations on the time domain for a given time series length and reaches zero at total similarity and total difference, but it does not distinguish among trivially and non-trivially organized time series.

Implications: The combinatorial measure of structure proposed here may be relevant for the modeling of processes that derive structure from a flow of events, with potential applicability in systemic modeling and cognitive science; it offers a path toward the definition of more sophisticated measures of potentially constructible structure.

Keywords: black box, time series, structure, information, entropy, complexity, cybernetic modeling, structure detection

3599

Session: Designing Educational Systems

SYSTEMS PROCESSES FOR INDIVIDUAL CONSCIOUSNESS and SOCIAL REVOLUTION

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Systems processes have become part of our vocabulary: We network. We draw boundaries. We bond with others. We experience chaos. We observe how things hit tipping points. Meanwhile, religions, philosophies, economic policies, and political ideologies divide us. Reframe experiences of love, higher consciousness, and wisdom in terms of flows, boundary conditions, bonding, and development and what is otherwise metaphorical and abstract becomes easily and universally understood. In this framework, all actions are ethical actions -- the flows of information, resources, and energy toward the well-being of human and natural systems. "Well-being" becomes a matter of design, and as such universally understandable, measurable and auditable. Divisive political thinking -- capitalism vs socialism, conservatism vs. socialism -- is re-articulated into values that contribute to the diverse perspectives required for defining and evolving quality design. Thanks to technology and the demands of rapid social change, learning is continual and in real time, requiring new systems for tracking and verifying diverse and unique forms of expertise. The transition is chaotic but evidence for the emergence of a new social order is increasing. Our language shows that we are only a few unifying ideas away from social evolution.

Keywords: systems processes; education systems; social system design; religion; economics; politics; ethics; systems processes

3606

Session: Systems Engineering and Systems Modelling

IMAGINING 'DO NO HARM' MALPRACTICE AVOIDANCE IN FUTURE SYSTEMS ENGINEERING

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The IEEE Global Initiative on Ethics of Autonomous and Intelligent Systems has a mission "To ensure every stakeholder involved in the design and development of autonomous and intelligent systems is educated, trained, and empowered to prioritize ethical considerations so that these technologies are advanced for the benefit of humanity." One way to identify meaningful and measurable criteria for these aspirations is to imagine conditions under which systems engineers might be held liable for failure to foresee harm. What

standard of care for 'Do No Harm' systems engineering might become the norm for the profession in the future?

Keywords: AI

3607

Session: Systems Pathology

DIAGNOSING FAILURES IN COMPLEX ENGINEERED SYSTEMS

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All living things malfunction or fail to varying degrees and the study of this failure, commonly known as pathology, dates to antiquity. Pathology in the medical field has been studied extensively, resulting in thousands of diseases or failures identified and categorized. The pathology knowledge base enables physicians or pathologists to diagnose diseases in an organism sooner rather than later. This approach usually allows for a better prognosis and recovery for the patient or a living system. If living systems are used as an analogy with complex engineered systems, a similar approach has been proposed for diagnosing failures or Systems Architecture Diseases (SADS) in complex engineered systems. This study reviews several case studies dealing with failures in complex engineered systems, including the Ariane 5, Demonstration of Autonomous Rendezvous Technology (DART) and the Mars Climate Orbiter, to determine the extent to which systems pathology can be practically applied in understanding these failures. For this study, case studies were analyzed, and their failures categorized based upon the current SADS. Failures that were unable to be classified with the current SADS are included in new SADS proposed because of this study

Keywords: Systems pathology; systems architecture diseases (SADS); complex engineered systems

3608

Session: Systems Pathology

RECURRING DYSFUNCTIONS IN COMPLEX SYSTEMS

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This talk and paper will present lists of recurring systems problems, dysfunctions, or pathologies found in natural and engineered systems. It will begin by citing the several reasons that the production of lists in several professions, for example, captaining ships, surgery, and piloting airplanes, has proven to reduce failures of complex systems and the human operation, design, or production of such systems. It will note that many such lists already have been assembled; but that there is a strong need for the diverse lists, produced by systems thinkers, systems scientists and systems engineers to become aware of each other and integrated. Because of the immense costs of such recurring failures, society could save a great deal of money and lives by avoiding the failures witnessed and documented in the past. Also that the problems are observed to occur and reoccur is an indication that there is something at the causal level of understanding systems that results in their repetitive occurrence. But these savings will be dependent on scrutinizing the current listings and finding similarities to reduce the list of redundancies. We will present 138 failure cases in systems engineering, 45 in the general systems fields, and 83 where the list-makers have tried to relate the systems failures to their fundamental systems causes. This produces a grand total of nearly 300 recurring problems to examine. The talk will end with suggestion of several institutional and organizational responses to the potential of this approach to systems pathologies.

Keywords: Systems pathology; recurring dysfunctions; systems architecture diseases (SADS); complex engineered systems

3609

Session: Systems Pathology

FROM SPT-ISOMORPHIC SYSTEMS PROCESSES TO SPECIFIC DISEASES IN A CLASS of SYSTEMS-LEVEL PATHOLOGIES: UPDATE ON ISSP FOUNDATION

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This talk and paper will present two separate but related items. First, it will describe how one can use the knowledge base of Systems Processes Theory and its definition of the steps in universal processes like feedback to predict the fundamental causes of many systems dysfunctions. It will emphasize how

recognizing and naming the dysfunctions is so important to diminishing the probability of doing the same mistakes over and over. It will also suggest how some of those specific dysfunctions in an isomorphic systems process can be remedied or fixed in ailing systems. Secondly, it will present a list of the accomplishments of the Systems Pathology SIG in starting a new professional society entitled the ISSP, International Society for Systems Pathology, citing the goals and objectives of the society, its By-Laws, establishing financing, its resources on the new topic, its establishment of an IBO (International Business Office) and its strategies for attracting new members. A series of slides will show plans for publications (Annual Review; Bulletins; Journal; and Proceedings). It will provide details on the reasoning for recognizing some 25 different and currently isolated domains and how they can learn from each other by identifying and promoting a universal integration, unification, and synthesis of Systems Pathology.

Keywords: ISSP, Int'l Society for Systems Pathology, SPT, Systems Processes Theory, Systems Pathology; systems architecture diseases (SADS); complex engineered systems

3611

Session: Organisational Transformation and Social Change

A SYSTEMS-ORIENTED APPROACH TO PLANNING and EVALUATING A PUBLIC HEALTH LAB CAPACITY BUILDING INTERVENTION USING A SOCIAL NETWORK PERSPECTIVE TO HIGHLIGHT PATTERNS of INTERACTION IN ORGANIZATIONAL RELATIONSHIPS

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Capacity building intervention activities are typically aimed at improving technical capabilities, employing changes in individual knowledge and skill as a way to increase the performance of some task. However, in public health systems, individual tasks are often interconnected across institutional processes, with shared coordination, management, and regulation of tasks across organizations. As a result, tasks can function as part of larger networks of cross-organizational processes, which must be leveraged to enable system-level change effects.

Rather than focusing on technical skill development, this program illustrates the importance of leadership development to enhance collaboration and coordination among organizations and institutions to strengthen entire networks. Exchanges within and across organizations, institutions, and even governments highlight the relational aspects of systems to promote better outcomes through increased capacity by focusing on activities that enhance partnerships, where there are or should be shared activities, resources and engagement.

In this program the system of interest is a network of cross-organizational processes with shared interest in outcomes. Therefore, this program leverages process-based relationships to enable organizational development beyond technical capacity building to expand the opportunity for institutional partnerships that foster networks and growth in regional capacity.

This presentation explores the use of social network analysis (SNA) as a pilot method to guide a biologic threat reduction program. A SNA is used during program planning, implementation, and evaluation to discover patterns in relationships in order to strengthen Bio-safety and security (BS&S) and Biosurveillance (BSV) networks within an established biologic threat reduction forum. Through a series of workshops and ministerial meetings, a systems approach will be used to explore cross-organizational relationships in understanding common risks, identifying mutually established goals, and encouraging regional collaboration and coordination using an organizational capacity driven approach. The efforts aim to leverage organizational change and institutional relationship building through targeted leadership capacity development.

The result of this pilot method is a systems-oriented approach to planning for and evaluating capacity building interventions using a social network perspective to uncover patterns in organizational relationships. Network characteristics are used to identify areas for leadership development. Program outcomes to be explored will measure cross border interaction and multi-lateral sharing of BS&S and BSV practices within and between participating nations and their relevant Ministries and sub-organizations. This presentation highlights key black box issues surrounding levels of capacity development and the hierarchical relationships within and across networks that can be leveraged through leadership development. Key linkages within BS&S and BSV networks are explicitly reflected upon to highlight levers in organizational leadership to be explored in relation to program outcomes.

Keywords: Systems thinking, Organizational change, Leadership development, Social network analysis, Public health

3615

Session: Systems Engineering and Systems Modelling

THE PURPOSEFUL HUMAN ACTIVITY SYSTEM DEFINED THROUGH PRINCIPLES

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All organizations are purposeful human activity systems that depend on varying degrees of specialized technical knowledge to fulfill their main purpose. However, as yet there is not enough specialized technical knowledge that can assist us with designing and managing purposeful human activity systems as such. In this presentation, we revisit work proposed at CSER where we proposed a purposeful human activity system model and a set of principles to guide the design and evolution of human activity systems. The significance of this development for systems science and systems thinking is that attention is brought to the critical need to develop scientifically derived methods to design robust purposeful human activity systems.

Keywords: purposeful human activity systems, systems principles

3616

Session: Systems Engineering and Systems Modelling

ENGINEERING ENDURING SYSTEMIC CHANGE IN ORGANIZATIONS: USING PRINCIPLES AS ACTIVITY DRIVERS

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Initiation and ultimate achievement of cultural change is a critical component for success in any modern organizations. However, there is a lack for methods that are general and that provide a sound theoretical framework to guide organizations. Another obstacle is found in the scope, cost, and time needed to design and realize complex organizational systems. 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.

Keywords: principles as activity drivers, purposeful human activity systems

3618

Session: Viable System Modelling (VSM)

BRAZIL'S PATH TO A HEALTHIER GLOBAL FUTURE: COMMUNITY CLINIC HEALTH SYSTEMS

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Introduction

Welcome to Brazil's Health Care Challenges

Strategic Overview

I. Think like a Chinese Peasant Foot Doctor

II. The Brazilian Health System

III. Stafford Beer talks in a London Health Center about Patient Information Transformation

IV. VSM Standard for Health Care by Clare Strawn

V. Brazilian Health VSM Fourteen Layer Analysis 1.0

VSM1 of conception of Brazil's health (including voodoo, African, primitive, native, evangelical Christian)

VSM2 of Brazil's health: Organized Happy Society

VSM3 of Brazil's health care system resources: Organizing the system

VSM State Level Health Care (Sao Paulo): Guarantee access to complex levels of care

VSM Basic Care Clinic (Basic Health Unit): Promote physical, mental and social well-being
VSM4A of Brazil's unified health system (Sistema Unico de Saude): healthy populations and individuals
VSM4B Brazilian Private Health System: Healthy Individuals and Profit
VSM5 is in a particular State of Brazil: Sao Paulo: Guarantee Specialists Consultations
VSM6 is the municipality's total health resources: Guarantee Primary Care Full Coverage
VSM7 is the health service delivery area of the particular program: AIDS
VSM8 is the particular program: AIDS: Universal Access and Empowerment
VSM9 is the clinic: Healthy and happy population
VSM10 is the Health Family Team: population full coverage: physical, mental, social
VSM11 is the interaction with a particular patient.

VI. Information Systems: Program Evaluation-Research-Administration

Office of Epidemiological Accountability: Actuality/Capability/Potentiality: Measuring Health Care Impacts

VII. VSM analysis for improving the Quality of Care in Sub-Standard Brazil and the UK

VIII. VSM analysis for Complete Re-Organization in Chaotic China and USA/California

Transforming the California Health Care Delivery System

China's Future Challenges

IX. Conclusion Redirecting Health Care towards Natural Reality

In this paper, we present two versions of the health care delivery system today, comparing them to an ideal standard, using Stafford Beer's Viable System Model: the current sub-standard model which pays lip service to universal care such as Brazil and the United Kingdom, and the non-system model of the California/USA and China, which do not even think about universal coverage, so they necessitate complete institutional transformation.

The ideal standard focuses on shifting resources to community clinics while using hospitals as back-up rather than entry point, community health teams with specialty support, a dynamic responsive health education program, sustained financial commitment of 10% of a nation/state/municipality's GDP, an efficient daily information system that holds health professionals accountable, and ongoing public dialogue about the management of the health care delivery system at the national, state, municipal and community levels. A goal to Establish an Office of Epidemiological Accountability to implement a VSM analysis at all levels of the health care delivery system, and establish daily accountability.

Keywords: Viable Systems Model, health, accountability

3636

Session: Systems Engineering and Systems Modelling

PROPOSED TEAM CONCEPT NETWORK: A SYSTEMIC APPROACH

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Teams are systems consisting of elements, purposes, boundaries and sets of relationships, aiming to achieve a set of team purposes through internal and external interactions. However, teams are rarely considered as complex systems by disciplines and are often studied in isolation. As a result, there is lack of congruency in how teams are defined and studied in different disciplines. The lack of consensus in team research proposed various team models that are only applicable under specific contexts. Therefore, practitioners face challenges to adopt proper team models for team assessment in complex real-world scenario. The integration of current team research is needed to address issues in application and suggest a cohesive understanding of teams for future team research.

In this presentation, the authors propose a framework to organize existing team research by applying system principles to study teams as human activity systems. Different perspectives of team research are studied to propose integrated team concepts with the support of General Inquiry Framework. In the end, the team concept network is constructed with the consideration of multiple disciplines, deriving essential team concepts for a general understanding of teams using the systemic perspective. This study aims to create consensus in team research to provide a theoretical foundation that suggests a systemic approach for future team research.

Poster Abstracts

3508

Session: POSTER

MICROSTRIP PATCH ANTENNA FOR WIDEBAND WIRELESS WEARABLE SYSTEMS

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A microstrip patch antenna for 5.6 GHz wireless wearable systems is presented. Cotton substrate with 3 mm of high and 1.5 of relative permittivity has been considered for the patch antenna. The available band reached by the patch antenna is 1.12 GHz, from 5.24 GHz to 6.36 GHz. The antenna has an omnidirectional radiation pattern.

Keywords: Patch antenna, wearable systems, wireless systems

3509

Session: POSTER

MICROSTRIP PATCH ANTENNA ARRAY WITH LMS ADAPTIVE ALGORITHM FOR 2.4 GHZ WIRELESS COMMUNICATION SYSTEMS

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The design and simulation of microstrip patch antenna array with Least Mean Square (LMS) adaptive algorithm is presented. The antenna design is oriented for 2.4 GHz wireless communication system. LMS is a gradient based algorithm that was studied recently to adaptively track incident signals from satellites and its application on wireless communication systems. This adaptive technique is based on minimization of mean-square error of the LMS algorithm. The calculated variable weights are introduced in order to automatically steer the main beam to a desired direction and reject interfering signals from specific directions. The LMS algorithm is used to obtain the corresponding weights for the element planar microstrip array designed for the operation frequency of 2.4 GHz. The desired signal direction is set to 30° with an interfering signal at -20°, both on H-Plane radiation.

Keywords: Microstrip patch antenna, planar microstrip array, LMS adaptive algorithm and 2.4 GHz wireless communication systems

3559

Session: POSTER

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 tripart 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 $i\pm 1$ 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 $i\pm 1$ 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

3560

Session: POSTER

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, Health 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,

3561

Session: POSTER

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 Four Noble Truths guided especially by the Right View and Right Thought in the Eight-Fold Noble 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 Noble Truth, Eight-Fold Noble Path , Spiritual Healthcare, Spirituality and Systems Science

3577

Session: POSTER

DATA STANDARDS FOR COMPUTATIONAL ECOLOGY: CONSTRAINING SOFT SUB-SYSTEMS TO INCREASE INTERNAL COMPLEXITY FOR COMMUNITY RESILIENCE

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The Creative Systemic Research Platform at the Design and Innovation College of Tongji University in Shanghai focuses on facilitating learning of a diverse set of organizations, researching on the quality of interactions occurring among different agents, both human and non, and their context. A major communication channel available today employs sensors to observe otherwise invisible conditions of the environment, enabling a detailed understanding of how patterns of interactions among biological elements influence the global conditions. To address some of the most urgent need resulting from urbanization, industrialization and globalization processes, in 2018 we started working on computational ecology to support agricultural practices delivering self-organization capacity in diverse human settlements. The complex web of interactions occurring in such a context calls for a rich qualitative analysis of its conditions. To start building knowledge models that fit diverse range of human agents, a case-study methodology is employed. Boundaries have been set to describe the diversity of the analysed contexts, ranging from urban indoor greenhouses to agro-forestry management, working on the edges of these systems to address functional clustering and distribution. The first case study reflects a semi-controlled environment to constrain the space and time of natural cycles of vegetation and water and the number of observable interactions as preconditions for a university class of Design Students to interact with an indoor greenhouse. This process led to work on the development of data standards for collection and integration protocols to embed qualitative observation. Ontological constraints in computational agriculture as a sub-system of living communities is key element to enable access to self-monitoring practice into farm management, distributing learning and adaptation capacity as basis for autonomous, ecologically fitting human settlements ready to address internal transformations.

Keywords: ecosystems, social systems, soft systems, computational ecology

3612

Session: POSTER

ISSS SPECIAL INTEGRATION GROUPS: VIDEO MEETINGS 2018-2019

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ISSS is currently organized into Special Integration Groups (SIGs) to explore the multiple perspectives of systemics. SIGs are formed from the collective interests of ISSS members and represent the dynamics of creative exploration and philosophical/scientific integration that is at the core of ISSS work.

SIG Activity over the past few years has largely been confined to serving as organizers for the presentation tracks at the annual meeting. Most SIGs did not meet between the annual meetings. Furthermore there was no explicit process to encourage integration between SIGs in support of the ISSS mission.

As incoming President of ISSS for 2018-2019 I was interested to learn more about each SIG and to explore how integration might occur in support of the ISSS mission.

A regular Saturday session of one hour online in a video conference using the Bluejeans Platform was started in December 2018. Each SIG was the focus of a conversation on one Saturday.

Topics emerged during the SIG conversations and extra topics were inserted on Saturdays when SIG chairs could not be present. These include vision for systems science, mapping relations between SIGs in support of ISSS mission and Systems Literacy update.

Over 75 people participated in the Saturday Sessions from 1 December 2018 – 15 June 2019

By June 2019 over 40 one hour sessions had been held and an average of 25 members attended each online SIG session, many on a regular basis. Over the course of seven months over 25% of current members have participated in one or more session. Most times after the one hour session many participants continued in conversation, sometimes upto a further two hours. Several projects and groups emerged from these sessions that are now ongoing, including VSM and ISSS, SIG relations and integration, systems science vision, ISSS future etc.

All recordings are viewable by members only at <https://www.myissss.org/sig-sessions-recordings/>

Keywords: integration, meta, conversation, meeting, video, participation

3614

Session: POSTER

SYSTEMS LITERACY EVOLVING OUR POWER TO ADDRESS THE ISSUES of OUR TIME

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Issues of complexity, governance, power, influence and control and climate among so many other issues are opportunities to develop systems literacy globally. Building on work in the systems sciences and social sciences we suggest an approach to inclusive design.

We seek to address the interests and needs of the whole society and environment that supports us. While we may not have intended these consequences, time has shown that our programs have resulted in societal threats to the ocean, earth, health, education, and infrastructure, political and social justice.

This poster proposes evolutionary improvements in the process of social design by developing a five-dimensional organizing process drawn from the natural wisdom in our languages of science, our native languages, and our language of light, darkness, and color (LDC).

Workshop Abstracts

3498

Session: Workshop

EMBRACING EMERGENCE: ESSENTIAL ROLES FOR BIRTHING NEW SYSTEMS

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The biggest challenge for human systems today may not be the increasing complexity of society but rather the difficulty individuals have in holding the tension between chaos and order. For the most part, when confronted with this challenge we tend to retreat into the comfort of stability and equilibrium. However, when we rise to the challenge, we open up multiple possibilities for innovation and creativity. What does it take to move beyond our discomfort and engage in the uncomfortable world of uncertainty? The short answer is relationships, however in reality, it is much more complex.

This highly interactive workshop draws on the work of Margaret Wheatley, Deborah Frieze, and Peggy Holman and their concepts of emergence and emerging systems. Emergence is simply the order that arises out of chaos, the phoenix rising from the ashes. In living systems, there is a continual process of dissipation and rebirth. The products of emergence are emerging systems. The goal of this workshop is to introduce participants to the concepts of emergence and emerging systems within human systems and the roles that individuals can play as the old system dissipates and a new system is born. Participants will examine what role they typically play in this process and what might enhance and sustain the new system.

Keywords: Emergence; chaos; emerging system; disequilibrium; dissipation

3499

Session: WORKSHOP

INNOVATION and OPTIMIZATION: EFFECTIVE PAPER PRESENTATIONS

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Enhance your presentation skills and develop strategies for communicating effectively with a variety of audiences through this workshop on effective paper presentations. Whether you are a seasoned presenter, or just starting out, this two-hour, hands-on session will provide valuable tools that you can adapt to every situation to engage audiences and make your presentation memorable.

The first part of the workshop will draw on strategies taken from nature to explore different types of presentations, structures, timing, and how to use visual thinking, as well as effective body language. In the second part, participants will collaborate to create mini-presentations using the skills and strategies covered in the first half. During this interactive session, participants will be grouped into teams to develop and practice their presentation skills, as well as play the role of stakeholders / audience members to give feedback.

This workshop is considered especially useful for students working on their dissertations, because it will provide a safe environment to co-create the dissertation journey using visual thinking tools and the input of colleagues.

Keywords: innovation, visual thinking, collaboration, dissertations, presentations, nature

3505

Session: WORKSHOP

CO-CREATING CONDITIONS TO THRIVE IN EDUCATION: A SYSTEMS INFORMED POSITIVE PSYCHOLOGY WORKSHOP

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"Systems leaders achieve seemingly impossible changes by tapping the collective intelligence, spirit and energy of their people." Peter Senge

In spite of increased awareness and concerted efforts to promote wellbeing and prevent mental illness, the mental health crisis for our young people continues to escalate. The reality is that in spite of a growing body of evidence of the short-term impact of wellbeing in education efforts, we are facing some daunting systemic challenges. Continuing to do what we are currently doing but doing it harder or smarter is not likely to produce very different outcomes. Real change starts with recognizing that we are a part of the systems we seek to change.....and the knowledge and skills to work within this to create systemic change.

This workshop draws on the cutting-edge research and practice coming out of the University of Melbourne's Systems Informed Positive Psychology team. The workshop will guide participants through a process using systems and design thinking fused with positive psychology. It is designed to equip participants with tools to take a systems approach to creating conditions for your community to thrive. This includes strategies to map the larger system in which you are trying to effect change; build generative and collaborative conversations; and move from reactive problem solving to co-creating the future. Trialled with 48 Principals and schools across Victoria, Australia, this unique approach has demonstrated sustainable and energising growth. If you are seeking to kick start real systems change, or to deepen your efforts to embed wellbeing education within the fabric of your community, then please join us to develop your capacity for systems leadership. This experiential workshop will challenge your thinking about how we currently educate, provide effective tools that you can utilise in your own practice, and share key insights from schools that are co-evolving towards thriving using this approach.

Keywords: well-being systems; systems leadership; ecosystems; education

3522

Session: WORKSHOP

NURTURING NATURAL PATTERN 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 modality 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. Biodanza originated over 50 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; systems education; embodied ways of knowing; creative movement; multiple ways of knowing, ecological consciousness

3523

Session: WORKSHOP

SYSTEMIC GOVERNANCE IN THE COMPLEXITY of AUTHENTIC DEMOCRACY

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A Kenneth Bausch Memorial track is proposed for a panel, associated papers, and a workshop to pursue the complex issues with democratic governance in the rapidly evolving civilizations in which we live and represent.

We are witnessing an historical moment occurring over the recent years when many predictions from systems thinkers and social philosophers have come to pass and roost. Critics of the global project, from Wallerstein and John Ralston Saul on the left to Huntington's "Clash" and others on the right, have revealed prescient, if unpopular foresight, though we hardly admit this in political discourse.

No discussion of the first-order concerns for the apparent breakdown of liberal democracies in Western civilization can be seriously engaged without a reckoning of the second-order forces tearing at the world system that remain assiduously ignored: The return of nationalisms as a response to the failure of globalization, extreme wealth gaps occurring due to Western monopoly neoliberalism, the breakdown in social contracts as governments enforce austerity regimes, while oligarchs buy desired policies and purchase sanctioning regimes against competitors. With such signal issues as the failure of the UK to accomplish the Brexit transition, the continuation of Yellow Vests" protests against yet another downward spiraling French government, the high potential for a second Trump term in the US, and the lowest trust in news media in history, Western societies face a critical legitimation crisis.

Perhaps if we expose the underlying multi-causes at work within the liberal system, we might discover that participation in democratic governance is low because democratic power, the influence of citizen will within modern societies, has been constantly eroded. We cannot blame a failure of democracy when we have democratic governance in name only, as policy decisions are arranged by corporate legislation, by permanent parasitic insiders, armies of global lobbyists, and untenable wealth growth driven by massive debt finance.

Two sessions are proposed, a panel and workshop. Jones and McIntyre convene the panel, and invite associated discussants with original work and panel topics addressing systemic approaches to democratic governance, and hybrid systems of decisionmaking in social, political, and multistakeholder (polycentric) governance.

Deliberative Democracy as a Sociotechnical System

Peter Jones and Janet McIntyre, organizers with Rudolph Wirawan and 2-3 additional paper/presenters invited/accepted

Panel and interactive discussion (60 minutes)

Workshop: Discovering the Democratique: An Experience of Systemic Deliberation

Peter Jones, Associate professor, OCAD University, Toronto and Systemic Design Association (SDA)

Dr. Jones convenes a participatory workshop for a simulation of and exposure to the foundational processes of systemic dialogue, enabled by the principles of Structured Dialogic Design (Christakis and Bausch, 2006). As a deliberation methodology, SDD provides the structure, logic, and process to facilitate high-conflict or multi-stakeholder interest groups to find shared meaning and reach consensus on action. This ISSS workshop is tailored to demonstrate the state of the art of SDD technology and process in a way that enables meaningful participative learning with members.

Keywords: Systemic governance; Dialogic design; World system; Sociotechnical systems; Problematique; Democratique;

3529

Session: WORKSHOP

FEDERATED WIKI and PATTERN LANGUAGE

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Bring a laptop or pair with a buddy to work on this hands-on workshop.

The original wiki technology was developed by Ward Cunningham in 1995 to support the Portland Pattern Repository. The project, which became formalized in the Hillside Group, followed an approach developed by Christopher Alexander at the Center for Environmental Structure at Berkeley. This platform simplified writing and reading hyperlinks between patterns, so that a pattern language could become generative.

Over the past 5 years, an open source community led by Ward has developed a technology whereby every individual could have his or her own set of wiki sites, and sharing across a federation of collaborators becomes as easy as dragging-and-dropping. The ISSS leadership has been discussing federated wiki as a potential platform on which systems literacy content might be progressed.

Individuals may choose to host wiki sites on their own web domain. Recently the Digital Life Collective (diglife.com) and the Open Learning Commons (openlearning.cc) have been piloting federated wiki as a community platform. Members in the federated wiki community have been piloting Open Science collaboration using the technology.

This workshop is an opportunity for ISSS conference attendees to explore the platform, appreciate the codevelopment of the systems sciences with pattern language, and have questions answered face-to-face. Attendees may continue to develop their knowledge and collaborate at a distance, after leaving Corvallis. In a related keynote talk. Michael Mehaffy will be presenting a pattern language that is available on a federated wiki.

Keywords: federated wiki; pattern language

3530

Session: WORKSHOP

EXPLORATORY GROUP WORKSHOP: SYSTEMS CHANGES RESEARCH PROGRAM

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The Systems Changes research program is exploring the shift of frames when the world is seen as more than a system (i.e. from singular to plural) and more than a change (i.e. from one event to continual). The program originated in fall 2018, amongst members of Systems Thinking Ontario, hosted by the Strategic Innovation Lab at OCADU in Toronto. Artifacts are posted on the systemschanges.com web site, with open communications through an online channel on the Open Learning Commons (chat.diglife.coop) and federated wiki sites on the Digital Life Collective (my.diglife.coop).

Progress to date includes work on a “more understandable” description of Systems Changes for practitioners and decision-makers. While the dominant paradigm for System Change is mechanistic solids with linear physics under constant conditions, Systems Changes see living fluids with nonlinear biochemistry under varying conditions.

This workshop will further test ways of explaining the approach, diagnosis and potential treatments associated with negotiating Systems Changes.

Deterrents to Systems Changes include (i) attention (c.f. intention); (ii) errors (c.f. other forms of ignorance; and (iii) traps (c.f. flows, not blocked in nature).

Theoretical foundations for the program include ecological epistemology, non-equilibrium thermodynamics; panarchy and resilience science; and the contextual dyadic philosophy underlying classical Chinese medicine and wuxing.

ISSS conference participants are encouraged to collaborate on the program, either via synchronous in-person meetings, or at a distance over the Internet.

Keywords: systems change

3536

Session: WORKSHOP

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.

Keywords: Conceptual systems, literature review

3543

Session: WORKSHOP

UNBROKEN SEQUENCE of SYSTEMS ORIGINS (USSO): A SYSTEMS-BASED THEORY of EMERGENCE

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Recently, several different internationally-recognized groups (e.g. Christian, Big History; Volk, Quarks to Culture; Morowitz & Smith, Origin/Nature Life on Earth) have harvested the hard work of several sciences to explain the Big Bang to now, but this society, ISSS, published earlier work on these same topics as early as 1972 (nearly half a century ago) & this author delivered his Incoming President’s talk on this in Oregon in 1989. Please join us for a comprehensive update on the Unbroken Sequence of Systems Origins from the Big Bang to our recent human experiments in civilization. The workshop will begin with a concise history of these attempts at describing what happened since the Big Bang & their various strengths/weaknesses.

We will present evidence from the appropriate natural and human sciences (cosmology, astronomy, physics, chemistry, biology, computer modeling, and mathematics to socio-economic studies) that gives several alternatives for each and every emergence of a new scale of system, that is, its origin or ontogeny for the 1sttime in our universe. We will suggest >40 such cycles of new systems integration and diversification (I/D cycles) and show that the universe keeps blossoming new systems at new scales, at unique times, with new components, new typical dynamics/mechanics, and continues to do so currently.

We will also show that when one perceives this unbroken sequence, there are several very important transdisciplinary conclusions: (1) most important there is a major case of emergence correlated with EACH I/D origin cycle; (2) that there is common mechanism that explains all of these origins; (3) that this gives rise to A General Theory of Emergence (which will be explained) and has been nowhere else; (4) there appear to be about 15 newisomorphic systems processes active at each emergence that cannot even be seen unless one compares across all of the I/D cycles; (5) there are consistent parameter trends that are proven across the hierarchical levels produced by the USSO; (6) that the entire sequence indicates that the universe is full of natural and human systems indicating the primacy of systems studies and understanding; (7) that comparison of cycles shows there also are “roots” or “paths” from earlier systems to recent systems for some major isomorphies.

Since these key conclusions cannot be evidenced UNLESS one compares across many diverse systems using many diverse (owned, accepted) science disciplinary methods, the entire USSO provides very strong support for general theories of systems approaches and the comparative systems analysis (CSA) method of, an as yet unrecognized, science of systems. The acceptance of a USSO provides rigor and substance to both GST & SS.

Keywords: systems emergence; scalar origins; hierarchy theory

3544

Session: WORKSHOP

INTEGRATED SCIENCE GENERAL EDUCATION (ISGE): "STEALTH" SYSTEMS SCIENCE COURSE FOR GE

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The prestigious NATIONAL SCIENCE FOUNDATION awarded two grants to the Institute for Advanced Systems Studies (IAS) in the nineties to design, test, and deliver a unique, fully-integrated, year-long, online course that satisfied the entire science requirement for general education (GE) for most every college student. Since there are more than 5,000 colleges and universities in the U.S. and nearly 24,000 in the world, such a course would promise massive impacts on the education of millions of undergraduates. Other grants from the CSU system and private Foundations added to the NSF support. What happened to ISGE? Since the ISGE program was completely systems-based, we consider it and its current status as a detailed case study of the promise, potential, and obstacles faced by all systems education programs, so pertinent to a wide range of ISSS participants. We even called it "stealth" systems science in earlier ISSS presentations. The ISGE Program accomplished INTEGRATION in several ways: (1) most directly pertinent to ISSS, it presented large numbers of case studies of phenomena (facts) researched by seven natural sciences NOT ORGANIZED BY THE SEPERATED SCIENCES (as in conventional GE) but rather re-organized according to 15 major GST isomorphies; (2) it showed how many unique phenomena in each individual science were integrated by Domain Integrator's (e.g. genetics in biology; or continental drift in geology); (3) it showed how some of the isomorphies provided "links" (between phenomena in one science), "connections" (between sciences), and even amazing "bridges" (between sciences and some of the arts & humanities).

It was also designed to deliver answers to dozens of problems in current general education in the United States. So it was designed to be a no-cost (to any adopting campus) alternative that addressed very important challenges facing higher education.

The course pilot was offered seven times on three CSU campuses. This workshop will report on (1) the statistics describing the pilot populations; (2) the results of the student evaluations for the integrated course and their reaction to "integration;" (3) the responses of several industrial groups that experience the ISGE Demo; (4) the impact that designing & developing the course had on both faculty and participating student programmers; (5) the outcomes on various campuses; (6) lessons learned for all systems education attempts; (7) future plans for a follow-up NSF \$1M+ grant to resurrect the program in the California State University System of 23 campuses and >half a million students.

Keywords: systems education; science GE; systems science; GST

3551

Session: WORKSHOP

OUR GSTS FOUNDERS' GOAL: A SINGLE GRAND ENCOMPASSING THEORY EMBRACING ALL SYSTEMS. THE FIRST PROPOSAL ON THE TABLE: JAMES N ROSE 'INTEGRITY PARADIGM'

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"Our universe harbors nothing 'alien' to its own existence."

(J N Rose, 1996)

The sentiment of this sentence embodies the ultimate validating quality of our universe, as proposed by the founders of a "(Single) General Theory of Systems". The universe is an existentially holistically related entity .. all of it. By necessity, there are qualities and relations shared by 'all possible behaviors and activities' in the universe. This implies that we should be capable of explicitly describing the underscoring shared properties of all events and instantiations of being.

Even in the most extreme conditions/qualia of existence possible, the universe has to be comprised in such a way that even the 'seemingly most antithetical' mutually exclusive incompatible properties .. actually can and do co-reside naturally within a larger perspective domain. Such as: "complete disorder" concurrently co-

resident with "perfect ordering". At first, the properties of one of those sub-domains would seem to have no interaction~relational properties for correlating and accessing information, or data, from -or- to, the other. Yet, in a wholly consistent and coherent universe, we have to posit their essential familial connectability and reconcilability of attributes. and be able to enunciate them accurately - architectures, dynamics, behaviors - the instantiations -and- the extant descriptive models/languages.

This is a first-in effort to identify and enunciate those universal qualia, properties, relations, mechanisms and action drivers – the primal non-volitional and the volitional - together.

Keywords: single hypothesis General Theory of Systems; unification of systems models; Integrity Paradigm; Ceptual Institute; Entropy; Systems Couplings.

3566

Session: WORKSHOP
SYSTEMS LITERACY WORKSHOP

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We will continue to develop themes and ideas based upon previous work while looking to the future and the challenges of systems behaviour, understanding, design, modelling and engineering for systems large and small. Building on theme of the conference and recognizing the US Next Generation Science Standards Cross Cutting Concepts we will develop a draft document to guide educators and learners.

Keywords: systems literacy, science, education, literacy, nature, NGSS, ocean, earth, atmosphere, climate, energy, network

3588

Session: WORKSHOP
MAPPING SYSTEMIC CHANGE

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In this workshop, we will analyze dominant social systems and imagine by analogy transformative necessities.

I will facilitate a series of participatory exercises in which we use the concept of "identity" to examine systemic change. Participants will be invited to reflect on the dissonance of participating in unhealthy social systems. Working in small groups, we will then then specify and compare understandings of what would constitute transformative change in such systems.

Time permitting, we will delve deeper into the bricolage of theory that underlies the exercises and then discuss related examples of systemic change mappings.

Keywords: identity, mapping, recursion

3596

Session: WORKSHOP
OPEN LEARNING COMMONS and THE DIGITAL LIFE COLLECTIVE

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Knowledge shared in the systems sciences community has been hindered by turnover in electronic collaboration platforms. University privileges are lost as affiliations change. Social media platforms (LinkedIn, Google+, Facebook) often remove or limit access to content.

The Open Learning Commons is proposed, for the systems sciences community, as persistent electronic medium on which open science can be conducted. This workshop will provide a introduction to, and hands on guidance on, the many features of the platform.

The Open Learning Commons includes:

openlearning.cc – the web landing page;

wiki.openlearning.cc – multiple perspectives authoring (Federated Wiki);

discuss.openlearning.cc – threaded posts and responses (Discourse);

notepad.diglife.coop – realtime authoring (CodiMD)

wekan.diglife.coop – team activity board (Wekan)

chat.diglife.coop – group and private chat (Mattermost)

These are some of the “Tech We Trust” open source tools, provided through the Digital Life Collective, a UK-based cooperative. Individual memberships are £8GBP or \$10USD annually.

The workshop time aims to prepare conference attendees for full participation in two subsequent ISSS workshops (i.e. Federated Wiki and Pattern Language; and the Systems Changes research program) as well as positioning for ongoing communications between annual meetings.

Keywords: open learning

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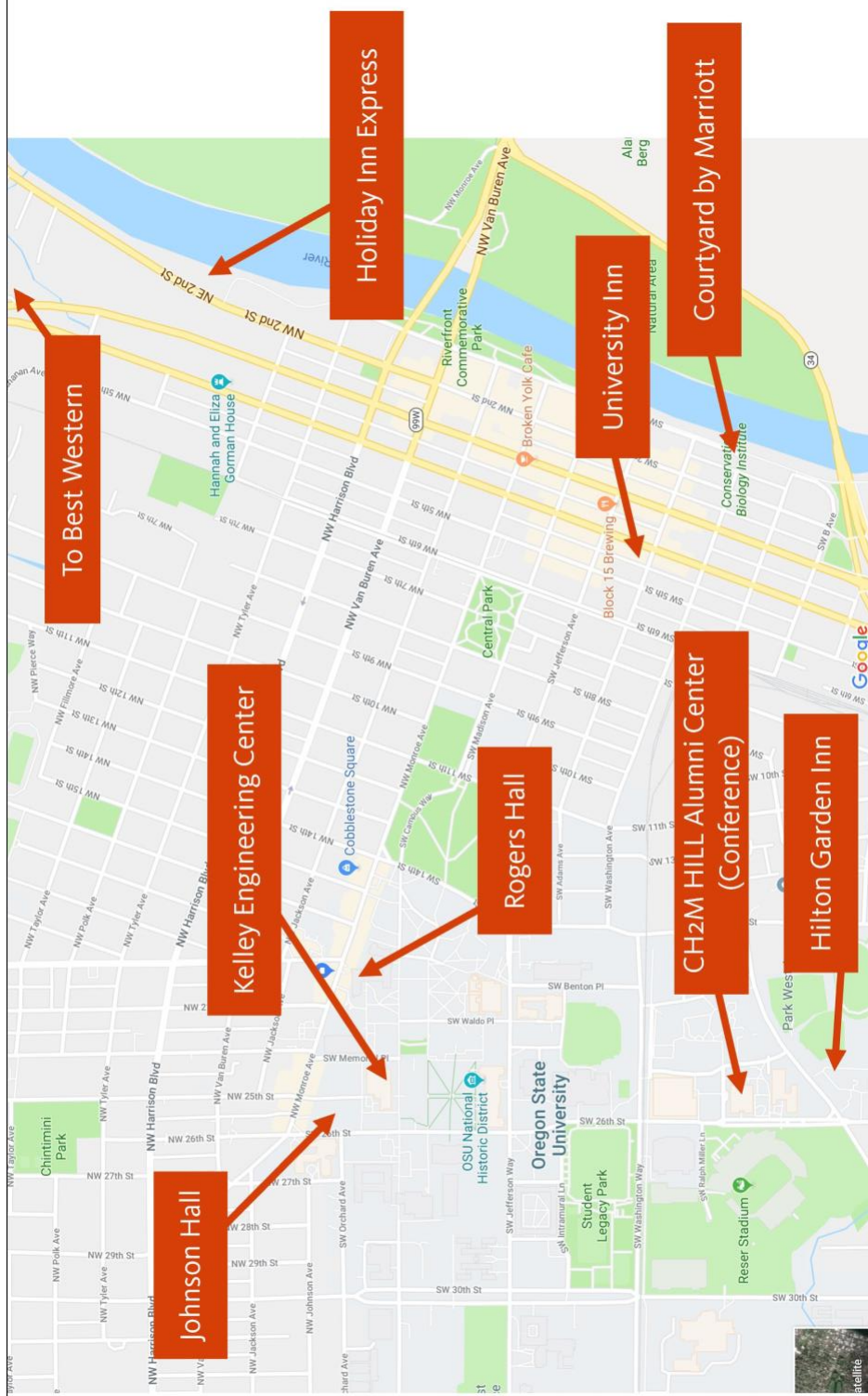
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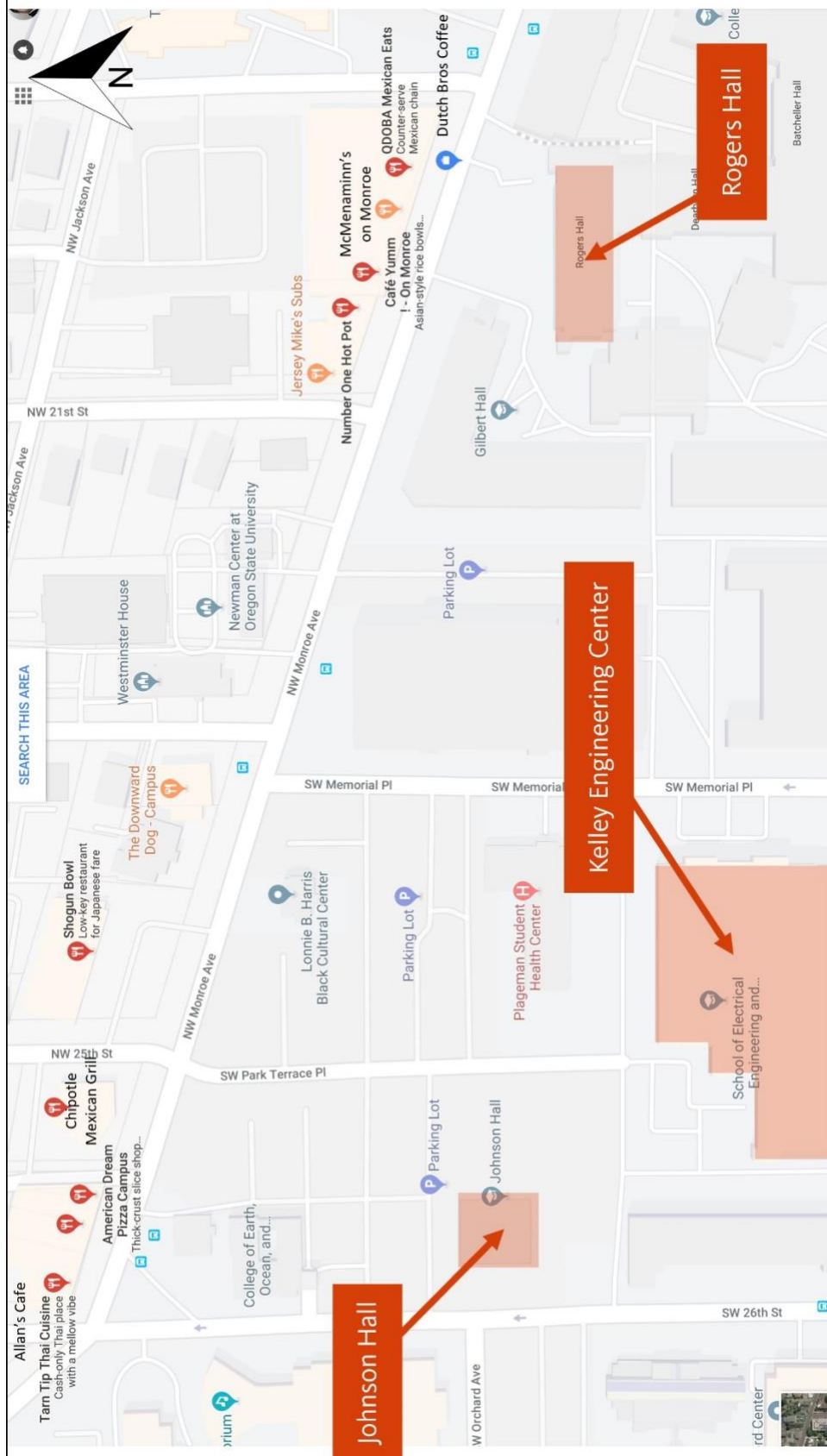
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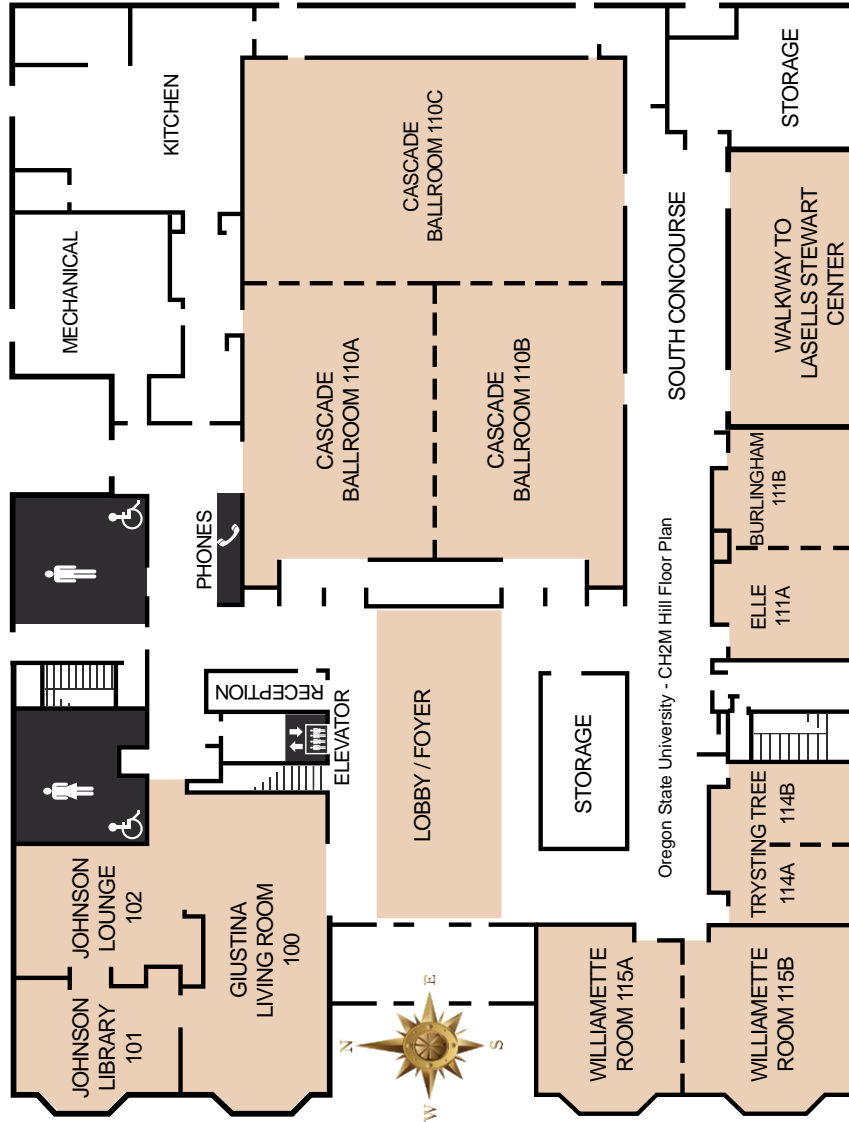
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Conference Location Maps





Conference Center Room Layout



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