Program and Abstracts

2016

Realizing Sustainable Futures in Socio-Ecological Systems

University of Colorado
Boulder, CO, USA
July 24 – 30

John J. Kineman
President

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LOGOS OF SPONSORS ISSS2016

Welcome to ISSS 2016
60th Annual Conference and Meeting
of the International Society for the Systems Sciences

Realizing Sustainable Futures
in Socio-Ecological Systems
ISSS-2016 Boulder, Colorado, July 24-30

Dear ISSS and collaborating members, speakers, authors and visitors:

Welcome to ISSS-2016 Boulder, which is being held in conjunction with many collaborating organizations, and with special public programs sponsored by the *WILD Foundation*, the *Center for Process Studies*, and the international *Future Earth* program, perhaps setting a precedent in outreach. We have also partnered with Vignan's University in India to have a twin conference venue. The India program is equally impressive in its focus and design for promoting sustainable systems. While the USA conference will focus more on systemic thinking and transformation on scientific, technical, political, and ethical levels, the India conference focuses on leadership in applying systems thinking for positive development and evolutionary change. Both conferences recognize a fundamental diversity of essential aspects of a balanced, whole system – giving a scientific, systemic meaning to the popular phrase: "unity in diversity".

In this Conference we have significantly increased our connection and collaboration with other groups to build stronger relationships between human and natural system fields. The Conference theme is a very positive and optimistic one, like last year, expressing the idea that we can indeed achieve global systemic sustainability. However, collaboration is essential to achieve that goal, and we have to remove past impediments. I personally believe that ISSS and its affiliated organizations have the right skills for these times, and that we are at the right place in human history to apply them.

This year we will complete our 60th year of ISSS conferences, an anniversary that has special significance in Indian tradition, where the 60th anniversary (start of the 61st year) is celebrated as the point of transition from one's immediate concerns of career and family to the concerns of humanity and nature, within the greater context of the universe. We will honor this tradition with an ancient ceremony, symbolizing our coming of age and responsibility; and by "walking the talk" through East-West collaboration.

The Conference Focus

Continuing ISSS' exploration of *The Anthropocene* from last year's amazing conference in Berlin, we now turn our attention to building relationships to realize sustainable systems in the future of the Anthropocene, through a balanced consideration of human and natural systems that we have traditionally treated separately. The task may seem incredibly complicated to most people trained to see the world through the lens of diverse phenomena; but our emerging understanding of systemic complexity, which will likely characterize the next Century of scientific and social thinking, suggests a number of avenues for finding or creating order in that diversity. Our focus in this conference is on how to get there – what are the "next steps", especially steps that will empower the next

generation. It is clear that Vision and genuine optimism about the future must come first; but it is equally clear that such enthusiasm must also be followed with genuine advances in science, policy, and praxis that incorporate new norms and a more expanded view of complex reality.

While mysteries abound in this effort, we must remember that we have 60 years of experience developing important methods, theories, praxis, and paradigms. That is a 60-year head start at a time when the world is suddenly awakening to the critical need for new approaches to deal with global human dominance of our hyper-complex relation with nature. The prospect of being suddenly in charge of such a system that has run itself effectively for 4.5 billion years, producing us, is certainly daunting: It challenges us to refine every skill we have and to innovate new capacity.

Indeed, even with numerous head starts in many disciplines, modern humanity is struggling to realize the capacity to live systemically and sustainability. The state of the world is clear evidence of that at a time when Calls are increasing for “Ecological Civilization”. The “next step” is therefore to identify and remove whatever impediments have been in place to prevent conceptual and practical progress despite many significant advances in systems thinking; to re-educate ourselves in new, more appropriate thinking and methods. For me this means a serious attempt to establish a working concept of wholeness. Without it we cannot really consider systemic sustainability except to hope that it will emerge as we rearrange the furniture.

For the above reason we have placed a strong emphasis in this conference on transforming Science and Education; Science to see a bigger picture and Education to explore new possibilities. One truly heartening trend today is the enthusiastic and rapid development of *Sustainability Science* and a genuine shift in mainstream thinking toward modern but healthy re-integration of humanity and nature. This is no longer a fringe agenda, but central policy of most governments and international bodies. What we lack, however, is systemic capacity – the very things ISSS has been working on for 60 years. That is the reason I believe this year is the right time to re-connect with groups we may have had to distance from in the past in order to explore new ideas; because now those ideas are needed and wanted.

Day 1 of the conference will glimpse a vision of the future and pathways leading toward it, particularly emphasizing innovation (going beyond repair) and the educational needs for a new agenda in “Systems Literacy”. Indeed, if we are to “change the game” as Gunter Pauli will emphasize in the first Keynote, we have to allow our students and emerging professionals to explore new ideas creatively and without past restrictions. We have to remove the taboo against “holistic” ideas and actively support research and development of holistic science and technology. These are not out-of-reach goals.

The Conference Design

A quick look at the program may give the impression of considerable diversity in the topics, which is a correct perception. However, there is also a unifying organization intended in the main conference themes, with specific outcome goals. Whether we will come to understand that unity or not is a matter for the conference itself to decide. The daily

program is designed around a null hypothesis, if you will, of five essential aspects of systems thinking, similar to the five aspects identified last year. These are:

Day 1: Vision
Day 2: Scientific knowledge
Day 3: Socio-cultural knowledge
Day 4: Putting theory into practice.
Day 5: All four of the above in relation (holistic synthesis)

I ask that we each keep this organization in mind as we explore the necessary dimensions for systemic sustainability throughout the week. Similarly, we should consider five outcome goals corresponding to the above template. These are:

- Innovation and future-driven paradigms
- Ways to advance Sustainability Science via complex systems thinking
- Policy recommendations for advancing systems research and management
- Priorities for developing General System Theory and praxis
- An agenda for the future of "Systems Literacy" education and outreach

Finally, I want to express my own passion for the subject we are addressing, which was kindled when I was 9 years old in Baltimore. We lived on the edge of an oak forest that was magical and, to me, infinite; until one day we watched as bulldozers transformed our universe. What once held awesome majesty and magic became defined by human control. My brother and I stared in disbelief. Then threw stones at the well-manicured houses. That was the wrong response, but we now know that kind of control is a myth – it is ultimately self-defeating. The grand challenge we face today is to re-engage with the complexity of nature, to appreciate and expand its natural wonder, to discover and innovate new and unheard of realities by working with and by natural principles. We have to recapture the infinite forest that is both wise and whole; that represents infinite possibility and that throughout history and art has been the source of human imagination and true prosperity of the human spirit. Thus I would like to issue a personal challenge: Take the first critical step of embracing an infinite future, and then remove the blocks to realizing that future.

Thank you. Please enjoy the conference!

John J. Kineman, ISSS President (2015-2016)

Inaugural Address

Leadership for Sustainable Socio-Ecological Systems

Vignan's University, Vadlamudi, 23-25 July, 2016

The Venue at Vignan's University for this international conference on "Leadership for sustainable socio-ecological systems" is a parallel meet with that of "Realizing Sustainable Futures in Socio-Ecological Systems" going on at University of Colorado, Boulder. Both these Indo-US meets come under the umbrella of International Society for the System Sciences. This society was initiated in 1954 by a group of biologists, economists and mathematicians at the Stanford Centre for Advanced Study in the Behavioral Sciences. Until now ISSS witnessed 54 Presidents and 18 annual meets were conducted. The current president Prof. John J Kineman **called on** our beloved Founder and Chairman of Vignan's Group of institutions Dr. Lavu Rathaiah garu and offered to host annual meet at Vignans' campus. That is the genesis for our congregation now at Sangmam seminar hall.

Human beings are undoubtedly gregarious like birds and insects and live only in societies and never in solitude. Since the time immemorial our society inevitably embraced complex systems - of course – the intensity of complexities is gradually at its upsurge decade after decade. The Classical single discipline and linear thinking approaches are no more adequate to solve complex socio-economic and managerial challenges. Therefore, the present generation is imposing on the requirement of technical level awareness, knowledge of systems approaches and tools – to integrate and extract the concepts from each of the disciplines to solve the complexities and crises.

Biological systems are endowed with a complex metabolic network. Diabetes, Atherosclerosis, Gout, Alzheimer's, etc., are undoubtedly metabolic syndromes. That is, the lacunae in the complexities of metabolic networks led to the development of the present day sustainable management of risk in complex metabolic networks. The tools and concepts of systems design and complexity management would be of immense value, for example, in counteracting health risks and maintaining adaptability in socio-ecological systems.

In this line, we are glad to have amidst us the stalwarts in the field of System Science thinkers namely Prof. Ockie Bosch (Adelaide), Dr. Nam Nguyen (Switzerland), Dr. Leonei Solomons (Sri Lanka), Prof Jan Hendrik Hofmeyr (South Africa),Dr. Gary Jacob (USA now currently at Pondicherry), Dr. Clemencia Morales (Columbia), Dr. Hameed Khan (Maryland, USA), Dr. Andreas Udbye, (Washington, USA) and Dr. MGPL Narayana garu, Vice President, TCS, Hyderabad.

About 6 technical sessions and one demonstration of the Ecopolicy Sensitivity model by Dr. Nam Nguyen and yet another demonstration of Yoga for sustainable health by Mr. M P Sandeep, Sivananda Meenakshi Ashram, Madurai are conceived in the present conference to appreciate the need, the tools and the system concepts to approach the various dimensions of socio-ecological complexities.

With this I conclude, wishing you all a comfortable stay at Vignan's Campus and welcoming you all again to revisit our campus at your convenience as this is one of the best platforms to percolate the tools and concepts in sustainable systems being endowed with the system of technical education.

Lastly, I take this opportunity to acknowledge the help and support rendered by Vignan's University in hosting ISSS conference.

Professor Sriram Krupanichi,
Head, Dept.of Biotechnology

Conference Program and Schedule
ISSS 2016

PROGRAMME NOTES:

There are codes on each paper this year. The day refers to the plenaries on Monday through Friday of the morning programme. The topics refer to the content, and a document explaining the topics is included in this programme before the list of Abstracts.

The bold 4-digit number is the abstract number you can use to locate the full abstract in this book, and if there is a 4-digit number following that (in parentheses) that number indicates there is a full paper available published online in www.journals.isss

There are also lists of Abstracts, Keywords and Authors in this programme book. If you have any questions regarding locating sessions, please check Sched.org or come to ask at the Registration Desk.

Pre-Conference Program (Boulder)

21 July (Thursday evening):
Start of Conference in India – Vignan University
16:00 – 21:00 **STiP** (grad course) **Student Welcome**
Instruction starts Friday before the conference, and continues through the Saturday after the conference. There are also Pre-conference and Post-conference assignments.
Chairs: Ray Ison, Peter Tuddenham, Gary Metcalf, Jeremiah Osborne-Gowey, Mary Edson.

22 July (Friday):
9:00 – 17:00 **Student Program**
Main Classroom: Baker W112
Break-out rooms: ECCR 131, 139
•
23 July (Saturday):
9:00 – 17:00 **Student Program**
18:00 – 20:00 **ISSS Board Meeting** (Taj Restaurant Basemar: 2630 Baseline; *303-494-5216*)

Sunday: July 24, 2016
Registration, Pre-Conference Workshops and Evening Reception

REGISTRATION DESK OPEN 08:00 – 17:30 (Lobby, Engineering Building, UC Boulder)

07:15 to 08:15 ISSS Global RoundTable—ECCR 139 **AND** 9:00 -18:00 Delayed Video Broadcast from India (Math 100)

10:00 – 17:00 Pre-conference Workshops Full Day		
1.	**Day IV: Topic(s) 8** **2932** Tutorial: Systems Processes Theory as a GST, Prototype Systems Science, and Knowledge Base for Systems Engineering & Sustainability, *Troncale, L. R.*	ECCR200
10:00 – 12:30 Pre-conference Workshops Morning Only		
2.	**Day I, II, III: Topic(s) 2, 3, 6** **2865** Systems Basics in Understanding System Wholeness "Reuniting Nature and Humanity": The Oriental Systems Thinking In the Teaching of Buddha. 系統論基礎工作坊之一：佛學的東方系統思維 - 以天人合一理解系統完整性 *Wong, Thomas S L; Huang, E C Yan*	ECCR 1B51
14:00 – 17:00 Pre-Conference Workshops Afternoon Only		
3.	**2849 Workshop Day IV: Topic(s) 7** Introduction to Spiral Dynamics Integral, *Levi, Ben*	ECCR 151
4.	**2948 Workshop Day IV: Topic(s) 8** Living Systems Analysis Workshop, *Simms, Jim*	ECCR 1B55
5.	**2735 Workshop Day IV: Topic(s) 7** Designing Digital Services: Unifying Information Systems Design and Service Systems Design *Kumar, Anand; Lokku, Doji Samson; Zope, Nikhil*	ECCR245
6.	**2930 Workshop Day III: Topic(s) 6** Multicultural World Views on Sustainability, *Surel, Dominique; Gupta, Vijay K.*	ECCR265
7.	**2866 Workshop Day I, II, III: Topic(s) 2, 3, 6** Systems Basics in Understanding System Wholeness "Reuniting Nature and Humanity": The Oriental Systems Thinking In Traditional Chinese Medicine, *Wong, Thomas S L; Huang, E C Yan*	ECCR 1B51
18:00 – 20:00 Reception		

18:00 to 18:30 60th Anniversary Ceremony – Visual Arts Complex (VAC) Plaza
18:30 to 20:30 Evening Reception in University Memorial Hall (UMC) South Terrace and Tent
19:30 to 20:30 US-India RoundTable II (Chair: Sue Gabriele)

Monday: July 25, 2016
Systems Thinking for Systemic Sustainability

REGISTRATION DESK OPEN 07:45 – 12:00 (Lobby, Maths 100); 13:30 to 17:00 Lobby, Engineering Building.
07:15 to 08:15 ISSS RoundTable Discussion (Treehouse Room, C4C Dining Room)

08:30 Plenary Session (Maths 100 Lecture Theatre)

08:30	**Plenary I –** ***The Challenge of System(s) Sustainability*** *Description:* This year's conference focuses on what it means for a system to be sustainable ("systemic sustainability"): exploring more holistic science and thinking to understand, manage, and create sustainability in complex socio-ecological systems. We are intentionally stepping outside traditional comfort zones to explore new territory and possibly find new answers. For this we recognize the importance of empowering students; removing philosophical and institutional blocks to their inquiry into such questions, and providing them with the best tools to guide their research and practical experiences. From development of new theories and practices to integration of existing ones, our challenge is to determine what will lead society into the transformations needed for a sustainable future and beyond to even greater symbiotic and innovative opportunities; and how we as a society can help initiate those changes. **Chair:** John Kineman ***Speakers:*** **Opening*:*** **8:30 Jennifer Wilby** – *Opening announcements* **8:35 John Kineman** – *Conference Program: Realizing Sustainable Futures* **Keynotes** (times include Q&A): 8:55 – 9:35 **Gunter Pauli** – *The Blue Economy: How innovations in technologies and business models set new rules for sustainability.* *9:35 – 10:15* **Peter Tuddenham** – *Systems Literacy Education Goals*

10:15 – 10:30 Tea/Coffee (Maths 100 Courtyard)

10:30	**Plenary II –*Towards Holistic Systems Thinking*** Description: Although every environmental agency today is calling for ways to manage whole ecosystems, we do not know how to do that. Our theories and methods to address the question of whole-system sustainability are incomplete and as a result our actions regarding individual processes, sectors, and resources can contribute to problems as much or more than to solutions. How can systems thinking help us move to another level of understanding where we can address the pressing complex systemic issues of inter-related socio-ecological systems to resolve the dysfunction of their often contradictory sectors and components? **Chair:** Judith Rosen **Speakers:** 10:30 – 11:15 **Judith Rosen** – *What The Science of Anticipatory Systems Can Illuminate about Science Itself.* 11:15 – 11:45 **David Rousseau** – *Scientific principles for a general theory of whole systems.* 11:45 – 12:15 **Shankar Sankaran –** *Think Hard! Act Soft!.*

12:15 Lunch (C4C Cafeteria – included in meal cards)

Paper Sessions 13:30 – 15:00						
Engineering Room ECCR151	**Engineering Room ECCR200**	**Engineering Room ECCR245**	**Engineering Room ECCR265**	**Engineering Room ECCR 1B51**	**Engineering Room ECCR 1B55**	**Benson 180**
SABI: Dialogue in Systems Applications in Business and Industry	**Socio-Ecological Systems**	**Designing Educational Systems**	**Foundation of Information Science**	**Systemic Approaches to Conflict and Crises**	**Critical Systems Theory and Practice**	**Discussion**
Chair: Louis Klein	**Chair: Stefan Blachfellner**	**Chair: Ockie Bosch**	**Chair: Anand Kumar**	**Chair: Gerhard Chroust**	**Chair: Jennifer Wilby**	**Chair: Mary Edson**
2776 **Day IV: Topic(s) 7** Industrial Ecology in Motion: A Theoretical Proposal for Innovation on SME's *Acero López, Andrés Esteban* **2808 (2821)** **Day IV: Topic(s) 7** New Strategies for the Mexican Petrochemical Industry *Villarreal, Elvira Avalos; Leon Vega, Cirilo Gabino* **2832 (2911)** **Day IV: Topic(s) 7** Using Viable System Model for Chinese Outbound Tourist Market Sustainability *Arenas-Resendiz, Tanya; Tejeida-Padilla, Ricardo; Morales-Matamoros, Oswaldo; Coria-Paez, Ana Lilia; Sanchez-García, Jacqueline Yvette*	**2724 (2906)** **Day II: Topic(s) 3, 4** Systems Thinking and Wildland Fire Management *Thompson, Matthew P; Dunn, Christopher J; Calkin, David E* **2758** **Day I: Topic(s) 1, 2** The Holistic Values of Socio-Ecological Systems and the Practice of Green Development In China *Fan, Dongping; Fu, Qiang* **2862 (2891)** **Day I, II: Topic(s) 2, 3** Framing a System *Fables, Ioven*	**2814** **Day I: Topic(s) 1** From Systemystery to Systemastery - A Toolbox for Developing Systemry *Daniel Allegro, Brigitte; Smith, Gary Robert* **Day III, V: Topic(s) 6, 9** Outdoor Adolescent Rites of Passages: Theoretical Foundations, Contemporary Shortcomings, and the Emerging New Model *Dooley-Feldman, Eric Adam*	**2818** **Day I: Topic(s) 1, 2** On the Information Processing Aspect of the Evolutionary Process *Kampfner, Roberto R* **2845** **Day IV: Topic(s) 7** Architecture of a Systems Modelling Platform *Kumar, Anand; Nori, Kesav Vithal*	**2754 (2854)** **Day I, II: Topic(s) 2, 3,4** Developing an Understanding of Violence using the DSRP Theory as a Framework *Macgill, Victor R D* **2787 (2857)** **Day II: Topic(s) 4** Anticipation and Systems Thinking: A Key to Resilient Systems *Chroust, Gerhard; Finlayson, Dennis* **2790** **Day 1, III: Topic(s) 1, 5** Sustainability Challenged – Comparing Two Competing Value Systems – What We Found "Shang Jun Shu (The Book By Shang)" From Chin' Dynasty 2000 Years Ago and the Islamist Ideology Today in Common *Hu, Jason Jixuan; Liu, Zhongjing William*	**2799 (2799)** **Day I, IV: Topic(s) 1, 8** The Thinking Space: the Enactment of a Platform for Critical Systems Practice *Ortegon M, Maria C; De La Torre, Alvaro Carrizosa* **2748** **Day II: Topic(s) 3, 5, 10** Taking Advantage of Systems Thinking to Improve a STEM Project to Promote Regional Development *Pinzon-Salcedo, Luis A; Van den Bergue Patiño, Erika; Castaño-Herrera, Angélica María* **2755** **Day I, IV: Topic(s) 2, 7** Developing a Systemic Framework for Evaluation Models and their Applications *Torres, Maria Alejandra*	**2886** **Day I, V: Topic(s) 2, 10** Towards Systems Literacy - The Role of Systems Research

15:00 Tea/Coffee (Engineering Lobby) – Poster Viewing in Engineering Lobby

Paper Sessions 15:30 – 17:00						
Engineering **Room ECCR151**	**Engineering** **Room ECCR200**	**Engineering** **Room ECCR245**	**Engineering** **Room ECCR265**	**Engineering** **Room ECCR 1B51**	**Engineering** **Room ECCR 1B55**	**Benson 180**
SABI: Dialogue in Systems Applications in Business and Industry	**Socio-Ecological Systems**	**Designing Educational Systems**	**Human Systems Inquiry**	**Systems Engineering and Service Systems Science**	**OPEN**	**Discussion**
Chair: Louis Klein	**Chair: Stefan Blachfellner**	**Chair: Ockie Bosch**	**Chair: Dennis Finlayson**	**Chair: Anand Kumar**		**Chair: Mary Edson**
2834 (2910) **Day IV: Topic(s) 7** A Systemic Approach on Human Resource Management in Tourism Small and Medium Enterprises Considering Socio-Ecological Systems *Nuñez-Ríos, Juan E.; Tejeida-Padilla, Ricardo; Badillo-Piña, Isaias; Morales-Matamoro, Oswaldo; Sanchez-García, Jaqueline Yvette; Jarquin-García, Brenda;* **2837 (2909)** **Day IV: Topic(s) 7** Systemic Complementarity In Micro, Small and Medium Tourist Enterprises Considering the Socio-Ecological System *Sánchez-García, Jacqueline Yvette; Tejeida-Padilla, Ricardo; Moreno-Escobar, Jesus Jaime; Morales-Matamoros, Oswaldo; Nuñez-Ríos, Juan*	**2763** **Day III: Topic(s) 3, 5** The System of Accounts for Global Entropy Production, (Sage-P): Nonlinear Accounting of Gross Domestic Product (GDP) In the Domain of the Ecosphere, Sociosphere and Econosphere *Friend, Marcus Anthony* **2764 (2848)** **Day III: Topic(s) 5** An Aggregated Qualitative Accounting Method for Developing Justified Policies *Friend, Michèle* **2770** **Day I: Topic(s) 1** The Reconstruction of Systems	**2796** **Day IV: Topic(s) 7** Exploring the Phenomenon of Technological Integration in K-12 Classrooms for Education Leaders *Raine, Alice* **2879** **Day V: Topic(s) 10** A Systems Approach to the Development of Research Capacity: A Case Study of a Systems Practice Masters Programme *Shaw Corrinn,; Le Roux, Kate* **2775** **Day III: Topic(s) 6** Indigenous Contributions to Sustainability and Systems Education *Morgan, Te Kipa Kepa; Fa`Aui,*	**2767** **Day 1, III: Topic(s) 1, 5** Emerging Possibilities: Adapting Carol Sanford's Stakeholder Pentad for the Nonprofit and Public Sectors *Gibbons, Kathleen; Jacobs, Marty* **2792** **Day I, III: Topic(s) 2, 5, 6** Leadership Practices for Thrivability of Complex Social Systems: Three Stories *Wilson, Patricia A.; Walsh, Elizabeth; Bush, Alan* **2803** **Day II: Topic(s) 2** Aristotle's Four Causes and Teamwork in Corporations *Kulak, Daryl*	**2835 (2940)** **Day I, II: Topic(s) 2, 3** Wholeness in Complex Socio-Technical Systems *Toth, William Joseph* **Service Systems Science** **2844** **Day IV: Topic(s) 7** Value Based Architecture of Digital Product-Service Systems *Kumar, Anand; Lokku, Doji Samson; Zope, Nikhil Ravindranath* **2742 (2881)** **Day I: Topic(s) 1, 2** Performance Evaluation System In Engineering Matters: Systematic and Theoretical Approach to Humanity *Takaku, Tatsumasa*		**2886** **Day I, V: Topic(s) 2, 10** Towards Systems Literacy - The Role of Systems Research

Enrique; Arenas-Resendiz, Tanya; **2838 (2912)** **Day IV: Topic(s) 7** Designing an Accessible Tourism Destination: The Soft System Methodology and the Triple Helix as a Theoretical and Practical Proposal *Matamoros-Hernández, Omar E.; Tejeida-Padilla, Ricardo; Briones-Juarez, Abraham; Morales-Matamoros, Oswaldo*	Paradigm: Study on the Idea and Model for Boundary-Balance of Nonlinear Society *Liu, Yiyu; Yan, Zexian*	*Tumanako Ngawhika*				
Dinner available at C4C (17:00 to 18:30 self-pay) or nearby local restaurants						

19:00 Evening	
19:00 – 21:00 **Macky Auditorium**	**Public Program:** ***Next Steps to Realizing a Sustainable Future*** (ISSS & the WILD Foundation, Public Event at Macky Auditorium*)* **DISCOUNTED TICKETS for ISSS $10 Available at Registration Desk or at the Door on Evening** **Description:** As we reach global limits of human growth in many dimensions, advanced thinking is required to operate in ecological balance with nature and to create more symbiotic opportunities. Join us for an informative evening of public talks on anticipating the future of nature and humanity. **Chair:** Amy Lewis **Panellists:** **Gunter Pauli** (The Blue Economy); **John Fullerton** (Regenerative Capitalism); **William Becker** (Global Change); **Marc Bekoff** (Life and Human Values); **Ilarion Merculieff** (Indigenous Wisdom); **Jeff Orolowski** (Nature Documentary); **Joshua Tewksbury** (Future Earth Science).

Tuesday: July 26, 2016
Global Science and Assessment

REGISTRATION DESK OPEN 07:45 – 12:00 (Lobby, Maths 100); 13:30 to 17:00 Lobby, Engineering Building.
07:15 to 08:15 ISSS RoundTable Discussion (Treehouse Room, C4C Dining Room)

08:30 Plenary Session (Maths 100 Lecture Theatre)

08:30	**Plenary III:** ***Connecting Human and Natural System(s) Research*** **Description**: Current ecological trends present a dramatic picture of potentially catastrophic change in the world. At the same time, our human and societal response mechanisms seem poorly designed for coping with complexity, and science seems unable to address systemic problems and systems as a whole. What are the challenges in science, policy, and ethics to become a sustainably healthy civilization with creative options for the future? **Chair:** Jeremiah Osborne-Gowey **Speakers:** 8:30 – 9:00 **Carol Wessman** (ENVS/CIRES) – *Linking Science, Policy, and Ethics in Sustainability Science at the University of Colorado* 9:00 - 9:30 **Bruce Milne** – *Sustainability Science* 9:30 – 10:00 **Joshua Tewksbury** – *Living in the Anthropocene: Science, Sustainability, and Society* 10:00 – 10:15 **Q&A**

10:15 – 10:30 Tea/Coffee (Maths 100 Courtyard)

10:30	**Plenary IV:** ***Crisis Science: Anticipatory, Real-Time, and Preventive*** **Description:** Adequate resilience and appropriate response (interventions) to crises and disasters and continuous improvement thereof is a growing global need and a social responsibility in view of the seemingly growing number of disasters endangering a growing number of people and even our civilization. Can we do a better job of anticipating, systemically understanding and mitigating the cycles of crisis and recovery by combining exploratory 'crisis science' with long-term 'sustainability science'? Can we unravel the antithesis of incompatible response systems and find new ways to integrate scientific, technological, cultural, ethical, political and economic influences? Preparedness must systemically consider the often emergent interplay of supporting and obstructing factors. Actual interventions (responses) must holistically evaluate the total situation and make decisions, unfortunately to be performed under high uncertainty, extreme stress and time pressure. Despite the often singularity of disasters we have to identify similarities and powerful abstraction in order to support scientific analysis and improved mitigation. A long range target could be an interdisciplinary 'Strategic Crisis Science'. The panel of international experts will discuss these issues from their different backgrounds and national priorities with respect to preparedness and interventions. We will attempt to establish common grounds and basic solutions. **Chair:** Gerhard Chroust **Speakers:** 10:30 **Gerhard Chroust** - *Expecting the unexpected, coping with crisis* 10:40 **Roberto Poli** – *Anticipatory Science – Science before the crisis* 11:15 **James P. Syvitski** – *From politics to remote sensing: The Indus Flood of 2010 – unfolding of a disaster and lessons learned* 11:50 **Q&A**

12:15 Lunch (C4C Cafeteria included in meal cards)

Paper Sessions 13:30 – 15:00						
Engineering **Room ECCR151**	**Engineering** **Room ECCR200**	**Engineering** **Room ECCR245**	**Engineering** **Room ECCR265**	**Engineering** **Room ECCR 1B51**	**Engineering** **Room ECCR 1B55**	**Benson 180**
Action Research **And Balancing Individualism and Collectivism**	**Human Systems Inquiry**	**Systems Engineering**	**Research Toward a General Theory of Systems**	**Curating Emergence for Thrivability**	**Organisational Transformation and Social Change**	**WORKSHOP** **PART 1**
Chair: Shankar Sankaran	**Chair: Dennis Finlayson**	**Chair: Janet Singer**	**Chair: David Rousseau**	**Chair: Alexander Laszlo**	**Chair: Louis Klein**	**Chair: Len R. Troncale**
Action Research **2760 (2903)** **Day I, IV: Topic(s) 2, 8** Participatory Action-Research as a Methodology for the Development of Appropriate Technologies by Communities *Acero López, Andrés Esteban; Ramírez Cajiao, María Catalina; Mejía, Mauricio Peralta; Payán Durán, Luisa Fernanda; Espinosa Díaz, Edier Ernesto* **2797** **Day II, III, V: Topic(s) 3, 5, 9** The Urban Village as a Living System: Building a Generative and Caring Local Economy and Society through Strategic Collaboration *Joseph, Brett R.*	**2780 (2942)** **Day I, II: Topic(s) 2, 3** Ingenieros Sin Fronteras Colombia: Improvement of the Water Quality In the Community of Santa Isabel de Potosí *Ramírez Cajiao, María Catalina; Sanabria Céspedes, Juan Pablo; Duarte Gómez, Diana María; Acero López, Andrés Esteban* **2795 (2913)** **Day III: Topic(s) 5** Civilization, Technology, and Money: The Challenge of a Human Fit *Kalton, Michael Charles*	**2728** **Day IV: Topic(s) 7** CONSYS Approach for Building: A Link Between CONOPS and System Models in the Context of Model-Based Systems Engineering *Yang, Sherry; Blessner, Paul; Olson, Bill* **2732 (2732)** **Day II: Topic(s) 3, 5** Systemic Integration on Spatial Knowledge in Business *Leon Vega, Cirilo Gabino; León Hernández, Ciro David; Reséndiz Vázquez , Rabiendranath* **2823 (2823)** **Day V: Topic(s) 9** A Systemic Model for Communication Innovation	**2793** **Day I, IV: Topic(s) 1, 2, 8** An Integrative Model of Four-Phase Adaptive Evolution in Organizations *Lin, Kingkong* **2807** **Day I, IV: Topic(s) 2, 8** Addressing the Whole Whole *Marzolf, Thomas R* **BY SKYPE** **2744** **Day IV: Topic(s) 7,8** Footprints of General Systems Theory *Malecic, Aleksandar*	**2740** **Day I, V: Topic(s) 1, 2, 10** A Whole Systems Approach to Education Redesign: A Case Study on the Need for Inter-Generational Perspectives and Inclusion *Laszlo, Kahlia Paola; Laszlo, Alexander* **2752 (2955)** **Day V: Topic(s) 10** Crucial Institutional Innovations: Evolutionary Change in Higher Education *MacVie, Leah* **2771** **Day I: Topic(s) 1, 2** The Lighthouse - Innovating the Systems Sciences System *Karabeg, Dino; Macvie, Leah; Rudan, Sasha Mile; Rudan, Sinisha; Grathoff, Annette;*	**2836** **Day I, IV: Topic(s) 1, 2, 7** How Teaching Cybernetics, in any Discipline, Can Bring Forth Systemic Change *Chapman, Jocelyn; McClendon, Karen* **2842** **Day I, III, IV: Topic(s) 1, 6, 7** The Illusion of Technology: A Generational Perception on the Need for a Human-Centered Approach in Dealing with Developments of Science and Technology *Von Mitschke-Collande, Joséphine; Alvarez Pereira, Carlos* **2889** **Day IV: Topic(s) 7** A Categorization of Socio-Technical Systems Approaches based on Context and Purpose	**2934** **Day V: Topic(s) 10** $5m Later … Assessment of Four Systems Education Programs: What Works, What Doesn't & Why *Troncale, L. R.*

2843 (2843) **Day I, II: Topic(s) 2, 3** Critical Systems Thinking Review on Decentralised Drinking Water Management in Nuali City, Indonesia *Simbolon, Jackwin*	**2745 (2893)** **Day I: Topic(s) 2** Typology of Social Actions Based on the Living System Theory *Riss, Ilan*	*Leon Vega, Cirilo Gabino; Iturri Hinojosa, Luis Alejandro; Ávalos Villareal, Elvira*		*Laszlo, Alexander; Hahn, Samuel*	*Rime, Elatlass,; Narwankar, Chinmay Sandeep; Calvo-Amodio, Javier*	

15:00 Tea/Coffee (Engineering Lobby) – Poster Viewing in Engineering Lobby **Paper Sessions 15:30 – 17:00**						
Engineering **Room ECCR151**	**Engineering** **Room ECCR200**	**Engineering** **Room ECCR245**	**Engineering** **Room ECCR265**	**Engineering** **Room ECCR 1B51**	**Engineering** **Room ECCR 1B55**	**Benson 180**
Action Research and Systems & Mental Health	**Systems Philosophy and Critical Systems Theory and Practice**	**Systemic Approaches to Conflict and Crises**	**Health and Systems Thinking**	**Curating Emergence for Thrivability**	**Organisational Transformation and Social Change**	**WORKSHOP**
Chair: Shankar Sankaran	**Chair: David Rousseau**	**Chair: Gerhard Chroust**	**Chair: Thomas Wong**	**Chair: Alexander Laszlo**	**Chair: Louis Klein**	**Chair: Mila Popovitch and Alexander Laszlo**
2887 (2888) **Day V: Topic(s) 9** A Communication System for Socio-Ecological Processes *Murillo-Sandoval, Sandra Leticia; Peon-Escalante, Ignacio E; Badillo-Piña, Isaías* **2777** **Day V: Topic(s) 9** Positive Systems Science: Using Positive Psychology to bring Systems Science to Life *Siokou, Christine*	**2762** **Day IV: Topic(s) 8** Dynamics as Demarcation *Silverman, Howard* **2884** **Day III: Topic(s) 5** Bringing Forth the Ecological Economy *Perkins, Skyler Knox* **2895** **Day IV: Topic(s) 7** Complementarist Approach to Categorize	**2791** **Day II, III: Topic(s) 4, 6** Comparing the Current ISIS and the (Not Yet) Past Leninist States (USSR and Pre-1979 China) *Liu, Zhongjing William; Hu, Jason Jixuan* **2872** **Day III: Topic(s) 5** Evolution of Supply Chain Management Towards Green Supply Chain Management: Drivers and their Impact	**2800** **Day II: Topic(s) 3** Managing for the Health of Coupled Human and Natural Systems at the Watershed Scale *Bunch, Martin Joseph; Morrison, Karen* **2813** **Day IV: Topic(s) 7** Architectural Parallels Between Biological and Engineered Solutions in Defence and Security Adaption,	**2778 (2935)** **Day II, V: Topic(s) 3, 10** Patterns that Connect: Exploring the Potential of Patterns and Pattern Languages in Systemic Interventions towards Realizing Sustainable Futures *Finidori, Helene* **2892** **Day I: Topic(s) 1, 2** Analogical Reasoning on Creation *Lee, Suehye; Shirasaka, Seiko*	**2819 (2947)** **Day I: Topic(s) 1,2** Opening the Field of Linguistic Design for Thrivability *Roth, Ian* **2833 (2874)** **Day I, III: Topic(s) 1, 5** How to Design All Together? The Triple Bottom Line *Barrera, Ricardo*	**Art and Performance**

2921 **Day V: Topic(s) 10** Developing a Theory of Systems Change Approach to Practice-Based Research in a Professional Public Health Doctoral Program *Pinsker, Eve; Welter, Cristina*	Different Stakeholders within Socio-Technical Systems *Calvo-Amodio, Javier; Narwankar, Chinmay Sandeep; Rime, Elatlassi; Wang, Siqi*	*Sami Georges ElNaddaf*	Anticipation, and Sustainment. *Daniel Allegro, Brigitte; Smith, Gary Robert* **2882** **Day II, III: Topic(s) 2, 3** Five Elements Systemic Healthcare Program for Physically Strong Emotionally Happy Mentally Kind Behaviorally Charitable and Spiritually Enlightened – Reuniting Nature and Humanity *Wong, Thomas S L; Huang, E C Yan*	**2900** **Day IV: Topic(s) 7** Unlimited Energy *Crespo, Fabiana*	**2898 (2898)** **Day III: Topic(s) 6** Transnational Knowledge: Its Creation and Distribution Exploiting Entrepreneurship and Organisational Behaviour *Hilton, Brian John*	

Dinner available at C4C (17:00 to 18:30 self-pay) or nearby local restaurants

19:00 Evening	
19:00 – 21:00 **BENSON 180**	**Colloquium:** ***Edge of Science: Thresholds and new paradigms*** **Chairs:** Dominique Surel and Pamela Henning **Description:** Participatory, real-time science, or holistic science is the heart of the emerging new paradigm of sustainability science and anticipatory science. We can see it exemplified in science conducted during a crisis, which is quite different from disciplinary science in which we are used to knowing the questions and priorities for research. During crises even the questions must be discovered, disciplines must be combined or transcended, and people and institutions must collaborate. We will look at some characteristics of this exploratory edge of science that seems so important for the study of systems. We will also examine social and psychological factors that tend to resist exploratory science, making it difficult to study complex phenomena, crises or impending crises; and thus requiring a special set of personal skills. Today the challenge of complex systems means a great need for new science that can deal with more than traditional causes and mechanisms. This will be an evening of penetrating discussion on three topics (a) the need for an exploratory phase of science, (b) requisite human capacity for systems thinking and (c) peer and institutional resistance to threshold ideas and new paradigms. **Program:** 19:15 - 19:45 **Gary Machlis** - *The Distinctive Characteristics of Science during Crisis* 19:45 – 20:00 **Dominique Surel** – *Human Capacity for Systems Thinking* 20:00 – 20:15 **Pamela Henning –** *Psychology of Empowering and Supporting Student Research* 20:15 – 21:00 Facilitated discussion

Wednesday July 27, 2016
Cultural, Ethical, and Economic Wisdom

REGISTRATION DESK OPEN 07:45 – 12:00 (Lobby, Maths 100); 13:30 to 17:00 Lobby, Engineering Building.

07:15 to 08:15 ISSS RoundTable Discussion (Treehouse Room, C4C Dining Room)

08:30 Plenary Session (Maths 100 Lecture Theatre)	
08:30	***Plenary V: Making Sense in Economics, Ethics, and Policy*** *Description:* We need to examine the foundation of our global economic system that assumes unlimited growth in a finite world, to consider the paradigms of regenerative capital, steady-state economics, and innovation. This means considering no-growth and negative-growth models, and perhaps shifting our concept of growth from quantity to quality, from extraction to investment in natural and human capital. **Chairs:** Alec Tsoucatos and Mila Popovitch **Speakers:** 8:30 – 9:00 **John Fullerton –** *Reimagining Capitalism: Transitioning to a Regenerative Economy* 9:00 – 9:15 **Alec Tsoucatos** – *The Economics of Care, Wisdom and Empowerment* 9:15 – 10:15 **Mila Popovitch** - *Economics of Dignity and New Economy: Valuing Planet, People and Progress* 9:15 – 10:15 **Panel Discussion** **Chair:** Mila Popovitch **Panelists:** **Elizabeth Kucinich; John Fullerton; Gunter Pauli and Alec Tsoucatos**
10:15 – 10:30 Tea/Coffee (Maths 100 Courtyard)	

10:30	**Plenary VI: Multi-Cultural Worldviews on Sustainability** *Description:* Ancient and native cultures have a direct experiential knowledge of whole systems and what is a sustainable natural balance. What are the lessons and how do we incorporate them into modern science, leadership, and society? **Chairs:** Dominique Surel and Vijay Gupta **Panellists:** **Bruce Milne, Greg Cajete, Jamal Martin, David Begay, Nancy Maraboy and Rudy Miick**
12:15 BROWN BAG LUNCH BOXES PICK UP AT MATH 100 then move to University Memorial Center (UMC) ROOM 235 for Special Lunch Programme (included in meal cards).	

Special Brown Bag Public Program: Inter-Faith Perspectives on Global Sustainability

Description: In the face of unprecedented global change, Pope Francis recently challenged people of all faiths to unite together for what he called "integral ecology." Is his appeal compelling? What of a similar nature has been said in other faith traditions and what is new about this appeal? This interfaith panel discussion on global sustainability will explore a variety of faith perspectives that may contrast or correlate with the Pope's *Laudato Si': On Care for Our Common Home*. Scholars and religious leaders representing diverse faith traditions will engage with one another to discuss the roots and meanings of "integral ecology" and this contemporary call to action.

Chairs: Andrew Schwartz and Alec Tsoucatos

Panellists:

Loriliai Biernacki – Hinduism; **Anne Parker** – Buddhism; **Aun Ali** – Muslim; **Glenn Morris** – Native American
Marc Soloway – Jewish; **Todd Wynward** – Christian; **Venugopal Damerla** and **Manu Raval** – Vedic Tradition**; Larry Goldberg (In Memorium)**

WORKSHOPS AND FIELD TRIP 13:30 – 15:00

NCAR is an NSF research facility that studies the global environment and is open to the Public. It is situated next to the Boulder Mountain Park and Mesa Trail. NCAR staff will greet each group and give a short talk about NCAR outside in the natural setting of the Mesa. Visitors are then free to browse the exhibits or walk along the Mesa trail.

NCAR / Mesa Trail	**Engineering Room ECCR200**	**Engineering Room ECCR245**	**Engineering Room ECCR265**	**Engineering Room ECCR 1B51**	**Engineering Room ECCR 1B55**	**Benson 180**
FIELD TRIP	**WORKSHOP**	**WORKSHOP**	**WORKSHOP**	**WORKSHOP**	**OPEN ROOM**	**POLICY SUMMIT**
Register at Conference Desk	**Chair: Pavel Luksha**	**Chair: Eric Dooley-Feldman**	**Chair: Shankar Sankaran and Pamela Buckle**	**Chair: Judith Rosen**		**Chair: Paul Sperry and Alex Tsoucatos**
Schedule: (30 persons in each Group; signup at Registration Desk) **Group I**: 13:30 departure from UMC Building – 15:15 return from NCAR	**2937** **Day V: Topic(s) 10** System Literacy and Systemic Innovation for Thrivable Future *Laszlo, Alexander; Karobeg, Dino; Luksha, Pavel*	**2783** **Day III, V: Topic(s) 6, 9** WILD: Wilderness Integration & Life Development: Co-creating the Emerging Model *Dooley-Feldman, Eric Adam*	**2738** **Day I: Topic(s) 2** Developing Capability using a Maturity Profile for Action Research: An International Collaboration *Sankaran, Shankar; Rowe, Wendy; Cady, Phil; Pamela Buckle*	**2949** **Day IV: Topic(s) 8** Anticipatory Systems and Gender Dysphoria *Rosen, Judith; Rosen, Donna*	observers.	**2964** Systemic Sustainability Policy – Recommendations of the Systems Sciences Community *Sperry, Paul and Tsoucatos, Alex*

15:00 Tea/Coffee (Engineering Lobby) – Poster Viewing in Engineering Lobby

Paper Sessions 15:30 – 17:00

Engineering Room ECCR151	Engineering Room ECCR200	Engineering Room ECCR245	Engineering Room ECCR265	Engineering Room ECCR 1B51	Engineering Room ECCR 1B55	Benson 180
NCAR / Mesa Trail	**WORKSHOP**	**WORKSHOP**	**WORKSHOP**	**WORKSHOP**	**OPEN ROOM**	**POLICY SUMMIT**
Register at Conference Desk	**Chair: Dino Karabeg**	**Chair: Jim Best**	**Chair: Thomas Wong**	**Chair: Judith Rosen**		**Chair: Paul Sperry and Alex Tsoucatos**
Schedule: (30 persons in each Group; signup at Registration Desk) **Group II:** 15:00 departure from Engineering – 16:45 return from NCAR	**2946** **Day V: Topic(s) 10** CET SIG Workshop: Collaboration for Impact 2016 *Grathoff, Annette; Hahn, Samuel; Karabeg, Dino; Laszlo, Alexander; MacVie, Leah; Rudan, Sasha Mile; Rudan, Sinisha*	**2784** **Day V: Topic(s) 9** Workshop (90 Minutes): Network Thinking and Liberating Practice for Creating Resilient, Diverse, Communities of Practice that Engage the Whole Person *Best, Jim*	**2905** **Day I, III: Topic(s) 2, 6** System Wholeness and Unity In Diversity within ISSS *Wong, Thomas S L*	**2949** **Day IV: Topic(s) 8** Anticipatory Systems and Gender Dysphoria *Rosen, Judith; Rosen, Donna*		**2964** Systemic Sustainability Policy – Recommendations of the Systems Sciences Community *Sperry, Paul and Tsoucatos, Alex*

17:30 – 18:45 ISSS Council Meeting (C4C Dining Hall) – Self Pay Dinner and Meeting

Dinner available at C4C (17:00 to 18:30 self-pay) or nearby local restaurants

19:00 Evening

19:00 – 21:00 **BENSON 180**	Special Evening Dialogue: ***Robert M. Hutchins Memorial Dialogue on Anticipating Global Futures*** **Description:** Robert M. Hutchins' dialogues were centered on the idea that systems theory is needed to anticipate the future of human and natural systems and to advance science, governance, societal development, and educational systems. Continuing in the spirit of these dialogues, this will be an open, multi-faceted discussion about issues of sustainability in socio-ecological systems. **Chairs: Judith Rosen and Debora Hammond**

Thursday: July 28, 2016
Systems Theory, Management, and Practice

REGISTRATION DESK OPEN 07:45 – 12:00 (Lobby, Maths 100); 13:30 to 17:00 Lobby, Engineering Building.

07:15 to 08:15 ISSS RoundTable Discussion (Treehouse Room, C4C Dining Room)

08:30 Plenary Session (Maths 100 Lecture Theatre)

08:30

Plenary VII: Engineering Sustainable Systems and Technology

Description: To build sustainable and thriving systems, societies, and civilizations we need to combine real-world experience with practical methods in engineering, design, cybernetics, ethical control systems, service systems, and other emerging technological fields such as bioneering and nanotechnology. How do we transcend current limits to realize innovative and entrepreneurial technological possibilities within a sustainability framework?

Chair: Gary Smith

Speakers:

8:30 – 9:00 Anand Kumar - *Reflections on the Tata Sustainability Journey*
9:00 – 9:30 Rick Dove - *Enabling and Facilitating Engineered Sustainability*
9:30 – 10:00 Diana Mann - *The Global Water Energy Nexus*
10:00 – 10:15 Discussion

10:15 – 10:30 Tea/Coffee (Maths 100 Courtyard)

10:30

Plenary VIII: Prospects for Scientific Systemic Synthesis

Description: Recent times have seen the emergence of new theoretical insights that may help to establish the frameworks, theories and methodologies we need to understand, design, build, explain, communicate about, utilize or operate, maintain, and evolve resilient and sustainable socio-ecological systems. In this panel we bring together experts to present on such emerging developments in the areas of engineering, science, research, practice and philosophy, and to reflect on how these different stands can contribute to the formation of a new systemic synthesis that will make the 'whole systems perspective' scientific and practical. The panel presentations will be delivered in the last plenary before lunch, and be followed by an open discussion between the panellists and audience in a break-out session immediately after lunch. *Chair:* ***David Rousseau**

Panellists:

10:30 – 10:55 Bill Schindel - *The S* minimal general systems meta-model, and its prospects as a general modelling foundation for Systems Engineering.*
10:55 – 11:20 Len Troncale - *Systems Processes Theory (SPT) , and its prospects as a general theoretical core for a science of systems and sustainability.*
11:20 – 11:45 John Kineman - *The PAR/Holon Relational Framework, and its prospects as a general methodology for Systems Research*
11:45 – 11:55 Jennifer Wilby - *Systemic methodologies and the prospects for enhancing them on the basis of emerging general systems theories and models.*
11:55 – 12:10 David Rousseau - *Systems Philosophy and the prospects for employing scientific general systems principles as the foundation of a systems worldview.*
12:10 – 12:15 Q & A

12:15 Lunch (C4C Cafeteria included in meal cards)

Paper Sessions 13:30 – 15:00						
Engineering **Room ECCR151**	**Engineering** **Room ECCR200**	**Engineering** **Room ECCR245**	**Engineering** **Room ECCR265**	**Engineering** **Room ECCR 1B51**	**Engineering** **Room ECCR 1B55**	**Benson 180**
Designing Educational Systems and Hierarchy Theory	**Organisational Transformation and Social Change**	**SABI: Dialogue in Systems Applications in Business and Industry**	**Socio-Ecological Systems**	**Human Systems Inquiry**	**SKYPE PRESENTATIONS**	**DISCUSSION**
Chair: Ockie Bosch	**Chair: Louis Klein**	**Chair: Andreas Hieronymi**	**Chair: Stefan Blachfellner**	**Chair: Dennis Finlayson**	**Chair: Delia Pembrey MacNamara**	**Chair: David Rousseau**
2870 **Day V: Topic(s) 10** Transforming to Sustainable Futures: Learning From 45 Years of Systems Thinking In Practice Pedagogy *Chris Blackmore,; Ray Ison* **2766** **Day V: Topic(s) 10** Agency and Causal Factors in Social Systems: Toward Heightened Learning, Performance, and Connection in our Schools and Workplaces *Gabriele, Susan Farr* **2927 (2927)** **Day I,IV: Topic(s) 5, 10** Analysis of Global Quality Indicators in the National	**2810** **Day I, V: Topic(s) 1, 2, 10** Design for Social Innovation: Integrating the Theory and Practice of Action Research and Participatory Design for Organizational and Social Impact *Laszlo, Kathia Castro; Schultz, Amelia B.* **2812 (2850)** **Day 1, IV: Topic(s) 1, 7** Proposing Values and Practices for a Culture of Organizational Ingenuity: Hacking Systems Thinking to Pursue the Preposterous and Produce the Impossible *Rosencrans, Kendra*	**2839 (2915)** **Day IV: Topic(s) 7** Toward a Diagnosis of Viability of Small Manufacturing Enterprises. Case: Metal Mechanic Industry *Salinas-Reyes, Marcos; Badillo-Piña, Isaias; Tejeida-Padilla, Ricardo* **2841 (2914)** **Day IV: Topic(s) 7** A Systemic Approach of the Technological Innovation Process in Mexico *García-Jarquin, Brenda; Delgado-Rodriguez, Alfredo; Aguilar-Fernandez, Mario; Morales-Matamoros, Oswaldo; Badillo-Piña, Isaias; Briones-Juarez, Abraham; Sistos-Mendoza, David; Nuñez-Ríos, Juan Enrique*	**2860** **Day I, II, IV: Topic(s) 1, 3, 7** Post-Normal Science V Citizen Science: An Exploration of Custom and Practice *Gregory, Amanda; Atkins, Jonathan Paul* **2966** Engaging partnership to improve corporate social responsibility in developing countries. *Opon, Dolores* **2782** **Day I, III, V: Topic(s) 1, 6, 9** Collaboframework - A Framework for Sustaining Socio-Ecological Systems through Dialogical Knowledge and Action Space *Rudan, Sasha Mile; Rudan, Sinisha; Karabeg, Dino*	**2820 (2916)** **Day IV, V: Topic(s) 7, 10** Towards Understanding the Effects of Visual Artefacts in Problem Structuring Processes: A Boundary Games Approach *Velez-Castiblanco, Jorge Ivan; Londono-Correa, Diana; Naranjo, Olandy* **2826** **Day V: Topic(s) 9** A Study of Systems Research Design: An Examination of Systemic and Systematic Methods used to Study Chinese Women's Decision to Study Abroad *Zou, Chen; Buckle, Pamela; Edson, Mary; Wilby, Jennifer*	**Systems Engineering** **2876** **Day IV: Topic(s) 7** Ethics for Cybersystems *Paola Di Maio* **Organisational Transformation and Social Change** **2747** **Day II: Topic(s) 3** Permanent Designing as a Way to Socio-Technical Systems Sustainability Achieving *Sazonov, Boris; Korolev, Anton; Kozhevnikov, Dmitry* **Action Research** **2883** **Day I, II, IV: Topic(s) 2, 3, 8** Returning to Nature, Co-Operative In Mind by Viable System Model *Gamero, Claudio; Acevedo Almonacid, Hector Ricardo*	**2880** **Day IV: Topic(s) 8** Prospects for a New Systemic Synthesis (Discussion)

Polytechnic Institute, Mexico *Patiño, Julian; Yarzábal Coronel, Nashielly; Patiño Ortiz, Miguel; Cuellar Orozco, Maricela; Ramírez Romero, Tonáhtiu Arturo* **2788**	**2815** **Day I, V: Topic(s) 1, 2, 9** Toxic Leadership in Context *Daniels, Teresa; Metcalf, Gary*	**2827** **Day IV: Topic(s) 8** Homeostats, Recursions and Time Scales: A Viable System Model Enquiry *Leonard, Allenna*		**2851 (2907)** **Day I, V: Topic(s) 2, 9** A Theoretical Framework to Capture Stakeholder's Perspectives for the Design of Collaborative Communication Structures for Specialized Organizations *Chongvilaiwan, Tanida; Calvo-Amodio, Javier*	**Research Toward a General Theory of Systems** **2922 (2923)** **Day I: Topic(s) 2,** The General Theory of Metadynamics Systemicity: Part 6: Neighbourhood and the 4d Neighbouring of Things *Blanc, Jean Jacques*	

15:00 Tea/Coffee (Engineering Lobby) – Poster Viewing in Engineering Lobby

Paper Sessions 15:30 – 17:00

Engineering Room ECCR151	**Engineering Room ECCR200**	**Engineering Room ECCR245**	**Engineering Room ECCR265**	**Engineering Room ECCR 1B51**	**Engineering Room ECCR 1B55**	**Benson 180**
Translational Systems Science	**Organisational Transformation and Social Change**	**Systems Ethics and Designing Educational Systems**	**Socio-Ecological Systems**	**Human Systems Inquiry**	**Research Toward a General Theory of Systems**	**WORKSHOP PART 2**
Chair: David Ing	**Chair: Louis Klein**	**Chair: John Vodonick**	**Chair: Stefan Blachfellner**	**Chair: Dennis Finlayson**	**Chair: David Rousseau**	**Chair: Len R. Troncale**
2811 **Day V: Topic(s) 10** Curriculum Making for TRITO Learning: Wayfaring into a Meshwork of Systems Thinking *Ing, David; Nousala, Susu*	**2753 (2938)** **Day I, II: Topic(s) 1, 2, 3** Creating Enduring Social Impact: A Model for Multi-Sector Transformational Change *Jacobs, Marty*	**2873** **Day IV, V: Topic(s) 7, 8, 10** Systems Modeling to Understand Threats to Research Integrity & the Effectiveness of Proposed Solutions *Amber D. Elkins,; Dennis M. Gorman,; Mark A. Lawley* **2920** **Day I: Topic(s) 1, 2** Mapping the Macro-Level for Interdisciplinary	**2737 (2939)** **Day I: Topic(s) 1, 2** A Framework for Understanding and Achieving Sustainability of Complex Systems *Mobus, George* **2918** **Day I,II, IV: Topic(s) 2, 3, 8** The Need for a General Systems Transdisciplinarity to Solve Serious	**2885** **Day I: Topic(s) 1** Thinking and Acting Systematically about the Anthropocene *Shim(Sim), Yeon-Soo(Youn-Soo)* **2901 (2901)** **Day II: Topic(s) 3** Resilience and Ecological Citizenship in Socio-Ecological Systems *Shim, Min-Hu*	**2809 (2925)** **Day III: Topic(s) 5** The Linkage between Systems Thinking and Ethics *Roth, William F* **2779** **Day I, IV: Topic(s) 2, 8** A General Framework for Systems Research and Modeling *Kineman, John J.*	**2934** **Day V: Topic(s) 10** $5m Later … Assessment of Four Systems Education Programs: What Works, What Doesn't & Why *Troncale, L. R.*

2856 **Day I, III: Topic(s) 2, 5** Anticipatory Factors in Dialogic Design: Systemic Design Theory and Practice for Collaborative Foresight *Jones, Peter* **2965** A 'Global Sustainability Architecture' towards a sustainable future *Agrawalla, Raman K.*	**2781** **Day I, V: Topic(s) 1, 9** Transformative Learning Networks *Goldstein, Bruce Evan; Risien, Julie; Osbourne-Gowey, Jeremiah; Frankel-Goldwater, Lee; Chase, Sarah Schweizer Claire* **2786** **Day I: Topic(s) 1** Opportunity Tension at the Center of Sustainable Organization: Positive Organizational Scholarship and Generative Emergence *Best, Jim*	Decision Making - A Visual Framework and Method *Hieronymi, Andreas* **2774** **Day I, IV: Topic(s) 2, 8** A Good Approach to Wicked Problems *Vodonick, John*	Systemic Challenges facing Present-Day Socio-Ecological and Socio-Technological Systems *Blachfellner, Stefan* **2878** **Day II, IV: Topic(s) 3, 7** Systems Models of the Social Ecology of Traffic Safety to Analyze the Effectiveness of Interventions *Amber D. Elkins,; Eva M. Shipp,; Dennis M. Gorman,; Mark A. Lawley*	**2902 (2902)** **Day II: Topic(s) 3** On the Domesticated Bodies of North Korean Residents *Shim, Jingon* **2953** **Day I: Topic(s) 2** The Future of Scientific Probing and Social Being: Quantum Computation, Artificial Intelligence, and Consciousness *Popovich, Mila*	**2756 (2917)** **Day I, IV: Topic(s) 2, 8** System Language: Understanding Systems *Mobus, George; Anderson, Kevin*	

17:15 – 18:00 ISSS AGM (Math 100)

19:00 Evening	
19:00 – 21:00	**Conference Dinner – University Memorial Center (UMC) Ballroom** **Best Paper Awards – Alexander Laszlo** **Goldberg Award – John Kineman** **Press Release – Paul Sperry and Alec Tsoucatos** **Incoming Inaugural Address ISSS2017, Vienna – Professor Ockie Bosch** **Cultural Programme- Mila Popovitch**

Friday: July 29, 2016
Education, Communication, and Capacity

REGISTRATION DESK OPEN 07:45 – 18:00 (Lobby, Maths 100)

07:15 to 08:15 ISSS RoundTable Discussion (Treehouse Room, C4C Dining Room)

08:30 Plenary Session (Maths 100 Lecture Theatre)	
08:30	***Plenary IX: Human Capacity, Communication, and Student Research*** *Description:* Systemic Sustainability and Systems Literacy ultimately involve transformative changes at the personal and social level. What individual competencies are needed and how will student researchers navigate the treacherous waters ahead for 'out-of-the-box' thinkers? We emphasize the importance of integrated personal skills and effective collaborative and innovative networking to build transformative communities. **Chair:** Pamela Buckle ***Speakers:*** **Pamela Buckle** (The Challenge of Graduate Research in systems science and practice) **Delia Pembrey MacNamara** (Ranulph Glanville Memorial Talk) – *Connection and Collaboration in the Networked World (for Systemic Purpose/Action)* **Student Award Papers (Vickers, Rapoport, Mead)**
10:15 – 10:30 Tea/Coffee (Maths 100 Courtyard)	
10:30	**Plenary X: *Systems Literacy Education and Outreach*** **Description:** Achieving sustainable and more synergistic futures requires education in systems thinking and connection with new modes of social communication. Our highest priority should be to legitimize whole systems research and to provide adequate guidance to student/expert collaborative learning within a program of Systems Literacy. How do we 'train the trainers' and launch this program? **Chair:** Peter Tuddenham **Speakers:** 10:30 – 11:30 **Graduate Course Student Report (introduced by Ray Ison)** 11:30 – 12:15 **Peter Tuddenham and Delia Pembrey MacNamara —** *Systems Literacy Dialogue*
12:15 Lunch (C4C Cafeteria included in meal cards)	

13:30 Plenary Session (Maths 100 Lecture Theatre)	
13:30	**Afternoon Plenary A: *Education Synthesis Panel*** **Description:** *Conference goals for an educational agenda were explored in a number of special workshops. While theories and approaches are diverse, this panel will provide an opportunity to connect different approaches and to explore common ground toward an agenda for the future of systems education, especially related to systemic sustainability praxis, science, policy, and ethics.* **Chair:** Ockie Bosch **Panellists:** ***Ockie Bosch, Peter Tuddenham, Dino Karabeg, Len Troncale, , Mary Edson, Ray Ison and Pavel Luksha***

15:00 – 15:30 Tea/Coffee (Maths 100 Courtyard)	
	Afternoon Plenary B: ***Conference Closing*** **Chairs:** Ockie Bosch, Peter Tuddenham, John Kineman and Mila Popovitch **Description:** Concluding Program Concluding remarks Closing Program

09:00 – 12:00 Planning for 2017 Session (Maths 100 Lecture Theatre)	
17:30 - 19:00 **19:00 – 21:00**	***Catered Reception at Fiske Planetarium (Lobby)*** **Sponsors:** Future Earth and ISSS. **Fiske Planetarium Program:** ***The Anthropocene Experience: Shaping Sustainable Futures, From Science to Society, with Josh Tewksbury*** **Chair:** Joshua Tewksbury **Description:** In the span of several thousand years, humans have gone from a minor player on the Earth to a species capable of reshaping the planet in profound ways. Join us for this immersive experience as Joshua Tewksbury of the global research group Future Earth takes you on a journey from the origins of human societies to the present day -- and addresses how the ingenuity of people around the world can shift the planet, either for better or worse. For more information on Future Earth: http://futureearth.org/. This event is being co-hosted by the International Society for the Systems Sciences (ISSS), as the final event of the ISSS 2016 Conference - Realizing Sustainable Futures in Socio-Ecological Systems. For more information: http://www.isss2016usa-india.com/

Saturday: July 30, 2016

09:00 – 12:00 Planning for 2017 Session (Maths 100 Lecture Theatre)	
09:00 – 12:00	**ISSS2017 Planning Meetings** 9:00 – 12:00 **Planning sessions for future events, focussing on ISSS-2017.** 9:00 – 12:00 **Graduate Course Final Session – Self organising.**

12:00 Close of Conference

Plenary Speakers and Panelists

JENNIFER WILBY

Jennifer Wilby is an emeritus senior researcher in management systems and sciences in The Business School, University of Hull. Jennifer's research interests include: developing systems resilience and flexibility in the management of complex systems, hierarchies and general system theory, service systems science and the development of critical systematic evaluations of research methods. Jennifer has also held a part-time (2007-2009) EPSRC post-doctoral fellow researching on the EmergeNet Emerging Sustainability Project. Prior to joining the University of Hull, Jennifer worked in urban planning, database programming and textbook publishing. She has worked at the University of Lincoln for two years and for five years at the University of York in the Centre for Reviews and Dissemination undertaking systematic reviews of health care interventions on behalf of the Department of Health (NICE). Jennifer is a Past President and is now Vice President for Administration for the International Society for the Systems Sciences (ISSS), and a past member of the board of the UKSS (United Kingdom Systems Society). Jennifer is Editor of Bulletin of the International Society for the Systems Sciences and Book Reviews Editor of Systemic Practice and Action Research.

JOHN KINEMAN

Dr. Kineman is an ecosystem scientist at the University of Colorado, currently developing a theory of whole systems (R-theory). He holds a Bachelor's of Science degree in physics and Earth Physics from UCLA, and a Masters and Ph.D. in Ecosystem Science and Environmental Studies from UC-Boulder. His primary interest is complex and living system theory from a trans-disciplinary perspective. His primary research is into whole system's theory and adaptive ecological niche modeling. He is working internationally between the USA and India to establish a global educational agenda in whole systems research focused on Crisis and Sustainability Sciences. John retired from the US National Oceanic and Atmospheric Administration (NOAA) in 1995, where he had worked in Ocean Exploration, Oil Spill (Crisis) research, marine ecology, global ecology, and informatics for Global Change research, the later in partnership with international programs in Africa and the Pacific. He has also done field work in conservation management at the Kenya Wildlife Conservation and Management Department, Karisoke Research Center in Rwanda, and UNEP in Kenya. His current theoretical research follows the work of Dr. Robert Rosen, a mathematical biologist who outlined a foundation for whole systems science that crosses disciplines. John began working in India in 2008 with a Fulbright Research Grant for ecological niche modeling (as a component of the broader theory) and consequently became interested in the relation between modern and ancient scientific philosophy as it relates to whole system's thinking. Part of his current research now involves the roots of Vedic philosophy as revealed to us in artifacts dating to 3000BC, suggesting a deep intuitive understanding of whole systems. John divides his time between residences in the USA and India.

GUNTER PAULI

Gunter Pauli (1956) graduated as an economist with an MBA ant then established ten companies of which two failed. He has never had a job and has always worked independently. Inspired by Aurelio Peccei, the founder of the Club of Rome, he set out to pioneer and be the change he wanted to see in the world. His endeavors cover business, culture, science and education. He co-authored a book with Fritjof Capra that was the first book ever presented on the Internet in broadband video casting on April

6, 1995. He organized the first ever global broadband internet conference on December 5, 1995. In this conference he linked: Nelson Mandela from his home in Pretoria, Shimon Peres from his office in Jerusalem, Jimmy Carter from a hotel in Atlanta to a gathering of Nobel Laureates chaired by Elie Wiesel and Ted Koppel in Hiroshima. He travels extensively navigating with great ease between cultures and continents. Fluent in seven languages, he has resided in Sweden, France, Japan, Colombia, the USA and Belgium. He is a global citizen, or perhaps better a modern day nomad. After retiring from business in 1994 he has dedicated all his energy to the design and the implementation of pilot projects, which demonstrate that a new economic model is not only feasible but it is a normal way of progression in society to permit innovation and creativity to identify possible paths towards a better future. He has spent ten years in the design of innovative learning methods, which have been tested, used and improved with over 300,000 children and 8,000 teachers, in Brazil, Colombia, Egypt, Japan, Germany and South Africa. His first fable "The Giving Tree" has been translated into over 100 languages. He has written dozens of books, including a series of children stories, which bring science and emotional intelligence to the young at early age. He is a visiting professor at the Politecnico di Torino and dreams about the creation of a new schooling system. He is married to Katherina Bach, and has three sons Carl- Olaf, Laurenz-Frederik and Phillip-Emmanuel.

PETER TUDDENHAM

Peter Tuddenham is Vice President for Systems Education at the International Society for the Systems Sciences, President / Executive Director of the College of Exploration and Vice President of Beta Resources Inc. and weconferences.com.

JUDITH ROSEN

Judith Rosen is a writer, researcher, and artist who, through interaction with her father, the mathematial biologist Robert Rosen, has a comprehensive understanding of his scientific work. She traveled on numerous scientific trips with Robert Rosen over the decade and a half prior to his death. After he passed away in 1998, she inherited all of her father's artistic and scientific work, both published and unpublished, which she intends to make fully accessible again either through republishing or through this website. In addition, Judith is continuing further development of many of her father's scientific ideas in ongoing research, with a focus on Anticipatory Systems Theory. Aside from the scientific work of her father, Judith also has her own creative work, including fiction, non-fiction, and art, to be marketed here.

DAVID ROUSSEAU

Dr. David Rousseau is the Founder and Managing Director of the Centre for Systems Philosophy, which promotes the use of Systems Philosophy as a methodology for addressing problems that require both scientific and philosophical analysis. In particular, he is interested in how we can use systems thinking to bring matters of ultimate concern into the domain of science. His academic background spans Engineering (with a specialisation in Systems Engineering), Philosophy (with a specialisation in Philosophy of Mind) and Religious Studies (with a specialisation in spiritual experiences). His early career involved more than 20 years in senior management, programme management and systems engineering roles in the aerospace and semiconductor industries. In 2007 he returned to academia, and in 2011 completed a PhD

study using Systems Philosophy to analyse the mind-body relationship in the light of exceptional human experiences. His current research is focused on the unity of knowledge, the modelling of the nature of Nature, the ontological foundations of moral intuitions, and the development of a General Systems Transdiscipline.

SHANKAR SANKARAN

Shankar Sankaran specialises in project management, systems thinking and action research. He is a Core Member and Joint Leader of the Organising Cluster at the UTS research strength - Centre for Management and Organisation Studies (http://www.cmos.uts.edu.au/) and Core Member of the UTS Research Strength - Centre for Creative Design Practices (http://www.ccdp.uts.edu.au/).He is the Director of the Built Environment Design and Management (BEDM) Outreach Group that links with industry from the school. He teaches project management at post-graduate level, in particular, Systems Thinking for Managers; Negotiation and Conflict Management; Commercial Project Management and Integrated Project Delivery. Shankar's own research covers project governance, leadership, evaluation of action research and innovation. Shankar was the lead Chief Investigator of an Australian Research Council (ARC) Linkage Grant on Project Governance worth $ 450K and Chief Investigator in an ARC Linkage Project in Leadership Development of Not-for-profit organizations worth $ 423 K. He was a partner investigator in an international grant from Norway with European, Chinese and Australian researchers investigating trust and ethics in project governance and a Canadian Social Sciences and Humanities Research Council (SSHRC) Grant Exchanging Knowledge on the Impact of Action Research in the Pacific Rim. Among many other appointments, Shankar is a Distinguished Fellow, Action Research Centre, University of Cincinnati, USA, Vice President (Research and Publications) and Chair of the Action Research SIG at the International Society for the Systems Sciences (ISSS), Associate Member of the Project Management Research Chair at ESG UQÁM Montreal, Canada, Member of the Advisory Council for Leadership Studies at Royal Roads University, Victoria, BC, Canada, Member of the Editorial Board of the International Journal of Project Management and Regional Editor (Asia Pacific) of the International Journal of the Built Environment and Asset Management Shankar worked for several years in industry before joining academia in 1999. His held Senior Management Positions in Yokogawa Electric Asia where he directed a large engineering operation delivering projects around the world. Due to his industry background Shankar is keenly interested in linking theory and practice. Prior to joining UTS Shankar was an Associate Professor at the Graduate College of Management at Southern Cross University, Gold Coast Campus, Australia teaching in a MBA program. Shankar is involved in managing conference tracks in Novel Research Methods in Organisational Project Management and Crisis Management and Recovery at the 2014 EURAM conference held at Valencia, Spain, and a Track in Project Management at the forthcoming APROS/EGOS conference being held in Sydney in 2015. He is also a member of the academic committee at the 2014 IPMA World Congress being held at Rotterdam promoting the 'human factors' subtheme.

AMY LEWIS

Amy Lewis is a positive personality with a high capacity for creative organizational problem solving. She is a fundraiser, policy analyst, and nonprofit management professional, and brings a fresh perspective and loads of initiative to all of her endeavors. Beginning with revamping volunteer recruitment processes at Teaming for Technology, doubling the number of volunteers available to Denver nonprofits, and culminating with program development and implementation at El Comité de Longmont, she possesses over 5 years nonprofit program coordination and development experience. Under her leadership, her programs have won state-wide awards and helped deliver new and vital services to at-risk populations. She possesses excellent public speaking skills with a proven track record in building consensus, and has also developed a host of online media campaigns using technologies and applications compatible with Web 2.0. With 7 years of public administration, policy, and social movement education and experience (with an emphasis in food policy), she is now the Director of Partnership Development at the WILD Foundation, putting her knowledge about people and the environment to work.

JOHN FULLERTON

John Fullerton is the Founder and President of Capital Institute, "a collaborative working to explore and effect the economic transition to a more just, regenerative, and thus sustainable way of living on this earth through the transformation of finance." Through the work of Capital Institute, regular public speaking engagements, and university lectures, John has become a recognized thought leader in the New Economy space generally, and the financial system transformation challenge in particular. John is also a recognized impact investment practitioner as the Principal of Level 3 Capital Advisors, LLC. Level 3's direct investments are primarily focused on sustainable, regenerative land use, food, and water issues. Through both Capital Institute and Level 3, John brings a unique theory and practice approach to financial system transformation. Previously, John was a Managing Director of JPMorgan where he worked for over 18 years. At JPMorgan, John managed various capital markets and derivatives business around the globe, then shifted focus to private investments and was subsequently the Chief Investment Officer of LabMorgan through the merger with Chase Manhattan before retiring from the bank in 2001.Following JPMorgan, and after experiencing 9-11 first hand, John spent years embarked on more entrepreneurial ventures as an impact investor while engaging in deep study of our multiple interconnected systemic crises that led to the founding of Capital Institute, launched in 2010.John was a member of the Long Term Capital Oversight Committee that managed the $3.6 Billion rescue of the distressed hedge fund in 1998. He is a Co-Founder and Director of Grasslands, LLC, a holistic ranch management company in partnership with the Savory Institute, and a Director of New Day Farms, Inc., New Economy Coalition, and Savory Institute. He is also an Advisor to Armonia, LLC, a Belgian family office focused on impact investments, RSF Social Finance, and to Richard Branson's Business Leader's initiative ("B Team"). In spring 2014, John was humbled to receive a nomination to the Club of Rome; he is now a full member. John writes the "Future of Finance" blog, which is widely syndicated on platforms such as The Guardian, The Huffington Post, CSRWire, the New York Society of Security Analysts' "The Finance Professionals' Post" blog, and other publications. He has appeared on Frontline, and been interviewed by New York Times, Bloomberg, Wall Street Journal, Barrons, WOR radio, Real News Network, INET, Think Progress, The Laura Flanders Show on GRITtv, Thom Hartmann, and The Free Forum Show with Terrence NcNally.John received a BA in Economics from the University of Michigan, and an MBA from the Stern School of Business at NYU.

WILLIAM S. BECKER

William Becker, 62, is Executive Director of the Presidential Climate Action Project (PCAP), which has created a comprehensive plan for the next President of the United States to jump-start federal leadership on global warming during his first 100 days in office. PCAP, delivered to the Obama Transition Team in November 2008, has been called the Gold Standard of policy guidance for the incoming President. Bill also directs two dynamic projects that have grown from PCAP: The Central Appalachia Prosperity Project is creating a plan for that region to make the transition from coal to a green economy; The Future We Want project is creating an interactive exhibit and world wide web site for the public to envision what the future will be like in a green society and to help design it. Prior to joining the University of Colorado Denver to direct these initiatives, Bill served as the Central Regional Director for the U.S. Department of Energy, where he and his staff of 30 helped spread the use of energy efficiency and renewable energy technologies in a 12-state area. During 15 years at DOE, he became the agency's principal expert on sustainable community development. While on sabbatical from DOE during 2005-2006, Becker served as senior advisor to the Global Energy Center for Community Sustainability at the Gas Research Institute and as an adjunct faculty member in the Colorado Energy Research Institute at the Colorado School of Mines. He led a DOE-sponsored team of US experts to Beijing to consult with Chinese officials on the "greening" of the Olympic Village for the 2008 Games; participated on a DOE team that traveled to Thailand to advise the government on tsunami reconstruction; and served as an advisor to the Louisiana Energy Office on the sustainable reconstruction of the Lower Ninth Ward in New Orleans, one of the areas most damaged by Hurricane Katrina. Bill has worked with many other disaster-damaged communities to help them

incorporate energy efficiency, renewable energy and sustainable design into their recoveries. After the Great Flood along the Mississippi River in 1993, he organized and led a team of sustainable development experts that assisted two communities in relocating from the floodplain and rebuilding on higher ground with sustainable designs and technologies. The projects were cited as prototypes of green community action by the President's Council on Sustainable Development. In 1996, he founded and directed DOE's Center of Excellence for Sustainable Development and its Smart Communities Network web site, the "granddaddy" of sustainable community resources on the internet. In the 1970s, as the editor/publisher of the weekly newspaper in Soldiers Grove, Wisconsin, Bill proposed and helped implement a pioneering project to relocate much of the community from the floodplain of the Kickapoo River and build the nation's first "solar village". The project has been featured in the television documentaries Solar Town USA and River Town, as well as in several books, including two authored by Becker: Come Rain, Come Shine, and The Making of a Solar Village. Becker's most recent book, The 100 Day Action Plan to Save the Planet, was published in October 2008 by St. Martin's Griffin of New York. Today, 30 years later, Soldiers Grove is being cited as a model of what communities worldwide must do to in this time of global climate change: Adapt to impacts such as flooding and extreme weather events, and reduce greenhouse gas emissions by using clean and renewable energy technologies. Bill serves as senior advisor to Natural Capitalism Solutions Inc. and on the Board of Directors of the Public Sustainability Partnership in California. He serves on the Global and North American Advisory Boards for OgilvyEarth, a program in which one of the world's largest communications firms is providing sustainability guidance for Fortune 100 companies. He is an advisor to the University of Cambridge Programme for Sustainability Leadership and its flagship program, the Prince of Wales's Business & the Environment Programme (BEP). He is a member of the Experts Advisory Group for the Institute for Environmental Security (The Hague), which is commissioned by the Dutch Ministry of the Environment and the United Nations Foundation to work on climate-related global policy coherence. Bill is a regular contributor to several prominent blogs on energy, climate and the environment including Huffington Post, Climate Progress, SolveClimate and the Environmentalist Magazine. He speaks frequently in the United States and Europe on the topics of climate change, national energy policy and the future. During his diverse career, Bill has served as a war correspondent in South Vietnam, where he won a Bronze Star medal; writer/photographer for the Associated Press; publisher of his own weekly newspaper in rural Wisconsin; editorial writer and columnist for the Wisconsin State Journal in Madison, WI.; associate director of the Wisconsin Energy Extension Service; research director for the Wisconsin State Senate; executive assistant to the Wisconsin Attorney General; Counselor to the Administrator of the U.S. Small Business Administration in Washington, DC; and communications director for the Assistant Secretary for Energy Efficiency and Renewable Energy. In his spare time, Bill is a landscape photographer, blues guitarist and fly fisherman. He and his wife Mary live in Golden, Colorado.

MARC BECKOFF

Marc Bekoff is a former Professor of Ecology and Evolutionary Biology at the University of Colorado, Boulder, and is a Fellow of the Animal Behavior Society and a past Guggenheim Fellow. In 2000 he was awarded the Exemplar Award from the Animal Behavior Society for major long-term contributions to the field of animal behavior. Marc is also an ambassador for Jane Goodall's Roots & Shoots program, in which he works with students of all ages, senior citizens, and prisoners, and also is a member of the Ethics Committee of the Jane Goodall Institute. He and Jane co-founded the organization Ethologists for the Ethical Treatment of Animals: Citizens for Responsible Animal Behavior Studies in 2000. Marc is on the Board of Directors of The Fauna Sanctuary and The Cougar Fund and on the advisory board for Animal Defenders and Project Coyote. He has been part of the international program, Science and the Spiritual Quest II, and the American Association for the Advancement of Science (AAAS) program on Science, Ethics, and Religion. Marc is also an honorary member of Animalisti Italiani and Fundacion Altarriba. In 2006 Marc was named an honorary board member of Rational Animal and a patron of the Captive Animals' Protection Society. In 2009 he was named a member of the Scientific Expert Advisory Panel of Voiceless, The Animal Protection Institute and a faculty member of the Humane Society University, and in 2010 he was named to the advisory board of Living with Wolves and Greenvegansand the advisory council of the National Museum of Animals & Society. In 2005 Marc was presented with The Bank One Faculty Community Service Award for the work he has done with children, senior citizens, and prisoners. In 2009 he was presented with the St. Francis of Assisi

Award by the Auckland (New Zealand) SPCA. Marc is also on the Board of Directors for Minding Animals International. Marc's main areas of research include animal behavior, cognitive ethology (the study of animal minds), behavioral ecology, and compassionate conservation, and he has also published extensively on human-animal interactions and animal protection. He has published more than 1000 essays (popular, scientific, and book chapters) and 30 books including Species of Mind: The Philosophy and Biology of Cognitive Ethology (with Colin Allen, MIT Press, 1997); Nature's Purposes: Analyses of Function and Design in Biology (edited with Colin Allen and George Lauder, MIT Press, 1998); Animal play: Evolutionary, Comparative, and Ecological Perspectives (edited with John Byers, Cambridge University Press, 1998), Encyclopedia of Animal Rights and Animal Welfare (Greenwood Publishing Group, 1998), and a book on the lighter side, Nature's Life Lessons: Everyday Truths from Nature (with Jim Carrier, Fulcrum, 1996). His children's book, Strolling with Our Kin was published in Fall 2000 (AAVS/Lantern Books) as was The Smile of a Dolphin: Remarkable Accounts of Animal Emotions (Random House/Discovery Books). The Cognitive Animal: Empirical and theoretical perspectives on animal cognition (edited by Marc, Colin Allen, and Gordon Burghardt) appeared in 2002 (MIT Press), as did Minding Animals: Awareness, Emotions, and Heart (Oxford University Press) and Jane Goodall and Marc's The Ten Trusts: What we must do to care for the animals we love (HarperCollins). Marc has edited a three volume Encyclopedia of Animal Behavior (Greenwood Publishing Group, 2004), and a collection of his essays titled Animal Passions and Beastly Virtues: Reflections on Redecorating Nature was published by Temple University Press (2006)

A summary of Marc's research on animal emotions titled The Emotional Lives of Animals: A Leading Scientist Explores Animal Joy, Sorrow, and Empathy and Why They Matter, was published in 2007 by New World Library and his and Jessica Pierce's book on the evolution of moral behavior titled Wild Justice: The Moral Lives of Animals was published by the University of Chicago Press in 2009. Marc has also edited a four-volume Encyclopedia of Human-Animal Relationships: A Global Exploration of our Connections with Animals for Greenwood Publishing Group (2007) and he and Cara Blessley Lowe have edited a book of readings on cougars titled Listening to Cougar (University Press of Colorado, 2007). Marc's book Animals Matter: A Biologist Explains Why We Should Treat Animals with Compassion and Respect was also published in 2007 (Shambhala Publications) and Temple University Press published Marc's children's book, Animals at Play: Rules of the Game in 2008. The two-volume revision and expansion of Marc's 1998 Encyclopedia of Animal Rights and Animal Welfare was published in 2010 (ABC-CLIO) and The Animal Manifesto: Six Reasons for Expanding Our Compassion Footprint was also published in 2010 (New World Library). Ignoring Nature No More: The Case For Compassionate Conservation and a collection of Marc's essays from Psychology Today called Why Dogs Hump and Bees Get Depressed: The Fascinating Science of Animal Intelligence, Emotions, Friendship, and Conservation were published in Fall 2013, and Rewilding Our Hearts was published in 2014. Jill Robinson (founder of Animals Asia) and Marc's award-winning children's book titled Jasper's Story: Saving Moon Bears was also being published in 2013 by Sleeping Bear Press. The Jane Effect: Celebrating Jane Goodall (edited with Dale Peterson) was published in 2015. Freedoms for Animals: Fostering Compassion and Coexistence in the Age of Humanity (with Jessica Pierce) will be published by Beacon Press in 2017.

Marc's work has been featured on 48 Hours, in Time Magazine, Life Magazine, U.S. News and World Report, The New York Times, New Scientist, BBC Wildlife, Orion, Scientific American, Ranger Rick, National Geographic Kids, on NPR, BBC, Fox, NaturGEO, in a National Geographic Society television special ("Play: The Nature of the Game"), Discovery TV's "Why Dogs Smile and Chimpanzees Cry," Animal Planet's "The Power of Play," National Geographic Society's "Hunting in America," and more recently in "What Animals Think" and PBS Nature's "Why We Love Cats and Dogs," "Animal Odd Couples," "My Bionic Pet," and "Animal Reunions." Marc has also appeared on CNN, Good Morning America, and 20/20.

ILARION MERCULIEFF

Larry Merculieff has almost four decades of experience serving his people, the Aleuts of the Pribilof Islands and other indigenous peoples in a number of capacities—locally, statewide, nationally and internationally. For his entire career, Merculieff has been a passionate advocate for indigenous rights/wisdom, and harmonious relationship with the Earth Mother. His reach has been broad and varied.

JEFF OROLOWSKI

Filmmaker Jeff Orlowski most recently served as director, producer, and cinematographer on the Sundance Award-Winning film, Chasing Ice. Orlowski's feature length documentary was invited to screen at the White House, the United Nations and the United States Congress and has captured over 30 awards from film festivals around the world. It went on to receive an Academy Award nomination for Best Original Song, and has screened on all seven continents. As founder of exposurelabs, a production company geared toward socially relevant filmmaking, Orlowski, 29, has served as director and producer of short film projects and online/broadcast commercial work. His clients have included Apple, General Motors, Stanford University, Blackboard, and the Jane Goodall Institute. His work has aired on the National Geographic Channel, CNN and NBC and has been featured in The New York Times, The Wall Street Journal, Time Magazine, NPR and Popular Mechanics. He has traveled on tour representing the Sundance Institute, President Obama's Committee for the Arts and Humanities, and the National Endowment of the Arts, and he is currently juggling more projects than he knows what to do with. He lives in Boulder, Colorado.

JOSHUA TEWKSBURY

Josh is an ecologist, conservation biologist, and planetary health scientist with experience both in academia and in civil society. Before joining Future Earth as the Director of the Colorado Global Hub, Josh was the Maggie and Doug Walker Endowed Professor of Natural History at the University of Washington, with appointments both in the department of Biology and the College of the Environment, where his work focused on major global change issues, including the impacts of climate change on biodiversity, the potential of landscape connectivity to mitigate the impacts of climate change, and the impacts of species loss on ecosystem function. In addition to his decade+ of academic work, which has been published in top journals, Josh also served as the founding director of the Luc Hoffmann Institute, a global research center based in Switzerland focused on the co-creation of multi-disciplinary research. As director, Josh launched over a dozen research projects, including work on the Food-Energy-Water nexus in South-East Asia, Development corridors in East Africa, global mapping of threats to biodiversity, and the development of regionally-appropriate low-carbon sustainability targets for urban areas.

JEREMIAH OSBOURNE-GOWEY

Jeremiah is a PhD student interested in the intersection of science and policy and how science is used in the policy-making process. His current research focuses on understanding the evolution of learning networks as they build resilience (social and ecological). His is currently working with the Fire Adapted Communities Learning Network (FAC Net) and the Locally Managed Marine Area (LMMA) Network of the Indo-Pacific. Jeremiah's interests are diverse and include statistics, ecology, behavioral interactions, community structure, impacts of introduced species, science communication and policy and the interplay between humans and the rest of the natural world (coupled natural-human systems; CNH). Previously, Jeremiah worked for over 15 years as an aquatic/landscape ecologist with Federal and State agencies, universities and private and non-profit consulting firms throughout the Western United States. Jeremiah enjoys spending time with his family, friends and animals in the great out-of-doors. Favorite activities include camping, backpacking, fishing, hunting, SCUBA diving, fly tying, traveling, photography, reading, gardening, geocaching, and home brewing/distilling.

CAROL WESSMAN

Ecosystem ecology, landscape ecology, regional and global biogeochemical cycling, ecological applications of remote sensing and geographic information systems. Current research includes studies of ecosystem controls over biophysical fluxes (CO2, water and energy) within global grasslands and semiarid lands utilizing remotely sensed spectral data in conjunction with simulation models; scaling site-level ecology to landscape and regional scales in the alpine; quantitative methods that link spatial patterns and ecological processes at broad spatial and temporal scales.

BRUCE T. MILNE

Bruce T. Milne holds the W.K. Kellogg Endowed Chair in Sustainable Environmental and Food Systems and is Professor of Biology at the University of New Mexico. He specializes in landscape ecology, fractal geometry, and scaling in complex systems. He received B.S. and M.S. degrees from the State University of New York at Albany, Ph.D. from Rutgers, and was a lecturer in ecology at Harvard Graduate School of Design. The International Association for Landscape Ecology recognized him for the best paper published in the field in 1992 and again in 2006 as Distinguished Landscape Ecologist. Research in his lab has included crop diversity as the basis of optimal food hub design, part-to-whole analysis of energy flow and waste in the US food system, landscape ecologies of the Mexican Spotted Owl and endangered Florida Panther, the climate niche of the Lesser Prairie Chicken, scaling of group size in human hunter-gatherers, tree diversity and diffusion along river networks, ecotones of pinon-juniper woodlands, and scaling in bird population dynamics. Dr. Milne founded the Sustainability Studies Program at the University of New Mexico which offers an undergraduate minor degree to students from across the entire campus. Recent start-up activities include the multi-disciplinary Food Systems Collaborative and the new Flagship Farm to support students on their way to careers in sustainable food systems.

GERHARD CHROUST

Gerhard Chroust is an Austrian systems scientist, and Professor Emeritus for Systems Engineering and Automationat the Institute of System Sciences at the Johannes Kepler University of Linz, Austria. Chroust is an authority in the fields of formal programming languages and interdisciplinary information management.

ROBERTO POLI

Roberto Poli is Associate Professor of Philosophy of Science at the University of Trento (Italy). He graduated in Sociology (B.A., with honors) at the University of Trento (Italy) in 1980 and obtained a Ph.D. in Philosophy at the University of Utrecht (Netherlands) in 2001. Poli has been awarded the first UNESCO Chair in Anticipatory Systems, is fellow of WAAS—World Academy of Art and Science and STIAS—Stellenbosch Institute for Advanced Study. Poli coordinates the research unit eVita—Età della vita (Ages of life) and is Director of the master in “Previsione sociale” (Social Foresight) of the

Department of Sociology and Social Research. Poli is editor-in-chief of Axiomathes (Springer), and editor of the series Categories (De Gruyter). Poli is member of the editorial board of the journals Futures, European Journal of Futures Research, Balkan Journal of Philosophy, Cognitive Semiotics, and Meinong Studies.

JAMES SYVITSKI

Professor James "Jai" Syvitski received doctorate degrees (Oceanography & Geological Science) from the University of British Columbia in 1978, where he developed a quantitative understanding of particle dynamics across the land-sea boundary. He held a variety of appointments within Canadian universities (1978-1995: U. Calgary, Dalhousie U., U. Laval, Memorial U., and INRS-oceanologie) and was a Senior Research Scientist within the Geological Survey of Canada at the Bedford Institute of Oceanography (1981-1995). James served as Director of INSTAAR from 1995-2007, and presently holds faculty appointments in in Geological Sciences, Applied Mathematics, Atmosphere and Ocean Sciences, Hydrological Sciences, and Geophysics. He has over 500 publications, including authorship or co-authorship of 65 peer-reviewed books, and has served in various editorial positions for many international journals. James has taken leadership roles in large International Projects (e.g., SAFE, ADFEX, SEDFLUX, COLDSEIS, STRATAFORM, EuroSTRATAFORM, CSDMS), and served as an advisor for NSF, ONR, ARCUS, LOICZ, IGBP, IUGS, INQUA, SCOR, GWSP, and various energy, mining, and environmental companies. James works in the forefront of computational geosciences: sediment transport, land-ocean interactions and Earth-surface dynamics. He is presently Executive Director of the Community Surface Dynamics Modeling System, an international effort in 68 countries to develop, support, and disseminate integrated computer models to the broader Geoscience community. James chaired ICSU's International Geosphere-Biosphere Programme (2011-16) that provides essential scientific leadership and knowledge of the Earth system to help guide society onto a sustainable pathway during rapid global change. He received the Royal Society of Canada 2009 Huntsman Medal for Outstanding Achievements in Marine Science, is a Fellow of the American Geophysical Union, and will accept the SEPM Francis Shepard Medal in 2016 and an Honorary Doctor of Science in Sustainability from Newcastle University in 2016.

GARY MACHLIS

In September 2009, Gary Machlis was appointed the first Science Advisor to the Director for the National Park Service. He is playing a key role in advancing science within the NPS, advising the NPS director on science policy and programs, and working with the Department of the Interior leadership, NPS managers and stakeholders as well as the scientific community. Machlis received his B.S. and M.S. in forestry at the University of Washington, and his Ph.D. in human ecology at Yale University. He is Professor of Conservation at the University of Idaho, where he has taught courses in protected area management, human ecology, and science policy since 1979. From 1995-2003 he served as the NPS Visiting Chief Social Scientist, and from 1998-2006 as the National Coordinator of the Cooperative Ecosystem Studies Unit (CESU) Network. Machlis has worked internationally on a range of complex ecological issues—including giant panda conservation in China, wildlife management in Kenya, climate change and its consequences for Asian urban centers, tourism impacts in the Galapagos archipelago and the ecology of warfare. Dr. Machlis currently is leads the Department of the Interior Strategic Science Working Group that is developing science-based scenarios for the Deepwater Horizon oil spill. Gary is an elected Fellow of the American Association for the Advancement of Science's (AAAS) and a member of its National Committee on Opportunities for Women and Minorities in Science.

DOMINIQUE SUREL

Dr. Dominique Surel specialize in the development of Intuitive Intelligence. She has created a unique methodology to enhance accuracy of intuitive insights by integrating the natural human skill of intuition with components of Controlled Remote Viewing (CRV) and critical thinking. The result is a flexible decision-making tool that integrates our cognitive skills with accurate intuitive insights.

PAMELA BUCKLE-HENNING

Pamela Buckle Henning She is an Associate Professor of Management at the Robert B. Willumstad School of Business at Adelphi University in New York. As a management educator in the United States, she teaches organizational behavior, leadership, teamwork and group dynamics, and supervises student thesis and independent study work. Pamela's scholarly and clinical work is oriented around the perspective that human psychology is a complex system embedded in densely-interconnected biological, interpersonal, institutional, and environmental systems. She collaborates with international researchers investigating the cognitive and emotional processes involved in systems thinking, and the worldviews and values systems of systems thinkers. Her interests include the processes involved in scientists' systems thinking, as well as "lay epistemics" (perceptual processes used by non-scientists). Pamela publishes in systems, management, psychology, education, and project management journals. She is a Visiting Fellow at the University of Bristol's Systems Centre in the UK, and a member of the editorial board of the Bertalanffy Center for the Systems Science journal: *Systems. Connecting Matter, Life, Culture and Technology*. She serves on the ISSS Board of Directors as Secretary and VP Protocol, and has worked in the not-for-profit, private, and public sectors in Canada.

ALEC TSOUCATOS

Alec Tsoucatos, Ph.D., Adjunct Professor, Economics and Business, Regis University and Metro State University. He was born in Alexandria, Egypt on December 6 1941 (a day before Pearl Harbor) of Greek parents. Alexandria then was a cosmopolitan city that embraced English, French, Italian, Greek, Jewish and Arab communities. Alec went to an English school for his primary education and in Athens to a Greek school for Junior and Senior high school. He came to the University of California, Berkeley 50 years ago exactly and received a Bachelors and Master degree in Economics. He received his PhD under Kenneth Boulding in 1978. He now teaches Economics at Regis University and Metro State University of Economics as an Adjunct Professor. He is particularly interested in the next form of Economic Organization once the present one withers away, as all systems must eventually.

MILA POPOVITCH

Ph.D. in Comparative Literature and Researcher at the University of Colorado Boulder Mila Popovich is an interdisciplinary scholar, an awarded performing artist in multiple dance forms, and a bilingual poet. With expertise in Comparative Literature and Humanities, her current work focuses on the issues of woman's migrations and migrant women's subjectivity in relation to globalization processes. She is an Associate Fellow at the World Academy of Art and Science, where she serves as the Chair of the

Academy's Membership Communications Committee and an international interdisciplinary lecturer of the World University Consortium.

ELIZABETH KUCINICH

Prof. Elizabeth Kucinich is an independent trans-Atlantic organizational development, campaigns and government affairs consultant based in Washington, D.C. Drawing from her extensive experience working inside the U.S. political system, paired with a sincere desire and international reputation for working to bring social, economic, health, agricultural and ecological systems into balance, Elizabeth works to strengthen the institutional capacity of organizations that support these goals. Elizabeth is a champion for business as an agent of world benefit, social and environmental justice and animal welfare.

VIJAY GUPTA

Vijay K. Gupta is a professor emeritus in the Department of Civil, Environmental and Architectural Engineering, and is a fellow emeritus of the Cooperative Institute for Research in Environmental Sciences at the University of Colorado, Boulder, Colorado. Vijay has widely published in major research journals in hydrologic and atmospheric sciences, applied mathematics, probability theory, and nonlinear processes in geophysics. Soon after completing his PhD in 1973, Vijay embarked upon highly interdisciplinary collaborative research. From the onset, he recognized the fundamental importance of Scale. It became a pervasive theme in all his work, which has uniquely ranged from the molecular to the planetary scales. His life-long collaboration with colleagues from many different disciplines and outstanding graduate students led to establishing the nonlinear geophysical foundations of floods in river networks on multiple space and time scales. The Iowa Flood Center at the University of Iowa is building on these foundations with new applications. Vijay modernized and developed a new graduate course over a decade titled "introduction to multi-scale hydrology", which has continued to be taught at the University of Iowa. Vijay served on the editorial boards of prominent international journals, and on important national committees. He was invited as a keynote speaker in several national and international conferences and workshops, and gave seminars at well-known universities in USA, Asia, Latin America and Europe. Recently, Vijay and Indira established a non-profit international research institute bringing the cutting-edge research in modern and ancient sciences into a coherent whole. Their life-long interest and Indira's background in psychiatry has brought the science of consciousness, mind and meditation at the forefront. This interconnectedness is necessary to address contemporary challenges of water and food shortages, health and health care crises, impact of climate change on floods and droughts etc.

GREG CAJETE

Gregory Cajete, Native American educator whose work is dedicated to honoring the foundations of indigenous knowledge in education. Dr. Cajete is a Tewa Indian from Santa Clara Pueblo, New Mexico. He has served as a New Mexico Humanities scholar in ethno botany of Northern New Mexico and as a member of the New Mexico Arts Commission. In addition, he has lectured at colleges and universities in the U.S., Canada, Mexico, New Zealand, England, Italy, Japan and Russia. He worked at the Institute of American Indian Arts in Santa Fe, New Mexico for 21 years. While at the Institute, he served as Dean of the Center for Research and Cultural Exchange, Chair of Native American Studies and Professor of ethno science. He organized and directed the First and Second Annual National Native American Very Special Arts Festival held in respectively in Santa Fe, NM in 1991and Albuquerque, NM in 1992. In 1995, he was offered a position in American Indian education in the University of New Mexico, College of Education Currently, he is Director of Native American Studies and an Associate Professor in the Division of Language, Literacy and Socio cultural Studies in the College of Education at the University of New Mexico. Dr. Cajete earned his Bachelor of Arts degree from New Mexico Highlands University with majors in both Biology and Sociology and a minor in Secondary Education. He received his Masters of Arts degree from the University of New Mexico in Adult and Secondary Education. He received his Ph.D. from International College – Los Angeles New Philosophy Program in Social Science Education with an emphasis in Native American Studies. Dr. Cajete has received several fellowships and academic distinctions, including the American Indian Graduate Fellowship from the US-DOE Office of Indian Education (1977-78); the D'arcy McNickle Fellowship in American Indian History from the Newberry Library, Chicago, IL (1984-85); and the Katrin Lamon Fellowship in American Indian Art and Education (1985-1986) from the School of American Research in Santa Fe, NM. Dr. Cajete also designs culturally-responsive curricula geared to the special needs and learning styles of Native American students. These curricula are based upon Native American understanding of the "nature of nature' and utilizes this foundation to develop an understanding of the science and artistic thought process as expressed in Indigenous perspectives of the natural world. Dr. Cajete has authored five books: "Look to the Mountain: An Ecology of Indigenous Education," (Kivaki Press, 1994); "Ignite the Sparkle: An Indigenous Science Education Curriculum Model", (Kivaki Press, 1999); "Spirit of the Game: Indigenous Wellsprings (2004) ," "A People's Ecology: Explorations in Sustainable Living," and "Native Science: Natural Laws of Interdependence" (Clearlight Publishers, 1999 and 2000).

JAMAL MARTIN

J.E. Jamal Martín, born in Norfolk in 1954, educated at the New School for Social Research, completed his undergraduate degree at Hawaii Pacific College and graduate degree at the University of Hawaii'i at Manoa with postgraduate work at the University of Michigan. He has conducted interdisciplinary research, taught and practiced in local, national and global settings in nursing, medicine and international health. He joined the faculty of the University of New Mexico in 2010 and received his PhD from that institution in 2002. His readings in the 'black experience' started in 1968 at the Schomburg Collection in Harlem, NYC and more extensively with postdoctoral area studies in the Africa and Middle East Reading Rooms at the U.S. Library of Congress. Alongside his complex problem solving (interdisciplinary) research and teaching interests lies African-Iberian historiography, the Moors, the ancient manuscripts of fabled Timbuktu, the study of Islam in Africa and the Americas, and Africa in antiquity. Equally important his praxis in Africana Studies emphasizes transdisciplinary discourse on revisiting and revising the 'black radical international tradition' with theoretical and practical contributions from Rabaka's (2009) 'Africana Critical Theory,' of contemporary culture and society. In short, the globalization of western educational ideologies and school organizations has racially colonized, oppressed, and exploited continental and diasporan Africans. Notably an agenda for research, policy, and practice for people of African descent means resisting 'epistemic apartheid.' In reality, 'decolonization and revolutionary re-Africanization' ought to promote the right to learn transformative knowledge and knowledge transfer for the construction of 'shared human products' (culture and civilization). As an illustration, the 'black experience,' the African struggle for liberation, coupled with American exceptionalism and power in national and international politics then calls for critical scholarship of racialization in democratic education. In view of Tocqueville's On

Democracy in America (1835, 1840), Myrdal's American Dilemma (1944), and Rawls' Theory of Justice (1971, 1975, and 1999), he sees the persistence of 'illiberal, undemocratic expressions' of and about 'the Negro Problem.' With this in mind, Dr. Martín sees Africana Studies as a platform for educational diversity and raising intellectual questions and imperatives about the human condition and the limitations of racialized hierarchies. As an African and African diaspora scholar and public health scientist-practitioner, moving from infectious and chronic disease epidemiology to psychosocial and forensic epidemiology, his praxis now includes global health justice and diplomacy, human rights and the use of critical legal theory in international institutional law. His investigations comment on the interactions between Pax Africana (Mazrui, 1967, 1980, 1983, and 1984); The Racial Contract (Mills, 1997), Pathologies of Power (Farmer, 1999, 2005); Structural Violence (Galtung, 1969; Ho, 2007); and his own research on trauma-related syndromes violence/aggression and stress (Martin, 2002, 2011).

DAVID BEGAY

David Begay, Ph.D., is a member of the Navajo Nation. He received his B.A. and M.A. from the University of Arizona, Tucson, in Political Science with a concentration in Policy Analysis and Indian Policy and Law Studies. He received his Ph.D. from the California Institute of Integral Studies, San Francisco, CA, with a concentration in Indigenous Science Education and Application of Traditional Knowledge. David is Adjunct faculty at NAU, Flagstaff, in the Department of Physics and Astronomy. He is VP for the Indigenous Education Institute, Friday Harbor, WA and works with the University of California, Berkeley, Space Sciences Laboratory through a grant from the National Science Foundation. He also works with NASA, JPL and Goddard Space Flight Center. He is currently Associate Research Professor with UNM, Albuquerque, in the College of Pharmacy. David is a cultural consultant to many organizations and corporations both in the United States and internationally.

NANCY MARABOY

Nancy C. Maryboy, Ph.D. is the President and Founder of the Indigenous Education Institute, a non-profit organization with a mission of preserving, protecting and applying indigenous knowledge. She is also President of Wohali Productions, Inc., consulting in areas of indigenous science, indigenous astronomy, Native American education, curriculum development, film making and strategic planning.

RUDY MIICK

Rudy Miick is founder and head facilitator of Leadership **i**n the Fall Line. His expertise comes from 30+ years of leading his own company, coaching leaders and building high performing companies. His client roster includes over 1,500 successful projects beginning in the fast paced volatile world of restaurants, hotels and resort. In the last 12 years his client list includes manufacturers, retail, health & fitness, martial arts and the automotive industry. Rudy's focus is leadership development, sales building, and profitability. His methodology is driven by the creation of vibrant values driven business culture, no matter the industry. Results? We drive performance that exceed median averages by 3 to 5 times in bottom line performance. This improvement ends up a combination of both top and bottom line performance shifts.

ANDREW SCHWARTZ

Andrew Schwartz is a Ph.D. candidate in Philosophy of Religion and Theology at Claremont Graduate University. He received his B.A. in Religion from Northwest Nazarene University (where he studied with Thomas Jay Oord), an M.A. in Theological Studies from Nazarene Theological Seminary, and an M.A. in Philosophy at Claremont Graduate University. Andrew's primary academic interests include Comparative Philosophy/Theology, Pluralism, Truth and Difference, Process Thought, Wesleyan Theology, and Paradox. He is the managing editor of Process Studies journal. As Managing Director of CPS Andrew is responsible for membership/subscriptions, office management, budgeting and accounting, as well as fundraising and development.

LORILIAI BIERNACKI

Loriliai Biernacki (Ph.D., University of Pennsylvania) is Associate Professor and Director of Graduate Studies in the Religious Studies at the University of Colorado at Boulder. Her research interests include Hinduism, the interface between religion and science, and gender. Her first book, *Renowned Goddess of Desire: Women, Sex and Speech in Tantra* (Oxford, 2007) won the Kayden Award in 2008. She is co-editor of God's Body: *Panentheism across World Religions* coming out with Oxford University Press in 2013. She is currently working on a study of the 11th century Indian philosopher Abhinavagupta that addresses notions of selfhood, body and cosmology. She is also currently working on the interstices between religion, science and panentheism. Loriliai Biernacki grew up in the deep rural South, in Louisiana, imbibing the hot humid summers full of lazy afternoons swimming in the creeks amidst the local alligators. How she made it to study on the East coast is a wonder, since neither she, nor anyone she knew, actually realized that it was possible to go to any other college than LSU or Southeastern University in Hammond, Louisiana until her senior year in high school when a mysterious recruiter for Princeton offered her the opportunity to skip out on a math test. She received her Bachelor's degree in English from Princeton University, where she studied creative writing, with an emphasis in poetry. She still enjoys poetry and once received honorable mention in a national poetry contest for a poem on her take on Indian philosophy, titled "Dvaita." Emboldened by the relish of Indian food, with such a wondrous plethora of vegetarian variety, her Ph.D. from the University of Pennsylvania brought her to new and foreign shores as she studied the 11th century Indian Tantric thinker Abhinavagupta. Apart from her study of Indian religions with an emphasis on Tantra, her favorite superhero is Max Guevara, that is, after Che Guevara. She hopes one day to penetrate Abhinavagupta's arcane philosophy well enough to get a clue about the fabulous siddhis Tantra promises. She is currently deeply engaged in Abhinavagupta's ideas of cosmology and the body with a study and translation of one of his as yet untranslated texts.

ANNE PARKER

Anne Parker is passionate about serving life and renewing our connection to and deep reverence for the Earth in her teaching and life work. She is a Professor of Environmental Studies, a full time Naropa University faculty member who has taught in both the BA in Environmental Studies and MA in Environmental Leadership since 1996. She grew up in the Bay Area of California, in love with her costal habitat and with the Sierra Nevada where she walked, skied and communed with the mountains with her family from a very early age. She lived in Switzerland during her middle school years and returned to California where, during her BA studies in Conservation of Natural Resources at UC Berkeley, she joined in the forefront of the emerging environmental movement. Focusing on National Park management and soil science, she worked with in a self-directed team of students who researched, designed and created Yosemite National Park's first wilderness permit system to protect this precious land. A hunger to see the rest of the world led her to learning directly from traditional

cultures, living with and learning from communities in the Himalayan region and Australia following her BA studies. She lived for three years in Australia, spending two of those years living with Aboriginal communities in the Central Desert, studying ethnobotany and learning from her Aboriginal colleagues about their deep knowledge of and reciprocity to the natural world and exceptional spiritual perspective. Studying with Tibetan Buddhist teachers, notably Lama Thubten Yeshe and the Dalai Lama, she began practice and study of this tradition that inspires her life in 1978. Taking every opportunity to live within and learn from this tradition she spent significant time living in India and Nepal – cumulatively over about 5 years studying in monasteries and carrying out research in traditional agriculture in Bhutan, Nepal and India with Fulbright grants and being mentored by these places and peoples. Her path led her to study Tibetan History and Inner Asian Studies at Indiana University under the Dalai Lama's older brother Takser Rinpoche, carrying out fieldwork in India interviewing refugees about land use and traditional agriculture in Tibet prior to the period of the Chinese invasion. Continuing in her studies to a PhD at the University of Oregon, she focused on research in eastern Nepal on traditional agriculture in a community comprised of seven ethnic groups and their Hindu, Buddhist and Shamanic traditions regarding perceptions of the land and life. Following this she became the Program Director of Interface in Boston organizing cutting edge programs in meditation, alternative therapies and spiritual modalities before coming to teach at Naropa University. Since arriving at Naropa in 1996 she has devoted herself to innovative and creative curriculum design in environmental studies and environmental leadership, joining perspectives in sustainability, social/environmental justice and contemplative practice. She has also engaged over the last 12 years in extensive practice and study in her European earth-based spiritual heritage, as well as study, publication and consultation in sacred geometry design. She is currently doing research on sacred sites in Europe, Israel and the Himalayan region. She is a key co-designer of Naropa's Bhutan study abroad program at the Royal University of Bhutan. She led the very first student group there in 2015 and is researching and developing curricula on contemplative intercultural studies. She loves teaching and adores her students.

AUN ALI

Aun Hasan Ali is the Assistant Professor of Islamic Studies at the University of Colorado. He joined the Department of Religious Studies in 2015. He works on the Islamic tradition. Ali studied Religion and Philosophy at Rutgers University, receiving his BA in 2003. That same year he travelled to Yemen to continue studying Arabic. He earned an MA in Islamic Studies from McGill University in 2007, and will receive his PhD in Islamic Studies from McGill University in 2015. Ali's research focuses on the intellectual history of Shi'ism, including both the pre-modern and modern periods. In particular, he is interested in studying Shi'ism through the lens of the concept of tradition and social network theory. Ali is also interested in Shi'i law and legal theory, especially the interplay between shariah and legislation. His current project examines intellectual life in the city of Hillah in southern Iraq in the twelfth and thirteenth centuries CE. Ali is also preparing the final draft of an article in which he examines the relationship between Sunnism and Shi'ism through the lens of the issue of documentary evidence in Islamic law. His recent publications include a translation of a Persian chapter about the Qajar philosopher Abu'l-Hasan Jilveh in *Philosophical traditions in Qajar Iran*, set to be published by Brill in 2015, and two articles on Shi'i legal theory, classical and modern, in *The Oxford Encyclopedia of Islam and Law*.

GLENN MORRIS

Glenn T. Morris is the Associate Professor and President's Teaching Scholar of the College of Liberal Arts and Sciences at the University of Colorado. Professor Morris' areas of expertise are indigenous peoples in the international legal and political arena, public law, civil liberties, and race/gender and the law. He has been active in the development of international legal standards for the defense of the rights of indigenous peoples for over thirty years. In the area of indigenous peoples' rights, he teaches "Indigenous Peoples' Politics," "Indigenous Political Systems," "Indigenous Peoples in International Law," and "Advanced Indigenous Politics." As a graduate of Harvard Law School, he also teaches a variety of law-related courses for the department, including "Race, Gender, Law and Public Policy," "Contemporary Issues in Civil Liberties," "Judicial Politics," and a freshmen seminar, "Law 101." Morris serves as the pre-law advisor for the department, and is one of two pre-law advisors for the College of Liberal Arts and Sciences. Professor Morris directs the Fourth World Center (FWC), for the Study of Indigenous Law and Politics at CU-Denver, www.fourthworldcenter.org. The FWC provides resources, research and other opportunities for the examination of the condition of indigenous peoples in a global context. For the past five consecutive years, Morris, through the FWC, has trained, sponsored and supervised the participation of dozens of indigenous students with the United Nations Permanent Forum on Indigenous Issues in New York. An example of this work was featured in Indian Country today, the largest American Indian newspaper in the United States: http://www.indiancountrytoday.com/archive/95123249.htmlProfessor Morris has been awarded the permanent designation of *President's Teaching Scholar* (the highest peer-nominated teaching/scholarly award bestowed by the University of Colorado). He has also been the recipient of the Rosa Parks Civil Rights Award, the Cesar Chavez/Cinco de Mayo Human Rights Award, Native American Educator of the Year Award, and the Martin Luther King Peace Award. He serves as a board member, advisor and/or consultant to several boards, commissions and councils at the local, state and national level, in both the Native and non-Native communities.

RABBI MARC SOLOWAY

Rabbi Marc Soloway has been Bonai Shalom's rabbi in Boulder, Colorado since his 2004 ordination from Ziegler School of Rabbinic Studies in California. Previously he was an actor and complementary medicine practitioner in London. He chairs Hazon's Rabbinical Advisory Board, was part of a 2012 rabbis' delegation to Ghana with AJWS, is a graduate of the Institute of Jewish Spirituality and a board member of Ramah of the Rockies. Marc narrates two films: PBS featured *A Fire in the Forest: Life and Legacy of the Baal Shem Tov* and *Treasure under the Bridge: Pilgrimage to Hassidic Masters of Ukraine*, released in 2015. Reb Zalman Schachter-Shalomi, in both films, has been a bridge between Hassidut and contemporary expressions of Jewish life and an important teacher for Marc, giving him secondary *smicha* shortly before he died in 2014. Marc had the deep honor of co-officiating Reb Zalman's funeral. With a commitment to a more sustainable community, Marc was listed in *The Forward's* most inspiring rabbis of 2014. **Vision |** Sustainability, creativity and spirituality define the ways in which I connect to and transmit Judaism to Jews and non-Jews, striving to bring a rich and nuanced past into a vibrant future. In the tradition of my teacher Reb Zalman and others, "neo-Hassidim" integrates the psycho-spiritual depth of the Hassidic masters with an urgent response to the issues and needs of our time, as activists and practitioners; healers and teachers. Most of those we serve and inspire crave that they be seen and heard, witnessed with love and authenticity. Our role is to hear them and to help them tell their own sacred stories along with the ancient narratives of our people, and to live lives of meaning and connection in a frightening and confusing world. Imagination and compassion help my rabbinate breathe.

TODD WYNWARD

Todd Wynward is a wilderness educator and author of *Rewilding the Way: Break Free to Follow an Untamed God*. Todd lives with his family in Taos, NM. When he is not re-imagining Christianity, Wynward is re-imagining public education and the American way of life, starting with his own. Locally he practices homesteading in the high desert, while nationally he works to galvanize movements in watershed discipleship, bioregional food covenants, and more-with-less living. He has been engaged in experiential education and social change movements for twenty years, and has spent more than a thousand nights outdoors. He is the founder of a wilderness-based public middle school, leads backpacking and river trips for adult seekers, and is an animating force behind TiLT, an intentional co-housing community. Patheos.com calls his novel "The Secrets of Leaven "a delicious mystery… exploring deep questions." His writings and doings can be found at leavenrising.com.

VENUGOPAL DAMERLA

Venugopal is a practicing Physician with the United States Department of Veterans Health Affairs in Denver. He was born and raised in Secunderabad, India. Over the last 25 years Venugopal has studied Vedic spirituality under the guidance of disciples of A.C.Bhaktivedanta Swami Prabhupada, a world renowned exponent on Bhakti Yoga. He has taught the Vedic Science of Yoga since 1992 in India and the US. Damerla graduated from Gandhi Medical College in 1995 where he underwent residency leading to Board Certification in Radiation Oncology in 1999. After moving to the United States in 2003 he studied Internal Medicine and Medical Oncology and Hematology where he became Board Certified in Internal Medicine and Integrative/ Holistic Medicine. Venugopal has contributed to Cancer research after practicing in renowned institutions such as Duke and Tulane. He has a number of publications in Oncology and has co-authored a chapter in the 2009 text Book on Prostate Cancer. Currently living Longmont, CO with his wife Ananda and 11-year-old son Bala. Damerla's current interests include Yoga, spiritually based Clinical Interventions and Ayurveda.

DEBORA HAMMOND

Program Director of Organization Development Graduate Program since 2009.
Growing out of my on-going involvement with the International Society for the Systems Sciences, I was elected to serve as the 2005-2006 President and hosted the 50th anniversary conference at Sonoma State University, July 9-14, 2006.
My book on the history of systems thinking, The Science of Synthesis: Exploring the Social Implications of General Systems Theory (2003/2010), examines the origins of systems thinking and discusses the work of the founders of the Society for General Systems Theory, including Ludwig von Bertalanffy, Kenneth Boulding, Ralph Gerard, James Grier Miller, and Anatol Rapoport. In addition to graduate work focusing on the history of systems thinking, I worked closely with Carolyn Merchant in the Conservation and Resource Studies program at Berkeley, which reinforced my interest in sustainability and social justice. Professional and Personal Interests include exploring ways of thinking about complex systems that might support more participatory and inclusive approaches to decision making.

GARY SMITH

Gary Smith is a senior expert in systems engineering at Airbus Defence and Space and INCOSE ESEP. He has been a lead systems architect for their border protection systems. He is an active contributor to the INCOSE/ISSS systems science working group and the healthcare working group where he participates as the outreach director for the EMEA region and is an INCOSE Healthcare Ambassador. In 2004, "just for fun", he undertook the Open University course S807 Molecules in Medicine and as a direct result of the course published "Cancer, Inflammation and the AT1 and AT2 receptors in the BMC Journal of Inflammation. This was featured in the UK national press, "Open University Student publishes new theory of inflammation". The paper has over 95 citations, including one in Nature Review Oncology. His more recent paper "Angiotensin and Systems Thinking: Wrapping your mind around the big picture" describes a mental model for understanding disease.

ANAND KUMAR

Anand Kumar has more than 20 years of Industrial experience in Systems architecture and engineering. He has been a researcher in Architecture and Business systems for more than a decade. His interests are in Business Systems, Architecture and Digital Product-Service Systems. He has been part of the Tata journey for the last 12 years.

RICK DOVE

Rick Dove is a leading researcher, practitioner, and educator of fundamental principles for agile enterprise, agile systems, and agile development processes. In 1991 he initiated the global interest in agility as co-PI on the seminal 21st Century Manufacturing Enterprise Strategy project at Lehigh University. Subsequently he organized and led collaborative research at the DARPA-funded Agility Forum, involving 250 organizations and 1000 participants in workshop discovery of fundamental enabling principles for agile systems and processes of any kind. He is CEO of Paradigm Shift International, specializing in agile systems research, engineering, and education; and is an adjunct professor at Stevens Institute of Technology teaching graduate courses in agile and self-organizing systems. He chairs the INCOSE working groups for Agile Systems and Systems Engineering, and for Systems Security Engineering, and is the leader of the current INCOSE Agile Systems Engineering Life Cycle Model Discovery Project. He is an INCOSE Fellow, and the author of Response Ability, the Language, Structure, and Culture of the Agile Enterprise.

DIANA MANN

Diana Mann is Principle Systems Engineer at Ball Aerospace & Technologies Corporation. She provides Systems Engineering and Project Engineering support to multiple programs and technology development projects, encompassing architecture and system-level analysis and design, requirements definition and management, project risk management, budget and schedule development and tracking, interface definition and control, technology and market surveys, simulator development, system integration and testing.

WILLIAM D. SCHINDEL

William D. (Bill) Schindel is co-lead of two global industry teams: (1) the System Patterns Challenge Team, part of the Model-Based Systems Engineering (MBSE) Initiative of the International Council on Systems Engineering (INCOSE), and (2) the INCOSE Agile Systems Engineering Life Cycle Model Project. His forty-year engineering career has included aerospace engineering with IBM Federal Systems, teaching engineering and mathematics at Rose-Hulman Institute of Technology, founding and leading a supplier of telecom carrier network control systems for the public network, and leading ICTT System Sciences, a systems engineering enterprise that has pioneered Pattern-Based Systems Engineering methods for transforming the productivity of the innovation process in medicine and health care, advanced manufacturing, aerospace, automotive, and consumer products.

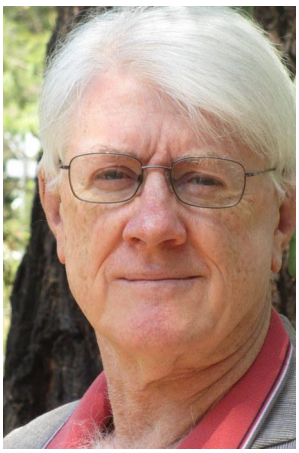
LEN TRONCALE

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.

DELIA P. MACNAMARA

"Consistently ahead of her time, Delia's Enterprise 2.0 training programs for business began in 2006, and were granted Foundation Award status by the University of Hull soon after. Her consultancy clients include the University of Hull, Hull City Council, NHS, East Riding Business Network, Beverley Chamber of Commerce, Immage Studios and many SME's. An international career working across several industry sectors encompassing training, business, organisation change management and IT has resulted in a unique overview of how technology impacts on the way we communicate and do business. With the increasing acceptance of "social media" in the business world, Delia's focus is now researching her PhD and developing a practical approach for "Systemic Leadership in a Networked World using a critical systems thinking approach."Specialties: systemic leadership; systems thinking,

philosophy and practice; boundary theory; collective intelligence; collective innovation; open innovation; internet evolution; social media; collaborative and digital technologies.



RAY ISON

Professor Ray Ison is Professor, Systems for Sustainability at the Monash Sustainability Institute (MSI), and Professor of Systems, The Open University UK (OU). He is internationally recognized for his Systems scholarship that draws on second-order cybernetics and the biology of cognition and for developing and pioneering the use of Mode-2 modalities of research practice e.g. systemic inquiry. His research is relevant to how we act in a climate change world e.g. 'Systems Practice: How to Act in a Climate-Change World' (Springer), is his latest book. Through his research, teaching and consultancy he has made significant contributions in the areas of systemic governance, systems practice and social learning, systemic environmental decision making, 'knowledge transfer', design of learning/inquiring systems and agricultural/food systems. His research and scholarship has found practical application in diverse fields including water management, organizational change, staff induction, Higher Education reform, food security and rural development. His recent work with colleagues elucidates through empirical, theoretical and systemic-design research how social learning could be employed as an alternative governance mechanism for managing in complex, or 'wicked' situations, particularly water catchments and other multiple stakeholder settings such as climate change adaptation. He also pioneered metaphor research in the field on natural resources management beginning in the early 1990s. He is responsible at present within the CADWAGO project (http://www.cadwago.net/) for a work package on systemic governance and leads the Systemic Governance Research Program in MSI (http://monash.edu/sustainability-institute/programs-initiatives/systemic-governance-research/); at the OU is co- responsible for managing a post-graduate program in Systems Thinking in Practice (STiP). He is the current President of the ISSS (International Society for the Systems Sciences). Ray headed the OU Systems Department (1995-8; 25 academic staff) then from 2000-04 successfully coordinated a major interdisciplinary 5th Framework program (30 researchers, 6 countries) researching social learning for sustainable river catchment management as well as running an EPSRC funded Systems Practice for Managing Complexity Network. His contributions to systemic governance research began with pioneering work on participatory natural resource management (1985). He is the (co) author or (co) editor of 5 books, 35 book chapters, 120 refereed papers, 60+ other publications, 5 journal special editions and has been an invited Keynote speaker at many international and national conferences. He has had a wide range of significant national and international appointments based on his academic standing.

OCKIE BOSCH

Professor Ockie Bosch was born in Pretoria, South Africa. He first came to Australia in 1979 where he was an invited senior visiting scientist with the CSIRO in Alice Springs. After one year in Longreach (1989) he emigrated to New Zealand where he was offered a position with Landcare Research. In 2000 he was offered a position as Professor in Natural Systems Management at the University of Queensland in Australia. In 2012 he moved to the University of Adelaide where he leads the Systems Design and Complexity Management Alliance in the Faculty of the Professions.

Professor Bosch is a practicing scientist for 43 years. He is currently Chair of the International Committee for Systems Education, Vice President of the International Society for the Systems Sciences (portfolio Systems Education), and an Academician of the International Academy for and Systems and Cybernetics Sciences. Professor Bosch's current research/professional specialties and interests are in Systems thinking and dynamics; Sustainable Development with a focus on whole systems, natural systems and business. His main teaching and research interests are in the application of systems theory in communities where it can make a difference and the development of systemic management guidelines for sustainable systems management; the development of computer software-systems for

efficient technology transfer; and development of processes and mechanisms for linking research and management. Special emphasis is on systems analysis with stakeholders, identification of options and strategies to solve problems/achieve goals; mapping data and information availability for evaluating ecological, social and economic outcomes; developing management and policy guidelines through collaborative learning processes. He is especially involved with the coordination and development of inter-disciplinary research programs; Integration of ecological understanding with social and economical issues in systems approaches; development of evolving information systems as information dissemination and collaborative learning tools; processes and mechanisms to link science with management and policy making. Professor Bosch has also played a major role in the redesigning of the Adelaide MBA, giving the program a systems foundation in order to produce Managers and leaders that are equipped with new ways of thinking that are systems design-led to deal with complex problems in a systemic, integrated and collaborative fashion and ensuring Business and government institutions are making socially responsible investment decisions in the face of a continually changing geo-political and socio-economic landscape. He has published more than 60 articles in scientific Journals around the world.

DINO KARABEG

Global issues such as the climate change, or the 'world problematique' as the Club of Rome called them, call for new ways of thinking and acting. Results in physics and cognitive science challenge the foundations on which the academic tradition has developed. Information technology allows us to organize the production and distribution of knowledge in completely new ways. In these circumstances a new academic frontier opens up, where we are called upon to create the very ways in which we are practicing our profession. Since 1995 I have been working as a prospector on this frontier, developing a portfolio of creative directions, exhibited on these pages.

MARY C. EDSON

Mary Edson is President of the International Federation for Systems Research. As a Scholar/Practitioner whose major interests are in Complex Adaptive Social Systems, she teaches courses in Executive Leadership, Strategic Project Management, and Talent Management including Diversity and Inclusion. Through experiential learning and development of organizational leadership competencies, her students apply systems thinking to improve business performance in their organizations. She also leads a team of Systems Scientists in the development of a Guide to Systems Research. As an Organizational Coach, she relies on a solid grounding in I/O Psychology, Organizational Behavior, Organization Development, and Project Management in the context of developing sustainable systems and organizational resilience. As a proactive Project Manager, she thrives in roles that require adaptive leadership by directing large team projects through analysis, design, development, implementation and evaluation. Her forte is helping others approach problem solving and decision making not only systematically, but also systemically (seeing whole systems beyond their parts).

DR. PAVEL LUKSHA

Dr. Pavel Luksha said the following about Kinematic SelfReplicating Machines The book provides a relatively good review on theory of selfreproduction. I found the book a very comprehensive study on possible designs of kinematic selfreplicators. One thing the book has successfully shown is that these designs, at least those theoretical, are vast. The book is without a doubt a compendium of projects for artificial self-replicators, both macroscale and microscale, showing some 15 designs for each. It was also interesting to see the discussion of the main problems of selfreplicator design (Section 5). I agree on the call for focused R&D with a "backchain design". Indeed, in every successful engineering project, efforts have been focused, starting with a concept and then elaborating on subparts. To agree on "what needs to be done" or to position a new development in a design space is important for building a working artificial selfreproducer. Dr. Pavel O. Luksha is a professor at the Higher School of Economics, Moscow, Russia and at the Academy of National Economy, Moscow, Russia. He is also an independent strategic consultant for a large machinery building plant in Moscow, Russia, a leading company in gift packaging in Moscow, Russia, a mass media/broadcasting company in Krasnodar, Russia, governmental structures in Kiev, Ukraine, and an international bank in Shanghai, China. Pavel's mother tongue is Russian, he is fluent in English, knows French, and speaks fair German. He has published over 40 scientific and analytical publications in international books, journals and conference proceedings on the theory of the firm, evolutionary theory, innovations, regional development, transitional economy, consumption theory, theoretical sociology, and system sciences. Pavel's publications include Memory as producer of subjective time and space in complex systems, Society as a selfreproductive system, Knowledge Rich Industries and Balanced Growth for Transitional Economies, Identification and basic structure of institutions, SelfReproduction of the Enterprise: Von Neumann's Model Applied, Some Reflections on Formalization in Social Sciences and Sociocybernetics, and Manifesto of new socioeconomic theory. He is a member of the Board of International Sociological Association, Research Committee 51 Sociocybernetics, and is a member of European Association of Evolutionary Political Economists and Association of International Consultants (AIC). Pavel earned B.Sc. Economics, M.Sc. Economics (major in mathematical methods in economics), and a Ph.D. Economics (thesis subject: 'Features of socioeconomic selfreproduction') all at the Higher School of Economics, Moscow from 1994 to 2006.

Associating Abstracts with Plenaries

I) **Systems Thinking for Systemic Sustainability**

1) **Challenge of Systemic Sustainability**
   Goals, purpose, vision, definition; future opportunities and constraints; role of systems science; new paradigms; transformation; evolution; ecological civilization; systems literacy needs; solution-orientation; futurism; strategic goals for sustainability; philosophy of sustainability; systemic health; millennium development goals, socio-ecological systems.

2) **Towards Holistic Systems Thinking**
   Systemic sustainability; philosophy of systems; anticipatory systems; pragmatism; realism; holism 'otherisms'; lineages and frameworks; praxis; GST; system of systems; general philosophy; relational science; new science; interdisciplinary and transdisciplinary approaches; whole system analysis.

II) **Global Science and Assessment**

3) **Connecting Human and Natural Systems Research**
   Assessment; monitoring; sustainability science; Integral science; coupling natural and human system models, new trends; human domination of Earth, issues of the Anthropocene; socio-ecological assessment; future of Earth systems; bridge between natural and human sciences, coupling models; integrating models.

4) **Crisis Science: Anticipatory, Real-Time, and Preventive**
   Paper topics (e.g., science in a crisis, hazards and risk assessment, ecosystem assessment, contingency planning, monitoring, and management; anticipatory, participatory, and exploratory science methods; crisis and holism, integral science).

III) **Cultural, Ethical, and Economic Wisdom**

5) **Making Sense in Economics, Ethics, and Policy**
   Steady-state economics; regenerative economics; zero growth economics; new capitalism; governance; equity; law; cultural; religious; ethical, political perspectives on sustainability

6) **Multi-Cultural Worldviews on Sustainability**
   Cultural beliefs about nature and sustainability, archaeology of holism, indigenous practices

IV) **Systems Theory, Management and Practice**

7) **Engineering sustainable Systems and Technology**
   Systems engineering, innovation, entrepreneurial activity, praxis, service systems, management systems, computation, cybernetics

8) **Prospects for Scientific Systemic Synthesis**
   General Systems Theory, systems dynamics, modeling, simulation, systems taxonomies, frameworks, praxis, lineages of systems thinking,

V) **Education, Communication, and Capacity**

9) **Human Capacity, Communication, and Student Research**
   Competencies, peer pressure, psychology of systems thinking, planning research, threshold concepts, academic culture, empowering student driven research, teaching through doing, processes of societal change

10) **Systems Literacy Education and Outreach**
   Pedagogy in systems thinking, educational models, evaluative frameworks, fundamentals of systems thinking, advanced concepts, public education, internship, entreprenurship, leadership concepts

Synthesis

- **Workshop Reports**; outcomes
- **Plans and Recommendations**; policy statement, recommendations, plans, meetings, ISSS-2017

Abstracts Table of Contents

Plenary Abstracts

2801

SCIENTIFIC PRINCIPLES FOR A GENERAL THEORY OF WHOLE SYSTEMS

David Rousseau, Centre for Systems Philosophy
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It is increasingly evident that, in order to minimize unintended consequences when intervening in or designing systems, we should be guided by a 'holistic' perspective that is sensitive to the impact of local activity on wider environmental contexts and 'higher' and 'lower' levels of complexity. A challenge for such work is that 'a science of whole systems' is still in its infancy. Neither the concept 'system' nor 'wholeness' has a stable scientific formulation. There is an urgent need to advance the discussion about 'whole systems' beyond philosophical speculations and have it attain empirical significance within both the social and the natural sciences.

Progress relevant to this issue has been made in the research programme for General Systems Transdisciplinarity (GSTD), which was formally launched at the ISSS conference in 2015. In this presentation I will discuss two general systems principles discovered under this programme. They jointly entail a new kind of 'Holism' that is philosophically coherent and also consistent with a Broad Naturalism. I will explain how these principles can be formulated in ways that make them scientifically useful, and how this could contribute to the development of a systems theory that resolves the widely perceived tension between classical science's reductionism and system science's appreciation for context and wholeness. One implication of these discoveries is that the foundational General Systems Theory (GST*) we are seeking will be a general theory of dynamic wholeness.

It is foreseen that, on the example and foundation these principles provide, further general systems principles will now be more easily discovered, advancing the practical value of General Systems Theory and the scientific standing of Systemology, and bringing us closer to the ideal of a science of whole systems.

2802

PROSPECTS FOR A NEW SYSTEMIC SYNTHESIS (PANEL PRESENTATIONS AND DISCUSSION)

Presenters: David Rousseau (Chair); Bill Schindel; Len Troncale; John Kineman and Jennifer Wilby

Recent times have seen the emergence of new theoretical insights that may help to establish the frameworks, theories and methodologies we need to understand, design, build, explain, communicate about, utilize or operate, maintain, and evolve resilient and sustainable socio-ecological systems.

In this panel we bring together experts to present on such emerging developments in the areas of engineering, science, research, practice and philosophy, and to reflect on how these different stands can contribute to the formation of a new systemic synthesis that will make the 'whole systems perspective' scientific and practical. Topics covered in the panel presentations will include:

The S* minimal general systems meta-model, and its prospects as a general modelling foundation for Systems Engineering (Bill Schindel)

Systems Processes Theory (SPT) , and its prospects as a general theoretical core for a science of systems and sustainability (Len Troncale)

The PAR/Holon Relational Framework, and its prospects as a general methodology for Systems Research (John Kineman)

Systemic methodologies and the prospects for enhancing them on the basis of emerging general systems theories and models (Jennifer Wilby)

Systems Philosophy and the prospects for employing scientific general systems principles as the foundation of a systems worldview (David Rousseau)

The panel presentations will be delivered in the last plenary before lunch, and be followed by an open discussion between the panellists and audience in a break-out session immediately after lunch.

2877

"WHAT THE SCIENCE OF ANTICIPATORY SYSTEMS THEORY CAN ILLUMINATE ABOUT SCIENCE, ITSELF"

Judith Rosen

Dr. Robert Rosen (1934-1998) was my father. He was also a Theoretical Biologist who, among other things, developed an area of science that elucidated why living organisms are alive, how that signature of life-- the behaviors and capacities peculiar to living organisms-- can be fully characterized in a rigorously scientific manner, and what is generating that signature. Collectively, I refer to this as Anticipatory Systems Theory. Among the realizations to come to light because of his work in this area were a fundamental understanding of what he called "The Modeling Relation". The modeling relation describes an entailment pattern within which a model encoded to represent some aspect of the universe can accurately predict actual future behaviors of that aspect of the universe. It is an entailment pattern that humanity makes use of in Science, to very good effect, an in fact Science would not be possible if this entailment pattern did not hold. But it so

happens that this entailment pattern reveals the existence of a fundamental Law of Nature. So fundamental is this entailment pattern that all living organisms have a systemic organization that incorporates the modeling relation into themselves and makes use of it at every level of biological organization. It is the activity of the modeling relation within system organization that is responsible for the emergence of LIFE. It is also responsible for the emergence of MIND. Anticipation is, in fact, the "signature of life", itself, which allows us to recognize a living system and differentiate it from a non-living one. In this paper, I will discuss in further detail all of these assertions and describe some of the ramifications for Science, as well as for our basic human understanding of ourselves and our own peculiarities as living, thinking organisms.

2919
EXPECTING THE UNEXPECTED COPING WITH CRISIS: PREFACE TO PLENARY IV "CRISIS SCIENCE: ANTICIPATORY, REAL-TIME, AND PREVENTIVE"
Gerhard Chroust
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In this paper we identify the different ways to react to the impacts of disasters. We stress the advantage of pro-actively fighting disasters by appropriate preparation and intervention. Two of the most important support strategies are Anticipation and Crisis Science used in combination and supported by Information and Communication Technologies (ICT). Based on the 5 phases of Disaster Management we identify essential activities to be performed before, during and after a disaster and point to the necessary application of Crisis Science.
Keywords: Disaster Management, Crisis Science, Anticipation, Intervention, resilience, ICT, phases, systems thinking

2926
ENABLING AND FACILITATING ENGINEERED SUSTAINABILITY
Rick Dove
Paradigm Shift International, Inc. and Stevens Institute of Technology, 2051 County Road B-014, P.O. Box 289, Questa, New Mexico 87556
Engineered system solutions are confronting an increasing rate of evolution in their operational environments – bringing both threat and opportunity. Sustaining these systems requires enabling and facilitating a capability to evolve in concert. The agility of a system to respond effectively to evolutionary change is a function of its architecture, design, and operational behavior. We will look under the hood of effective examples, focusing on the enabling and facilitating design characteristics that manifest as resilience and composability. Comparisons will be made of natural system sustainability-mechanisms with artificial system analogs. The law of natural selection rules well beyond the organisms in the biosphere, with the operational environment harshly determining what is sustained. The points to be made come from 25 years of analyzing countless systems for common concepts that enable and facilitate sustainability, and more recently, application of these concepts to a critical need for agile security in the face of intelligent and determined agile adversaries.

2928
FRAMEWORKS FOR SYSTEMIC SUSTAINABILITY: “WHEN ARE COMPLEX SYSTEMS SUSTAINABLE?” PLENARY I: THE CHALLENGE OF SYSTEM(S) SUSTAINABILITY
Diana Mann
The Global Water Energy Nexus (GWEN) encompasses the complex interdependencies between generation and consumption of both energy and water resources, and displays all the characteristics of a wicked problem. Wicked problems are particularly difficult or impossible to solve because of incomplete, contradictory, and changing stakeholder requirements that are often difficult to recognize. With current trends toward more water-intensive energy sources, such as biofuels and unconventional oil and gas production, and more energy-intensive water treatment technologies, such as desalination and deeper ground water pumping and production, strategies for implementing sustainable interdependent solutions become necessary. As a complex system of socio-technical systems, GWEN presents a profound challenge to system sustainabilty. This challenge can be met by applying the principles and tools of Transformational Systems Engineering, Analysis and Synthesis, as the framework for addressing both the social and technical aspects of the GWEN phenomonenon.

2944

SYSTEMS LITERACY AS A PATH TO REALIZING SUSTAINABLE FUTURES

Peter D. Tuddenham
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Systems Literacy is a coordinated ongoing effort to create a greater awareness and understanding about "Systems" in society, schools and universities and engineering and to develop a comprehensive set of big ideas, supporting concepts and learning progressions. This Plenary is an invitation to join this initiative throughout the conference and beyond. The presentation will describe the work completed in the past 12 months since this project began at last year's ISSS Annual conference in Berlin 2015. The International Society for Systems Sciences is partnered with the International Council on Systems Engineering (INCOSE) and the International Federation for Systems Research (IFSR) to develop Systems Literacy. In 2000 work began at the National Geographic to encourage geographic literacy. This work progressed with the support of U.S. Government agencies such as the National Science Foundation, the National Oceanic and Atmospheric Administration, NASA, Department of Energy, Department of Interior and many varied not for profit and educational organizations, to embrace projects on ocean literacy, earth science literacy, atmospheric literacy, climate literacy and energy literacy. These subject areas are a good foundation and models for exploring how Systems Literacy can be a path towards realizing sustainable futures. The specific case of the Ocean Literacy project will be described as a model for Systems Literacy. It was started in 2004 and has now influenced US Ocean Policy, the development of the recently published Next Generation Science Standards and now European Union sponsored projects on ocean literacy in Europe. A similar aspiration and challenge for Systems Literacy will be described. Connections to other conference plenaries and the themes of this conference will be made. Learning opportunities and ways to contribute will be outlined. A look forward to Plenary X will be made with the intent of building a richer picture of the Systems Literacy project development possibilities and plans by the Friday of the conference.

2945

POSSIBLE INDIVIDUAL AND COLLECTIVE COLLABORATIVE ACTIONS TO DEVELOP THE SYSTEMS LITERACY INITIATIVE GENERALLY, AND SPECIFICALLY IN THE CONTEXT OF REALIZING SUSTAINABLE FUTURES.

Peter D. Tuddenham
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The Systems Literacy Plenary on Friday will draw together outputs, outcomes and learnings from the whole week to produce a set of actions to follow the conference in the development of a set of fundamental Systems big ideas, supporting concepts and learning progressions. A variety of creative systems literacy explorations, knowledge sharing, information mapping, social media, audio and video media contributions and other sources completed over the week will be summarized. This Plenary will repeat the invitation made on Monday to join this initiative in the coming years. The role of new technologies for systems change, and social media, for Systems Literacy will be outlined. Approaches to thinking about measurement of Systems Literacy will be discussed. Specific "Big Ideas" or fundamental ideas that are specifically related to realizing sustainable futures in socio-ecological systems that can be identified as possibly part of a Systems Literacy campaign will be identified.

2950

FROM POLITICS TO REMOTE SENSING –THE INDUS FLOOD OF 2010: THE UNFOLDING OF A DISASTER AND LESSONS LEARNT

JP Syvitski and GR Brakenridge, CSDMS and The Flood Observatory, U Colorado, Boulder CO 80309

The Pakistan flooding, July-November 2010, caused ~2000 fatalities, displaced 20,000,000 inhabitants for weeks to many months, and was 7.5 on a duration-area affected-intensity scale that compares flood magnitudes on a global basis. Exceptional damage was inflicted on crops and cropland and on agriculture support systems such as canals and levees. Total economic impact reached 43 billion USD; 4,500,000 mainly agricultural workers lost their employment for 2010-2011. The catastrophic flood was associated with unusually intense but not unprecedented rainfall in the upland catchment. Most damage was caused by multiple failures of irrigation system levees, and by barrage-related backwater effects that initiated failures and led to avulsions (sudden changes in flow location). The meteorological events did not cause the catastrophe. Instead, the lack of planned accommodation to the river's high sediment load set the stage for super-elevation of the Indus above the surrounding terrain, dangerous levee failures, and channel avulsions. The dynamics of this remarkable event demonstrate that planning for major flow diversions is a necessary component of effective flood control along this and other avulsion-prone rivers. This disaster will serve as an example to discuss the 'lessons learnt' for all stakeholders.

2951
RANULPH GLANVILLE MEMORIAL TALK: CONNECTION AND COLLABORATION IN A NETWORKED WORLD (FOR SYSTEMIC PURPOSE AND ACTION)
Delia Pembrey MacNamara
We live in a world that is increasingly networked technologically, with a growing diversity in methods and media of communication and connection, providing an ever increasing level of complexity. This network of complexity and diversity is presenting both opportunities in terms of innovation and community, and threats in terms of uncertainty, risks and unforeseen disruptive events. Yet is this network, or ecology of networks, a system? When does a network become a system and what is our role within the system to harness the potential of the networks for systemic purposes and systemic action? Exploring critical systems thinking, in particular the boundary, cybernetics and design thinking, can we build effective systemic capacity for collaboration and purposeful action to educate, inform and inspire engagement with systems literacy within and beyond the systems community?
Keywords: Critical Systems Thinking, Boundary, Boundaries, Objects, Cybernetics, Networks, Collaboration, Connection, Leadership, Systemic

2952
THE DISTINCTIVE CHARACTERISTICS OF SCIENCE DURING CRISIS
Gary Machlis
Science Advisor, Parks, Recreation and Tourism Management, Clemson University, 263 Lehotsky Hall, Clemson, SC 29634-0735
Major environmental disasters (from earthquakes to oil spills) require significant inputs from the scientific community as decision makers deal with emergency response and restoration choices. Conducting science during crisis has several important and distinctive characteristics. These include the necessity of interdisciplinary systems analysis, advanced visualization, actionable scientific review, speed of response, and more. Based on examples ranging from the OSS research arm during WWII to the Deepwater Horizon Oil Spill and Hurricane Sandy, the presentation describes these distinctive characteristics and calls for innovation in delivering science during crisis.

2954
THE PLATE AS THE CENTER OF SYSTEMS TRANSFORMATION
Elizabeth Kucinich
While our economic structures and consumer cultures are major drivers of ecological devastation, there is one legitimate area of our daily lives where we are consumers, and that is food. This session will explore how ecological thinking – the logic of nature, is being employed in regenerative organic agricultural practices to enhance yield, climate resilience, nutritional content, soil, air and water quality and remediation, all while addressing arguably one of the greatest challenges of our time, global warming, through soil carbon sequestration.
While the global conversation on climate change is framed negatively, this session will help to reframe this moment in history as our greatest opportunity to invoke appreciative insight, utilize systems consciousness and leverage natural ecological dynamics in order to transform our agricultural systems, our health and ultimately the World. Regeneration of our planet will come from the integration of regenerative consciousness, regenerative capitalism and regenerative agriculture.
References/background:
Rodale White Paper on Regenerative Organic Agriculture & Climate Change - http://rodaleinstitute.org/assets/WhitePaper.pdf
A Critique of Regenerative Capitalism, Kosmos Magazine, by Elizabeth & Dennis Kucinich, Winter 2016 - http://www.kosmosjournal.org/article/on-regenerative-systems-a-critique-of-regenerative-capitalism/

2957
REIMAGINING CAPITALISM: TRANSITIONING TO A REGENERATIVE ECONOMY
John Fullerton
Capital Institute Founder & President and Former JPMorgan Managing Director
Global threats — from climate change and accelerating inequality, to the financial crisis of 2008 — have led an increasing number of thought leaders and policymakers to question the long-term viability of today's mainstream, extractive economy. This lecture will look at the emergence of the regenerative economy as a necessity. All living and non-living systems share universal principles and patterns of systemic health and development that. If effectively harnessed, they can be utilized to benefit society and the economy. Or, to put it another way, the entire system can prosper if it is designed to do so. This holistic approach emphasizes ethics, caring and sharing, and building healthy human networks to create a new paradigm for capitalism, rather than an incrementally improved model. A regenerative economy naturally seeks to harmonize the multiple kinds of capital essential to planetary well-being (financial, social, environmental,

etc.). This lecture will cover the interconnected principles of a regenerative economy and how we can work together to affect this paradigm shift.

2958
REFLECTIONS ON THE TATA SUSTAINABILITY JOURNEY
Anand Kumar
The Tata group is committed to improving quality of life by integrating environmental, social and ethical principles as part of its business code of conduct. As a result, sustainability considerations are routinely incorporated into the decisions and operating procedures of all Tata companies. These sustainability principles and policies are ingrained in all the activities performed by the group associates and collectively serve as the culture and ethos of the Tata group. This talk will reflect the sustainability journey from the point of the presenter as well as discuss the impact and change in world-view this culture had on the presenter.

2959
ECONOMICS OF DIGNITY AND NEW ECONOMY: VALUING PLANET, PEOPLE AND PROGRESS
Mila Popovich
National and global economies are in crisis and prevalent economics cannot hold. This state of affairs leads to pillaging and plundering, financial blackmailing and racketeering, economic assassinations of peoples and countries, resource grabbing, dumping of uranium-depleted military surplus, indenturing youth, violently pornographic culture of media distractions and seductions – rampant soil, society and spirit depletion. And even where there is wealth, it does not buy wellbeing. This system cannot hold exactly because it lacks systems vision. It lacks deep understanding that each one and all of us, all life forms and environment are embodied and embedded interdependent and ever-evolving systems.
This state of affairs is bringing postmodern economic thought to a post mortem of current economy, whose core measure of economic progress – gross domestic product – is being reevaluated as a gross indicator of prosperity in search of more genuine value drivers in the 21st century. What kind of new value system, then, needs to be engendered to hold a more wholesome space for a reinvented and revitalized new economy? What kind of theoretical framework, set of values and range of policies do we need to envision and enact in order to be able to determine new worth and true price of everything? Complex times call for paradoxical measures – we now need those things that, paradoxically, multiply when they are shared. We need sourcing of intrinsic worth to generate wealth not for accumulation but for adding value, making beneficial impact and paying forward.
This is the domain of Economics of Dignity as that which deals with the priceless; with that which determines the value of everything yet itself remains invaluable – the human in the fullness of his/her potential. Economics of Dignity is, then, a field at the vital interface of economic exchange, human rights, community building, governance, deep ecology, spirited science and social artistry. We know what makes an economy - creation, relationships, exchange, values – but we choose how to define these determining properties. What kind of economics are we choosing now to ensure the emergence of a more wholesome new economy – more just, more equitable, more peaceful, and more creative? In the spirit of that search, I will present one such initiative, New Economic Theory (NET) working group, by the World Academy of Art and Science, which gathers a wide range of passionate individuals and institutions to envision the new economic framework. I will propose here that some of the measures of re-valuing planet, people and progress will need to be unhinging democracy from capitalism, restoring the order of care, rearranging desires, reinventing currencies, opening freedom as partnership in power, rewarding transformation and, yes, re-enchanting ourselves with our world.

2960
THE ECONOMICS OF CARE, WISDOM AND EMPOWERMENT
Alec Tsoucatos, PhD
The Earth is full of Economies and the Earth is a system that is not growing in size, therefore what the Earth contains cannot grow indefinitely without harming another part. We must discover therefore, other kinds of economic systems that do not have growth as the primary goal. The “engineering constraints” must be non-growing economies that nevertheless provide for human and non-human wellbeing. What sources can we find for inspiration and insight to travel this very new, exhilarating and formidable trail? What are the consequences for teaching economics and policy recommendations?

2961
PANEL VI: MULTICULTURAL WORLD VIEWS ON SUSTAINABILITY
The purpose of the panel is to familiarize the conference participants with the world view of Ancient/Native/Indigenous/Tribal (ANIT) cultures that has guided sustainable living for thousands of years. The panel is a follow-up to the documentary on the Force of Nature to be shown in a workshop on July 24

and discussion of a paper: Gupta, Gupta, and Saldarriaga. Conscious World View Transforming Individuals, Science, its Education and Research. Accepted for publication in Ancient Science. May, 2016. The paper will be distributed to the panelists and the audience before the conference. Each of the 5-7 panelists will be asked to introduce himself/herself (1-2min (name, affiliation, field)). Collectively they will spend 20 minutes each on three triggering questions: (1)The difference between Indigenous/Ancient vs. Industrial/Modern Worldviews (a 5 min video). What challenges and opportunities do you see in translating indigenous/ancient wisdom and science into sustainability science for the modern age? (2) Can science explain the scientist? (International conference in Bangalore, August 26-27, 2016) ? (3) What, then, has to change to understand societies and civilizations and steer them towards sustainability? The audience will be given 30 min for Q&A.

2963

HOLISTIC THEORY WORTHY OF THE SUSTAINABILITY CHALLENGE.

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A holistic theory for sustainability is commensurate with the totality of human understanding of what constitutes nature, with humans as both clients and participants. Theory needs to address: (1) dynamics in general whereby what we see is explained as a consequence, not a static condition, and (2) diagnostics by which to interpret observations. The theory accommodates physical reality and strategic priorities set for sustainable development. Here I open a conversation by offering interconnected, but not necessarily inclusive, elements of such a theory. The elements are: openness, thermodynamic foundation, closure, organismal experience, consciousness, and narrative legitimacy. Openness – The state of the earth at every moment is a consequence of cumulative changes from the Big Bang forward and of relationships among entities; it is communal and accommodating of all forms (T. Berry). Human understanding of that history, scope, and prospects for the future color the imagination, values, and choices we make; past and future potentials coexist in the mind (Whitehead). Other species share aspects of human understanding. Thermodynamic foundation – Energy transformation and flows of material and information are interconnected to constitute economies, with GDP as derivative of the cumulative economic production over millennia (Garrett); what we do today matters in perpetuity, implying profound responsibility to future generations. Closure – Systems organization involves interplay of extensive and intensive properties (Giampietro) leading to part-to-whole relations. Globalization is an attempt to close the flows of information, material, and energy whereby resilience obtains from entraining greater energy flow, higher entropy, and therefore less constraint. Organismal experience – The nature of life on earth reflects constraints imposed at the level of the solar system which selected for organisms adapted to the solar spectrum, to annual cycles, and to finite habitat area. Universal principles govern organismal design and thus requirements for persistence. Consciousness – A topic lacking consensus, but wide open to disruptive discoveries that promise to support a secular sacredness, or sense of awe, that would guide choices toward both the kind and purpose of development (Meadows, Huxley). Narrative legitimacy – Recognition that each life is a privilege worthy of expression, dignity, and fulfillment within the constraints of physical, social, and ecological reality. The elements are illustrated and mapped to sustainable development strategies currently at play whereby to audit the prospects for holistic outcomes.

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TOWARDS A SCIENCE OF ANTICIPATION?

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Why a Conference on anticipation?

Anticipation is increasingly at the heart of urgent contemporary debates, from climate change to economic crisis. As societies are less confident that tradition will provide an effective guide to the future, anticipatory practices are coming to the foreground of political, organizational and personal life. Research into anticipation, however, has not kept pace with social demand for insights into these practices, their risks and their uses. Where research does exist, it is deeply fragmented.

A better and more complete understanding of anticipation and its effects will improve theories and models of individual and collective human behaviour and its consequences. The arising benefits will thus assist those who are explicitly seeking to understand and design ‘the prepared society’, to make more effective and sustainable use of technologies, to create more inclusive democracies and to explore the boundaries of human endeavours. Such benefits are consistent with the strategy for a smart, sustainable and inclusive society. Further, the ability to anticipate in complex (self-generating, unpredictable) environments greatly improves the resilience of societies facing threats from a global proliferation of institutions, agents and forces, by articulating insecurities through anticipatory processes.

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SYSTEMS THINKING AND WILDLAND FIRE MANAGEMENT

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A changing climate, expanding ex-urban residential development, and increasing pressures on ecosystem services raise global concerns over growing losses associated with wildland fires. New management paradigms acknowledge that fire is inevitable and often uncontrollable, and focus on living with fire rather than attempting to eliminate it from the landscape. A notable example from the U.S. is the National Cohesive Wildland Fire Management Strategy, which aims to bring multiple landowners and stakeholders together to achieve three broadly defined goals: resilient landscapes, fire-adapted human communities, and safe and effective response to fire. Implicit in the structure of these three goals is the nexus of three systems: the ecological system, the social system, and the fire management system, respectively. This systems-based structure reflects a perspective that contextualizes fire as a disturbance agent that influences and is in turn influenced by other agents and processes within a broader socio-ecological system. While the need for transformative system change is well-recognized, at least three central challenges remain: (1) the need to accept that how fires are managed is in many instances the limiting factor of system behaviour; (2) the need to improve our understanding of the characteristics and complexities of the fire management system itself; and (3) perhaps most fundamentally, the need to coherently apply systems analysis principles in order to improve system performance. In this presentation I will attempt to bridge these gaps by applying systems thinking to contemporary wildfire management issues in the U.S. One thread of the presentation will focus on synthesizing findings from various lines of fire-related research and identifying how collectively they reflect systemic flaws stemming from feedbacks, delays, bounded rationality, misaligned incentives, and other factors. Particular attention will be devoted to the “fire paradox,” whereby a legacy of fire exclusion in fire-prone forests has led to hazardous accumulations of flammable vegetation such that future fires burn with higher intensity and are more resistant to control; today’s “success” begets tomorrows failure. The second thread will outline a roadmap for redesigning the fire management system so that behaviour better aligns with purpose. This discussion will focus on recommended actions including breaking down institutional silos, investing in pre-fire assessment and planning, improving monitoring and performance evaluation, and adopting core risk management principles. Ideally this line of research will yield insights that can lead to meaningful systemic change and improved fire management outcomes.

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CONSYS APPROACH FOR BUILDING A LINK BETWEEN CONOPS AND SYSTEM MODELS IN THE CONTEXT OF MODEL-BASED SYSTEMS ENGINEERING

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According to US National Institute of Standards and Technology (NIST) Planning Report 02-3, across the entire system development life cycle (SDLC), 70% of the defects are introduced in the Requirements Gathering and Analysis/Architectural Design stage. Enterprise Level Concept of Operations (CONOPs) may exist but are not linked to system models. The missing link between CONOPs and system models causes the requirements either inadequately or incorrectly defined. As systems become more complex and concepts continue evolving, there is a need for approaches that combine CONOPs with system models to build an integrated modelling environment.

This paper proposes a CONSYS approach that extends system models to CONOPs in the context of Model-Base System Engineering (MBSE). This paper evaluates the benefits of this CONSYS approach. The goal is to build a link between CONOPs and system models so that CONOPs are baselined and change controlled as the way system models are. SysML has been widely adopted as the language to capture system models. A case study example is presented to demonstrate the CONSYS approach using a SysML tool and to show the benefits of this approach. The areas for further research is also discussed in this paper.

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A FRAMEWORK FOR UNDERSTANDING AND ACHIEVING SUSTAINABILITY OF COMPLEX SYSTEMS

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This paper takes a systems approach to outlining a framework for the sustainability of complex systems. Complex systems have one or more functions that strongly interact with their environments, or meta-system in which they are embedded. The success of the system in interacting with its environment over an extended time frame depends on that system's ability to regulate its activities, both internal and external so as to remain 'fit'. The concept of fitness derives directly from the evolutionary theory of phenotypic traits and capabilities (behaviors) being selected for or against by the environment of the system. But it is generalized beyond the standard neoDarwinian biological process. The roles of adaptivity and evolvability and the mechanisms of a hierarchical cybernetic governance subsystem in maintaining these are advanced as necessary conditions for achieving sustainability.

An operational definition of sustainability is advanced along with a set of necessary conditions that must obtain in order for complex systems to achieve it. Several systemic dysfunctional conditions are explored to show how complex systems fail to achieve sustainability by failure of the hierarchical cybernetic governance subsystem. Examples from several natural and human-built systems are used to demonstrate these conditions.

Clarification of the meaning of complexity across a spectrum of system types is given. A definition of complexity based on hierarchical levels of organization is given to ground the discussion of the hierarchical cybernetic governance subsystem and justify its necessity to achieve and maintain stable dynamics in unstable environments.

The purposes and uses of this framework are discussed and examples provided. A brief description of the use of systems analysis to explore and discover functional and dysfunctional subsystems within the hierarchical cybernetic governance subsystem and how this might provide insights for the design of better performing subsystems is also provided.

The paper concludes with a projection of the benefits of applying this methodology to the governance of the human social system (HSS).

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A WHOLE SYSTEMS APPROACH TO EDUCATION REDESIGN
A CASE STUDY ON THE NEED FOR INTER-GENERATIONAL PERSPECTIVES AND INCLUSION

Kahlia Laszlo with Alexander Laszlo

This study was commissioned by the Global Education Futures forum for presentation at its fourth International Conference in Moscow, Russia, from 29 February to 2 March 2016 (http://edu2035.org/#program). The objective was to conduct field research with a special focus on the vision of the future of education held by young people. This report presents some views and perspectives of my generation regarding what they want education to be like in the future. In northern California, my teachers Ms. B and Mr. Wahanik used the framework of questions and activities that my father and I developed to gather this kind of information by running a sort of "focus group" with my 10th Grade class and to find out what their views, perspective, opinions, ideas, hopes and concerns are regarding this theme. This group consisted of mainly 15 and 16 year olds, and there are around 40 students in my class. They had less than an hour to run the whole process, but everyone already knew each other really well so they could go quickly through the process, as described in this report.

A similar process was run with a group of young people in Buenos Aires, Argentina. Here I had to work with people whom I had never met before and who also didn't know each other at all. We had exactly 12 students from a variety of public and private schools with an age range from 12 to 17 years old. However, we had a total of three hours with them, so we could do an icebreaker and take our time to move through the whole thing.

In both cases (California and Argentina), the idea was to engage young people in a series of structured creative Future Thinking adventures that helped them "invent" what education (learning and teaching) should be like in the year 2035. The idea behind this is that educators and those involved in the systemic re-design of education systems might want to include this kind of data and these kind of perspectives in the work they are doing. I would like to present my findings at the ISSS and to see whether others think more of this kind of work should be done.

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PERFORMANCE EVALUATION SYSTEM IN ENGINEERING MATTERS: SYSTEMATIC AND THEORETICAL APPROACH TO HUMANITY

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As systematic approach to engineering matters, the performance evaluation system is proposed and examined theoretically by using mathematical model. The systematic and theoretical approach to humanity is described. In the long history of human activity, engineering, culture, tradition, customs, life style, language have been formed gradually based upon politics, economics, natural and social environments. In usual, facility (F) behaves and performs a certain interaction (I) under some environments (E). This general phenomenon (physics/chemistry) is due to nature laws and also applies to a general social phenomenon and human activity. Above F,E,I are considered to be primary elements of basic system V(F,E,I).The performance of V(F,E,I) is evaluated as a result of phenomenon. As rating index (p), five elements are defined: time(t), space(x),money(m), humanity(h), quality(q). Basic system V(F,E,I) is expressed in form of V(t,x,m,h,q) because of having rating index built-in. Performance evaluation system is formulated by mathematical model (partial differentiation form)of δV(F,E,I)/ δp. Primarily, it is revised to organize the basic system V(F,E,I) ,then build each hierarchy in detail, integrating independent phenomenon.
1) Partial cause /effect analysis : δV(F,E,I)/ δp= δV1(F)/ δp+ δV2(E)/ δp+ δV3(I)/ δp . 2) Primary evaluation: δV/δp (gradient/grade), quick/slow (t), large/small (x), tough/fragile, strong/weak (q), beautiful/dirty, bright/dark (h), expensive/cheap, rich/poor (m).
3)Secondary evaluation:δ2V/δp2 (acceleration/inertia/potential), life evaluation (t), spread characteristics, broad spectrum evaluation (x), safety, reliability evaluation (q), public opinion, reputation, use-related evaluation (h), money making characteristics, economic evaluation(m).
4) Multifarious evaluation δ2V/δp1δp2: System V is revised from different viewpoints. δ2V/δmδt: change of stock prices. δ2V/δhδt: reputational future risk in time history. 5)Sequence order of evaluation time: The decision making is handled depending on a situation to develop one by one. The conclusion highly depends on time processing. 6)System V is classified to be function separated type and function integrated type, which results in big influence on performance evaluation in decision making（δ2V/δp1δp2 type.
As the two-dimensional（X,Y）problem, the expression method of block diagram is discussed. It should be orthogonally designated by independent phenomenon each other. In X-Y axis, time(t),space(x), money(m),humanity(h),quality/quantity(q) are usually chosen as the rating index which are mutually exclusive and independent phenomenon each other. As a model, a risk diagram (occurrence probability-hazard relation) is used. In which for X-Y axis, rating index m/t are orthogonally designated. Furthermore, division of risk category A,B,C,D are made as risk matrix and used for risk management/control. The shape of this block domain highly depends on nature law (probability density function). The shape factor k has some properties: 1) k>1,too active/top heavy type,2) k=1, stable/natural type,3) k<1,reserved/long tail type. Block diagrams are available in some extent: situation appraisal, problem analysis, decision making analysis and potential problem analysis. As the second example, PM theory (performance function Y/maintenance function X) is discussed, which is handling the personal/professional duty performance. By potential reserved theory (X*Y=constant), the human ability falls into four categories in form of block matrix. The job site is worked by specialist and managerial staff. There are personnel training and a principle of the right man in the right place there. Some other examples are explained about their expression and validity.
Keywords: theoretical approach to humanity, performance evaluation system, rating index, primary/secondary evaluation, block diagram.

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FOOTPRINTS OF GENERAL SYSTEMS THEORY

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In order to identify General Systems Theory (GST) or at least have a fuzzy idea of what it might look like, we shall look for its traces on different systems. We shall try to identify such an “animal” by its “footprints”. The footprints manifest as phenomena and scientific disciplines. Different scientific disciplines often use different methodologies and terminologies for the same aspects of reality. Should they resemble more than it is the case nowadays and look for isomorphies and overlapping in order to have a broader insight into reality and avoid multiplication of research and terminology? If not, why not? Do different systems resemble each other more than modern science makes us believe? Is GST a single set of rules or a presumably small number of such independent sets? A discussion about these and similar questions looks like a good way to identify the footprints and to try, if GST really is the skeleton of science, to reduce it to “bare bones”. “Systemness” in nature can for instance be found in thermodynamics, chaos, science of life and consciousness (and anticipatory systems and teleology), and quantum mechanics. More precisely, a strong candidate for GST should reveal whether or not the exemplars of systemness in nature from the previous sentence are relevant

and whether they should be improved or replaced by some other systems (system processes) in nature. Also, perhaps such a theory with or without additional details could tell us something about Constructor Theory and the Universal Constructor, (in)determinism and causality, computation and computability (and similarities and differences between these concepts), etc. GST might be an outcome of the process of abstraction, i.e. reduction of different systems to their basic ingredients. If that were the case (without the consensus about GST or the set of such theories we can just make assumptions in the rest of this paper), the opposite process of deabstraction would describe specific systems (How long is the line of deabstraction from GST to a specific system/scientific concept?) within different aspects of reality or scientific disciplines. Moving back and forth between abstraction and deabstraction could allow us to assess different systems theories and compare their causal and explanatory power. Another way to assess the strength of a candidate for GST would be its resemblance to publications by different authors and from different scientific disciplines. Systems mimicry as an application of GST and insights about natural systems (emerged and selected by nature over millions and billions of years) to systems engineering (both hard and soft – including but not reduced to modelling and simulation, computation/computability, and control systems) would at the same time allow new understanding of how to improve engineering and to what extent natural systems such as life and consciousness (Perhaps even interpretations of quantum mechanics?) can be understood and simulated. A Structural Theory of Everything resembles aforementioned Constructor Theory (at least they are outcomes of similar mindsets) and the concept of Biomathics resembles Systems Processes Theory (there are more systems processes than just more obvious feedback, synergy, and hierarchy) and Linkage Propositions. Those concepts, if they didn't significantly overlap, would at their mature stage communicate between each other.
The author actually has his, already published, candidate for GST and it is difficult for him to write this paper without thinking about it. Hopefully this text is independent and unbiased enough to provide to the reader new insights about systems theory and systems thinking in general.

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TYPOLOGY OF SOCIAL ACTIONS BASED ON THE LIVING SYSTEM THEORY
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It is impossible to make progress in social theory without inquiring about social actions; therefore, many leading sociologists refer to this notion in their work. Max Weber, Talcott Parsons and many other sociologists attempted to ground not only their works but also the science of sociology as a whole on a theory of social actions. Max Weber defined sociology as "the science which attempts the interpretative understanding of social action in order thereby to arrive at a casual explanation of its course and effects". Moreover, he explicitly singled out social action as the "central subject matter" of his sociology. Hence, comprehensive typology of social actions can be very helpful in sociological analysis.
Usually, social actions are classified by actors' intentions. In this paper, types of social actions are categorized both by actors' intentions and by the actions' results, including both the intentional and unintentional outcomes. This was achieved through consideration of the social actions in the framework of J.G. Miller's living systems theory. This theory regards each living system as composed of 20 subsystems that process information and matter/energy inside the living system and between the living system and its environment. These 20 subsystems are considered at eight levels: cell, organ, organism, group, organization, community, society and supranational systems. The first three constitute the level of biological living systems; the other five comprise the level of social living systems. Social actions are interactions among living systems or among different parts of one living system at the social level. The proposed typology of social actions is based on analysis of developmental, reproductive and interactional processes in the social systems.
In order to live and function, living systems must allow their matter/energy-processing subsystems to work, so all social actions in social living systems can be associated with the functioning of these subsystems. Seemingly, the number of goals for social actions as well as the number of their outcomes is very high, however, by relating principal intention and main outcome of the considered social action to specific matter/energy-processing subsystems, their number can be significantly reduced. This is done by determining the main subsystem that was intended to be affected by the planned social action, and the main subsystem that was actually impacted by it. In many cases, it is the same subsystem; that is, the intention coincides with the consequence. As a result of this analysis, the two-dimensional matrix of types of social actions was constructed, and the methodology of assigning any social action to a specific cell in the typological matrix was proposed. Every social action in this typology is designated by the names of the pair of the involved subsystems; if they coincide, the type is labeled by the name of one subsystem. Obviously, as in any classification, there also exists an element of arbitrariness in the relating of the social action to its type. More detailed typology of social actions on the basis of the living systems theory can be developed by including in the analysis the information-processing subsystems.

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PERMANENT DESIGNING AS A WAY TO SOCIO-TECHNICAL SYSTEMS SUSTAINABILITY ACHIEVING

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The authors evolve ideas of the Moscow Methodological Circle that was established in 1954 and has been working till 1994 under Georgy Shchedrovitsky leadership.

The objectives of this paper – to consider the specific features of socio-technical systems designing, and to suggest the permanent designing approach as a way to achieve sustainability of -similar systems. This approach includes such mechanisms as designer's self-identification, reflection, orientation to collaboration between designer and designing objects, designer's activity at the implementation stage of system development and others.

If the designing of technical systems supposes a strict separation between the stage of project documentation development and the one of techware production, the designing of a socio-technical system is tightly related with implementation processes. The fundamental restriction of rational, analytical or engineering description of a developing system eventual behavior shall be compensated by the means of permanent modernization/evolution of the project during its implementation/approbation. In other words, there are two parallel but related processes – the process of project designing and the process of project implementation. From this point of view a socio-technical project remains an open and unaccomplished system that is capable of radical transforming within its implementation. The task is to consider this obvious fact as an object of technological equipping. We name such kind of technologies as permanent designing of socio-technical systems.

Socio-technical designing goes further than technical designing – even if a designer is not included into his "object", i.e. designing activity initially, he shall do it through managerial participation in project implementation processes. This new field of activity and interaction becomes in fact a target of methodological designing.

For a designer's activity it means that this activity shall regularly become an object of project reflection. The reflection of any activity supposes that each of its elements can be the subject of critical analysis and transformation. Thus, values and orientations, problems and tasks settings, instruments in use, models and methods, performing project function organizational structures can be reflected – reviewed and transformed, especially in project implementation context, etc.

We think that today an important metamorphosis took place, which considerably affected the relation between a designer and a socio-technical object to design. Directive managerial relation of a designer to designing object changes by an orientation to their collaboration. It begins from understanding that the project implementation goes more effectively when in designing process take part those people which would be affected by results of this project. It's supposed that as a result of such collaboration the participants' interests would be taken into account as well as most of inconsistencies between them, which are unavoidable in case of serious project innovation, can be smoothed.

Including one or another representative of designed object into managerial or, in fact, designing activity, supposes that he is able to form and occupy definite place in this activity by taking on a responsibility for the result of this activity. It means from our point of view that the person become self-identified as a subject of designing activity. There would be created social, institutional conditions, in which an activity participant challenging for his subject position can realize it.

The permanent character of designing process and its implementing in enabling system defines the specific of lifecycle. The system lifecycle for traditional designing ends at the production stage. In modern systems engineering the project became wider and expands the whole lifecycle of product including its retirement. On the contrary a social project doesn't retire but overlap the social reality and still live according to the rules of its reproduction.

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TAKING ADVANTAGE OF SYSTEMS THINKING TO IMPROVE A STEM PROJECT TO PROMOTE REGIONAL DEVELOPMENT

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Between 2014 and 2016, a group of researchers from three different universities and a social innovation park, developed a STEM Project to promote regional development in three areas from the province of Cundinamarca, Colombia. The project was financed with public funds and supported the official regional plans. The intervention was carried out by a group of almost thirty researchers using several systemic and

non-systemic approaches. The involvement of researchers from diverse disciplines who believed in very different paradigms, as well as the participation of communities with dissimilar interests and problems, posed serious challenges to the project. During the research inquiry the participants experienced the difficulty of integrating elements from apparently incommensurable paradigms from the social sciences, the natural sciences, and several engineering disciplines. This experience, as well as others that involved the promotion of regional development by taking advantage of the science, technology, engineering, and mathematics disciplines, served to propose a systemic model of intervention that we consider might be helpful in developing future STEM projects to promote regional development. The aforementioned intervention drew upon several systems thinking principles, methodologies and techniques, such as boundary critique, soft systems methodologies, critical systems heuristics, Midgley's creative design of methods, and system dynamics. The model proposed for new regional STEM interventions takes advantage of several systemic methodologies, principles and techniques, and proposes a new multi-paradigm multimethodolgy that aims an improving the efficacy and effectiveness of regional interventions. The model includes several key elements that we consider particularly relevant: the promotion of community capacity to guarantee a sustainable future, community development at different levels (cultural, social, economic, etc.), training that involves both individual and social learning, and continuous evaluation. This paper also illustrates the important role that computer supported collaborative learning and other information and communication technologies can play in these interventions, as well as the relevance of the communities of practice theories to address diverse issues but particularly identity, power and learning issues.

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CRUCIAL INSTITUTIONAL INNOVATIONS: EVOLUTIONARY CHANGE IN HIGHER EDUCATION

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In 1969, Erich Jantsch published his paper about the disruptive forces affecting higher education and society. He was serving as a research associate at MIT and studying the futures of MIT and the American University at the time. Jantsch (1969) said students were concerned about whether the college curriculum was relevant. Meanwhile, society was concerned about the degrading side effects of technology on the systems of human living, cities, and the natural environment. Lastly, Jantsch pointed to the rising concern about the lack of systems and futures thinking. He coined these concerns "disruptive forces" and believed that the university was well-positioned to assume a new leadership role in society in order to assist in transforming these concerns. Jantsch predicted (hoped for) five crucial institutional innovations in order to transform disruptions into "cohesive forces". Jantsch passed away ten years after the publication of this document and didn't have the opportunity to see if his ideas came to fruition. Using a mixed methods approach, this study explores the evolution of higher education institutions by posing questions that revolve around Jantsch's five crucial innovations, including a new purpose for the university, socio-technological system engineering, altering the structure of the university, re-orienting the operational principles of the university, and a more active relationship between the new university and society. Five institutions highly referenced for their innovation will be invited to participate in this research. Jantsch's "crucial innovations" frame this investigative study. The conceptual framework consists of the concepts of disruptive forces, the three functions of higher education, self-renewal, and integrative planning. This paper will present the preliminary findings to this study.

Keywords: Erich Jantsch, higher education, disruptive forces, self-renewal, integrative planning, innovation.

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CREATING ENDURING SOCIAL IMPACT: A MODEL FOR MULTI-SECTOR TRANSFORMATIONAL CHANGE

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The nonprofit and public sectors are in the midst of a paradigm shift from addressing community concerns individually and competing with each other for existing funding to working collaboratively and thinking collectively across sectors to solve some of our most intractable social problems. This transition requires new approaches that challenge assumptions and generate new knowledge. Existing models for change, while theoretically sound, are difficult to adapt to multi-sector transformational change. Undertaking multi-sector transformational change is substantially different than the vast majority of change efforts that take place within a single organization, differing in scope, complexity, and leadership.

This paper describes a new model specifically designed to address the unique needs of multi-sector change efforts. It is built on the theoretical framework of complexity science and complex adaptive systems, organization development, transformative and organizational learning, and multi-sector transformational change. Multi-sector transformational change efforts take place within highly complex systems, where stakeholders (components of the system) come together to do work that none of them can accomplish

alone. This work requires participants to develop their adaptive capacity in response to a constantly changing environment where outcomes are uncertain and thus, cannot be planned for. Participants must also be capable of surfacing and challenging their own assumptions through transformative and organizational learning in order to create space for generative dialogue. These frameworks are essential to the success of multi-sector transformational change.
The model consists of five phases: (1) discovery and dialogue; (2) deepening, refining, and assessing; (3) infrastructure, communication, and coordination; (4) ongoing implementation and progress reporting; and (5) learning, celebration, and sustainability. Phase 1 focuses on understanding current reality, identifying key stakeholders, building relationships, and creating a shared vision. Phase 2 continues to deepen and refine the work of Phase 1 while at the same time establishing a practice of reflection. Phase 3 initiates implementation and establishes feedback mechanisms. Phase 4 delves deep into implementation, launches feedback mechanisms, and looks ahead to sustainability. Phase 5 provides more formal evaluation of the project outcomes and processes and requires participants to decide whether the effort is completed or if it continues. These five phases represent a cycle that is designed to be iterative, building on new knowledge gained from the previous cycle.
Aside from providing a new approach to multi-sector transformational change, the significance of this model is its adaptability and flexibility, with the caveat that certain critical processes not be omitted. Broad stakeholder representation is essential to mobilize and engage those who care about or are affected by the particular issue. Building strong relationships with those stakeholders, as well as sponsors, funders, and partner organizations, establishes robust connections that will serve to propel the project forward and reinforce the project during challenging periods. Identifying influential champions, those who reduce barriers, open doors, and make connections, provides the project with loyal advocates. Fully funding a facilitation, communication, and support organization enables organizational and community leaders to focus on the creation of new knowledge and provides a level of oversight that will maintain the momentum throughout the project. Developing the transformative learning capacity of all participants and weaving that together to create a learning organization will ensure that the wisdom of all participants is brought forth to understand the nuances of the issue and explore possibilities. These five processes provide the backbone for any multi-sector transformational change effort.
Keywords: Multi-sector, Transformational Change, Transformative Learning, Organizational Learning, Complexity, Complex Adaptive Systems, Organization Development, Dialogue, Stakeholders

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DEVELOPING AN UNDERSTANDING OF VIOLENCE USING THE DSRP THEORY AS A FRAMEWORK
Victor Ronald David MacGill
Cabrera and Cabrera's DSRP model outlines the cognitive foundations for anything that arises. It proposes four mutually arising fundamentals: distinctions, systems, relationships and perspectives that are evident in any system. All living systems are complex adaptive systems that maintain their state through a flow of energy, resources and information across the system boundaries. Violence can be defined as the invasion of a boundary or the disruption of a flow across a boundary.
When a boundary is set by a distinction, inside and outside is created. That which is excluded becomes the other and is often disowned, demonised and marginalised and thus becomes an easy target for violence. The parts of a system created by the boundary interact. Sometimes parts invade other parts so they are controlled by that part, thus impacting on the functioning of the whole system and reducing the requisite variety.
The relationships between the parts can likewise be distorted, so that one part of the relationship uses power and control over the other. The parts have perspectives. A point of view makes one particular way of meaning making possible, but excludes others from being revealed. If people can be coerced into accepting one particular perspective, they can be deceived and thus have their behaviour controlled. Violence is thus a fundamental quality potentially inherent in all complex systems.
Since complex adaptive systems are fractal, so is violence. We can thus gain an understanding of the patterns of violence at all fractal levels, from bacteria interacting to individual humans to whole societies. Violence springs from the same underlying systems dynamics, but is expressed in different ways depending on the level at which the system is operating. Galtung has identified three types of violence: direct, cultural and structural. Each of these will be discussed in relation to the DSRP model.
Dutton's Nested Ecological Model is used as a framework to explore factors behind the choice to use violence and makes the links to factors that tend to perpetuate violence from one generation to the next. Through being a victim of violence a person becomes vulnerable to factors that predispose them to perpetuating violence themselves.
Having determined the way CAS are disrupted through violence, we can recognise the actions that will be needed to rebuild resilience and help restore the effective functions of the CAS and can thus formulate actions that may help reduce the likelihood of violence being passed on from generation to generation.

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DEVELOPING A SYSTEMIC FRAMEWORK FOR EVALUATION MODELS AND THEIR APPLICATIONS

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The following paper presents the development of a systemic framework for the classification of evaluation models, based on the reflective process that takes place when selecting an evaluation model and the study of processes of marginalization. For such purposes, several classifications proposed by various authors for systemic methodologies are taken into account. We should begin by stressing the importance of the concept of assessment or evaluation as it allows us to make judgments about the performance of organizations, projects, programs, staff and activities at different levels enabling the implementation of activities or actions to reduce the gap between the current state of a system and its desired state. These activities not only seek a gap reduction but are also oriented to process and human group sustainability through the achievement of best practices that will bring benefits in the long term. When selecting an evaluation model, the evaluator is usually based on the best-known features, such as the methods used, the research questions that it follows, and the kind of problems that could be targeted. However, as evaluation is entirely based on judgments, each assessment model necessarily has a set of underlying values that are rarely taken into account and should be aligned not only with the purpose for which the evaluation is done but also with the moral characterization of the problems it tackles. Such judgmental nature, implies that any judgment must be based on a set of guiding principles, standards or ideals that determine the position of the object evaluated with respect to such values. An individual, which in this case is the evaluator, must carry out a reflective process to establish this set of elements. For this reason, this paper describes the development of a systemic framework that seeks to classify the various models of evaluation of projects, policies and programs according to the values underlying each of them considering their deontological and methodological bases. In this paper deontology comprises the ethics and principles underlying the evaluation profession and specifically in the conducted evaluation process, while methodology is seen as the basis that validates a set of procedures and tools. For the development of this framework we took into account the framework for the classification of systemic methodologies proposed by authors such as Banathy and Burrell & Morgan, as well as the theory of “knowledge-constitutive interests” proposed by Jurgen Habermas and the context classification of a problem. The development of such a classification allows the individual that is conducting the evaluation to be able to select an appropriate and accurate methodology in accordance with the purpose for which the assessment will be carried out.

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SYSTEM LANGUAGE: UNDERSTANDING SYSTEMS

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Current languages for system modelling impose limitations on how a system is described. For example system dynamics languages (e.g. Stella) assume that the only concern in modelling a system is its dynamics which can be expressed in stocks, flows, and regulators only. A language for describing systems in a general framework provides guidance for the analysis of real systems as well as a way to construct models of those systems suitable for simulation. The language being developed, system language (SL) for lack of a catchier name, consists of:

A set of lexical elements, terms that represent abstractions of components and entities that are found in all dynamic, complex systems to one extent or another - e.g. regulator, process, flow, boundaries, interfaces, etc.

A syntax for constructing the structure of a system including:

- describing the boundary and its conditions (including expansion of boundaries as needed)
- describing the hierarchical network of connections and relations (e.g. system of systems)
- describing interfaces and protocols for entities to exchange flows
- describing the behavior of elements in the system (e.g. functions)
- providing specific identifiers naming the abstract lexical elements (e.g. electrical power flow)
- providing a set of attributes appropriate to the nature of the element (e.g. voltage, amperage, etc.)

A semantics that establishes patterns of connectivity and behavior including:

- distinction of material, energy, and message (communications) flows
- laws of nature to be observed, e.g. conservation principles and second law of thermodynamics
- imposes process-oriented abstraction on subsystems (similar to object-oriented modularization)
- establishes rules for interfacing entities through flows
- provides higher order organization and functions such as:

- ♣ adaptivity (a capacity to vary behaviour in response to environmental changes within limits)
- ♣ agency (an ability to make decisions – operational, logistical, tactical, or strategic in the framework of a hierarchical cybernetic governance system)
- ♣ evolvability (an ability to add or modify functionality either through foresight or by chance).

The language pragmatics is drawn from general systems theory as explicated in a set of principles of systems science. The language is formal and imposes rules of expression and construction that assure the resulting descriptions correspond with the nature of real systems in the world.
It is proposed that SL can capture the essence, structure, and dynamics of any real physical system. For example, the author has used this language to describe the human brain and its relation with the body and environment meta-system. The construction involves analysing the brain as a hierarchical cybernetic governance system (HCGS) that manages the internal operations of the body (operations and logistical management) and its near-term interactions with the environment (tactical management). The human brain has been additionally shown to provide strategic management (coordination with a world that might be in the future!) A very similar analysis has been applied to organizations and their management.
A recent survey of existing modelling languages has revealed only a limited capacity for these languages to support the SL framework. Existing languages generally support basic system dynamics and/or agent based (e.g. for explorations of emergent behaviour) approaches. Some are extensible through additional programming in languages like Java but do not directly address some of the more important features of SL. These results indicate that a new language should be developed to provide native support for SL directly. One immediate advantage of doing so is that the development approach can include support for massive multi-processing so that extremely large systems models can be developed. Modelling the human social system (HSS) would be an obvious target to help us understand our apparent predicament from a systems perspective.

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THE HOLISTIC VALUES OF SOCIO-ECOLOGICAL SYSTEMS AND THE PRACTICE OF GREEN DEVELOPMENT IN CHINA

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The continuous intensify of ecological crisis has aroused a strong sense of ecological protection. Since the 80s of the 20th century, a serious of movement aimed at environmental protection, ecological movement, and feminism appeared in the developed countries in Western Europe. The movement which is called the Green Movement treated intellectuals and middle class as the main participants. The serious environmental problems also emerged in the process of realizing the rapid development of economy in China. Therefore, the Chinese government focus on the ideas of Green Development. The green development requires the whole society to establish a reasonable value of natural capital, to form new social and moral norms, to promote green lifestyles, and so forth. The way of China's green development has get the world's attention. From the green movement to the green development, it has formed a systems holistic values of socio-ecological system gradually. Firstly, we support the intrinsic value of natural system and oppose the traditional philosophy values which considered the tool value of nature as primary only when it is related to the subjective purpose of human beings or meets the needs of humans. Secondly, we propose that the values of natural system is holistic. The intrinsic value of natural system and the tool value can be converted to each other. As Rolston III said, the intrinsic value and the tool value would be converted among lives, species, systems and surroundings by the transformation of systems, so as to maintain the stability and integrality of systems. In socio-ecological system, the interaction between the natural values and human values and the function of each other formed the value chain of system dynamics and integrity. Thirdly, the order parameter of socio-ecological system is bearing threshold of systems, the order parameter emerged by the synergistic reaction of social system, economic system and natural system will constraint and control the collaboration optimization of each subsystem of the socio-ecological systems in turn.
Modern systems science and complexity research has provided a new perspective and theoretical basis to the intrinsic value of natural systems and the holistic values of socio-ecological systems when it refers to the holistic property and emergence, adaptation and evolution, purpose and values of systems. The holistic values of socio-ecological systems pay more attention to the holistic interests of human social system, economic system and natural system. It has great significance to solve serious ecological crisis and realize sustainable futures in socio-ecological systems.

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PARTICIPATORY ACTION-RESEARCH AS A METHODOLOGY FOR THE DEVELOPMENT OF APPROPRIATE TECHNOLOGIES BY COMMUNITIES

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The social and environmental development potential of countries like Colombia, shows the need to articulate right from the communities, the processes and projects relevant to their territories. Furthermore when vital aspects of human health, such as access to clean water and water consumption, are also opportunities for the development of innovative technological solutions, stemming from the relationship between society and natural systems. In Colombia, for example, 62% of the municipalities have a medium to high risk of water availability vulnerability, and the remaining ones are on areas hard to reach or with a low population density. This amount increases to 80% if only the main cities are taken into account, which points to the importance of an efficient water resources management.

In this context, a group of researchers together with a community of about 1,500 children and 15 teachers from schools of several municipalities of Cundinamarca department (Colombia), have been developing a technological platform founded on the community-based action research proposal of Ernest Stringer. This interactive technological platform, based on the use of SMS and the web, is called the “La Liga del Agua”. It is a jointly constructed space where synergies between the different stakeholders around the proper use of water resources can arise, based on the self-recognition of waste water problems on each of the participants’ homes. Thus, the problem is approached from the daily practices and the technological inefficiency, generating an empowerment of the water importance.

The main theoretical foundation of this technological co-construction is based on the spirit of participatory and democratic systemic intervention, from the soft systems methodology of Peter Checkland, as well as the socio-cultural vision of the community that, voluntarily, intend to solve a problem collectively, as suggested by Rusell Ackoff. In this participatory co-construction, the following aspects were considered: i) the supply and environmental care systems are mediated by the interaction between the community stakeholders, ii) to develop solutions, it is not enough with the construction of appropriate technologies, research processes aimed at social appropriation of innovation are essential, and finally iii) the knowledge management, the use of technology and the impact of the teachers in the development of socio-environmental skills of the participating students.

In this article, we will show the jointly design process of the “La Liga del Agua” platform and the incidence on the increase of the good practices of water resources usage. In addition, the results of the teaching strategies and recreational activities that seek to increase the empowerment by the actors and their interaction with the technology, will be presented. To conclude, all the learnings of the proposal will be introduced, so it can be replicated on other contexts with environmental concerns.

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DYNAMICS AS DEMARCATION

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Like science, systems faces a demarcation problem. How might one specify what counts or doesn’t count as systemic thinking and practice? In this exploratory talk, I will review distinctions that others have drawn, and then describe a framework for understanding dynamics as a basis of distinction. This dynamics-as-demarcation approach has several advantages, including: illuminating various ways that systems thinking and practice have been described, historically and currently, and affording a “sweeping in” from across relevant academic fields of study and practice. A particular advantage of a dynamics-as-demarcation approach is the way in which it can be used to inform understandings of purposeful social change.

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THE SYSTEM OF ACCOUNTS FOR GLOBAL ENTROPY PRODUCTION, (SAGE-P): NONLINEAR ACCOUNTING OF GROSS DOMESTIC PRODUCT (GDP) IN THE DOMAIN OF THE ECOSPHERE, SOCIOSPHERE AND ECONOSPHERE

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GDP is a linear measure at market prices of the annual production of the (final) goods and services produced in the National Economy. It is gross insofar as it excludes the degradation of the capital stock. The accounts are divided into four categories: (i) P = production/income (i.e., payments for work and/or rent from property), (ii) C = consumption/expenditure (i.e., payments for goods and services), (iii) T = trade with the-rest-of-the-word, (i,e,, payments to/from nonresident consumers/producers), and (iv) K = capital/surplus, (i.e., investment with an expected flow of future income). We shall redefine the categories of GDP as product of the Second Law of thermodynamics: (i) Production = Pe = negentropy. (ii) Ce = consumption = entropy, (iii) Te = international trade in net-valued export/import of entropy production Te = (Pe - Ce), (iv) Ke = Low Entropy Fund (LEF) available for human consumption = Ke = Pe/Ce. The three states of LEF: (a) surplus-state = Pe/Ce > 1, (b) deficit-state = Pe/Ce < 1, and (c) steady-state = Pe/Ce = 1. We shall apply the System of Accounts for Global Entropy Production (SAGE-P) in order to construct Gross Domestic Entropy Production accounts, GDPe. The first step is to calculate to LEF for the Nation x. The second step is a correspondence mapping of LEF on the four categories of GDP. The third step is to introduce the valuation method unique to the domains: (A) Ecosphere, (i.e., values conserved-in-themselves, or intrinsic, (B) Sociosphere, (i.e., values conserved-in-use, or participation) and (C) Econosphere, (i.e., values conserved-in-exchange, or market prices. A, B and C are nested sets in the form: A [B,(C)]. The fourth step is a GDP correspondence mapping of the rate of change of entropy production ∂ Pe/Ce on the value-added to the economy of primary production, (i.e., natural renewable and non-renewable resources), secondary production, (i.e., manufactured goods) and tertiary production (services). The policy objective is to minimise the rate of entropy production per unit of consumption that is: (a) feasible, (b) socio-culturally acceptable and (c) maximise the per capita human welfare.

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AN AGGREGATED QUALITATIVE ACCOUNTING METHOD
FOR DEVELOPING JUSTIFIED POLICIES

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"Qualitative accounting" is almost an oxymoron. The word 'accounting' includes the word 'count', and we cannot count qualities.1 More precisely, we cannot meaningfully add qualities to each other, a quality cannot be measured by a standard unit. Therefore, aggregating qualities for the purposes of accounting might sound like sleight of hand, or deceptive advertising. Fear not. The result will turn out to be quite robust, given a modicum of intelligence and sensitivity. The method is original and useful.

The structure of the paper is given by the following sections: (1) an introduction to the topic, by looking at each word in the title, (2) we look at the UN mandate which will be used as an example to illustrate the method, (3) an explanation of the first part of method: working with the UN mandate, (4) the second part of the method: two orders of sensitivity used for reflection, and why this adds to the robustness of the method (5) broadening the conceptions underlying the method and lastly (6) uses of the method for policy.

The following is the virtual address for some computer software that does the calculations for you, so that you can experiment with the parameters and indicators. The software was developed by Dolsy Smith http://gwdev-dsmith.wrlc.org:8083/gunas_test.html. The site is free to the public and is offered as an intellectual service.

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AGENCY AND CAUSAL FACTORS IN SOCIAL SYSTEMS: TOWARD HEIGHTENED LEARNING, PERFORMANCE, AND CONNECTION IN OUR SCHOOLS AND WORKPLACES

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In spite of significant advances in technology in today's world, our large social systems are marked by increasing social decline. A human systems paradigm can inform and be informed by analysis and

[1] We can count adjectives, but there will be an infinite number pertaining to any object. This is made most obvious if we consider negative qualities such as 'not being physically connected to the Eiffel tower on Saturday 12th January 2018', or if we consider that we can translate relations into adjectives if we so choose. Also, while there are only a finite number of adjective words, in any natural language, we can make adjective phrases. Each of these will be finite, but there is still a potential infinity of them. The important point about counting qualities is not so much that we cannot count them, but rather, that we cannot measure them, except some in a rather artificial sense.

clarification of the hard facts of our soft social systems. This paper aims to identify flaws in practice and theory underlying our current social systems, then correct them using a wider knowledge base gathered from relevant disciplines. 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 display/pickup paradigm is proposed. The leader's new role is display of 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 automated social control systems are proposed to allow organizations and system members to flourish.

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EMERGING POSSIBILITIES: ADAPTING CAROL SANFORD'S STAKEHOLDER PENTAD FOR THE NONPROFIT AND PUBLIC SECTORS

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The nonprofit and public sectors are constantly challenged to create greater impact with fewer and fewer resources. The recession of 2008 has resulted in less funding for both sectors and increased demand for their programs and services, pushing many organizations to the brink. With the likelihood of change in the current state slim, nonprofits and public agencies are eager for new approaches that will enable them to create greater value from existing resources in a socially responsible manner. This paper introduces one possible tool, which was adapted from Carol Sanford's stakeholder pentad introduced in her book, The Responsible Business: Reimagining Sustainability and Success. Sanford's pentad is intended to shift a business's focus away from measuring success based purely on financial returns to one of a quintuple bottom line centered on developing relationships with the following five sets of stakeholders: customers, co-creators, earth, community, and investors.

The pentad for the nonprofit and public sectors includes a slightly different set of stakeholders: beneficiaries, co-creators, earth/humanity, community, and investors/funders. Beneficiaries are those for whom programs and services are provided. Co-creators are those with whom non-profits and agencies partner and may include volunteers, staff, partnering organizations, and other stakeholders. Earth/humanity is the pentad point of the global, long-term perspective and is based in relationship to earth and to humanity. The community point in the pentad refers to how an organization's actions impact the community, and the local perspective and social context in which they operate. The investors and funders for nonprofits and public agencies are local, state, and federal funders, taxpayers, donors, foundations, and board members, without whom these organizations could not realize their visions. Attention to these five stakeholder groups creates a strong sense of resilience in the organization's community.

A case example of how to apply the nonprofit and public sectors pentad to an existing organization is outlined in this paper. It is described through Sanford's four phases for reconstructing an organization already steeped in its processes and culture. These four phases are (1) cultural evolution, (2) strategic direction, (3) capacity building, and (4) work redesign. This approach will enable nonprofits and public agencies to thrive in the face of scarcity and high demand.

Keywords: Carol Sanford; stakeholders; stakeholder engagement; nonprofit sector; public sector; living systems; sustainability; resilience; cultural evolution; strategic direction; capacity building; work redesign; critical systemic thinking; human service organizations

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THE RECONSTRUCTION OF SYSTEMS PARADIGM: STUDY ON GREEN DEVELOPMENT IN CHINA WITH THE PERSPECTIVE OF PROCESS PHILOSOPHY

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The development of contemporary China is in a unique complex situation which refers to a nonlinear system situation stems from the complex interactions among elements, structure, function and environment of Chinese social system. One of important features of this complex situation is the unpredictability of system evolution at the edge of chaos. One fundamental dilemma for Chinese social system in transition is how to build a paradigm to adapt to this complex situation.While the endeavors to transplant "linear ideal model"from Western society failed, and the "Simple Science Paradigm"which once dominated Chinese society is deep in crisis now. The serious environmental problems derived from these endeavors force China to build a new approach related to green development.

As one of important thought sources to build the paradigm to adapt to this complex situation, process philosophy provides us with enlightening thinking tools. First, ontologically speaking, process philosophy help us to understand interactions between human activity systems and natural systems from the perspective of time-space-matter relationship. Second, epistemologically speaking, process philosophy emphasizes the construction of “organism” knowledge at the level of life community. Third, methodologically speaking, process philosophy attempts to rebuild a co-existence relationship between human activity systems and natural systems with the “prehension” methodology.
We believe that the critical steps for solving the fundamental dilemma for the development of contemporary China include--focus on the deep contradictions between current economic development and environmental protection, taking process philosophy as one of important thought sources, based on modern systems science and complexity research, popularizing the new idea of Eco-society, rebuilding a paradigm for social system with the characteristic of the continuous emergence of sustainability, and promoting the continuous evolution of this paradigm in practice.

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THE LIGHTHOUSE – INNOVATING THE SYSTEMS SCIENCES SYSTEM
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The authors of this abstract sought to discover a way to communicate key systemic insights to a wider audience and the integration of those insights in real-life systems where they will have impact. The Lighthouse is a prototype alternative to traditional methods of disciplinary scholarship. The Lighthouse is a result of applying systems research, specifically systemic innovation, to the very system by which systems research is performed and communicated. A designed socio-technical system is added to complement the disciplinary organization, by taking advantage of recent advances in knowledge media research and development, and contemporary communication design.
By design, The Lighthouse undertakes to fulfill in the systems movement, and in the CET SIG in particular, a function analogous to a lighthouse – of showing ‘stray ships’ (various change or sustainability or thrivability initiatives) a way to the safety of a ‘harbor’, which is an outpost of a ‘continent’ where issues can be handled and understood systemically. The Lighthouse focuses on a single key issue: Whether the evolution and control of core societal systems can be relegated to free competition (“the market”) – or whether it must be informed by systems research and insights. The current prototype has three phases: (1) synthesis or federation of points of view and results relevant to our issue, through a media-enabled transdisciplinary dialog of experts; (2) rendering the results of Phase One in accessible, communicable and engaging formats by applying state-of-the-art communication design; (3) strategic placement of the results of Phase Two in public sphere, and public awareness.
The Lighthouse prototype is designed to evolve continuously, by observing how it meets the real-world challenges, and assimilating insights and results from relevant disciplines, notably the systems research and the knowledge media R&D. In this way this prototype of media-enabled transdisciplinary research is also conceived as a prototype ‘boundary object’ linking two communities and interests – systems research, and IT innovation. By it, systemic insights are allowed to directly influence technological, and also social-systemic innovation.
The Lighthouse is part of our initiative to develop the CET SIG as a systemic innovation hub, where the emergence of better ways of transdisciplinary and transcommunity cross-fertilization is being curated.

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A GOOD APPROACH TO WICKED PROBLEMS ABSTRACT

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One of the reasons that systems thinking has developed over the years is to address problems that seemed to be unresolvable; the social equivalent of a Gordian knot. Since the term was first used in 1973 by Rittel and Weber (1973) these difficult problems have become known as “Wicked Problems”. A Wicked Problem is usually a social or cultural problem that is difficult or impossible to solve. Wicked problems become “wicked” not because they are innately evil , but due to the number of stakeholders, resources, lack of knowledge upon the subject, cost involved, the great possibility of unanticipated results and other factors that multiply the complexity of the issue to be addressed.. One of the defining characteristics of a Wicked Problem is that “solutions to wicked problems are not true or false, but good or bad. Ordinary problems have solutions that can be objectively evaluated as right or wrong. Choosing a solution to a wicked problem is largely a matter of judgment”

Questions of what is the good and what is the bad are informed by systems of ethics. There are numerous ethical approaches to the ultimate question “what is to be done”? This paper argues that the version of American Pragmatism that has come to be known at Neo-Pragmatism is a good choice to approach Wicked Problems. Neo- Pragmatism is uniquely suited to finding a “good” approach to a Wicked Problem due to the social nature of Wicked Problems. Since a Wicked Problem is fundamentally social it consists of constantly changing and shifting parts. If there is any stability in a Wicked Problem it is the stability of constant change. Neo- Pragmatism is founded on the understanding that all elements of human society are fundamentally contingent; that is to say that again the only constant is change. Neo- pragmatism is simply the only ethical structure that can readily adapt to the constant flux that is a Wicked Problem.

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INDIGENOUS CONTRIBUTIONS TO SUSTAINABILITY AND SYSTEMS EDUCATION

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The denigration of the world’s ecosystems has been driven by the economic imperatives of insatiable multi-national corporations whose goals are to concentrate the ownership and control of global resources in a progressively narrowing band of society. The impacts of this denigration are understood as crises called, ozone depletion, global warming, sea-level rise, extreme weather events, water scarcity, and the shrinking polar ice regions. These challenges involve significant degrees of complexity in our rapidly changing world. Engaging societies and communities in the meaningful changes of behaviour necessary to halt and reverse the denigration of our life-supporting ecosystems is extremely difficult, given that the majority of these societies are a significant part of the problem. They rely almost universally on the same epistemological basis of understanding the world as the multi-national corporations that are destroying it. In many ways, these societies support the behaviours of the multi-national corporations through their consumerism and political systems of representation.

Decision making frameworks based on systems thinking can facilitate enhanced understandings of sustainability and potentially enlighten societies to behave differently. However to do so they must communicate an understanding of complexity that engages society at the level of values and beliefs, as these determine actions. They must also be transparent, inclusive, contextually relevant, and based on epistemological concepts that are much more strongly aligned with sustainability.

The epistemologies of Indigenous Peoples are based on principles of interconnectedness, holism, relevance over long periods of time, inter-generational equity, and uniqueness to place. Indigenous Peoples have out of necessity had to develop ways of retaining their values and beliefs while accommodating the enforced changes associated with the destructive colonisation processes experienced in many parts of the world. The Waitangi Tribunal was born of the first recognition of New Zealand’s 1840 founding document in the Treaty of Waitangi Act 1975. This tribunal was established to avoid further transgressions of the Treaty. Many early claims were about environmental degradation while others related to the retention of cultural values, knowledge and language. Claims all identified impacts upon mauri, life supporting capacity. Indigenous concepts raised in hearings included; retention of intrinsic values / mauri; spiritual and cultural values; obligations to enhance mauri; and implications for future generations. Often successful, these claims resulted in significant rethinking of projects and ultimately informed changes in law. The Resource Management Act (1991) has the purpose of promoting sustainable development taking into account environmental, social, cultural and economic well-being of society. However while the ground-breaking new law incorporated numerous indigenous concepts, it stopped short of actually including mauri.

The Mauri Model Decision Making Framework allows Indigenous Peoples to contribute understanding based on their own knowledge so that they can be effectively included in resource management decision making processes. The Framework adds a strengthened decision making context due to its ability to incorporate

culturally relevant knowledge seamlessly alongside scientific understandings of a situation, incorporating both quantitative and qualitative data consistently into the same assessment. When mauri is defined as the life supporting capacity of the air, water and soil the theoretical basis is created for relevance in terms of New Zealand law, and a means to measure and evaluate impacts in a holistic way then exists.
Thus through integrating systems techniques and the indigenous concept, Mauri, the Mauri Model Decision Making Framework creates a new approach to cross-cultural communication and action. Independent research has assessed the Mauri Model as an exemplar against Bellagio STAMP and it is now included in curricula in engineering, planning and international studies at the University of Auckland, as well as being an online resource.

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INDUSTRIAL ECOLOGY IN MOTION: A THEORETICAL PROPOSAL FOR INNOVATION ON SME'S

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Since 80s and 90s industrial engineering research has been looking for new ways to handle and manage natural resources on the planet. Water sources contamination, waste generation, industrial treatments of these wastes and greenhouse gases produce consequences on communities' quality of life, startling authorities and societies in general. As a result, there is an interest in the agenda of policy-makers and academics to generate innovative process and products around better ways to put closer production models and socio-ecological systems.
Several initiatives has been proposed to accomplish this in the last years (e.g. cleaner production and pollution reduction) but only one seeks a holistic way to approach to problematic situations, Industrial Ecology (IE). IE has a relevant importance for systems sciences because this discipline understands natural and industrial process in a systemic way. IE try to perceive companies not only like productive isolated entities, but living components that change across time, take decisions and works on an ecological system. Also, IE see processes as complex systems where humans, material flows and technology are taking into account, evolving from unsustainable production forms to resilient and innovative structures.
As such, small and middle enterprises (SME's) are a research challenge to industrial engineering and IE. The differences between big industries and small production lie on usage of appropriate technologies for environmental management, intensive use of manpower and low control by policy-makers. Moreover, SME's play a key role as part of the economy and source of innovation.
This paper contribution is to understand the relationship between innovation process on strategies of environmental care and rules or routines at the organizational level on SME's. The results of the interaction on each one of the firms on an economic environment or social system is to exchange goods and services using several incentives and rules. These rules are created, adopted, retained and abandoned by SME's according to environmental, social and legal conditions, but also by selective pressures that modifies the system. Creating synergies for companies and their rules would lead to a stable and resilient behavior on a global scale. Therefore, using systemic thinking into an evolutionary way, where every heterogeneous and autonomous firm take environmental and economic decisions, self-organization processes will arise. As a result, innovative processes' creation could be replicated and adapted by other SME's.
In this paper I will show a theoretical proposal for innovation on industrial ecology based on the evolutionary ontology proposed by Kurt Dopfer. I will also present the mechanisms of variation and selection at micro, meso and macro level and their relation with ecologically responsible and systemic viable decision-making process. Finally, the author will present several recommendations that will help to apply these strategies on the industry, from eco-industrial parks for SME's to evolutionary models with agent-based simulations.

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POSITIVE SYSTEMS SCIENCE: USING POSITIVE PSYCHOLOGY TO BRING SYSTEMS SCIENCE TO LIFE

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This paper introduces Positive Systems Science (PSS), which combines the strength-based lens of positive psychology with the holistic lens of system science, with the ultimate goal of bringing about desired systems change that supports the well-being of living systems. Systems science is an interdisciplinary field that studies the nature of systems—from simple to complex. Positive psychology aims to empirically understand and build wellbeing, resilience, and optimal function in individuals, organizations, and communities (Seligman & Csikzsentmihalyi, 2000). Like a pair of spectacles, each lens is valuable in and of itself, but we suggest that the synthesis of the two fields transcends the value of either one alone.
Systems theory draws from diverse disciplines, including biology, sociology, ecology, engineering, computer science and philosophy. It enables interdisciplinary dialogue between autonomous areas as well as within

the science itself. Although there are numerous approaches within systems science, they share three common aspects: 1)A desire to understand inter-relationships; 2)A commitment to multiple perspectives and 3)An awareness of boundaries (Williams & van't Hof, 2014).

Despite its successes and the potential of the science to address the complexity of real world problems, system science has never captured the attention of a wide audience. There is a vast literature on systems theory and methods that newcomers can feel overwhelmed, with nowhere to start. New users have to master a large number of theories, ideas and techniques and a subscription to a particular view of what system thinking is. Further, there is a lack of research on its practical application.

In contrast, positive psychology has successfully engaged researchers, professionals, policy makers, and the general public, with scholarship in the field increasing by 410% of the past decade (Rusk & Waters, 2015). It provides scientific understanding of the human psyche and methods for affecting mindsets, motivations, and individual behaviors. We suggest that positive psychology adds value to systems thinking theory by emphasizing the importance of mindsets and motivations, and methods for shifting individual behaviour. Further, drawing on its strategies for connecting with various audiences, positive psychology can help make systems tools more useable, practical, and engaging.

As an example, we demonstrate how a commonly used systems framework, Peter Senge's 'system archetypes' can be adapted and strengthened by interpreting the archetypes from a positive lens. We will show how making tools more user friendly invites researchers from other disciplines, policy makers and practitioners to try on parts of the theory and benefit without having to master a large number of ideas and techniques before they can apply them in their work and life.

Notably, the popularity of positive psychology has come at the cost of application going well beyond the science, with interventions and programs blindly implemented while ignoring the complex context in which people reside. Systems science challenges positive psychology to add sophistication to the methods and theories, which better captures real world experiences. Systems tools can take positive psychology to a deeper level that will have more sustainable impact.

Thus, systems science and positive psychology both have strengths and weaknesses, and we suggest that the synthesis of the two perspectives will create frameworks, tools, and applications that are greater than either perspective alone. Such an approach does not simply identify and address existing problems, but generates pathways toward yet unimagined futures.

2778

PATTERNS THAT CONNECT: EXPLORING THE POTENTIAL OF PATTERNS AND PATTERN LANGUAGES IN SYSTEMIC INTERVENTIONS TOWARDS REALIZING SUSTAINABLE FUTURES.

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"On each continent and in each nation one can find creative bubbling, a multitude of political initiatives in the direction of economic, social, political, cognitive, educational, ethical or existential regeneration. But everything that must be connected is yet dispersed, fragmented, separated. These initiatives are not aware of each other, no institution enumerates them, and no one is familiar with them. They are nonetheless the breeding stock for the future. It is now a matter of recognizing, aggregating, enlisting them in order to open up transformational paths. These multiple paths, jointly developing, will intermesh to form a new Path which will decompose the path we are following, and which will guide us toward the still invisible and inconceivable metamorphosis." (Morin, 2011, p34)

Working towards more sustainable systems is a critical endeavor of the 21st century requiring collaborative efforts for the broad development of systemic literacy. This paper explores the potential of patterns and pattern languages as tools for systemic change and transdisciplinary collaboration, investigation and design, and outlines the ways they could be further operationalized to develop and leverage collective intelligence and agency towards Curating the Emergence of Thrivability and Realizing Sustainable Futures in Socio-Ecological Systems.

Considering patterns and pattern languages, social organization, and systemic change from a variety of perspectives, the author suggests that the concept of pattern has an unfulfilled potential as cognitive technology for meaning-making, mediation, systemic configuration and exchange of knowledge, both within and across domains of human activity. In particular, patterns have properties that could help address the unity versus diversity dilemma while dealing with complex challenges.

Rather than giving a complete theoretical review of the field of transdisciplinarity and systemic change, the paper sets key elements of the context and investigates possibilities and directions for future work. Starting with an outline of the nature and dimensions of the complexity challenges the world is faced with from a systemic and cybernetic perspective, the paper explores the versatile properties and functions of patterns and shows how they could help conceive and develop a whole family of tools for systemic focus, interpretation and connectivity. Finally, it presents possibilities of applications of pattern-based approaches in transdisciplinary intervention contexts, using patterns as boundary objects to bring into focus different dimensions of complexity.

Keywords: complex systems, patterns, pattern languages, systems literacy, critical systems thinking

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A GENERAL FRAMEWORK FOR SYSTEMS RESEARCH AND MODELING

John J. Kineman

R-theory was proposed in 2011 as a general relational framework for understanding and modeling systemic wholeness as a fundamental property of nature. Specifically, that framework is a relational holon. Recent research confirms mathematical consistency of R-theory with Robert Rosen's use of category theory and modeling relations and extensions of that work by Aloisius Louie to describe "functional entailment", which is also called "inverse entailment". In the holon extension of relational theory, the inverse entailment is expressed explicitly (in terms of arrows, as with efficient entailments) as a final cause agency that induces a formal cause mapping via context; thus resolving a question asked by Erwin Schrodinger, and discussed by Rosen, as to how an inertial object can become an agent. Technical and philosophical implications of this result are discussed.

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INGENIEROS SIN FRONTERAS COLOMBIA: IMPROVEMENT OF THE WATER QUALITY IN THE COMMUNITY OF SANTA ISABEL DE POTOSÍ

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Santa Isabel rural community is located between the municipalities of Guasca and La Calera in Colombia, it was composed of different stakeholders that coexist around the “El Asilo” creek. The people collect water from this water source for consumption and daily use. The water comes from Chingaza moorland, one of top three of water generation ecosystems in the country. Given the close relationship between the community and the ecological system, the environmental damage of this creek has generated big problems in health and quality of life of the inhabitants. Through joint work with the community was proposed a project called "Improvement of the quality of water in the community of Santa Isabel de Potosi".

The group with the community is nowadays performing an analysis based on community-based decision-making taking into account the possible alternatives that could be implemented in order of diminishing in some percentage the impact of the issue and this way try to avoid the complete deterioration of the brook and the ecosystems in the area. Among the alternatives of intervention these are found: generation of a new method of community cooperation in behalf of the sanitation of the brook and the implementation of homemade filters in the improvement of the quality of the drinking water.

This paper presents the analysis of the problem taking into account different points of view such as the environmental as well as the organizational one, highlighting the fact that this is not an isolated issue but an evidence of the possible environmental disaster that Colombia could live if nothing is done at the right time. Also this paper presents how engineering and work with the communities has been able to define the guidelines of intervention that are going to allow the next stage of the project, putting in practice the solutions proposed in behalf of a better quality of life.

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TRANSFORMATIVE LEARNING NETWORKS

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Learning networks combine multistakeholder collaboration with community-spanning interaction and exchange across sites and scales. They are inter-organizational voluntary collaboratives that support innovation and social learning to promote systemic change. Learning networks are often attempted in situations where existing institutional arrangements cannot address looming challenges, and change is thwarted by a combination of lack of capacity and a powerful status quo. The four learning networks we are examining address the challenges of ecological fire restoration, urban resilience, fostering adaptive capacity to climate change and other unprecedented challenges in developing countries, and the deep cultural divide between the academy and the public (also see our team website www.brugo.org).

We will consider how these LNs increase capacity to transform complex adaptive systems in which they are embedded. Our definition of resilience is grounded in how collective action can purposefully reconfigure systemic relationships to promote a new and desired state. We will explore how learning networks can balance the autonomy that individual organizations and communities require with the cohesion required to catalyze transformative change in policy and institutions operating at higher spatial/temporal/organizational scales. Different kinds of learning take place at each of different network levels – it is the effective interweaving of these heterogeneous interactions that fosters transformative capacity. Learning networks are bridging organizations: they form a bridge between different ways of knowing in communities and organizations, and they bridge to alternative futures by fostering innovation. Learning networks disrupt old habits and foster new collaborative relationships, reinforcing participants' shared ties and purpose while providing freedom to experiment with innovative approaches.
Learning networks rely on effective design and ongoing facilitation to function effectively. Network facilitators or "netweavers" may be formally identified or may emerge from among network participants. These netweavers collaborate with participants in identifying goals and an effective network topology and infrastructure. Netweavers initiate activities that build community and promote a shared identity that provides the foundation for common practice and purpose. Ties within the network deepen over time as participants identify collaborative solutions. We will explore these features by drawing insights from the origin, design and netweaving of our four learning networks. We will show how effective learning networks possess a loose, light structure that allows them to learn and adapt as their membership becomes more confident and experienced, as new needs and opportunities are recognized, and as resources and institutional support require. We will also consider how network design is cross-scalar, combining interpersonal and group collaboration with network-spanning interaction and exchange. Finally, we will reflect on how networks foster transformative capacity, an idea that is both conceptually subtle and difficult to detect over the short timescale of our fieldwork.
To the extent possible, our work is conducted by our being embedded in network leadership teams and actively participating in ongoing discussion about the network design and facilitation. We will also discuss how participatory action research and developmental evaluation frameworks enable this balance between participation and analytical engagement.

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COLLABOFRAMEWORK - A FRAMEWORK FOR SUSTAINING SOCIO-ECOLOGICAL SYSTEMS THROUGH DIALOGICAL KNOWLEDGE AND ACTION SPACE

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In this paper we discuss how socio-technical intervention in socio-ecological systems can increase understanding of burning issues that drives systems unstable and unbalanced.
Using the challenge of drilling oil in the Yasuni National Park ecosystem in Ecuador and balancing it with the diversity of socio-cultural inhabitants in the ecosystem, we show how we can develop a space for evolution of mutual understanding of a CoI (Community of Interest) consisting of multiple system stakeholders and what mechanisms can help us in articulating concrete actions happening across different domains - ranging from scientific findings and publications all the way to artistic and emotional-engaging interventions, evolving in this way from mere transdisciplinary to rather holistic approach of solving complex socio-ecological problem.
Paper presents outcomes of the pre-event, at-event, and post-event interventions at the workshop "Which data to look for? How to build thriving knowledge communities?" related to the BunB conference. Our unique approach was to provide CollaboFramework (consisting of CollaboScience and CollaboArte socio-technical systems) that creates a dialogical space for mapping mutual fuzzy and multi-truth knowledge of known issues and guiding evolution of that initial knowledge through the set of dialogical interactions among stakeholders.
CollaboFramework system is a novel approach that unites infrastructure for the collective-knowledge space with the set of socio-technical tools that incrementally evolve that collective-knowledge weaving. With CollaboFramework we recognize uniqueness and complexity of transdisciplinary dialogue of CoIs that aim solving wicked problems. We provide support for modeling personalized socio-technical processes governing each of those communities. Processes coordinate different components of CollaboFramework in the most efficient way for particular CoI and challenges it is facing at the moment. Processes guided with socio-psychological insights help CoIs to converge multidisciplinary knowledge into coherent and landscaped knowledge with the set of insights that will be capable of governing future actions and interventions in the problem-space, namely creating public media and artistic projects that will engage society and let all relevant stakeholders to be heard and recognized. In the future iterations of the CoI events, this will bring additional insights and start another iteration in the spiral of CollaboDialogue and calls for actions.

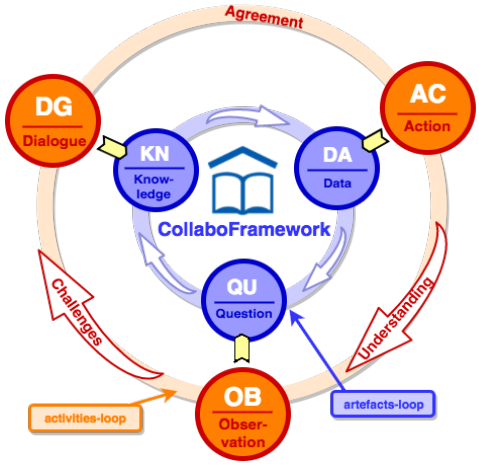

Figure: Sustainable loop of CollaboDialogue

Keywords: Collective-Intelligence, Equilibrium, Indigenous Knowledge, Cross-Community Learning, Community Building Methodology

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OPPORTUNITY TENSION AT THE CENTER OF SUSTAINABLE ORGANIZATION: POSITIVE ORGANIZATIONAL SCHOLARSHIP AND GENERATIVE EMERGENCE

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It is widely understood that the complexity of the challenges we face globally and locally in this increasingly interdependent and VUCA world require our collective intelligence to create emergent adaptive approaches that sustain. Benyamin Lichtenstein has developed a framework for emergence that synthesizes previous scholarship and has gone further to identify the concept of “opportunity tension” that is at the core of the individual and collective entrepreneurial spirit that can create generative emergent social structures through acts precipitating sufficient disequilibrium in a system. Opportunity tension combines the extensive entrepreneurial literatures of both opportunity and motivation. This paper posits the critical and pivotal nature of opportunity tension as a driver of emergence. Five factors are identified that contribute to a nonlinear increase in the sense of opportunity tension.

1) The sense of opportunity tension perceived by those involved is expanded in a mutually reinforcing way as participants bring their capital (physical, human, social, cultural) to the endeavor. The more capital, the more opportunity surface is exposed.

2) Positive organizational behaviors (positive emotions, high-quality connections, enhanced knowledge creation, positive human traits, etc.) are mutually reinforcing and are consistently associates with positive outcomes in groups. They are attractive and inherently motivate participation.

3) Mutual reinforcement creates an upward spiral (nonlinear) sense of increased opportunity

4) All of these factors operate from the micro to the meso to the macro creating a web of reinforcing forces across scale and across units of analysis. This cross-hierarchical web becomes a powerful driver of cross scale action and cross-scale disequilibrium.

5) Emergence manifests across scale as a result contributing to a rising tide effect.

The evidence for this deepening theory of opportunity tension comes from very extensive literatures in positive organizational scholarship, recent frameworks for types of emergence, and a developing body of thought around complexity leadership.

The paper draws together these bodies of literature and the empirical evidence to create a richer theory of generative emergence of collective social structure from individual intention and sense of opportunity. Understanding this process is critical to developing organizations that use positive organization behaviors grounded in a relational calculus of organization as organism rather than organization as machine.

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ANTICIPATION AND SYSTEMS THINKING:
A KEY TO RESILIENT SYSTEMS

abstract submitted to SIG "Systemic Approaches to Conflict and Crises" in ISSS-2016

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Disasters often endanger the foundations of our society. Due to many factors (larger popula- tion, more dependency on more complex technology, more and greater interference in natural systems and the environment, dramatic changes in the environment, ...) the number and the severity of disasters seem to grow, additionally exaggerated by the media coverage.

The ultimate aim in the case of disaster is to save as many lives as possible and also safeguard the survival of the society in total and to protect as much of the societal structure, infrastructure and environment as possible. This requires the social system to show an amount of resistance and stability with respect to an incident that can cause endangering disasters.

An incident of this kind can be attributed to the interaction of three overall factors: an external or internal hazard, a vulnerability of the system and an insufficient reactive capacity of the system to shield or resist the incident.

With respect to the system's capacity two countermeasures are essential to overcome an incident of that kind:

* Anticipation of the incident and as a consequence the provision of adequate preparation and
* Systemic Thinking in order to understand the relationship of and cybernetic loops within the components of the affected system and the incident.

Anticipation and as a consequence a timely preparation of responses to future disasters will help to avoid the worst possible consequences and improve the chances for survival.

Additionally, we need a better understanding of the complex relationships causing the hazard and the long-term effects of our interventions on nature, human society, and environment: Systems Thinking.

In this paper we analyze the key factors potentially leading to a system disturbance: Hazard, vulnerability of the affected system and capacity of the affected system. We classify these disturbances (incident, emergency, crisis, disaster, and catastrophe) and analyze the different reactions a system can show (fragile, fault tolerant, elastic, resilient, robust, antifragile).

By discussing the phases of disaster management we can identify the information required for effective Anticipation and for the identification of critical systemic relationships. Finally, we analyze the phases of Disaster Management, emphasizing the need for and the application of Anticipation. We identify the source of information needed for a successful anticipatory view.

As a conclusion we identify systemic problems encountered during disaster management, especially in view of anticipatory actions.

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OUTDOOR ADOLESCENT RITES OF PASSAGES: THEORETICAL FOUNDATIONS, CONTEMPORARY SHORTCOMINGS, AND THE EMERGING NEW MODEL

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The proposed presentation will present the theoretical findings of my master's thesis, as well as their practical application to youth engagement programming around the world. The presentation will first outline a traditional rites of passage framework as it relates to community-based engagement of youth. Research from the fields of psychology, anthropology, experiential education, and systems dynamics will be presented to demonstrate the importance of such practices in healthy youth and community development. The challenges that contemporary outdoor youth engagement programs are encountering will be explored, highlighting the specific system obstacles they face in effective implementation. The presentation will progress to present a research backed, theoretical model for the development of community-based outdoor rites of passage programming. The proposed model involves active community mentorship networks, locally based preparation and reintegration of participants by community members, and self-directed adolescent design of rites of passage experiences. Lastly, I will discuss the practical application of this model in various youth engagement initiatives around the world. The audience will be engaged to both share their own outdoor rites of passage experiences, as well as contribute tangible additions to the emerging new model of community-based outdoor youth engagement. Future research on the relationship of such programming to asset building communities will be proposed and discussed at the end of the presentation.

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SUSTAINABILITY CHALLENGED – COMPARING TWO COMPETING VALUE SYSTEMS – WHAT WE FOUND "SHANG JUN SHU (THE BOOK BY SHANG)" FROM CHIN' DYNASTY 2000 YEARS AGO AND THE ISLAMIST IDEOLOGY TODAY IN COMMON

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Sustainability of this civilization is only a wishful thinking without frank analysis of, followed by strategic plans to deal with, the competing value systems currently playing on the stage of the international politics. High profile keywords here are refuges, terrorism, China Threat, globalization, and "conflict of civilization" (even we do not quite agree with the term in Huntington's original sense). Among the major competitors with our current mainstream value system are Chinmunism (Hu, 2010), i.e. the so-called Chinese way of order (including social order, state order and world order, with cultural genes traceable back to Chin' Dynasty 2000 years ago and to Communist movement from 1917 to 1990), and the Islamist Ideology or Islam fundamentalism (e.g. Goldberg, 2015) that becomes a high profile issue in media and our lives for obvious reasons. A guestimated of 50%+ of Chinese-speaking people (700 million) might support a Chinmunistic world view, and in at least 25 countries that 50%+ of Muslims prefer the Sharia Law to be the law of their land (PEW Research, 2013). The authors have noted, among many differences of the text and the context of the two sets of ideas and values, i.e. one sets up of the ruling paradigm for China in 2000 years, and another defines a desirable world of "Umma", there is an interesting commonality between them: They all aimed at reducing the diversity, complexity, and the degree of freedom of the society they take control, an interesting case for Ashby's Law of Requisite Variety. This paper compares the similarities and differences of these two value systems to facilitate the readers to draw their own conclusions and decide for their own actions.

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COMPARING THE CURRENT ISIS AND THE (NOT YET) PAST LENINIST STATES (USSR AND PRE-1979 CHINA)

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What our media named as terrorism today are perceived as revolution by some. What we call revolution in mainland China and Russia, are no less violent and cruel than terrorism too. This paper observes and identifies the roots, the triggering historic events, the similarities among the differences, of the two huge phenomena and their two driving ideologies, i.e. the Extreme Islamism and the Bloody Communism, that have deep influence to our time and our daily life. As one of our subject has been just fading away into history (not really) and another is still going on while this paper is being written, we highlight the similarities or even isomorph of these two violent social phenomena, raising a question behind such similarity – what are the driven forces that enable these phenomena to emerge, or, why on this planet a certain number of people are doomed to believe, engage, fight for, and victimized by such pathological ideologies?

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LEADERSHIP PRACTICES FOR THRIVABILITY OF COMPLEX SOCIAL SYSTEMS: THREE STORIES

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The authors compare three collaborative action research projects aimed at generative systems change. The goal of the article is to reflect on the dialogic methodologies they employed, the impacts and outcomes experienced by the participants as leaders and innovators of systemic change, and the evolution of the authors' own practices as facilitators and catalysts of change.

Wilson reflects on a three-year action research project in peri-urban Mexico on sustainable community development. Focusing on the emergent edge of the evolving system of local-state relationships, she recounts the changing attitudes, emotions, and behaviors of the public sector professionals and local community leaders engaged in the project. Wilson reflects on the sense of vulnerability and insecurity raised by the dialogic methodology she used, and the impact on her own practice and sense of self in the presence of these tensions.

Bush explores a year of engagement within two urban systems within Asheville NC: public housing and community schools. Using distributed ethnography, he follows public housing's resident leadership's efforts

at self-organizing governance and an Ashoka Change-Maker School's experience in spreading its educational approach. Offering propositions about leadership for resilience in urban systems, he reflects on the challenges to and evolution of self-awareness for individuals, organizations, systems, and himself as a practitioner-researcher.
Walsh reflects on her praxis in regenerative development from 2006 to 2015 in the context of environmental gentrification in a neighborhood in Austin, Texas. To become an instrument of critical, creative, and collaborative change, she developed and fostered regenerative dialogue for green home repair and a community food forest. Walsh reflects on the ways this approach supported her and the residents in harnessing the generative potential of social conflict and vulnerability.
The comparative analysis of the three stories concludes with propositions for leadership practices that foster thrivability in complex social systems.
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Keywords: social systems design, leadership, thrivability, urban systems, generative dialogue

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AN INTEGRATIVE MODEL OF FOUR-PHASE ADAPTIVE EVOLUTION IN ORGANIZATIONS
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How do organizations become order-created and extinct through emergence and immergence in their evolutionary dynamic states? How macrosimplicity emerges from microcomplexity and how sophisticated behavior emerges from the interaction of relatively simplistic parts？ Organization scholars have debated those questions for decades, but only recently have they been to gain insight into combining the linear and non-linear dynamics that lead to organizational bottom-up emergence and top- down immergence by explorative and exploitative learning, through the use of the complexity science. Two intriguing features of complex systems have been discussed in this paper: simple behavior at the high level emerging from convoluted underpinnings, and sophisticated behavior at the low level immerging from simple underpinnings. Complexity theory has sometimes concerned itself with the one sort of bottom-up emergence, sometimes with the other top- down immergence, and sometimes it seems to aim for both at the same time, seeking to explain behaviors that are both surprisingly stable and surprisingly sophisticated.
Studied for organization science research, this paper summarizes these literatures, including the first comprehensive review of macro-simplicity and micro-complexity, cybernetic modernism, chaotic postmodernism and organizing postmodernity's chaos in each of the 20 complexity science disciplines. In doing so, the paper makes a bold proposal for a discipline of organizational bottom-up emergence and top-down immergence by explorative and exploitative learning, and proposes an integrative model of four-phase adaptive evolution in organizations.
The paper begins with a detailed premise of organizational theories, models and phenomena of order-creation and extinction, and then rigorously maps the processes of order-creation and extinction discovered by that complexity science to identify a four-phase adaptive evolution model in organizations. By way of conclusion, the author expects the four-phase adaptive evolution model could be applied to enact bottom-up emergence and top- down immergence by explorative and exploitative learning within and across organizations.
Key words: bottom-up emergence, top- down immergence, exploration, exploitation, four-phase adaptive evolution

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CIVILIZATION, TECHNOLOGY AND MONEY: THE CHALLENGE OF A HUMAN FIT
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Civilization in its science-enabled industrial form highlights and gives exponential growth to forms of agency and motivation so removed from the dynamics of eco-systemic mutual constraint that the troubled culture-

nature interface has finally assumed the proportions of a sustainability crisis. With the emergence about 12,000 years ago of agriculture and the subsequent rise of the complex, settled societies we refer to as "civilization," our models of ourselves and of the world transformed in ways that decisively separated the character of human agency and motivation from the behaviors by which other forms of life make a living. The science-enabled Industrial Revolution made central and self-aware the long-nurtured civilized thrust to control and shape the world to our purposes, refining that mindset into what Jacques Ellul has described as the "technological mind," the probing seach for an improved way of doing whatever we turn our minds to. With this mentality technology has moved to center stage both as our first resort in approaching any kind of problem and as our chief lever for economic growth. We have collapsed the constraints of space and time and the world of nature is quite outflanked by the speed and power with which thoughts and plans in the human mind can reshape and modify environments from the expectations structured into the way other species make a living.

This puts a new and critical weight on the thoughts, feelings, and motivation of the human mind-and-heart. All living beings are motivated to act in order to achieve and maintain well-being. But human motivation is far from the direct response to needs and dangers common to other forms of life. Our motivation as action is mediated by technology, and our technology loops back to shape our motivation. As a well-being guided response our motivation is mediated by money, which offers none of the inherent guidance of actual well-being. The "better" achievement of whatever that is the animating thrust of technology promises an open-ended more: more productivity, more speed, more convenience, more ease. And at the heart of money is another more, the profit motive that guides us to proud achievements and likewise to humiliating dysfunction. We market the promise of the technological "more" for profit, and the drive for more profit powerfully fuels the technological drive for all sorts of innovation. Thus the incremental thrusts embedded in technology and money work in synergy to bring us to the exponential burst of transformation in culture and the natural world. In the process guidance of real well-being becomes hit or miss, distorted by a thirst for and expectation of novelty stoked by endless advertising or overshadowed in the anxious pursuit of profit.

Seeing the deep structures that have brought civilization so rapidly to such an innovative and world-transforming peak reveals no easy answers: we cannot simply change ourselves without the difficult and uncertain process of reconfiguring elements structured into civilization that make us the kind of unpredictable and uncontrollable species we are at present. But it helps to know there are other ways available, perhaps even other ways of doing a civilization. If those alternatives are in any way open to our deliberate contrivance, that deliberation will have to include serious reflection on how the way we maintain our well-being has come to fit so ill with the well-being as pursued in the rest of the community of life. For humans, understanding is the guide to moving into a better future.

Keywords: civilization, technology, money, motivation, Neo-lithic Revolution, Industrial Revolution

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THE PHENOMENON OF TECHNOLOGY IN K-12 CLASSROOMS 2 Abstract

EXPLORING THE PHENOMENON OF TECHNOLOGICAL INTEGRATION IN K-12 CLASSROOMS FOR EDUCATION LEADERS

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Throughout the years, there has been a concern about how the school systems in the United States can be improved. As population growth continues and existing issues remain due to a insufficient funding, it becomes more complex to address the specific areas where training is needed, students with special needs are forgotten, growing classroom sizes, parent involvement student health and more. The current issue we can see now is the lack of resources schools have to spend on research and development. By utilizing technology to conduct the research and collect data, it may be possible to optimize resources of faculty and improve student learning. Similar to any change in organizations, there will be resistance among not only the faculty, but also the parents and students whose cooperation and belief in the technology is needed.

The presentation will build upon the ideas that success in implementing technology into classrooms relies heavily on collaborative teamwork from educators and education leaders, an established digital platform as a tool to keep all team members in constant communication and in sync, and well as trust in the relationships between the technology, the user, and the leaders advocating for this transition into the 21st century. Leaders who are successful should likely have less feelings of frustration, doubt, or impatience with the process. On the contrary, leaders who have achieve levels of technology integration in their schools should feel hopeful, eager, enthusiastic, and inquisitive with their responsibilities.

The analysis will be strictly K-12 focused considering that Higher Education operates significantly different than K-12 (Ensminger, 2005). The demonstration will attempt to provide insight not only on the success of what leaders have experienced through integrating technology in K-12 schools, but also some of the challenges they had encountered when working with students and parents to accept and believe in the technology they want to use. This investigation will help shed light on some of the likely obstacles and the solutions decided by these leaders in order to prepare future education leaders for the transition as more

and more school board members and leaders begin to embrace technology as a positive and efficient change for their organizations

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2797

GUIDING PURPOSEFUL COMMUNITY REVITALIZATION IN THE CITY OF CLEVELAND: ENGAGING HUMAN POTENTIAL THROUGH THE PRAXIS OF EVOLUTIONARY SYSTEMS DESIGN

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This paper investigates whether and how organizational leaders and citizen activists, by adopting and refining the praxis of designing conversation within the context of a current stakeholder-led initiative to foster revitalization of diverse place-based communities situated in or around the City of Cleveland, Ohio, USA, might foster ideal-seeking social change inspired by an awareness and appreciation of values and qualities found in communities as thriving, living systems.

Using the method of community action research (CAR), this research sought to create a space for disciplined inquiry that would enabled participants to coalesce as an evolutionary learning community (ELC). The discursive process of inquiry combined generative and strategic dialogue with other forms of discourse, whereby design conversation is viewed as a human activity system expressing the dynamic qualities and purposeful characteristics of an evolutionary guidance system (EGS). In conversation, the participants worked to advance community revitalization by transforming habitual patterns of thinking and shifting awareness towards appreciative qualities of communities as purposeful social systems, thereby building collective evolutionary competencies that enable self-organization and unfolding of human evolutionary potentials at the levels of self, organization, community, and society.

A group of 7 study participants, reflecting a diversity of backgrounds and organizational affiliations, were recruited to form an inquiry group to investigate the following three-part question:

1) How might we understand and describe our community system of interest, so as to encompass and facilitate dialogue regarding its emergent qualities and characteristics, its intrinsic social, physical, technological, and ecological elements, and its dynamic relationship with the larger systems in which it is embedded?

2) How might we translate the constructs and language of evolutionary systems theory into a community praxis that yields measurable outcomes indicative of the progressive unfolding of values, qualities and emergent potentials found within healthy, thriving social-ecological systems? and

3) How might we illuminate, critically deconstruct and transform our habits of perception, thought and behavior, including our prevailing language and cultural narratives concerning values and institutions, in ways that enable us to access our individual and collective potentials as change agents and leaders of regenerative political economy?

The participants met on multiple occasions, and also via an on-line learning platform, contributing their complementary skills, insights and creative potentials. The study proceeded through three cycles of learning and action: 1) entry and preparation; 2) evolutionary design; and 3) embodying the evolutionary learning community (ELC) as an embedded community system. Through each of these learning cycles, participants were afforded an opportunity to directly participate in complementary processes of data collection, evaluation and reporting. Working under the guidance of the Saybrook University dissertation committee, the principle investigator distilled data from participant journaling and transcribed conversations, summarized research outcomes, and interpreted results through critical, systemic evaluation and hermeneutic analysis.

The results of this study demonstrate how community stakeholders and practitioners had successfully formed and established a level of cohesion and explicit common intention that enabled rich sharing of ideas, experiences, knowledge, understanding, and insights, with clear potential for continuous improvement as an appreciative social system and self-sustaining peer learning community. These results further demonstrate, at least tentatively, how designing conversation as a strategic approach to community revitalization praxis enabled participants to coalesce as a dynamic learning community, expressing evolutionary consciousness and competency and developing a more integral (or holistic and multidimensional) shared understanding of Cleveland's communities as continuously evolving and appreciatively self-guided, living systems. Finally, the evidence provided by individual and group reflection is suggestive of an expanding participatory awareness and emerging implicate consciousness at the level of the collective, with potential to guide and shape understanding at the level of place-based community culture.

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THE THINKING SPACE: THE ENACTMENT OF A PLATFORM FOR CSP

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This paper focuses on describing the process of enactment of a 'platform', namely, The Thinking Space (TS), as a device for Critical Systems Practice CSP. This is part of a research project that generated a series of findings contributing to the study of the process whereby different systems methodologies, methods, tools and techniques are used in combination. This process is known as Critical Systems Practice (CSP). The study yielded 'defensible generalisations' from a series of research themes explored. These defensible generalisations or contributions relate to three research issues relevant to CSP, namely, (a) pluralism, (b) improvement, and (c) the role of the agent. The learning derived from these research themes led the researcher to formulate the 'transferable problem solving capability' of the study: the enactment of 'platforms' as devices for operationalising CSP. Platforms are defined as 'organisational and intellectual spaces' enacted by actors and evolving with the changing nature of actors' moment-to-moment interactions, by means of engaging in a continuous mutual research endeavour and of engaging in enhancing collective competence, in order to pursue an informed practice (to pursue CSP).

The study is the result of reflection and debate, which was reciprocally enriched by theory and practice. It presents the findings of an organisation-based action research project, where the researcher entered into a real-world situation and aimed both at improving it and acquiring knowledge about the experience. He became, for a period of three years, involved in the flux of 'real-world problems' within an engineering company that invited him to do research by using systems ideas in practice.

This paper thus recapitulates on the contributions that this research endeavour had on the three research themes focusing on the emergence of a particular 'platform', the Thinking Space (TS), as a device for operationalising CSP; the fourth 'emergent' research theme. Concerning the 'transferable problem solving capability' of the study, the TS is one particular device considered to provide evidence for proposing the research theme of 'platforms'.

Keywords: platforms; Critical Systems Practice; transferable problem solving capability, pluralism; improvement; role of the agent.

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MANAGING FOR THE HEALTH OF COUPLED HUMAN AND NATURAL SYSTEMS AT THE WATERSHED SCALE

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Within all watersheds, ecosystem health is intrinsically linked to human health. The pathways of this coupling are multiple, diffuse and interacting. For example, the percentage of canopy cover in a given area is an indicator of both human and watershed health; more shade lowers surrounding temperature and helps to reduce rates of heat stress and skin cancer caused by sun exposure, and treed areas mitigate rainfall runoff, assist water infiltration and reduce risks of flooding. A recent study in Toronto found that having ten more trees on streets had a health impact equivalent to being seven years younger. To understand and manage such relationships requires an approach that appreciates the complex coupling of human and natural systems. The work we describe in this paper demonstrates an ecosystem approach to human health and well-being (a.k.a. an ecohealth approach) at the watershed scale.

To explore the extent to which watershed governance agencies activity manage for both ecosystem and human health, we drew upon the Watershed Governance Prism to develop case studies and inform a self-assessment of five watershed governance organizations (the Fraser Basin Council, Cowichan Watershed Board, Save Our Seine Environment Inc., Otonabee Region Conservation Authority and Lake Simcoe and Region Conservation Authority). Through this work, we identified the need for a more strategic approach to watershed governance that actively seeks linkages with public health institutions to meet goals that are common to both the health and environment sectors. We found that watershed organizations' programs affect the social and environmental determinants of health at multiple spatial and organizational scales, but awareness and indicators of the potential benefits are underdeveloped and poorly conceptualized.

Stepping out from this study, researchers at York University and the Credit Valley Conservation Authority have collaborated on a project that seeks to understand and communicate the relationship among various watershed ecosystem components and human health and well-being. In the first phase of this project, we surveyed residents within the Credit River watershed about their perceptions of the connection(s) between their health and their surrounding environment, and we facilitated a workshop with governance stakeholders to identify key indicators of such relationships. Among our findings, we noted that some residents of the Credit River watershed understood that such fundamental relationships exist among the natural environment and their health. For example, many believed that places associated with water, such as streams and ponds, had a stronger effect on their health than other green spaces. We also found that older respondents

had a greater appreciation of such connections than did younger respondents. Governance stakeholders identified several environmental indicators of health that would better communicate environment and health relationships. The top three were: percentage of canopy cover, access to green space, and percentage of impervious surfaces.
We used this information in the design of an interactive web-based tool and geographic information system. This web-GIS displays provincial, regional, and municipal data related to the Credit River watershed, including indicators of health and descriptions of how they influence human health and well-being. It also includes a storytelling component that provides an opportunity for residents within the watershed to share personal experiences of their connection to the environment. The web-GIS is intended to educate the public about ecosystem services and their influence on people, and to demonstrate the impact of the work of Credit Valley Conservation not only on ecosystem health but also on human well-being. In the second phase of the project, we are further developing the web-GIS tool to support scenario planning for ecosystem and human health in the Credit River Watershed.

2803
ARISTOTLE'S FOUR CAUSES AND TEAMWORK IN CORPORATIONS
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Aristotle might be the original systems thinker. In this session, Daryl will show how consideration of the Four Causes from Aristotle can inform creation of effective teams in the business environment. Helping teams to connect to the real business value of their work, to collaborate and self-organize all benefits from a Four Causes perspective. Learn how to solve real-world teamwork problems using Aristotle's ancient ideas.

2807
ADDRESSING THE WHOLE WHOLE
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This paper argues the need to develop a comprehensive, coherent, system-oriented description of the universe, and that doing so over time is quite feasible with the right approach.
Charles Francois has stated: "We are indeed still - and mostly unconsciously - subservients to the general Cartesian reductionist model, which, after destroying the relationships network for the sake of 'simplicity', does never reconstruct it as an organized whole." This implies that the most important mission of the systems movement is to reconstruct the organized whole. We are deterred from this mission because of its apparent difficulty.
It has long been recognized that "the whole" must be addressed to understand a system. But what exactly is "the whole"? The whole includes all of a system's parts. It also includes the relationships and processes of interactions among the objects and with the environment. And it requires addressing all in concert. (Let's call this all of the whole.)
Furthermore, since a system's environment consists of other systems, these other systems must be considered part of the whole. This line of thinking expands the scope of the whole and when taken to its logical conclusion encompasses the entire universe. Hence the whole must be interpreted to mean not just a single system but the universal system of systems (the whole whole). While instances of the system pattern are interesting individually, the system pattern is most significant as a key element of the architecture of the universe.
Finally, the universe is evolving, not static. The deep hierarchies of systems existing today provide clear evidence of continuing system evolution since the Big Bang. Hence the universal process of system evolution (whole history) must also be included in the whole.
The whole means all of the interconnections within the broadest scope of space and time. It means the universe viewed as a system of systems, including all of the whole, the whole whole, and system evolution over the whole history.
How can a system so large and complex be addressed? The system pattern, being fundamental to the functioning, structure, and evolution of the universe, provides a basis for organizing a universal description. While we can never describe the universe completely, we can develop and persistently improve and extend a description of the web of interacting systems. To do so we must systematically integrate, unify, and generalize the relevant nuggets filtered out of the existing vast sea of information. With modern tools and techniques the complexity of such an effort can be managed.
The dominant approach for centuries has ignored systems in order to avoid complexity. The opposite trade-off is now required: we must embrace complexity so as to understand systems. By embracing and learning to effectively manage complexity, it is possible to describe the whole in the broadest sense and so to develop an unprecedented understanding of the universe as a system of systems. This paper aims to show that doing so is now viable.

2808

NEW STRATEGIES FOR THE MEXICAN PETROCHEMICAL INDUSTRY

Elvira Avalos Villareal

It is necessary to define new strategies for achieving a proper growing and development of the Mexican Petrochemical Industry. As each product can be used as a final product or as raw material the influence of its production is remarkable all over the national production chains. Petrochemicals in Mexico have been classified as basic and secondary ones, by political reasons. These two groups allowed governmental institutions to regulate private activity versus public activity in this sector. At the beginning, the first group was devoted to the first chemical transformation and the secondary one to subsequent transformations. For last 30 years, petrochemical industry has not been developed as the Mexican people wanted. The trends showed that total production has remained at the same level, many installations were left out of service and imports grow very fast. The official explanations to justify the present situation of Mexican Petrochemical industry are diverse : low investments, reduced scale sizes of plants and uncertainty in government rules for new investors and for gas price as a raw material. These are the main reasons which explain the lack of competitiveness in the global market That is why this paper focuses the strategic problem of how to rescue this industry and how to promote a new outline for achieving the desired development.

Keywords petrochemical chains, strategies , regulation, industry.

2809

THE LINKAGE BETWEEN SYSTEMS THINKING AND ETHICS.

William F. Roth

In order to understand the linkages between systems thinking and ethics it is important to first understand the five systems domains that together configure our reality. We work to do so by using science to identify their characteristics. The first and by far the largest of these domains includes what we will call non-living natural systems such as the universe, our solar system, ocean currents, weather, the changing seasons. The challenge addressed by science is to understanding these natural systems by breaking each down system in order to define its parts and the interactions of these parts as well as the interactions between the system as a whole with the larger system of which it is a part.

The second domain includes technological systems created by scientists, engineers and others to improve quality of life. A systemic approach to learning about technology again begins with questions like “How does it work?” How does it produce motion or an x-ray or a shoe or data or information or a new drug or a spaceship? How will it be useful? Again, we generate answers by dissecting it and study the parts, the interactions between the parts, and by defining its role in terms of the larger system of which it is a part. The purpose and characteristics of systems in this second domain are designed into them and cannot be changed unless the designer changes them. Thus, they are called “purposive” systems. Systems in this domain can be designed to interact with each other and support each other. At a school, for example, the lighting, heating and air conditioning units, water fountains, CD projectors and laptops all work together to make classes more comfortable and interesting.

Systems in the technological domain are not alive. Systems in the third domain, the organic domain, however, are. The latter encompasses two categories. The first category includes plants and animals that also have their characteristics designed into them, usually through their genes. The genes tell what plant seeds will grow into, what animals like ants and honey bees will spend their lives doing. Thus, they are also “purposive” systems. These “lower level” plants and animals also interact, supporting and depending on each other

The second category of systems in the organic domain includes no plants but only “higher level” animals including human beings that can decide what they want to do and how they want to do it. More importantly, they can change their mind concerning what they want to do and/or how they want to do it. These organic systems are also directed to a large degree by genes. But they possess the power to overrule their genes, to modify their direction and behavior. Thus, rather than “purposive” systems they are called “purposeful” systems. An example of this inherent talent would be a student deciding what profession he or she wants to pursue then changing his or her mind.

The fourth domain where systems are important is that of societies composed of organisms that support each other in some way. Lower level organisms can create societies where the members interact, support and depend on each other. Many animals feed on plants. But plants also feed on the bodies of dead animals. Some animals feed on other types of animals. Some plants grow on other types of plants. And on it goes, an endless cycle of interdependencies. The activities of such lower level societies composed of lower level organisms, however, are again dictated by genes so that they are again purposive.

Upper level organisms such as elephants, baboons, porpoise and humans create upper level societies that are purposeful in that members can decide the values and activities of the society and can change those values and activities when such change is desirable.

The fifth domain is that of organizations. Organizations are groups of humans that come together in a society to use their expertise, usually aided by technology, in order to achieve a common objective. That objective is the generation of a material product or of a service that will in some way benefit the organization. In the fifth domain the purposive instruments of the technology domain and the purposeful humans of the organic domain integrate activities. Organizations are found in every area of human society at every level. They must also interact with each other either directly or indirectly as well as with the larger environment of which they are a part in order to produce the desired societal results.

Traditional systems thinking deals with the characteristics of a system's parts and their interactions, both with each other and with the larger system of which they are a part. When we are talking about humans as an upper level organism, human societies, and organizations, however, we must include another element important to their "purposeful" perspective. The most important force driving human activity after survival is the desire to improve one's quality of life as an individual, as a family member, as a member of society, as a member of an organization.

Our purposefulness given us the flexibility necessary to do so. But human as individuals, society members and organization members need a frame of reference to guide their efforts. Thus, the field of ethics has evolved and become critical to individual human, societal and organizational development. Throughout history philosophers in this field have worked to come up with a standard that serves the necessary role. Four major schools of thought have evolved.

One is utilitarianism. Those who support this approach believe that the most ethical answer in any situation is that which provides the greatest good for the greatest number. But how do we define the "greatest good?" For example, should we think short term or long term? Should foreign cities, economies and populations be destroyed in order to increase our immediate security or should we take into consideration what might happen in those regions once they have been destroyed, what the long term costs might be? The best vehicle adopted thus far for defining the "greatest good" in a society or organization is the democratic practice of voting. But what about the needs and desires of minorities that are frequently not taken into account once votes have been tallied?

Another weakness of utilitarianism is, "How do we define the greatest number?" The United States and other developed societies in order to improve the quality of life for our "greatest number," in order to make things cheaper, might be exploiting "the greatest number" of workers earning poor wages in third world countries where the products are manufactured.

A second school of thought is egoism which is diametrically opposed to utilitarianism. Egoists believe that the most ethical answer to any challenge is that which benefits the individual making the decision the most with no consideration for others. Ego is important. It is one of the forces driving us to do our best, to continue improving ourselves and our situation. When out of control, however, the individual egos can hinder a society's or an organization's effort to achieve overall, continuous improvement. Examples of out of control egos and the damage they have done are found throughout history.

Pure laissez faire economic theory is built largely around the concept of egoism. Adam Smith, credited with reintroducing it to modern western society, proclaimed that the greatest good would come to the greatest number if each individual was encouraged to pursue his or her own self-interest whole heartedly. When asked what would prevent egoists from taking advantage of the public, he said, "man's inherent good" coupled with the law of supply and demand. This, of course, was not the way things worked out. During the late nineteenth and early twentieth centuries a small group of "robber barons" in the U.S. gained control of the entire economy and milked it to their own benefit with little consideration for the vast majority of workers whose lives were not improving. The government eventually had to step in and introduce regulation.

A third school of thought includes the deontologists. Supporters of this approach try to establish a code of proper conduct based on the rights of the individual. Unlike advocates of utilitarianism and egoism they are not focused on whom we should pay attention to when making decisions including an ethical component. Rather, they focus on what frame of reference we should use. They believe that every individual possesses inalienable rights that must be respected and try to spell these rights out. Thus, we have the Ten Commandments from Biblical days that center on respecting the rights of others and offer a series of "Thou shall nots" to guide our actions. Thus, we have the more modern U.S. Bill of Rights that focuses on the protection of individual rights and spells out what the individual should legally expect in a democracy.

One problem with deontology is, of course, "Who gets to define our individual rights?" An example would be today's well publicized difference in the economic philosophies of the two major U.S. political parties. For Republicans the right to increase wealth and one's standard of living is primary. For Democrats emphasis is increasingly on encouraging social stability, every citizen possessing the right to a decent job and a decent quality of life.

Another problem arises when the rights of two individuals conflict. One deontological model that has evolved is called the "political model." It guarantees freedom to follow one's conscience when defining right and wrong. It also guarantees the right to freedom of speech. But what happens when your right to freedom of speech, your right to say what you want goes against my right to follow my conscience, to act in a manner

that I believe to be ethical, in a manner that contradicts what you are saying? Who's right is the most right? How is that decided?

The fourth school of thought is relativism which is diametrically opposed to deontology. Relativists believe that ethical decisions must be made subjectively according to the individual situation. This means that the same challenge might elicit a different decision under different circumstances. When disagreement arises, participants in the decision making process must work to reach an acceptable compromise Relativism, therefore, offers the flexibility that deontology lacks. But this same flexibility is the approach's major weakness. On an individual level personality and mood can play a major role in decisions make. On a group level there might be serious disagreement, even conflict. How does a "winner" evolve? Should we follow the person who seems the wisest or the person who is most persuasive?

So, each of the four schools of traditional thought has serious weaknesses as well as strengths. As a means of eliminating the weaknesses and taking advantage of the strengths philosophers have combined the two sets of opposites. In terms of utilitarianism and egoism they have come up with "enlightened self-interest." Followers of this approach focus on satisfying their own interests but, at the same time, take into account those of others affected. In terms of combining the strengths of deontology and relativism, "the Golden Rule" school of thought has resulted. In all situations decision makers must treat others the way they would want others to treat them if others were making the decision.

The two schools of thought resulting from these combinations are obviously similar except that in the first the individual is making the decision while in the second a model is sought or created by society. Both could serve as the desired ethical standard when discussing the unique aspect of the upper level purposeful human organism, of societies and organizations composed of these organisms and how to make them the most productive.in terms of improving our quality of life. Also appropriate and similar to both is Emanuel Kant's Categorical Imperative which he proposed as the sought for standard and which says, basically, not to make decisions that you and others affected cannot live with in the long term.

All of these alternatives, however, can be traced historically back to Aristotle's pronouncements which eventually came to be called The Development Ethic. Aristotle said that life has three primary dimensions in terms of development – making, doing, and knowing. "Making" concerns the production of material goods and services necessary to survival as well things we simply want in order to improve our quality of life. "Doing," according to Aristotle has to do with the quest for moral virtue. He defined "happiness" as the essence of moral virtue and said that the quest for it is a selfish one but that man realizes he cannot succeed in his individual quest for happiness without taking into account the happiness of others. "Knowing" involves the quest for the three types of requisite knowledge – that required to make things; that required to reach appropriate moral decisions in our quest for happiness; and that concerning the nature and process of knowing.

Aristotle said that four basic categories of societal input are necessary to healthy development. The first he labeled "plenty" which has to do with acquiring requisite amounts of wealth. The second is access to "learning." The third is the stuff of morality and the forth has to do with satisfying ours aesthetic senses. Russell Ackoff, one of the key figures in shaping modern day development theory, relates Aristotle's contribution to our world saying that development is "the process is which an individual increases his or her ability and desire to satisfy his or her own needs and those of others," that the four critical inputs are plenty, truth, good and beauty. He adds that the individual can never be fully developed, that there is always room for improvement.

A further update honed the definition to "the purpose of life is to develop and enjoy ones positive potential to the fullest possible extent then to use that potential to enhance the development of others." The lingering question with this definition must be, of course, "Who defines 'positive' and how?" With Ackoff's version the word in question is "needs." Who defines which needs are legitimate? The update also adds "time" to the list of necessary inputs. During Aristotle's era most people did not work fifty to sixty hours a week. In the modern world employees might have access to all the other required inputs but lack the time necessary to take advantage of them.

It is obvious that "enlightened self-interest," "The Golden Rule" school of thought, Kant's Categorical Imperative, and the development theory espoused by Aristotle, Ackoff, and the update have much in common, are pushing in the right direction if the purpose of systems theory in the realm of purposeful individuals, societies and organizations is to provide an ethical standard that complements the design part and helps improve our quality of life. It is also obvious that this standard can be called "The Development Ethic."

2810

DESIGN FOR SOCIAL INNOVATION: INTEGRATING THE THEORY AND PRACTICE OF ACTION RESEARCH AND PARTICIPATORY DESIGN FOR ORGANIZATIONAL AND SOCIAL IMPACT

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This paper explores the similarities, differences and potential synergy between action research, social systems design, and design thinking. As three distinct participatory approaches to systemic change with different origins and assumptions, the authors explore ways in which these approaches can converge for maximum social impact.

Kurt Lewin is often referred as the originator of action research within the field of social psychology. In the late 1930s he created the foundation for organizational behaviour and introduced an interactive cycle of reflection, discussion, decision and action which empowered people affected by a problem to cooperate in its solution. Social systems design, as developed by Bela H. Banathy in the 1980s, is a disciplined future creating inquiry that synthesizes and grows from the soft systems science tradition. Its emphasis is in designing the ideal system through a values-driven dialogic process that engages stakeholders into an exploration of "what should be" rather than trying to fix the existing problems. Design thinking is a recent articulation of a similar way of thinking but with the intention of addressing the lack of creativity and innovation capacity in business corporations. Tim Brown coined the buzzword in 2009 and his design company, IDEO, became the leader is popularizing 'human-centered design" for creative problem solving. Although there are differences in language, assumptions, and methodological approaches, these three participatory processes share the intention of involving people in the creation of new possibilities that will directly impact them. When looking at the complexity of social problems, it is becoming clear than trying to "fix" the current social systems is not sufficient to create a peaceful and sustainable culture. A systemic, future-oriented, and ideal-informed design orientation is necessary to innovate the evolution of human institutions. Education is one of those institutions that is ripe for radical redesign. Rather than continuing to prepare our youth for a broken socio-economic system that does not produce equity and is destroying the environment, we need to empower future generations to engage in a learning process that explores the edge between the known and unknown, and in the spirit of design, involves them in the design and experimentation of new possibilities.

As part of the inquiry, the authors share insights, lessons and reflections from the experience of designing an alternative high school program. A group of stakeholders from a charter school in California engaged in the redesign of single subject classes to trans-disciplinary workshops, replacing grades with competency-based assessments such as digital badging, and incorporating deeper experiential learning throughout the high school curriculum. Designing a school in collaboration with the stakeholders was enlightening beyond developing pedagogical innovations customized for the community of learners. Concepts in human-centered design were critical to assist stakeholders, especially traditionally trained teachers, in embracing the systemic changes. Emotional challenges, such as anxiety and apprehension, were addressed through design-thinking principles, such as empathy. The authors learned how elements of each of the three methodologies of action research, social systems design and design thinking each contribute critical components in the process of creating systemic change.

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CURRICULUM MAKING FOR TRITO LEARNING:
WAYFARING INTO A MESHWORK OF SYSTEMS THINKING

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In winter 2016, the Systems Thinking 2 course in the Creative Sustainability (CS) program at Aalto University was led by one of the original curriculum developers from 2010. Over five years, the core CS curriculum had evolved, allowing the level of learning amongst student to advance to a higher level. While this winter 2016 cohort of students was challenged by the intensiveness of the course, satisfaction in the learning appeared to be high.

Following the phenomenological ecological practice theory of Tim Ingold, curriculum making should not be framed primarily as a transmission of information, but instead as a togethering environment where knowledge reproduces amongst the learners. Becoming an authentic systems thinker has each individual progressing on a unique line, wayfaring through an education of attention. Each learner builds on his or her

distinct prior experience to stake a position on new ideas, observe the positions of others, and describe a new synthesis in a meshwork of knowledge.
The Systems Thinking 2 course was launched with a orientation where students groups were given 3 weeks to digest references into a group position. Each group then guided classmates through ideas that resonated for them, often amplified through metaphorical stories and exercises. Challenge groups inquired on the positions staked, surfacing deeper questions in dialectic. Each student was then to write a short blog post within a day or two on his or her learning, encouraged on public online web sites where the instructor would comment. Concluding the course, the student groups each prepared an infographic highlighting the most salient content not just of their original positions, but of their appreciation of systems thinking across all they had heard within the past three weeks.
In the logical categories developed by Gregory Bateson, the value of Systems Thinking 2 is in elevating students to becoming trito learners, beyond the levels of proto learning and deutero learning in the prior core courses. These skills are expected to help reduce the commission of errors of the third kind (E3) and fourth kind (E4), in a meta-system of inquiry described by Ian Mitroff.
Keywords: systems thinking, curriculum making, wayfaring, meshwork, trito learning

2812

PROPOSING VALUES AND PRACTICES FOR A CULTURE OF ORGANIZATIONAL INGENUITY: HACKING SYSTEMS THINKING TO PURSUE THE PREPOSTEROUS AND PRODUCE THE IMPOSSIBLE
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What is the difference between people outside, or within, organizations that look at a problem with a lot of limits and see unusual and new possibilities, and those who look at a problem with a lot of limits and see no way out? How would an organization intentionally transform its worldview and its problem-solving practices to creatively reconsider its own structures, policies, and assumptions when solutions to key needs and complex problems are limited or prevented by institutional or resource constraints? Education, government, and business leaders agree that creativity and innovation are essential for future organizational success and even survival, yet leaders are often blinded by past policies, organizational goals, or assumptions about resources and systems relationships when faced with complex and changing problems. However, research suggests that there are qualitative differences between individuals, teams, and organizations that become cleverly, resourcefully innovative in the face of complex problems under constraints, and those who do not. The culture and practices that activate shrewd, transdisciplinary, and unconventional problem-solving in the face of resource limits and other constraints are associated with a familiar, but largely unexamined, concept called ingenuity. Most frequently, ingenuity has been used to describe innovative solutions that are surprisingly smart, unconventionally resourceful, and contextually superior, often completely changing an institution or social-technical culture. In this messy intersection where creative, innovative problem-solving is at once demanded and prevented, ingenuity is the human factor necessary to hack the hairball, to pursue the impossible by being willing to seek unconventional connections arising from diverse knowledge, skills, and perspectives; dialogue at the margins; resilience; imagination; creative and resourceful improvisation; and systems thinking. The culture and practices of organizational ingenuity integrate systems thinking into a framework designed to provoke the unconventional approaches to complex problems that produce exponentially better solutions for sustainable business and a sustainable world. As organizations develop broad-based cultures and capacities for ongoing innovation, there is a need to distinguish the concept and value of an innovation culture that integrates systems thinking and the resilient, empathetic, value-driven, collaborative, improvisational, diverse, counter-intuitive, paradoxical capacities of ingenuity.
Keywords: systems thinking, innovative, business, resilience, human factor

2813

ARCHITECTURAL PARALLELS BETWEEN BIOLOGICAL AND ENGINEERED SOLUTIONS IN DEFENCE AND SECURITY – ADAPTION, ANTICIPATION, AND SUSTAINMENT.
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Bio-mimetics have often provided a useful means of inspiration for engineering design – for instance in fabrication of materials for aerospace. One more recent area of interest, from the perspective of cyber security has been in the remarkable ability of the immune system to cope with the diversity and evolution of threats such as bacteria and viruses. The focus of this presentation is to further examine the architectural parallels between biological systems and engineered solutions in defence and security. Systems thinking and modelling are the tools utilized in examining the architectures and the capabilities of the biological systems such as anticipatory, adaptability and sustainability. In performing such an examination it is anticipated that insight and potential improvements may be found in both directions – improvements in our

approaches to combat complex disease and also possible inspiration in the science, architectures and designs for our sustainable systems.

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FROM SYSTEMYSTERY TO SYSTEMASTERY - A TOOLBOX FOR DEVELOPING SYSTEMRY

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As systemists we need to be able to communicate using a common reference for the science of systems. Such a reference should provide a simple compelling framework for understanding systemist attitudes and systems concepts. It should be compelling for scientists, engineers and for people, even children, who are just starting out in their journey to understand systems. A candidate framework explored during the INCOSE international workshop in 2016 was used as a basis for developing a game at the IFSR conversation in 2016. The game is intended as a candidate contributor to Systems Literacy.

The intended experience of the game is to help people to act in a systemic way when presented with a new situation. By playing the SysteMystery game the learners will be able to reflect on a situation and make improved decisions or judgements.

Through playing the game learners will be able to grasp and expand their knowledge of core systems concepts. Through practice the learners will begin to naturally use concepts effectively when converting information into knowledge and forming their mental model of a bigger picture.

Playing the game has three phases: a phase of experience which could be a story, game, poem, song or explanation of problem or situation; a phase of reflection and analysis of the experience using the SysteMystery cards and a post analysis phase where improvements to the SysteMystery framework are considered and fed-back to the repository.

2815

TOXIC LEADERSHIP IN CONTEXT

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A sizeable body of research and literature is developing about toxic leadership and workplace bullying. Our earlier work found distinctions between tough bosses and true bullies in the workplace. A later study showed that military officers were able to clearly identify differences between hard but effective leaders and toxic leaders. That work was extended into the organizational climates which seem to promote toxic leaders and bullies. Other colleagues have explored potentials for changes in bullying behavior through executive coaching interventions, noting that some executives simply lack awareness of their behaviors, or the effects on those around them. The focus of this paper is the synthesis of earlier findings, to begin a more systemic understanding about the relationships between individual, organizational, and societal behaviors with respect to bullying and toxic leadership.

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ON THE INFORMATION PROCESSING ASPECT OF THE EVOLUTIONARY PROCESS

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A premise of this paper is that the dynamics of any system, by which we mean here the collection of processes that perform its functions and thus achieve its purpose, needs information for the execution, control, and coordination of such processes. The information processing aspect of a dynamics is precisely what provides the information that it needs in order to proceed. The dynamics of the Earth ecosystem, for example, includes the processes that encompass the origin and evolution of life and the development of human society. In this paper I refer to the part of this all-encompassing process that includes the behavior and evolution of biological systems and human organizations as the evolutionary process. The main focus of the paper is the information processing aspect of this evolutionary process. More specifically, I focus on the evolution of the information processing capabilities of biological organisms and systems, including human individuals and organizations. Especially important is the emergence through this evolutionary process of increasingly complex structures that have made possible more complex behaviors and, consequently, more complex ways of processing information. Superimposed on this evolution is the creation and development of artificial means of information processing and the integration of their use into the information processing aspect of human individuals and organizations. The idea is to contribute to the understanding of the potential that the development and use of artificial information processing devices and systems offers for the effective support of the functions of modern organizations and their adaptability. However, the tremendous potential of computer-based information systems and information technology cannot be fully realized if they do not appropriately extend the information processing capabilities that exist at all levels of the dynamics of the

organizations that they support. A sufficient understanding of the information processing aspect of this evolutionary process is in my opinion necessary for the appropriate, synergistic extension, with computer and information technology, of the information processing capabilities that already exist in modern organizations.

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OPENING THE FIELD OF LINGUISTIC DESIGN FOR THRIVABILITY

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Language functions as a complex adaptive system. With time and circumstance, both its building blocks—the words that comprise it—and the guidelines according to which those blocks can be arranged—its grammar—are subject to evolution. Perhaps because it is often considered a function of culture, the question of how such linguistic evolution might be acted upon with intention is rarely considered. Yet language is no more a function of culture than culture of language. The two act interdependent and interdeterminant. And the manner in which disparate elements such as academic developments, political correctness, and pop culture drive linguistic change is both uncoordinated and acting on relatively weak leverage points. The foundational concern of this paper will be the ways in which the structures of language affect human behavior. It will employ existing research from the field of comparative economics to suggest the importance of approaching linguistic evolution from an idealized design perspective arguing that sustainability and thrivability are outcomes which, to be realized, must be supported by the language employed in their pursuit. Though this paper will, to some extent, address the role of neologisms in linguistic evolution, its focus will be on the more foundational aspects of language—on grammatical structures such as verb tense, possessives, pronouns, and article usage—and the behaviors they most readily facilitate. Just as a systems approach to organizational behavior must look beneath events and patterns for the structures and mental models that underlie them, this paper is intended to serve as the starting point of large scale inquiry into the mental models that are embedded in the linguistic structures of English and how they might be altered to better support human wellness. As the first global language, English is not only a convenient central test case for the inquiries of this paper, it is also an impactful one. In investigating the structures of English and the mental models they embody, the field of comparative linguistics will be pertinent providing points of comparison from other languages. By seeing what variations of language have evolved elsewhere, the project of envisioning an idealized version of English will provide itself with a range of possibilities upon which to draw. In that language is adaptive and contextual, it will not be possible for this paper to prescribe a final version of what is being proposed. Rather, the goals of the paper will be to propose the importance of this design question alongside suggestions about possible directions responses to it might take. In that its central argument will be that linguistic design is a field to which time and effort should be dedicated, this paper will also have to address the question of whether the changes proposed are realistic. In arguing that they are, evidence of how this approach has already been successfully employed and a summary description of how existing resources and networks might be employed in its realization will be presented.

2820

TOWARDS UNDERSTANDING THE EFFECTS OF VISUAL ARTEFACTS IN PROBLEM STRUCTURING PROCESSES: A BOUNDARY GAMES APPROACH.

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The construction of agreements about the nature of the problem confronted by a group can be seen as the aim of problem structuring methods. Visualizing the issues to facilitate the discussions plays a protagonist role in the process. However, we know little about how these visual artefacts catalyse the structuration of the problem and there is a lack of methods for doing so. This paper builds towards these two questions by analysing the interactions using Boundary Games, a theoretical synthesis based on philosophy, language pragmatics, and boundary critique. The Boundary Games framework shows how actors' communications affect the boundary of what is considered relevant in a situation. Boundary Games have been applied to study oral segments of interaction; in this case, its application is extended to simpler visual artefacts such as whiteboard and presentations. The preliminary analysis shows that visual artefacts allow people to keep track of distant and varied ideas and that the visual is helping to connect and reinforce those ideas. This work can be seen as a stepping stone for understanding models, a more complex visual device of common use in structuring problems.

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A SYSTEMIC MODEL FOR COMMUNICATION INNOVATION

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A Systemic Model for a telecommunications innovation system was designed with the proposal for technological development, to avoid situations that endanger the cancellation, by the International Union of Communications of the satellite orbits assigned to Mexico, and thus promote public and private investment through the integration of basic and applied scientific research in enterprises. The idea is to make appropriate innovations and make significant improvements to products, thus meeting the demands of domestic and international consumers.

Keywords: Systemic model, innovation, and technological development.

2826

A STUDY OF SYSTEMS RESEARCH DESIGN: AN EXAMINATION OF SYSTEMIC AND SYSTEMATIC METHODS USED TO STUDY CHINESE WOMEN'S DECISION TO STUDY ABROAD

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In this paper we examine the systemic methodological choices involved in studying the ethical decision space within which Chinese women come to decide to go to an American university to pursue a business education. In the research we wished to develop insight about the role of the student herself in the decision making process in relation to others involved. Insofar as the decision making process involves a multitude of interacting influences, the researchers conceived of this space as a system of people and ideas that contribute to a sense of the "rightness" of studying abroad in a young adult Chinese woman's life.

From a research design perspective, exploring a decision space like this was not straightforward. We were studying what we conceived as a systemic ethical decision making phenomenon, fraught with the difficulties inherent in cross-cultural data collection. This research was not designed to critique the complex decision making processes that study participants had engaged in before coming to study in the U.S. Nonetheless, we faced the very real potential that women participating in the research could perceive themselves as having to hide certain information, or conversely, display their idea of favourable responses to the researchers' questions. We needed to overcome differences of both language and culture between members of the research team and research subjects. Further, we set for ourselves the challenge to formulate a design that would be both systemic and systematic.

No extant theories existed on the ethics of decision-making processes resulting in Chinese women coming to study abroad. Consequently, we used grounded theory methods to inductively illuminate the emergent meaning-making processes involved in such a decision, given this method's systematic and rigorous set of procedures and techniques for theory building. Along with grounded theory-informed interviews, we facilitated each study participant in developing a rich picture of the systems of people, processes, and meaning-making that exerted influence on her decision to study abroad. Together, interviews and rich pictures enabled our participants to make explicit the contextual complexities of their decisions and to communicate those complexities to us. Importantly, the research techniques we used helped participants to explore ethical complexities of their decision in a safe way.

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HOMEOSTATS, RECURSIONS AND TIME SCALES: A VIABLE SYSTEM MODEL ENQUIRY

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The Viable System Model is a broadly applicable organizational model originally developed by Stafford Beer in the steel industry and includes a number of homeostats, including the one between the attention to the present and to the future (the three/four homeostat monitored by System Five), the vertical authority/horizontal autonomy homeostat and the homeostat between the system (systems one/two and three). Also important are the many homeostats that connect the system with its present contractual and contextual environments and the ones oriented toward varying aspects of future time.

The Viable System Model is recursive: that is that each system is embedded in a number of other more comprehensive subsystems ranging from authority relationships to community and regulatory ones. These are not authority relations in the strict sense as, although a community has standards and norms, and a regulatory body its rules, these apply primarily within strict boundaries or parameters.
These homeostats and recursive relationships do not follow a normal ordinal pattern or straightforward time scale. A lower level of recursion may be (e.g. the 'grass roots' where the most far reaching potential innovations are explored while the more comprehensive level may be constrained to pursue mainly those 'possible futures' that are acceptable to the full range of their members. They may have shorter or longer feedback cycles and they may be working within frameworks that are anywhere from hundreds of years old to yesterday. This can and sometimes does lead to systems pathologies as well as new opportunities for integrated approaches.
In this presentation, I will illustrate some of these homeostats and their implications for progress on environmental, social and organizational fronts.
Keywords: Viable System Model, homeostasis, recursion, time scale

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USING VIABLE SYSTEM MODEL FOR CHINESE OUTBOUND TOURIST MARKET SUSTAINABILITY
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Tourism industry benefited worldwide economy providing services to Chinese Tourists who traveled to foreign in 2014 generating income by 165 billion dollars and accounting for 13% of international tourism. Realizing this market's acquisition means growth opportunities for destinations; as well as the added difficulty in services nature of being unsteady, improvable and involving many factors. This article reaches the assembling of chinese outbound tourism market sustainability through the premise of a different perspective for conceptualizing, designing and delivering tourism services as part of a whole socio-ecological system; and sets out a reflection on sustainable responses to some emergencies derived from the increasing tourist activity of the chinese outbound market system.
As examples of a problematic situation are augmenting infrastructure demand, transport and public services in peak season that exceeding load capacity generates negative results for residents and tourists; repercussions on wildlife by large tourist flows during critical moments of migration, breeding or rearing; impacts on local cultures due to the encounter between contrasting lifestyles.
Therefore, the opportunity to expand choices grounded on the convenience of systemic approach for sustainable tourism study and decision-making. The outcome is the Chinese Outbound Market System diagnosis and teleology, the determination of recursive levels, interrelations and conflicts; as well as the systemic integration between it's elements using Viable System Model to configure a holistic construct composed of relevant subsystems oriented to viability and sustainability.
It is concluded that tourism planning that omits sustainable character, reduces social benefits severely with consequences not only ecologically harmful, but also economically self-destructive. In that way it could be possible to confront currently systemic socio-ecological issues.
Keywords: Sustainability System, Emergence, VSM, Chinese Outbound Tourism Market

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HOW TO DESIGN ALL TOGETHER? THE TRIPLE BOTTOM LINE
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Business´ owners want their enterprises are profitable, and that profits stay forever. In other words, they want business economic and financially sustainable. Citizens want business socially responsible, and also environmentally careful, and contribute to recover it.
The liquid societies (Bauman, 2000) create and destroy markets very quickly, and shareholders demand CEOs adapts their enterprises to those changes, maintaining profitable. Corruption scandals promote strong society claims, demand ethic behaviors. There are more sights about the environment. Paris signature authorities tell "these are not enough" (Paris Climate Agreement, 2016).
There are theoretical papers about each of these aspects, but there aren't a holistic view trying to find systemic answers.
How have enterprises that are simultaneously sustainable, ethically behavior in all domains, and environmentally responsible:
Are enough to choose a CEO who can make the triple goals?
Can move the enterprise with a consulting work to the triple ends?

Must promulgate laws, with strong penalties, to force enterprises to obtain the triple line?
Is it necessary to (re-) design the enterprise to put on the way to the triple results?
The first three questions are not enough. To choose a CEO with those capabilities is possible only for a few numbers of organizations, if it is possible. Consulting is, by definition, limited in time, and it needs a corporation's behavior for the entire life. And if we have laws about, they cannot explain how to do it. It's necessary that ALL the company, their members and all around collaborate and coordinate to have a chance to arrive.
In recent times there are proposals to a new way of enterprises, with linked profit business with social impact and environment, call hybrid organizations. They try to generate at the same time, economic, social and environmental value (triple bottom line). Combine the current concepts of sustainability and systemic impact on all the dimensions requires a new design.
In general, it is observed that the treatment of comprehensive way concerned is omitted. It focuses from one or another aspect, emphasis on certain features, but not about taking the overall design, which makes it difficult to appear companies at the same time achieve sustainability on all fronts. Those that exist are shown as successful examples, but is veiled how they succeeded, and the small number shown not allow inferring a viable design. It is about advancing the design companies that meet all requirements and work in line with the systemic dimensions that define Sustainability. Design tools and business models wide target.
How to design organizations broad objectives that are sustainable from economic, social and environmental perspective, taking into account its surroundings and prospects?
Cybernetic models available, such as VSM, systemic tools developed in recent decades, as models of Ackoff, Ulrich, Jackson, Checkland, Bosch, among others, suggest that counted with enough devices to address the design of this new type of companies.
It is necessary to consider the behaviors of businessmen, culture and expectations, since what is being proposed are, to some extent, a Copernican shift in the way of acting and directing companies. It is necessary to consider that it will be necessary not only explain the design, especially its possible results and advantages compared to traditional.
Today, when Millennium Development Goals post 2015 seeking simultaneously to defeat the scourge of poverty, and lead humanity to sustainable development, we must make all the productive forces in each place are aligned to work simultaneously on all fronts: economic, social, environmental, etc. This requires having previously developed academic responses, otherwise treated no objectives or goals but mere wishful thinking. Perhaps this is a small step in the right direction.

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A SYSTEMIC APPROACH ON HUMAN RESOURCE MANAGEMENT IN TOURISM SMALL AND MEDIUM ENTERPRISES CONSIDERING SOCIO-ECOLOGICAL SYSTEMS
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The context in which Small and Medium Enterprises (SMEs) of lodging carry out their operations is turbulent. This Human Activity Systems (HAS) develop certain practices that threaten aspects such as internal equilibrium, resilience, their relation with natural environment and hence its permanence in the sector. The purpose of this paper is to present the basis for an autopoietic management system of human resources within mexican tourist SMEs in order to generate self-organization and adaptation considering social and natural dimensions. The methodological approach is carried out using the Soft Systems Methodology (SSM) looking to reduce problematic situations generated for whom manage the systems as well as those related to the human resource management. With respect to the findings, a conceptual model was designed consisting of subsystems that consider heterogenity in tourist SMEs and human resource management problems, in that sense is intended to regulate its complexity and maintain an equilibrium with the environment. It is considered that actors with managerial functions may benefit from a holistic approach that looks for the transcendence of the whole system in its current context.
Keywords: Soft Systems Methodology, Tourism, SMEs, Human Resources Management.

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WHOLENESS IN COMPLEX SOCIO-TECHNICAL SYSTEMS.
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Highly complex social and technological systems are ubiquitous in the modern world. Many of these systems are associated with high levels of energy; potential, kinetic, and human. The consequences of system failure can be extreme. Observation of catastrophic technological failures such as two space shuttle

disasters, the nuclear power plants at Chernobyl, Three Mile Island and Fukushima, and many others, show clearly that creators and managers of these systems must take great care with system design and operations. Human system failures such as those seen in espionage or mass killing cases also highlight the need for both responsible and humane organizational management and sustained attention to defensive measures.

Lack of attention to any of vast systemic issue both social and technical can result in organizational or defence system defects. These defects can be described as holes or shadow aspects and these pertain to the technical systems, the human systems and the socio-technical system interplay. Responsible technology and social system design requires addressing these holes and shadow aspects to eliminate them and therefore make the system complete or whole. Organizational wholeness is a continuous process of attention to and mitigation of these types of defects. Sustainability in this context is the continued focus on safe and secure operations and life affirming human dimensions to respond to environmental changes and adjust defences accordingly. This paper will describe propose a model that may be useful for hole and shadow aspect identification and issues related to their management or mitigation.

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HOW TEACHING CYBERNETICS, IN ANY DISCIPLINE, CAN BRING FORTH SYSTEMIC CHANGE

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One way educators can work toward meaningful change in socio-ecological systems is to foster transformative change in students' thinking. Since today's students are tomorrow's decision-makers, it can be argued that we have a responsibility to help students develop an understanding of how knowledge is constructed so that they might take responsibility for how they make sense of our world and see the connection between knowing and acting. Specifically, the reform in thinking needed is from our culturally conditioned habits of reductionism, duality, and linear thinking to more relational, systemic thinking. Educators are largely responsible for shaping the minds, values, and perceptions of students. We hope to inspire more educators to take their responsibility to heart and foster the kind of complex thinking that students will need to address the increasingly complex problems of our pluralistic world.

In this presentation we will share our experiences, as teacher and student, in Creative Systemic Studies, an online doctoral program founded on the principles of cybernetics and systems thinking. Since epistemological change is transdisciplinary, it does not matter what discipline we teach in when we attempt to change minds. The Creative Systemic Studies program was designated a non-clinical Marriage and Family Therapy degree, yet students' transformative learning experiences were not discipline-specific; they were triggered, in part, by learning cybernetics. In fact, students frequently testified that cybernetics changed their personal relationships and how they attended to the issues they were involved in, including homelessness, coaching youth, missionary work, grassroots organizing for social change, and therapeutic practices.

Using a few concepts from cybernetics as examples - control, feedback, and distinctions - we will show how the principles of cybernetics can be creatively presented and integrated into any course of study. And we will show how these concepts influenced the way students think and know. We will also use these examples to highlight the fundamental principle of second order cybernetics which is that the observer is inextricable from - and responsible for - her observing. After introducing students to the subjective nature of interpretation and engaging this topic from multiple perspectives, students begin to see how their biases, values, and past experiences influence how they make meaning. Our knowing is necessarily self-referential and participatory. Cybernetics, General Systems Theory, chaos and complexity theories each have differences and a range of interpretations yet they are unified in that they all indicate a way of thinking that is intrinsically different from the reductionist/objectivist/deterministic orientation of modernist, rational thought. We use cybernetics as our exemplar for teaching students to think differently because we like it so much, but any of these theories would represent, and foster, epistemological change.

We assert that changing minds has profound consequences because habits of mind become habits of action. Furthermore, every way of knowing contains an ethical trajectory. The ethical trajectory of cybernetics includes knowing that since we construct meanings, we are responsible for them - and we must respect this responsibility in others. Inspiring and developing in students a paradigmatic change from objectivity to a self-referential, participatory epistemology fundamentally concerned with responsibility is a nontrivial way that educators can foster meaningful change in socio-ecological systems. Additionally, it makes teaching even more exciting and satisfying.

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SYSTEMIC COMPLEMENTARITY IN MICRO, SMALL AND MEDIUM TOURIST ENTERPRISES CONSIDERING THE SOCIO-ECOLOGICAL SYSTEM

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In Mexican context, the tourism sector has prioritized the income generation, without consider social and ecological dimensions and the impact on ecosystems and social inequality. Characterizing tourist Micro, Small and Medium Enterprises (MSMEs), some aspects are identified such as heterogeneity, absence of international standards as well as the inability to cope the disruption of the environment.

This paper proposes to implement the systemic complementarity concept as an alternative to bring closer the tourist MSMEs to the exelixis considering the socio-ecological system, in which it operates. The methodological approach is carried out through the Soft Systems Methodology (SSM), given that this methodology allows considering the subjectivity and complexity in problematic situations integrating relevant actors.

Regarding the findings a conceptual model is proposed based on a associative transformation among MSMEs emphasizing the use of variety, considering its integration. Also, this model seeks to provide emergent properties to the whole system that determine internal functioning and amplify capacities to transcend in its current context.

This proposal will benefit the tourist MSMEs potentializing, through their diversity, the local dynamic and the identity of the destination in consonance with the socio- ecological system.

Keywords: Tourism MSMEs, complementarity, soft system methodology, emergence, socio-ecological systems.

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DESIGNING AN ACCESSIBLE TOURISM DESTINATION: THE SOFT SYSTEM METHODOLOGY AND THE TRIPLE HELIX AS A THEORETICAL AND PRACTICAL PROPOSAL

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Accessible tourism has its origin in the 90´s, at the beginning it was proposed as part of the Social Tourism or Tourism for All programs that had their basis in the human rights. Later, with the changes in the paradigms about people with disabilities accessible tourism has not only become a matter of human rights but also an opportunity to develop business that satisfy a growing population of people with disabilities and older people that acquires one or more types of disabilities.

Demographic factors such as the increasing in life expectancy, better health care and retirement of people increase the needs of designing and building products and services that satisfy this demand. The Soft System Methodology, developed by Peter Checkland consider social factors and complex relations in tourism, its 7 phases allow the researcher to compare and simulate different scenarios that brings to the most viable practice, it brings an approximation to a model of accessible tourism, gathering elements such as research, infrastructure needs, human resources and labour market, communications, signalling, and other things that should be considered in a competitive destination.

The Triple Helix, as a theoretical and practical model allow the three main sectors, Academy, Government and Industry to join efforts to strengthen the tourism industry. The Triple Helix from Etzkowitz and Leydesdorff show that innovation can have its origins in the academy, considering that knowledge is the most valuable element nowadays in the innovation policies around the word.

The Triple Helix propose that academy should work with the research and design of products and services, the government, as the policy maker should provide elements that enable academy and the industry to work together in the incorporation of research, development of products and services and funding projects.

This model, designed from the Soft System Methodology considering the Triple Helix as the basis of the tourism offer propose a better way of building policies, products and services for people with disabilities and senior adults, making more competitive the destinations and it can be considered not only for this population, research has shown that accessible destinations are conceived as better places for all people because its conditions allow tourists to walk along, drive, take a bus in an easier way.

2839

TOWARD A DIAGNOSIS OF VIABILITY OF SMALL MANUFACTURING ENTERPRISES. CASE: METAL MECHANIC INDUSTRY

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The purpose of this research is to determine, from the point of view of Systems Science, the weak organizational viability of Small Manufacturing Enterprises (SMEs) in order to advice how to raise its organizational and functional structure to face market complexity , for example attenuating the factors which affect the operation to early close enterprise . To achieve this end it were identified and ranked the most frequent factors that cause early closure of SMEs , these data were analyzed conceptually based on the Model of Viable Systems, defining a total of 30 (thirty) elements that , empirically, provide the benchmarks for diagnosing and redesigning the organizational and functional operation of an SME in order to viable organization, that is, not only to maintain its existence but to transcend the variety of market.

Keywords: Viability, SMEs, Viable System Model, Variety

2841

A SYSTEMIC APPROACH OF THE TECHNOLOGICAL INNOVATION PROCESS IN MEXICO

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Schumpeter points out that innovation is a dynamic force that causes the continuous transformation of social, institutional and economic structures which ensures a plausible quality of life of its inhabitants. Innovation is a complex process of interactions between different actors can be understood best as a system where different social and institutional agents interact and promote the innovation and the development of the countries. To try to understand the complexity of this process were studied 41 variables which were related through network analysis and it was found emergent properties that reveal that less than 10 % of the variables are relevant and there are political and social, this result was mainly in developing countries like Mexico which was analyzed from 1980 to 2015. The results also show that these actors found in systemic innovation process have hampered the efficiency of the process.

Keywords: Systemic Approach, Innovation, Networks

2842

THE ILLUSION OF TECHNOLOGY: A GENERATIONAL PERCEPTION ON THE NEED FOR A HUMAN-CENTERED APPROACH IN DEALING WITH DEVELOPMENTS OF SCIENCE AND TECHNOLOGY

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We are at the turning point of an era with a huge potential of change in which humanity can decide to finally address the failures of our economic, social, governance and belief systems.
However the current narrative build around the hopes of being saved by science and technology is getting more and more traction into a society in which digitalization, the illusion of zero marginal costs, sharing economies and big data seems to be the answer to our most pressing problems.
This is ironical, since science and technology (S&T) have been not only central to the development model followed by human societies in the last centuries but often very effective instruments of mass destruction, environmental degradation and social exclusion. S&T have been definitely part of the problem, a key component of our model of economic development, and not only an exogenous factor as considered by mainstream economics, which anyway recognize their crucial role to improve productivity and sustain long-term growth. But they are also deemed to be the core of the solution, a paradoxical vision grounded in the idea that finding a technical fix is a good way to avoid the less comfortable question of how power and wealth are distributed in society and with what consequences.
In particular the younger generation seems to be distracted by the excitement about technological and scientific new developments and its untapped potential. Addressing the systemic underlying root causes which are the real drivers of our problems is too complex compared to building the new app and the social enterprise that goes with it.

While for previous generations changing the world for the better would require also political and social innovations, now it seems that S&T has even displaced every other source of hope. The launching of the latest digital artifact creates a widespread frenziness, but also a true and exciting entrepreneurial spirit is mobilized by the potential of technologies to address human challenges. In a sense, we put S&T at the core of societal evolution, or to say the least we do not conceive any transformation without them playing a significant role, and this is also why we think they should rescue us from all disasters, even those provoked by ourselves.
In light of these developments I would like to emphasize the following questions in my contribution to ISSS 2016: How can we go beyond a paradigm of "S&T solutionism" and channel the huge potential these developments will bring? How can we change the route towards a future in which humanity has to adapt to digitalization and its consequences, instead of putting digitalisation at the service of humanity?

2843

CRITICAL SYSTEMS THINKING REVIEW ON DECENTRALISED DRINKING WATER MANAGEMENT IN NAULI CITY , INDONESIA

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This paper is based on a PhD project that strives to assess the performance of decentralised drinking water management in the city of Kupang, Indonesia. The implementation of decentralised government system followed by decentralizing some functions including drinking water services, is unsatisfactory in providing access to drinking water for all residents in the city of Kupang. Kupang Municipality that has just split up as an autonomous local government under the decentralized government system in Indonesia, is facing conflicts in providing water provision to the society, since there are three public water companies in this region: PDAM of Kupang City, PDAM of Kupang District, and BLUD of the East Nusa Tenggara Provincial Government. Furthermore, these governments and water companies seem to forget the main objective of government in water provision as stated in the Indonesia Constitution: to fully control the water and manage it for meeting the people's needs. The aim of this research is to apply Ulrich's critical systems heuristics (CSH) to address the following research questions: (i) how effective is the current decentralized water management system?; and (ii) how the current system can be improved and what ought to be done?
Keywords: Systems thinking, drinking water management, decentralisation, sustainability

2844

VALUE BASED ARCHITECTURE OF DIGITAL PRODUCT-SERVICE SYSTEMS

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In this services economy, products are increasingly taken for granted and services often serve as the differentiator for businesses. Invariably, product focused businesses package services around their products and service focused businesses package products around their services. As a result, in any business offering, there is a product component as well as a significant service component. In such a scenario, the architecture of product-service systems gains significant importance. This is further prompted by the change in employment patterns, job opportunities, contribution to GDP, ownership of intellectual property and reduction in sales. Such product-service systems have benefitted immensely due to the massive pace of digitization wherein businesses are adopting digital to connect to their customers in order to bring in a difference in their offerings.
As a result, the convergence of digital technologies has become the platform for businesses wherein new product-service systems are created by fusing digital and physical worlds. In this setting, it has been found that the presence of many digital technologies contributes to innovation, competitiveness and growth of a business. Gartner is of the view that the nexus of forces (Cloud, Mobile, Social, and Information) are the driving factors for businesses. TCS is of the view that the digital five forces (Cloud, Big Data, Social, Mobility, and Robotics & Artificial intelligence) are the driving factors for business. HBR is of the view that smart, connected, miniaturized devices (Internet of Things) alter the structure, competition and value offered by a business. In essence, "digital" has established itself to be a force to be reckoned with by businesses and they increasingly strive for achieving domination on "Digital product-service systems".
While there exists numerous architecture frameworks, processes and reference models for architecture of enterprises, systems, products, software and services, it is often the case that most of these artefacts are not suited for "Digital product-service systems". This paper presents a value based approach for architecting "Digital product-service systems". As part of this approach, six different interdependent perspectives are considered as useful for architecting the system-of-interest. These perspectives are:
Context Perspective: The context perspective aids in understanding the situation and identifying the operative context based on the cause and effect relationships that exist in the situation. This perspective aids in the problem situation formulation and its appropriate expression.

Value Perspective: This perspective aids in developing a set of value propositions that would lead to customer delight, customer satisfaction and enhanced customer experience. This perspective aids in the formulation of value proposition of the Digital product-service system.
Quality Perspective: This perspective aids in understanding the ways/means by which the benefits can be delivered. This perspective aids in the development of the concept of operations, which describes the characteristics of the offering from the viewpoint of an individual who will consume it.
Purpose Perspective: This perspective aids in defining the statement of purpose of the offering. This perspective aids in the identification of the purpose and development of the function model.
Structure Perspective: This perspective aids in defining how the different components and their interfaces are organized and composed in order to provide the necessary resources for achieving the purpose.
Process Perspective: This perspective aids in defining how the different components are utilized to enable the purpose. The process perspective ensures that the supporting capabilities are available when and where necessary.
In this paper, the use of these perspectives to architect “Digital product-service systems” and its application in businesses is illustrated with a case study.
Keywords – Products, Services, Digital Technologies, Product-Service Systems, Digital Product-Service Systems, Context, Value, Quality, Purpose, Structure, Process

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ARCHITECTURE OF A SYSTEMS MODELLING PLATFORM
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Systems are multi-dimensional, complex and have multiple ideals. One of the biggest problems with systems is the uncertainty on where do they begin and where do they end; what is inside and what is outside. This is because what is perceived to be the system is an approximation of the real system. It is possible to learn about the real system incrementally and improve the approximate system or system-in-focus; as the gap between the approximate and the real system is the source of the feedback and the basis for the incremental understanding. One iteration of understanding the real system could be identifying interesting properties, cognizing interesting insights based on these properties and creating models that capture this information.
In the world of systems, an iterative approach to incrementally obtain understanding involves successively spanning many dimensions of the system and adopting a holistic attitude with regard to it. Holism spans multiple dimensions and is based on independence. Traditionally, system thinkers adopt an array of modelling approaches (influence diagrams, system dynamics models, viable system models, living systems models and so on) to develop an understanding of the system. In order to create a holistic view of the system, multiple models are collated, with each model defining a set of properties corresponding to the respective concerns.
The different models allow system thinkers to look at the system at different levels of detail. They can be used to structure, identify, analyse and synthesize systems wherein each model commutes with the systems and relates to it. Each model is understood, worked upon and then composed keeping in mind the constraints of the system and the conditions in which the system exists. They can be either independent or dependant and dynamic. Each model is a different perspective in representing the system and if semantically motivated explains how the system is understood, analysed and synthesized.
In this paper, the architecture of a modelling platform that provides the ability to model different aspects of the system is discussed. The objective of this platform is to support modelling as a capability so that a holistic understanding of the system can be developed. The focus is on those models and modelling approaches that can be supported by information systems in the form of tools. The discussion in this paper also stems around a unified model of the system which is constructed by taking into account the different perspectives obtained by modelling the system using different approaches. The instantiation of the architecture to realize a platform for modelling systems is presented.
Keywords – Systems, Models, Multi-Models, Holism, Modelling Platform, Modelling Approaches.

2851
A THEORETICAL FRAMEWORK TO CAPTURE STAKEHOLDER’S PERSPECTIVES FOR THE DESIGN OF COLLABORATIVE COMMUNICATION STRUCTURES FOR SPECIALIZED ORGANIZATIONS
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Small consults business often specialize in one aspect of the business analyst. This specialized focus is done by necessity due to scarcity of resources and to maintain a proprietary market niche. However, this specialized focus results in a growth inhibitor due to their lack of ability to address all the potential client’s

needs. Moving to a multiple entity collaborative approach can provide a competitive advantage. By having many specialized business analysts and interactions can provide different value generation objects to co-produce a product or service to best serve customer requirements. Yet, interacting with multiple entities that do not communicate with each other well can be dysfunctional and unsatisfying for themselves and most importantly for clients. When multiple interests and beliefs are in place, soft systems methodology (SSM) and CATWOE tool can assist leaders to find the “middle” ground for all participants to collaborate. However, SSM is based on the observer doing all the design work, a feature not desirable when designing collaborative structures. In this research, a participative version of Soft Systems Methodology for energy analysis was developed to assist E3 (Economic, Energy, and Environment) practices and principles by using a set of questionnaires to capture information regarding the diversity of stakeholder's perspective. The resulting data then lead to the creation of root definition and the design of communication structure in the collaborative organization. The resulting version is capable of assisting collaborative specialized organization’s leaders in the design of communication structures to coordinate collaborative efforts.

2856

ANTICIPATORY FACTORS IN DIALOGIC DESIGN: SYSTEMIC DESIGN THEORY AND PRACTICE FOR COLLABORATIVE FORESIGHT

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Applications of the systemic practices of dialogic design (Structured Dialogic Design and it variants) have recently developed and integrated futures and foresight models as anticipatory frameworks for policy and long-term planning situations (Weigand, et al, 2014). We have identified this model of practice as collaborative foresight, reflecting the perspective from practice that futures literacy must be considered an essential complement to multi-stakeholder deliberation where complex and competing interests are considered in planning and decision making. This study proposes approaches to advancement in science and practice that integrate essential properties of collective anticipatory modelling for design decisions.
Scientific principles for dialogic design have been developed and practiced over the course of nearly 50 years of developmental evolution, following Warfield’s (1986) Domain of Science Model (DoSM) and Christakis’ (2006, 2008) research extending the DoSM. One of the key principles in the DoSM refers to the recursive learning necessary to develop systemic practices, a second-order (deutero) learning process as noted in Warfield’s DoSM cycle. The standard model requires warranted claims to be evaluated from their testing in the Arena of real-world practice and reflective learning in order to advance new theory for inclusion in the accepted Corpus (theory supported by accepted evidence).
Recent developments from practice following from advanced design and strategic foresight theory lend support for progressing the models of dialogic design to explicitly entail methods of design and futuring within the historical model of dialogue. The observation driving this proposal can be summarized as “participants in collective designing efforts are likely to fail in their expected outcomes if they do not facilitate the requisite anticipation of future complexity in their domain of action.” Simply put, people will make significantly better plans and policies together if they can develop competency in futures thinking and share their understanding with one another.
An abductive approach to DoSM enhancement based on design science suggests that anticipatory design methods within dialogic practices might yield more comprehensive reproduction of the benefits expected from enduring principles of systemic dialogue. These principles include the proposed axioms and laws of dialogue (Bausch & Flanagan, 2013), as well as long-standing principles embodied in Buberian, Gadamerian, and Bohmian dialogue practices. Another issue regards functional purpose access to the multiplicity of ontologies held among actor-stakeholders in a social system.
By re-examining these principles in the context of the DoSM, we might integrate anticipatory modelling into a more inclusive systems theory of dialogic engagement for systemic design for complex and multi-organizational policy development.

2860

POST-NORMAL SCIENCE V CITIZEN SCIENCE: AN EXPLORATION OF CUSTOM AND PRACTICE

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We live in an age of complexity and complexity gives rise to uncertainty. Recognition of this, over 25 years ago, led to the suggestion of post-normal science which provides a method to support the explicit recognition and management of uncertainty. The suggestion of such a method, though, challenges the pre-eminent status of scientific knowledge and, as such, it is hardly likely to find support from scientists or the policy makers they advise who expect certainty and hard evidence. Hence it is not suprising to find there has not been a massive take-up of post-normal science. Yet, at the same time, another alternative form of

science, citizen science, which also challenges the scientific establishment in suggesting that the interests of citizens should drive the research agenda, has grown signficantly. So, why has one achieved traction and the other not? In this paper, we look to address this question by exploring the custom and practice of both post normal science and citizen science.

2862
FRAMING A SYSTEM
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Boundaries of a system are largely determined by human perception. As a result, the boundaries are to an extent arbitrary but to an extent created in response to changing environmental conditions. Given this dynamic, the way a system is framed in terms of its boundaries affects human action on a global scale. Understanding this framing can empower the human agent and enable a recontextualization of human potential such that our planetary system is approached and maintained in an ecologically equitable and sustainable fashion. This paper outlines how such framing relates to different scales of human civilization and what some of the important practical distinctions are related to such an act of framing.

2870
TRANSFORMING TO SUSTAINABLE FUTURES: LEARNING FROM 45 YEARS OF SYSTEMS THINKING IN PRACTICE PEDAGOGY
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The ASTIP (Applied Systems Thinking in Practice) group at the Open University (UK) began Systems teaching and research at the outset of the university in the 1970s. Since then the academic group has been through many iterations and has made a wide range of contributions concerning systems thinking in practice (STiP) across disciplines, programmes and contexts. This paper takes a step back to reflect on and critically review some of the ideas and techniques that have developed from the OU's Systems traditions. Educational elements found to be particularly useful as a part of learning system design when considering sustainable futures from a socio-ecological systems viewpoint are highlighted. Over time the OU's traditions have both drawn on and built on the work of many key systems thinkers such as Bateson, Vickers, Schön, West Churchman and Checkland. Because of the focus on an active pedagogy much of what students learn has been applied in their personal or professional circumstances. Systems diagramming and various conceptual frameworks intended to encourage STiP have been central to the OU's Systems work. In this paper specific examples will be drawn from recent activities in the Masters' level modules 'Managing systemic change: inquiry, action and interaction' and' Making environmental decisions' and an international research project on climate change adaptation and water governance (CADWAGO).

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EVOLUTION OF SUPPLY CHAIN MANAGEMENT TOWARDS GREEN SUPPLY CHAIN MANAGEMENT: DRIVERS AND THEIR IMPACT
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Historically, the evolution of supply chain management passed in four stages: the physical distribution management (1960s); the logistics management (1970s-1980s), the SCM (1980s-1990s) and the Green Supply chain Management (1990- Till now). Green supply chain management (GSCM) integrates environmental thinking into supply chain management; from conceptual product design to the delivery of final product to the consumers, and also involves end-of-life management. The implementation of GSCM is supported by few factors which are known as GSCM drivers. The aim of this paper is to study the state of green supply chain in the Lebanese food industry and investigate focally on the drivers affecting GSCM. To approach this investigation, we selected four companies due to their size in the Lebanese food industry.

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SYSTEMS MODELING TO UNDERSTAND THREATS TO RESEARCH INTEGRITY & THE EFFECTIVENESS OF PROPOSED SOLUTIONS
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The study tests the hypothesis that research integrity can be improved through changes in the incentive structure of scientific disciplines and that the effects of such changes can be estimated by viewing the production of scientific knowledge as a complex adaptive system. The study conceptualizes research integrity in terms of the use of flexible data analysis practices and distorted reporting of results, and contends that the diffusion of such behaviors through a scientific discipline is a process largely driven by the incentive system existing within it. From a systems perspective, the success of such a change in the incentive structure of a discipline will depend on the initial conditions existing within that discipline (e.g., the relative importance accorded hypothesis testing compared to exploratory research, the number of journals within the discipline, the prestige of journals adopting registered reports, and the flexibility of researchers within the discipline to publish beyond discipline-specific journals not using registered reports). Accordingly, the study develops a system dynamics model capturing the causal relationships between indicators of research integrity (i.e., positive results “manufactured” through use of flexible data analysis practices and distorted reporting); organizational and environmental incentives driving use of flexible data analysis practices and distorted reporting; and proposed interventions for reducing use of such practices.
The study analyzes the Center for Open Science’s Preregistration Challenge as an example of an incentive-based intervention to promote research integrity. The goal of registered reports is to remove the incentive to use flexible data analysis practices by making publication dependent on methodological rigor and not the production of positive results. The Preregistration Challenge is designed to encourage researchers to use registered reports by offering $1,000 to 1,000 researchers for publishing the results of studies they have preregistered. Over time, it is hoped these practices will diffuse through the population of researchers within a discipline, thereby becoming common practice and improving research quality and integrity. The financial incentive offered by the Preregistration Challenge to preregister a study with a journal is just one of the incentives that influence researchers' decisions as to how to analyze their data and where to publish their research findings. Consequently, it will not entirely solve the problems that arise through using flexible data analysis practices and distorted reporting but should reduce the flow of manufactured effects. The analysis also examines if it would be better targeted at one or two specific disciplines or offered to researchers irrespective of their academic discipline. If a targeted approach was to be used, the model could help identify which disciplines exhibit initial conditions that favor adoption of registered reports and hence are the best targets for the $1 million initiative. Such an experiment would be time-consuming and costly in the real world, but could be conducted with relative ease in a virtual environment once the basic model had been constructed, further exemplifying the use of systems methods to this budding area of research.
The study provides the nascent field of research integrity studies with a better understanding of the dynamics that drive the use of flexible data analysis practices and distorted reporting and the potential of proposed solutions to curtail the use of these practices. More specifically, develops a theoretically informed system dynamics model of the normative and organizational incentives influencing the use of these practices and identify leverage points for interventions. The ultimate goal of the research is to develop an optimal portfolio of research integrity interventions that can be used to influence the quality of publications, universities and academia, and the betterment of science to guide their activities in this area.

2876

ETHICS FOR CYBERSYSTEMS

Paola Di Maio

Artificial Intelligence and Systems Automation are becoming increasingly embedded in everyday electronic appliances. Typically, these technologiesare developed integrating knowledge representation techniques such as framesand rules, which model human cognition and behaviour, to support autonomous 'intelligence' and decision making capabilities which enable these systems to fulfil their intended function. One of the most pressing concerns - fictionally symbolised by the dilemas of HAL in Space Odyssey - is the ability of intelligent systems to make ethical decisions [1] When it comes to define the ethical dimensions - answering questions such as 'what can be considered an ethical intelligent decision?' - humans refer to spiritual traditions and religions. Largely these can be summarised and synthesised as generic principles for example 'do no harm'. In real life decisions are generally not binary, and more complex than simpleethical vs non ethical decisions. Sometime an less than optimal (less than ethical) decision must be taken (say, sacrifice a human life to save more lives) But is that ethical?This paper synthesise principles of good conduct and ethics as taught in professional ethics and proposes a generic ontological reference model and knowledge

representation of human cognition that embeds ethical principles to guide the development of intelligent ethical systems.
Keywords: artificial intelligence, cybersystems, roboethics

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SYSTEMS MODELS OF THE SOCIAL ECOLOGY OF TRAFFIC SAFETY TO ANALYZE THE EFFECTIVENESS OF INTERVENTIONS

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The study will inform the development of a systems model(s) of the social ecology of traffic safety to test intervention effectiveness in reducing motor-vehicle crashes, injuries, and deaths for the State of Texas by accomplishing the following three objectives: (1) analyze the traffic safety goals proposed in the Texas Department of Transportation's Highway Safety Plan for 2016 from a systems perspective; (2) assess the applicability of different systems modeling methods suited to analyze the causal relationships and effectiveness of interventions; and, (3) develop preliminary recommendations for a systems model(s) of traffic integrating the conditions and relationships perpetuating motor-vehicle crashes, injuries, deaths, and their potential interventions. The study will provide the fields of traffic safety, bioinformatics, epidemiology, biostatistics, behavioral, human factors, and engineering research with a better understanding of the dynamics driving motor-vehicle crash injuries and deaths to (a) improve crash and injury outcomes and quality of life; (b) decrease spending and/or use of those that are ineffective and increase use of those that are; and, (c) increase understanding of the causes and the outcomes of motor-vehicle crashes, injuries, and deaths individually, socially, culturally, and economically. Collectively, this enables previously impracticable prevention efforts and is a novel way for assessing the effectiveness of different interventions aimed at reducing motor-vehicle-related morbidity and mortality.

Systems approaches are capable of capturing the dynamic complexity inherent within traffic and social systems in ways traditional approaches cannot. This analysis will involve identifying suitable systems approaches for analyzing relationships between the traffic system and interventions, including traditional countermeasures to reduce crash and injury morbidity and mortality, such as Texas traffic policies and regulations for motor-vehicles (e.g., speed limits, licensing and educational requirements for motor-vehicle drivers, road geometry and material requirements, safety belt requirements; indicators of motor-vehicle crashes, injuries, and deaths (e.g., morbidity and mortality data for accidents that involve alcohol, drugs, intersections, large trucks, and pedestrians); and, proposed interventions for increasing the use of such practices (e.g., incentives driving use—or lack thereof—of motorcycle safety gear, monetary discounts for safety training programs). While policy makers, economists, and other constituents have proposed specific goals or targets to decrease motor vehicle injuries, crashes, and deaths, none have been tested using methods that capture the dynamic complexity of real-world social systems to not only understand how and why these problems occur, but also what are the best leverage points for change given the effect and cost of the proposed solutions.

Accordingly, the systems model to be developed could be used to conduct virtual experiments to test whether the goals set in the Texas Department of Transportation's Highway Safety Plan for 2016 would be better targeted at one or two specific populations or applied more generally across the state but respective to important social, policy, and environmental factors. If a targeted approach was to be used, the model could help identify which populations or environments exhibit initial conditions favoring adoption of a proposed intervention(s) and hence are the best targets for the intervention. Ultimately, the study seeks to create an optimal portfolio of motor-vehicle safety interventions for use by state and local governments to address the need for truly effective interventions to reduce motor-vehicle crash and injury morbidity and mortality. The model will fulfill a significant need within traffic safety, bioinformatics, epidemiology, biostatistics, behavioral, human factors, and engineering research, as it provides a novel way to assess proposed solutions for reducing motor-vehicle crashes, injuries, and deaths through a means capable of

capturing dynamic interactions, adaptivity, and non-linearity inherent within traffic and social systems, that are less time-consuming, and far less costly than traditional approaches.

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A SYSTEMS APPROACH TO THE DEVELOPMENT OF RESEARCH CAPACITY: A CASE STUDY OF A SYSTEMS PRACTICE MASTERS PROGRAMME

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This paper brings together a systems approach and an academic literacies perspective to offer a response to the problem of how to support professionals enrolled for postgraduate study in the transition to scholarly research practice. While such study presents exciting opportunities for practice-led research, there are a number of challenges for the academic staff member who supervises the research. For becoming a researcher and scholar is more than a process of bridging a gap between the world of work and academia, as these students seek to maintain their professional identities while navigating what is valued in the academy and the power relations in and between contexts.

Recent approaches to research capacity development have shifted away from viewing the transition to scholarly research practice as simply a matter of transferring skills across contexts or as socialization into the valued research conventions. Rather, from an academic literacies perspective, becoming a research scholar means coming to participate in a practice characterized by particular knowledge, tools, values, behaviours, ways of using language, and power relations, some of which is tacit and some of which is explicit. From this perspective, language use such as reading and writing is central to the process of thinking, producing data, and generating new knowledge. Supporting students in this process can present a challenge to academic staff for whom, as experts, the process of doing scholarly research has become tacit. Pressure to increase graduation rates and to reduce time to completion in postgraduate programmes, has placed the role, practice and responsibility of the supervisor in facilitating the development of research practice under increased scrutiny. Many universities have intensified their efforts at supervisor and research training by creating human activity systems with purposes aligned with this goal. At the University of Cape Town where the research reported in this article is located, discipline experts have also taken the initiative to draw on language and literacy experts to support students in research writing development for the research report or dissertation. This contribution of the literacy expert has often been in the form of a course or series of lectures as a service to a programme or group of students.

This paper reports on an example of the systemic collaboration, at the level of a programme, between literacy and discipline experts in the design of a dissertation process. This programme attracts students who are working full time, usually in engineering disciplines and is offered as a block release Systems Practice Masters Programme. The purpose of supervisory practice in this programme is to develop practice-led research drawing on systems theory and practice. The specific aim of the collaboration between discipline and literacy expert is to facilitate the holistic development of the reading and writing practices valued in scholarly research practice.

This design incorporates the integration of activities, modelling and feedback that facilitates interaction between the conventions of the research practice, what the student brings to the practice, and the agency of the student. The systemic approach involves working together at programme level with a clear conceptual framework of academic literacies.

In this paper we present the integrative design as an activity system. We present preliminary findings of our investigation of the development of students' research writing practices and their perceptions of the dissertation preparation process. These findings are based on the analysis of student texts, focus group interviews and reflections on the impact of supervisory practice.

Key words: Academic literacies; dissertation preparation; postgraduate research capacity development; practice-led research; systemic design for learning; systemic collaboration

2882

FIVE ELEMENTS SYSTEMIC HEALTHCARE PROGRAM FOR PHYSICALLY STRONG EMOTIONALLY HAPPY MENTALLY KIND BEHAVIORALLY CHARITABLE AND SPIRITUALLY ENLIGHTENED – REUNITING NATURE AND HUMANITY

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Systemic wishes for the Chinese New Year is the blessing to each other in China in the beginning of each year. According to the Five Aggregate Human Mind system developed by Buddha, our minds are composed of five systems. Systemic Healthcare should be about balancing each one of these systems, and balancing between the systems. The ultimate goal is to live healthily so that we can work and play and achieve our tasks in life. In this paper, we try to classify the Traditional Chinese healthcare therapies according to these five aggregates to help human to become physically strong, emotionally happy, mentally kind, behaviorally charitable, and spiritually enlightened.

The basic essentials in life include clothing, food, housing and transportation. In the Confucian classic, one of the disciples once said “Food and sex are basic instincts of human beings”. The desire for food ensures the physical survival of oneself, and the instinct on sexual desire makes sure the continuation of the family, clan and race. In order to have a stable flow, better basic essentials are required. They are usually related to the following four-character blessing phrases.

These desires stimulate the research into efficient and effective methods for good survival and continuity, and part of the Traditional Chinese Medicine (TCM) Healthcare is about physical body healthcare. Here we will try to match it with the physical component of the Five Aggregate Human Mind System developed by Buddha. TCM healthcare can be divided into three different secret ingredients.

The goal of emotional healthcare is to remain undisturbed by negative emotions thus falling into a vicious cycle. One should instead consistently concentrate on positive emotions, gradually and naturally resulting in the distillation of happy emotions and pleasant bodily sensations.

Mental Healthcare aims to improve one’s habitual love and hate tendencies. We should eliminate feelings of jealousy for the rich and contempt for the poor. One should also forsake employing improper means purely to succeed. Nor should one selfishly seek pleasure at the expense of the feelings of others. In contrast we should develop our love towards the four pure characteristics in the teaching of Buddha, and relinquish the three evil toxic characteristics of human, namely craving, aversion and ignorance. The four pure characteristics can be simply understood as “unconditional love” towards others, mercy on the elderly and weak, sympathetic joy of sharing, and acceptance of the reality of life and human relations.

Behavioral Healthcare is about our action, and we try to match it with the “Action Aggregate” of the Five Aggregate Human Mind system of the teaching of Buddha. Buddha divides the Action Aggregate into three different kinds, namely the bodily action, the verbal action and the mental intention action (brain wave? energy field?). The teachings of Buddha include: “Do not withhold an action because it will only do little good, and do not perform an action because it will only do little evil”. Therefore we should choose only charitable actions with goodwill. Only such actions could achieve the traditional Chinese wish of “Everyone embraced in one harmonious Qi”. The definition of being healthy by the World Health Organization, WHO, includes healthiness in three aspects, namely the physical, mental and “social”.

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. Here we must put our foundation in the fundamental teaching of Buddha in the “Four Nobel Truth”, guided especially by the “Right View” and “Right Thought” in the “Eight-Fold Nobel Path”, which is the fourth part of the Noble Truth.

2883

RETURNING TO NATURE, CO-OPERATIVE IN MIND BY VIABLE SYSTEM MODEL

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In this article, we face climate change and its socio-economic effects, such that, one of the authors implements its research in organizational cibernétcia. a work cooperative constituteson six (6)hectares in Chilean Patagonia, which try to achieve sustainability and ecosystem viability through the implementation of viable system model, undertaking this action research.

Keywords: Social-Economy and cooperativism, Organizational Cybernetics, Economy of Complexity, Complex Adaptive Systems, systems thinking.

2884

“BRINGING FORTH” AN ECOLOGICAL ECONOMY

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This paper looks at the development of Ecological Economic theory through the lens of second-order cybernetics. Ecological Economics aims to integrate Ecological and Economic disciplines while maintaining their distinction. This is required for the concept of “scale” which relates the size of the ecosystem with the size of the economy. Beyond the dynamic and complicated nature of these systems; this task is also conceptually difficult. How can the ecosystem be part of the economy but also distinct from it? How can the

economic system be part of the ecosystem and also distinct? Which is the correct framing? While Ecological Economics was conceived in the era of “open systems” and “sub-systems”, second order systems theory may shed light on the paradoxes which naturally arise from this perspective. As second-order systems theory would suggest, this fundamental paradox of observation results in a circularity. This circularity can be illustrated by attempts within Ecological Economics to generate definitions of sustainability; most notoriously through valuation of ecosystem services but also within alternative social and ecologically based models. This yields a tension between a desire for objectivity and submission to relativity. Thus, authors within the field are calling for clarity regarding ontological and epistemological commitments. Second-order systems theory operates within this territory even if it does so on its own terms.
By embracing this circularity with second-order cybernetics, a few possibilities open up. Primarily, it is my interest that the “organization” of the Ecological Economy be considered; such that the diversity of activities which considered within the domain of Ecological Economics become coordinated. As a student of both Ecological Economics and systems theory, I have been fascinated by the ongoing efforts within Ecological Economics to construct a perspective. This offers a great example of recursive cybernetics with natural tensions between variety and order.

2885
THINKING AND ACTING SYSTEMATICALLY ABOUT THE ANTHROPOCENE
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Living in a globalized society implies that political thinking necessarily extends beyond the national level to encompass our roles as citizens of the world. Living in today’s globalized society also requires a new level of political thinking commensurate with the complexity of its challenges. To overcome the many difficulties facing the planet on which we live, and therefore our very existence, in the Anthropocene era, it has become incumbent on human beings to practice systems thinking. This paper will first attempt to clear the ground by examining how three common approaches to systems theory are unlikely to facilitate a resolution of the Anthropocene crisis. It will then examine how general systemic thinking, critical systems thinking, and whole healing systems thinking can help us both to comprehend the rifts in the earth’s system and to repair them.
Keywords: Anthropocene; global citizen; cosmopolitanism; Earth System; systems theory

2887
A COMMUNICATION SYSTEM FOR SOCIO-ECOLOGICAL PROCESSES
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This article outlines a unified Communication Theory linking cyber-systemic, and cyber-semiotic perspectives. The objective is explaining communication as an emergent system from the interaction process between socio-ecological systems. The emergent communication system seen from a unified perspective is applied as a participative integral transformation process toward the harmonic relationship between human communities and their dynamic social and natural environment. It includes the description of an evolutionary communication process between social and environmental leaders of organizational networks under real conditions. It describes the evolutionary stages of the communication system between different social and environmental leaders who have been working in social organizational networks of Mexico in the last thirty years. The last stage of this emergent communication process among social organizational networks leaders began in 2009, is called: the Ecosystemic Dialogues, it is communication system with qualitative complexity and critical awareness. It is a social laboratory of change under real conditions, through a participative action-research cybernetic process, for a harmonic and sustainable relationship between human and natural systems, through a complex communication dynamic. It is a process toward the sustainable systemic health of the planet.
Keywords: Communication, cyber-semiotic, qualitative complexity, emergent properties, ecosystemic metaphor.

2889

A CATEGORIZATION OF SOCIO-TECHNICAL SYSTEMS APPROACHES BASED ON CONTEXT AND PURPOSE.

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Socio- technical systems are systems where humans interact with technology (hardware or software) towards the achievement of a goal. Because of the presence of the human behavior and the constant change and evolution of technology, such systems are constantly changing and are difficult to define. Various approaches exist to analyze and understand socio-technical systems' behaviors, however many of these approaches analyze socio-technical systems from a certain discipline's weltanschauung, problem context, and purpose of the system. Therefore, the proposed approaches only provide partial definitions that are difficult to generalize. The objective of this research is to provide a categorization of socio-technical systems based on their context and purpose, within the functionalist systems paradigm(s). The resulting categorization will serve as a foundation for a socio-technical systems framework to assist analysis select and/or design the right socio-technical intervention approach based on context and purpose.

Keywords: Socio-Technical systems, Critical Systems Thinking, Problem Context, Methodological Purpose, Systems Thinking

2892

ANALOGICAL REASONING ON CREATION

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People get empirical knowledge through experience. It makes people being available to imagine something and reason several possible-world which could be happened in the future. Here are differences between knowledge by education and knowledge by experience. Empirical knowledge is not for reaching a certain answer what is required at education. This is useful when we need to have multi-answers and making a response to unpredictable objects. To experience world is meant that something interacts with objects and subjects with cognition. This zone could be called 'the field where cognition and act coexist'. Furthermore, if we start to concern relations between cognition and act, the following questions are arisen "how to transfer feeling by body to perception in which is cognition part?" and "how people have utilized those abilities in real world?". I focus on creation process to the above questions. In creation, human would utilize their whole knowledge spontaneously. Thus it is produced by creativity which one of the most important abilities in creation, even though we don't know where is creativity and what is it precisely. In this paper, I argue how analogical reasoning works between cognition and target object. I discuss possible way how this research reaches to enhance creations in creativity way.

2895

COMPLEMENTARIST APPROACH TO CATEGORIZE DIFFERENT STAKEHOLDERS WITHIN SOCIO-TECHNICAL SYSTEMS

Javier Calvo-Amodio, Chinmay Sandeep Narwankar, Elatlassi Rime, Siqi Wang

Socio-technical systems is a systems approach to understanding complex systems when interactions between humans and technology are dominant. Thus, the term socio-technical relates to the relationship between complex human activity systems and the technical infrastructure that governs the nature of the system. Socio-technical systems typically have multiple stakeholders, either in charge of systemic development, governing the system, or being affected (directly or indirectly) by it. Thus, in order to understand a socio-technical system, it is important to understand the different roles the stakeholders have within the system of interest. This research contributes in providing a complementarist and pluralist approach in recognizing the roles of stakeholders within socio-technical systems and categorizing them by introducing a formative taxonomy flexible for any socio-technical system, dependent on its context and purpose. Critical systems thinking and boundary critique are utilized as a foundation for categorizing stakeholders, while the onion model along with soft system methodology are used to delineate the stratified spheres of influence each stakeholder category has on the system. Even though, the obligations vary across the different systems context and purposes, the proposed flexible approach is expected to be beneficial to system thinkers and analysts in realization, recognition and categorization of stakeholders within socio-technical systems.

2898

TRANSNATIONAL KNOWLEDGE: ITS CREATION AND DISTRIBUTION EXPLOITING ENTREPRENEURSHIP AND ORGANISATIONAL BEHAVIOUR

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How can knowledge be created (incentivised) and distributed (shared socially) when it is what economists define as a public good - it is very expensive to produce, its use by any one person leaves no less for anyone else and it is generally difficult to sustain property rights over? In economic terms the marginal cost of distributing knowledge is zero and as marginal cost should equal price for optimality, price should be zero. Clearly if the price were zero there will be no incentive for anyone to produce it. So what is to be done? To charge for it on a per use basis is hard as it can be cheaply and costless transferred from one person to another.

Despite this it is undoubtedly been made available in ever increasing quantities and quality. Universities were one traditional way of creating new knowledge in the public domain. These were supported out of general taxation or endowment and scholars working in them were expected to make their ideas available free to all who might be interested. Modern academic capitalism seeking to establish IPR in academically produced knowledge undermines that. These essence of creative advance in knowledge is that the ideas of all are available to all to do with what they will. If for commercial reasons sharing in this way may be undesirable and if it does not occur then a particular line of inquiry will be blocked of and in the longer term this could kill creativity.

Distribution especially of tacit knowledge is extremely difficult and in some ways is about creating new normative commitment through training and staff development that then impacts on affective and continuous commitment.

In the 21st Century economic value are ever more rooted in knowledge creation and distribution. Distribution occurs both intra and inter-organisationally. Intra-organisationally this is generally through staff training or development programmes. The first moves ideas and the latter people. Inter-organisational transfers are increasingly driven by both informal and formal links between private enterprise and university research.

2900

THRIVE HUMAN BEINGS II: UNLIMITED POWERFUL ENERGY

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"We are gods in human bodies"

Continuing on the line of the previous two abstracts : "Science and Spirituality" and "Thrive Human Beings" (Fabiana Crespo, ISSS conferences 2014 and 2015), where were considered that the human being is composed by mind, body and spirit. And if the human being is aware of the vital energy that can create, redirect and transform, he not only can heal, nourish and empower himself but also can use this energy for his projects and aims. Deeper in this sense, focused this paper on the wisdom that is hidden for most people: "The Alquimia", as it is named in sacred books. Quantum Physics, Physics, Quantum Mechanics, Sacred Geometry, Mathematics, Numerology, Biology, Neuroscience and many other disciplines inter and intra related give us the evidence that we are a kind of "Gods in Human Bodies". That is to say, we are capable to create the same powerful energy to perform whatever we want (miracles as God, for those religious people) within our limited bodies.

Most of us -meanwhile we don't develop our consciousness-, use to think in a local linear way. And Quantum Physics shows that the atoms exists in more than one places. In other words, an atom is spread out all over the place, is only in a particular place if a conscious observer decides to look at it. Quantum Mechanics describes parallel universes, parallel electrons. So, why many of us are using a local linear way to relate ourself instead of a multidimensional one? On the other hand, the rate the world is changing nowadays is exponential because of the new technologies, that have exponential formats: digitalized, in the language of the computers. So, why not "digitalize" human beings multidimensional way of thinking?

Imagine the human being as a computer. Our brain is like a radio, receives and emits electromagnetic waves, as bioelectrical pulse frequency hertz. An EEG -electroencephalogram- can show this. We are like WIFI systems, we can perform wireless transmissions all the time. And instead of being local linear thinkers we can begin thinking in a exponential format. We can think as complex multidimensional holographic entities. And digitalize our related thoughts so as to grow in an exponential way, for human beings.

Like a conscious point within the whole, the human being etheric energy body can behave as an unlimited spherical consciousness dot. Aware of the whole within it. What do you think would be the impact of this exponentials formats to relate the human being with the Universe?

2901
RESILIENCE AND ECOLOGICAL CITIZENSHIP IN SOCIO-ECOLOGICAL SYSTEMS
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As the current discussion of an Anthropocene geological epoch suggests, human planning and intentions have had tremendous effects on the earth's ecosystems. One lesson has been that there must be a positive feedback loop for the proper resiliency in terms of system processes. Just as resilience is needed in the interactions across and within species for an ecosystem to persist over time, it is also a human imperative when faced with crises such as the massive perturbations of the Earth System we now call the Anthropocene. Among the variety of human capacities that the crisis will call upon, perhaps the most crucial is spiritual recovery. Resilience and sustainability of ecosystems will be possible only through spiritual enlightenment building on the open-minded attitude of individuals around the globe.
Keywords: Ecological Citizenship, optimal resilience, cultivating spirituality

2902
ON THE DOMESTICATED BODIES OF NORTH KOREAN RESIDENTS
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North Koreans' social ecological resilience may be recovered by removing their vulnerability and facilitating their adaptability to a changing environment. North Koreans must improve their social relationships with inner or outer environments. Idolatrous social relations have enslaved the bodies of the inhabitants of North Korea. Only changes in the ruling ideology will enable the North Koreans to heal and transform their bodies in a social ecological recovery.
Keywords: philosophy of the body, social ecological resilience, North Koreans

2918
THE NEED FOR A GENERAL SYSTEMS TRANSDISCIPLINARITY TO SOLVE SERIOUS SYSTEMIC CHALLENGES FACING PRESENT-DAY SOCIO-ECOLOGICAL AND SOCIO-TECHNOLOGICAL SYSTEMS
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Based on the concrete request of the European Commission (EC) for Mobility and Transport to support the cabinet in political decision processes as Special Advisor the author will elaborate in his contribution the need for and potential advantages of a General Systems Transdisciplinarity to solve serious systemic challenges facing one particular socio-ecological and socio-technological system. The EC for Mobility and Transport has announced its political agenda "A roadmap to a single European Transport Area towards a competitive and resource-efficient transport system" in 2011 and set the goals to foster further economic growth and job creation while anticipating resource and environmental constraints, e.g. drastically reduce world greenhouse gas (GHG) emissions, with the goal of limiting climate change, supporting the development of innovative sustainable transport systems. Growing transport and supporting mobility while reaching the 60 % emission reduction target seems to be contradictory. But the EC strongly assumes that through optimising the performance of multimodal logistic chains, including by making greater use of more energy-efficient modes and through increasing the efficiency of transport and of infrastructure use with information systems and market-based incentives the systemic challenge can be unravelled. As this endeavour addresses multiple layers, multi-stakeholder, and cross-sectoral systems the EC called for a solid systems model to support and guide their political decisions and actions.
Large scale technological and social behavioural changes are needed resulting in technological and social innovations. The EC takes on the responsibility of an active enabler of the emergent opportunities in the

transport system through legislation and investments. Thus understanding the system and its emergent properties becomes a key success factor.
The layers of the European transport eco system have been identified as Transport Infrastructure, Data, Applications, Service and Solutions, and Value Networks. But these layers are embedded in multi- and cross sectoral systems like the current inter-dependent political systems, economic systems, technological systems, environmental systems, social systems and cultural systems.
Each of the systems can be addressed, analysed and through interventions possibly designed with different systems approaches, but we are today lacking the integration of these disciplinary grounded methodologies stemming out of and representing different schools of systems science in a sound transdisciplinary general systemology, bridging and enriching the disciplines like e.g. engineering, design, economics, and social sciences. The author assumes that through such real life complex challenges a most needed General Systems Transdisciplinarity can be put forward. The contribution is just one starting point, but a call for interested academic allies to co-create appropriate approaches to inform the development of a General Systems Transdisciplinarity for Discovery, Insight, and Innovation.

2920
MAPPING THE MACRO-LEVEL FOR INTERDISCIPLINARY DECISION MAKING - A VISUAL FRAMEWORK AND METHOD
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Universities are organized into disciplines, but most real world problems are interdisciplinary. Holistic conceptual models could help to overcome this fragmentation in our thinking and allow a more multi-perspective view of issues. When analyzing complex problems in business or politics, there are a wide range of micro- and macro-economic factors involved. One of the most often used concepts in business literature is the so called PESTEL framework (Political, Economic, Social, Technological, Environmental, Legal) – some variations on this are PEST and PESTLE. The PESTEL framework is used for environmental scanning of risks and trends in strategic management. Despite its worldwide distribution there are known to be a couple of flaws with this framework. The selection of categories is questionable; the categories are often discussed in separate boxes and important interconnections between variables are lost. What is needed is a more systemic approach that does not cut complex issues into fragmented pieces but provides a more coherent picture. However it must still be easy and efficient to use in business practice.
The goal of this current project is to build on the tradition of PESTEL but also to suggest some adjustments that would lift the concept up to new levels of analysis, application and visual representation. The new framework is the result of a cross-comparison of several dozen category frameworks used in business, politics and sustainability. The criteria for the development process and present version were a well-balanced selection of categories, practically useful for team work in the business context and beyond, and providing a better representation of important interconnections. The result is establishing a bridge between the PESTEL tradition and systems methods such as causal loop diagrams and thus allowing a more holistic view of complex issues. It allows visualizing global risks, megatrends or other topics of interest on the global or local level.
Keywords: Problem solving, management, strategy, decision making, sustainable development, visualization, causal loop diagram, interdisciplinary, transdisciplinarity

2921
DEVELOPING A THEORY OF SYSTEMS CHANGE APPROACH TO PRACTICE-BASED RESEARCH IN A PROFESSIONAL PUBLIC HEALTH DOCTORAL PROGRAM
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At the University of Illinois at Chicago School of Public Health, we are developing a distance learning doctoral program in public health (DrPH) focusing on adaptive leadership. Students complete dissertations, some explicitly using action research models, but all in support of the overarching program goal of developing practice based evidence for guiding systemic change. Core principles and skills embedded in our curriculum include systems thinking and systematic reflection. Dissertation research begins with building a problem statement for a “wicked” problem the student wishes to address, with associated initial action relevant broad research questions (how do we solve this problem?). We have required students to articulate their assumptions about what the problem is or might be and critically consider alternative ways of framing their problem statements, and have drawn from soft systems, systems dynamics, and Bob Williams’ syntheses of these and other systems traditions in doing so. As a next step, we require students to develop a conceptual framework and a visual representation of it that draws both from scholarly literature and from

reflection on their practice experience. Identifying alternative ways of stating the problem does itself open up the exploration of more possibilities for solutions. Since, however, the ultimate goal of student scholarship is to contribute to solving a problem, not just stating it, developing the conceptual framework or model often involves describing a current state of affairs, selecting and specifying constructs or dimensions relevant to a description of this current state, as well as envisaging a more desirable future state and a pathway(s) to get to the future state from the current state. So there is a "theory of change," or assumptions about what gets included in a description of the system, and how to get from point A to point B, that is at least implicit in the student's model or conceptual framework, which we want to see made explicit. Furthermore, students need to develop, and operationalize (be able to apply to data collection and analysis) specific research questions investigating those pathways for change and/or refining the description of the current state. Thus far, not surprisingly, the results of research often include a re- or amended conceptualization of the model with which the student started, which can become the basis for action recommendations for change. In the more participatory action research options taken by some of the students, the student researcher is an active agent in those pathways for change, for instance acting as a developmental evaluator or facilitating community of practice discussions.
In a "theory of change" approach one of the sources we draw from is evaluation methodology: evaluators from the Aspen Institute used the term in the 1990's to discuss a participatory approach to evaluation that directed evaluators to facilitate discussions among stakeholders about what assumptions about how change happens they were bringing to a given intervention and, ideally, come to some consensus about this before finalizing a logic model for the intervention and relevant indicators. This has been further developed in evaluation circles via increasing critical attention paid to program logic and theory and intervention models. Another, more research-based approach to developing 'theories of change,' however, has to do with comparing the received ideas of the students as public health practitioners with what is supported in systems and social science literature. We would like to discuss with ISSS colleagues the implications of taking a "theory of change" approach to the development of conceptual frameworks and associated research questions as applied to the "wicked problems" our students select, and to that end will present some examples from our recent work with students.

2922
THE GENERAL THEORY OF METADYNAMICS SYSTEMICITY
PART 7: PERCEPTION AND SENSE GIVEN
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The theory of Systemicity emerged from applying the principles of "The Bioethism Transdisciplinary Paradigm" to "Universal systems" and "Living systems" during their temporal survival", which the author J.-J. Blanc has developed since 1996. "Systemicity" surge from interrelations, intricacy2 … and a permanent interdependency of synergetic things. The systemicity of atomic and molecular cycles has made and goes on sustaining both cosmic systems and Life on planet Earth. In order to exist, cosmic objects and living creatures cope with environmental changing events, replicate and evolve within global, glocal and local areas, while permanently confronted with changes both at endogenous and external environmental ecosystems' milieus.
As a reminder, the author's past proceedings developed, part after part since 2004, are meant to show the structure and chapters of a "General Theory of X-dynamics Systemicity." One will observe that the building-blocks of the theory are being centered on the Universe dynamics diversity, such as peta3, teradynamics, gigadynamics', metadynamics', dynamics' and microdynamics' inducing results to a systemic feedback symbiosis named "Systemicity". The publication of the Systemicity theory is meant to support the acquisition of a wide transdisciplinary understanding of the x-dynamics' which systemicity sustains the whole evolution of the Universe ecosystem's components as well as those of the livings. While systems natural structure and behaviors are adapting with their milieu by "neighboring" within "neighborhoods" (ecosystems), they specifically cope with endogenous and exogenous events that induce the temporal retroactivity to result as structuring things.
The Universe dynamics and Cosmo-planetary Metadynamics's systemicity have participated in the Sun and its planets to form, and particularly Earth orbiting around it on a right "habitable green zone." The General Theory shows the close links between cosmo-planetary and terrestrial x-dynamic systemicity, its strength, fluxes and moves cycles that made Life to have happened and thriven. Life emerged from the apparition of proto-organisms which, evolving, drove humans to develop, as forged with their individuality, social traits

[2] - **Intricacy:** the quality or state of being complex or having many parts : the quality or state of being intricate
[3] - **Petadynamics:** in physics, multipliers are defined in powers of 10 from 10^{-24} to 10^{24}, proceeding in increments of three orders of magnitude (10^3 or 1,000).

and behavioral statuses that have accounted for the species biodiversity developing, evolving or getting extinct over billions of years.
For example, when the Earth became a "snowball" from a nearly total glaciation (-600 Mo/y), the survival of some bacteria and micro-organisms escaping the drastic extinction of most species, conversely boosted up an extraordinary explosion of marine species bearing quite new functions (- 545 Mo/y), that after volcanism reheated the planet from the systemicity of interrelated terrestrial and cosmic metadynamics.
These giga and metadynamics are the main physicochemical drivers of the universal X-dynamics sets that are atomic, cosmic, galactic, stellar, planetary and terrestrial which as feedback processes, participate in forming matter and cosmic objects (nebulae, baby stars, stars and planets), within a molecular world originated from after the “Big Bang”.
The neighboring of sub-atoms, atoms, matters and gas, within a set of synergetic retroactivity results, promote dynamics (forces and fluxes) which systemicity permanently goes to specific directions in the 4D environment of the Universe. Life is a whole set of “neighboring” ecosystems, which components are confronted with gravitation, electromagnetism, chemical and physical phenomena …, particularly with temperature, water and the “thermodynamics of entropy lethal effect”. They are all being forces and fluxes which are driving the structure and behavior diversity of objects, species and things up within their systemic neighborhood and their intricate concomitance, in other words, integrating facts existing or occurring with or by something else.
Furthermore, ecosystem neighborhoods (ecosystems) are confronted with the terrestrial x-dynamics cycles of water, minerals, and climate statuses which currents and physical effects permanently drive up their metabolism. Among drivers are the coalescence, conjunction, co-evolution, convergence, symbiosis, percolation, phase transition and threshold outputs that together comply with adaptations to neighborhood components varieties and temporal sustainability. At each step, perception means (chemical, biological, physiological, social…) are transducing a sense given from a variety of signals both endogenous and exogenous.
To convert energy from one form into another will infer from the level of survival need components. Then feedback driving the universal atomic, molecular and physicochemical worlds is permanently provoking a change and evolution among the several x-dynamics systemicity cycles containing signals.
The specific bonds and traits in the structures and behaviors of “living creatures” as well as in their evolution trends reveal the survival quality of their neighboring knowledge towards actions-reactions (drivers) events.
The treatment of ago-antagonistic signals and stimuli emerging from their ecosystems and socio-systemic metabolism and environmental conditions are of a major priority surviving. The confrontation between bodies and entities, their milieu components and the natural environment necessitates treating signals and information which perception is adequately setting with the fundamentals of “survival dynamics” and “drivers” like “symbiosis” and “feedback” according to the sense given over to sustaining. Processing stimuli and signals is an adaptation of trends participating with the metabolic dynamic balance pertaining with both internal and external changing conditions as to cope with survival needs.
Part 5 of this theory (2010) only describes some drivers: symbiosis, coalescence, convergence and synergy, percolation, phase transitions, threshold output, feedback … that permanently influence the systemicity of cosmic and terrestrial matter, objects and things interacting among
the universal networks of the 4D worlds. Feedback driving the survival metadynamics systemicity sustains “the atomic and molecular cycles from cradle to grave.”
Part 6 of this theory (2015) is describing some of the effects of neighboring between individuals and ecosystems which, among and living species, characterize their apparition, their adaptation and evolution as well as the causes of their extinction. Both are a matter of balance.
Part 7 of this theory, here in 2016, is developing what is perception between objects, entities and other things as driving entities and neighbor’s coexistence the way they are giving sense to sense. Consequently, one observes these dynamics are having a general systemicity from the convergence of symbiotic and retroactive phenomena and their signals.
Keywords: neighboring, x-dynamics, systemicity, symbiosis, metabolism, synergy, convergence, coalescence, feedback, survival drivers, entropy, plants, ecosystems, perception, sense given, e-psops4, known, unknown.

2927

ANALYSIS OF GLOBAL QUALITY INDICATORS IN THE NATIONAL POLYTECHNIC INSTITUTE, MEXICO.

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[4] - E-psops: a contraction of “environmental-psychosomatophsychism”, a new concept developed by J-J. Blanc (2004)

The public education of quality can mitigate educational differences between rich and poor families, according the report of United Nations about Human Development in 2014. The Human Development Index (HDI) is an index that measures the achievements of a country in three basic dimensions of human development: 1) A long and healthy Life, 2) Access to education and knowledge and 3) Dignified standard of life.
The same report states that primary and secondary education worldwide remains at acceptable progress but in higher education levels there are large gaps between developed countries and those it in developing.
Derived of policy national and institutional in education of Mexico, quality indicators involve various parameters within which highlighted, approval rating, the reproof rate and the desertion rate; although these rates are not the best way to measure the quality that exists in the process of educational training.
It has been observed that ethics and responsibility of all stakeholders in the education system of this level have an influence unfavorably on the values presented by the mentioned parameters.
This research attempts to find relation between educational performance and the behavior of the actors involved in the educational system; employing, a systemic methodology that allows us to evaluate the problem and contributing to the resolution of a holistically.
Keywords: Quality indicators, Educational Performance, Ethics, Responsibility.

2953

THE FUTURE OF SCIENTIFIC PROBING AND SOCIAL BEING: QUANTUM COMPUTATION, ARTIFICIAL INTELLIGENCE, AND CONSCIOUSNESS

Mila Popovich

Assessing the state of the art advances in scientific research and the state of the affairs in our social life, this paper evaluates and forecasts the course of the future human development. In particular, it addresses both sides of our polarized responses to the progress of artificial intelligence and transhumanism - the celebratory excitement, on the one side, and the anxiety-infused doom pronouncement, on the other - and it searches for an outlook that would go beyond both.
I begin by referring to the joint work of Roger Penrose, mathematical physicist, and Stuart Hameroff, anesthesiologist and consciousness researcher, on the relatedness of the quantum physics processes and human consciousness processes. Proposing the notion of quantum gravity, Penrose developed with Hameroff a model of how quantum computation can occur at the sub-neural scale of our brains.
Preoccupied with the issues of the high level of computational complexity and the non-computable, they maintain that the brain is performing quantum computation and that consciousness is a quantum process in the time/space geometry. Consciousness is defined by them as a self-organizing process at the fundamental level of the Universe, which is characterized by the principle of non-locality according to which everything is connected to everything else.
The notion of interconnectedness does not only preoccupy these fields of research but also deeply affects and increasingly manifests in the expansion of our social lives. Our times are marked by the parallel advances in what Jean-Luc Nancy, one of the most renowned philosophers of our time, calls the Copernican revolution of Social Being. Paradoxically, the revolution in social consciousness and social being simultaneously questions the potentially detrimental effects of scientific research and is also informed by the finding of such research that alerts us to the laws on non-locality and entanglement on the deepest lever of our bio-chemistry. On that level, theoretical physics, quantum mechanics, neuroscience, and consciousness studies demonstrate that advances in scientific probing and revolution in social being are interrelated developments.
When it comes to the matter of artificial intelligence and deeper probing into human consciousness and biomaterial, Penrose and Hameroff point out the difference between intelligence and consciousness, consisting of qualia (uniquely subjective way of experiencing life) and capacity for emotions (a nuanced emotional range of our inner life). Consequently, increasing computational complexity might mean taking artificial intelligence to the brink of consciousness. And yet, from AI there will always remain an irreducible difference, distance, and deferral to consciousness. As I examine the question and problematic of clones and qualia; prosthetic bodies and artificial minds, I evaluate what we have charted for our future course. As we push the frontier of exploration and forward into the ever-receding horizon of inquiry, we are poised to evolve and transition into a society lead by collaborative work between consciousness experts and scientific visionaries who are themselves interdisciplinary boundary benders; a society which is engendering an increasingly spiritualized science and scientifically supported spirituality.

2965

A ‘GLOBAL SUSTAINABILITY ARCHITECTURE’ TOWARDS A SUSTAINABLE FUTURE

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Sustainability is the need of the time. There has been long standing debates and discussions worldwide on the need for sustainability

everywhere and every time a critical aspect seems to be missing in such discussions and deliberations and that it does not consider 'people' or 'human being' in its full or 'total' concept. In other words, only touching the human side in a shallower way may not yield the results of sustainability in a sustained way. We thus need a 'Global Sustainability Architecture' that touches not only the human side of the human; also the spiritual and moral side of the human; without overlooking the means needed for the material development. Thus, the 'Global Sustainability Architecture' comprises or subsumes the 'total human' idea considering all its dimension namely human, spiritual, material and moral; as illustrated in the figure below.
In the proposed 'Global Sustainability Architecture', embracing all the presented dimensions, one can reimagine sustainability and thus shape a sustainable future for the mankind "transcending from self-to-surrounding in thinking, feeling and doing". In other words, reimagining sustainability and shaping a sustainable future entails going beyond our empirical self (pure consciousness plus body and mind) to total self (empirical self plus family, society, culture and nature at large) for realizing sustainability and a sustained future.
As described in the figure, to really have a sustainable and 'circular' economy, to achieve sustainable growth and development and above all to realize 'a sustainable future'; it is important and instructive to have an architectural and on the issues therein; be it starting from the proposition of 'limits to growth' in the 1970s to Brundtland's 'our common future' and the subsequent 'Earth summit' and series of other apex level meetings and conferences (including ISSS conferences); also discussions on 'Anthropocene' and what cultural theorist Michiel Schwarz and the designer Joost Elffers term 'Sustainism'. However, it would be really difficult to shape a sustainable future in a sustained way unless our endeavors touch the 'human being' in its totality. It has been observed that thinking and that is why the present work proffers a 'Global Sustainability Architecture'. The mainstay of the Global Sustainability Architecture is its emphasis on the people being placed at the center stage of the architecture; people in all its dimensions; as a 'full or complete or total concept'.

To sum up, we are living in a world that is locally vibrant, globally digital and increasingly networked. In this world, we need a 'Global Sustainability Architecture' for realizing sustainable future. The successful design and implementation of the 'Global Sustainability Architecture' calls for all the four dimensions of 'human, spiritual, material and moral' being harnessed simultaneously entailing respect for the earth and nature and all living realizing their ethical, social and environmental responsibilities to live and let live.

2966
ENGAGING PARTNERSHIP TO IMPROVE CORPORATE SOCIAL RESPONSIBILITY IN DEVELOPING COUNTRIES
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The CSR concept as it exists does not capture the essence of the kind of partnership required by CSR in developing countries to make the needed impact. In the bid to make CSR more beneficial in addressing developing country needs, partnership among stakeholders has been advocated as the panacea for CSR. In an attempt to develop a suitable CSR partnership for developing countries therefore, the study analyzed some NGO/corporate partnerships and community/corporate partnerships currently being used for CSR delivery in Ghana. Benefits of the NGO/corporate partnership include the availability of expertise and funds

for CSR projects while the community/corporate partnerships benefit from the close interaction between the key stakeholders and targeted funding from the MNCs. The major drawback of both partnerships is their inability to engage in CSR from a systems perspective thus excluding some key stakeholders, particularly the communities. The government of Ghana which is in a pivotal position for development has no clear polices regarding CSR implementation and rather plays an indirect role in facilitating CSR by granting licenses and approvals for development projects.
While NGO/corporate partnership and community/corporate partnerships met some CSR needs they were not effective in delivering the CSR that Ghana and developing countries require. I therefore posit the community corporate partnership responsibility (CCPR), a three stage concept that recognizes the key role of partnership among stakeholders for meaningful and mutually beneficial outcomes. The CCPR process involves community pre-entry processes, community engagement processes, and the CSR implementation processes and activities.
Keywords: Corporate Social Responsibility; Partnership; Systems; Developing Countries; NGO/Corporate Partnerships; Community/Corporate Partnerships

2735

DESIGNING DIGITAL SERVICES: UNIFYING INFORMATION SYSTEMS DESIGN AND SERVICE SYSTEMS DESIGN

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Globally, information systems are gaining prominence and their proliferation has been substantial considering the rate of adoption by the masses. Information systems facilitate design of solutions that are useful, usable, desirable, efficient, effective and different. People, technologies, and processes are brought together to address a problem by conceiving a solution that creates value for users. As a result, the world at large is witnessing a massive pace of digitization wherein businesses and governments are adopting different forms of information systems to connect to their customers in order to bring in a difference. As a result, increasingly the term “Digital” has been utilize to characterize such information systems. Digital is far more pervasive now than it was previously and its mass adoption has enabled information generation and application in diverse areas. However, digital by itself is not beneficial to anyone. Only when Digital enables a sector/domain, it becomes useful.

Businesses have realized the importance of digital as a differentiator in customer engagements so as to stay competitive and relevant in their respective areas of business. They have also realized that digital has transformed social interactions, customer relationships, as well as reshaped the ability to access and leverage information. They have experienced that business decisions are no longer based on opinions but on verifiable data. To cope with this, businesses deal with interconnected, global systems that interact with multiple role players across multiple geographies, addressing multiple concerns of stakeholders across multiple disciplines by utilizing emerging technologies in a dynamic and challenging environment while providing near real time response and rich customer experience.

Over the last few decades, product companies who were traditionally involved in creating digital solutions have moved into service businesses as the market for their core product has reached maturity. This is further prompted by the change in employment patterns, job opportunities, contribution to GDP and reduction in product sales and license fees. However, such companies need ways and means for improving and standardizing their services as the reputation for the quality of their services is generally poor affecting their customer’s loyalty and brand image. Since digital has standardized quality in other domains, it is obvious that digital can provide key advantages to these companies by improving quality of their services. In this discussion, such digitally enhanced/enabled services are considered as digital services.

Digital service is an integration of people, processes, infrastructure and digital technologies, which are independent and operable, and which are networked together for a period of time to deliver a service for the benefit of another entity or the entity itself in real world. The formation of the digital service is not a permanent phenomenon but rather a necessity for integrating and networking the different components to achieve the desired quality levels for the service. The digital service emerges from a combination of the constituent elements (people, processes, infrastructure, and digital technologies), the interactions between themselves and their interactions with the customer’s environment. While delivering digital services, businesses need to deal with interconnected, global systems, interact with collection of related services, multiple geographies, multiple stakeholders with differing concerns, multiple disciplines, emerging technologies, dynamic and challenging environment, interconnectivity and variety, near real time response and rich customer experience.

Digital services design aims at synthesizing services that are useful, usable and desirable from the consumer perspective, and efficient, effective and different from the provider perspective. It brings together people, skills, technology, methods and tools to address change and create value for customers. It involves solving multiple problems across multiple disciplines. It is iterative and requires participation of several stakeholders’ along with relevant domain experts. Existing service design methodologies are implicitly software/product design methodologies and they require tweaking to be applied in a servicing situation. Applying the same mind-set to designing a service as to the design of product/software will lead to solutions that are possibly not appropriate to the servicing scenario. Services cannot be treated in the same way that software are treated and it is necessary to have a different perspective for designing services.

Currently, while numerous architectural frameworks and service design approaches as well as numerous digitization case-studies exist, a unified systematic approach for designing digital services does not exist. In this workshop, the foundational concepts and the underlying processes for an approach to design digital services is presented.

Keywords – Information Systems, Services, Digital Solutions, Digital Services, Architecting Digital Services, Transforming Digital Solutions, Enabling Services

2738

DEVELOPING CAPABILITY USING A MATURITY PROFILE FOR ACTION RESEARCH: AN INTERNATIONAL COLLABORATION

Background: Borne of the practical turn in social science epistemology, action research typically espouses claims of personal, team, organizational, and community improvement/ transformation. It is also widely promoted as an effective framework of empowerment and emancipation to improve a social situation or condition (Reason & Bradbury, 2008; Stringer, 2007): an intent which appeals to leaders wishing to create improvement, particularly in low socio-economic and disadvantaged communities (Sankaran 2016). Validity of such espousals has been substantially unexplored, and where evaluations have occurred they have been focused more on process than impact. A group of international researchers are engaged in an evaluative study of over 100 action research initiatives (ESAR study) using a variety of methods, tools and conceptual frameworks. The Maturity Model is one of the conceptual frameworks adopted in the ESAR study.

Maturity models have their origins in the Capability Maturity Model (CMM) developed through research to address the poor performance of software projects delivered to the US department of defence in the 1980's. The purpose of the CMM model was to help contractors increase capability to improve their software engineering processes from an ad-hoc state to more formal and repeatable state and eventually to optimise the processes to be able to deliver consistent outcomes. Maturity models have found their way into many other organisational contexts such as project management, knowledge management, process management, research capability and even for information systems action research project management.

A typical maturity model consists of a sequence of levels that form a path to follow to move from an initial to an advance stage of maturity. These models help organisations to evaluate their current level of maturity of a process and set goals to move towards a higher maturity level. While maturity models often use 'business speak' in their definition and terms used to describe levels of maturity the authors feel that they can be made palatable and useful to action researchers to improve the ways in which they can manage their projects to deliver sustainable outcomes. This resulted in the development of the maturity profile.

The international ESAR research team have developed a framework of process and outcome indicators to represent stages of implementation and accomplishment for AR initiatives. Data from pilot case studies were used to develop a maturity profile for AR initiatives, representing levels of maturity and evaluative outcomes at different stages of a project. A questionnaire has also been developed for key attributes of a maturity profile that will be used at the proposed workshop to be validated and trialled by action researchers.
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The proposed workshop will be conducted using a 'World Café' format with the following schedule (Overall 90 minutes)

Welcome and Introductions (10 minutes)
Welcome to the workshop –
Key Question to discuss today
Introduction of the facilitators
Allocation of participants to tables
Introduction to the process – (5 minutes)
World Café Rounds (50 minutes)
Break (10 minutes)
Prioritization (15 minutes)
Close

The results from this workshop will be compared with similar workshop s that were held at the ALARA World Congress held in Pretoria in November 2015 and a workshop proposed at the next ALARA World Congress being held in November 2016 held in Adelaide.

The data from the three workshops will be analyzed and submitted as a journal paper by the authors in Systemic Practice and Action Research.

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2783

WILD: WILDERNESS INTEGRATION & LIFE DEVELOPMENT. CO-CREATING THE EMERGING MODEL

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This workshop will expand upon the content and ideas provided in the earlier session: Outdoor Adolescent Rites of Passages: Theoretical Foundations, Contemporary Shortcomings, and the Emerging New Model. Participants will be engaged by exploring personal connections to the outdoors and meaningful experiences they have had in the wilderness. A practical and working model of a community-based outdoor youth engagement initiative will then be presented. Participants will be asked to contribute to the development of this model through critical feedback, generative dialogue, and human-centered design. Participants will leave the workshop with a deeper understanding of how outdoor rites of passage can be offered in any community, as well as having contributed to the development of a practical initiative in Colorado.

2784

NETWORK THINKING AND LIBERATING PRACTICE FOR CREATING RESILIENT, DIVERSE, COMMUNITIES OF PRACTICE THAT ENGAGE THE WHOLE PERSON

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The workshop develops a network thinking lens then builds inter-organizational networking capacity with participants using Network Weaving principles and processes (Holley, 2010). Participants interact using Liberating Structures (Lipmanowicz & McCandless, 2014) to build relationships in the session and unleash collective intelligence to form inclusive networks of diverse stakeholders. An exercise makes the group's structure visible first on butcher paper and then modeled in a free on-line network mapping tool (Kumu). An appreciation of the power of network thinking is developed. Techniques for building action-oriented, intentional, relationship-rich, and supportive networks can be applied to participant's respective domain practices. Facilitated structures that achieve surprisingly good group engagement are easily adopted upon returning to participant home organizations. And we have fun!

This highly participatory workshop addresses the challenge of sustainability in human collectives working for change together by harnessing their diversity through intentional and systematic relationship building. It uses information technology to make relationship structure visible (Kumu). It uses a "social technology of discourse" (Liberating Structures) to engage the active intelligence and diversity of every participant to build a social structure (Community of Practice) that can affect change through harnessing and coordinating their common intention.

Participants learn and take away:

A network thinking lens

Use a network thinking lens to engage differently in organizations

Use Network Weaving principles to begin to build out intentional networks for action

Holley, J. (2012). Network weaver handbook: A guide to transformational networks. Network Weaver Publishing

Learn the Liberating Structure called "1-2-4-all" to enhance the generative potential of any meeting

Learn the Liberating Structure "Social Network Webbing" so face-to-face groups visualize their networks

Capture the value diversity brings through full participation; encourage every voice

Lipmanowicz, H., & McCandless, K. (2014). The surprising power of liberating structures: Simple rules to unleash a culture of innovation.

Connect with people doing similar work, create Communities of Practice

Use Kumu to capture and model those relationships

Get support from like-minded network builders in the session when we return to our practices

https://kumu.io

Participants discuss how and why building intentional networks based on strong, supportive relationships result in action. We'll demonstrate Network Weaving concepts and methods applied to organizational networks. We'll make networks visible by actually capturing and modeling the network of participants. Using Liberating Structures that hold both the individual and collective in the session enables participants to try them in their practices. Participants leave with new perspectives, increased skills in facilitating conversations, and accessible demonstrations of simple tools that support ongoing organizing.

The session is a micro-iteration of a participatory action research cycle. By observing, thinking, acting, and reflecting, the participants move together through cognitive and behavioral transformation about network thinking. The session uses a series of generative and participatory interactions (Liberating Structures) to engage people to learn and build a Community of Practice (CoP) for thinking from a network perspective and for building effective networks. The community structure is modeled in a tool (Kumu) that will allow participants to easily access each other after the session and use the tool to model their own native relationship and intentional networks.

Impact? Effective large-scale collaborative relationship building and network thinking can be part of sustaining structures of intention and agency. Networks can address the challenge of systemic power imbalance; encourage peer relationships, valuing everyone's unique contribution. Network thinking can empower everyone to step into leadership roles. Networks reach across a diversity of stakeholders drawing them near to each other in adaptive interaction. Promoting network thinking in a group of passionate change practitioners can lead to changes at scale.

2849

INTRODUCTION TO SPIRAL DYNAMICS INTEGRAL

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This introductory workshop will teach you the fundamentals of the Spiral Dynamics integral (SDi) theory as developed by Dr. Don Beck. We can go as deep as the class wishes to go, and I will frame the conversation through the lens of SDi. We will balance learning through various styles (teaching, dialogue, a/v) and you will come away with an appreciation of the beauty as well as complexity of the model.
Ben Levi has taught certified Level 1 and 2 courses with Dr. Beck for seven years, and has studied SDi and integral theory for sixteen years.

2865

SYSTEMS BASICS IN UNDERSTANDING SYSTEM WHOLENESS "REUNITING NATURE AND HUMANITY": THE ORIENTAL SYSTEMS THINKING IN THE TEACHING OF BUDDHA.

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Wholeness could be explained from an oriental point of view, but in the end it seems to coincide with modern western systems thinking. It starts from the concentration on the parts in Reductionistic thinking, to the concentration on wholeness in Systems thinking. The second step involved the combination of the observer and decision maker with the teaching of Buddha. Finally last step would be to investigate the structure of the environment.
The application of system theory requires the understanding of ourselves, each other, the nature, the past and future possibilities in a systemic way. That is, we need to understand both the structure and dynamics of our physical body systems, and of our mental observers. Research shows that the composition of our body and that of our mind may be explained by the same system theory relating energy, matter, life and information. We employed this simple ancient system theory as taught by Buddha to investigate how our naturally systemic-structured mind artificially developed all this non-systemic and problematic thinkings. We use our body to experience the world around us but our mind is the one who is observing and making the decisions to change the world. System theory sees the world composed of observers,decision makers, systems, the environment, the boundaries and the relationships among them. And there are two opposite forces in the world that constantly interacting with each other, creating the flow of energy, matter and information between systems and the environment. On one hand we have the disorder force governed by the second law of thermodynamics that drive everything into a equilibrium state with maximum entropy. On the other hand we have the organizational force governed by the constrains of a system that drive the system into a particular desired steady state with a low entropy.
Our mind is both the observer and the decision maker with a major problem. 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. In this workshop 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.
Death is the end of our lives or just the beginning of another new life? A system undergoes a transition of system state upon death, but will the system continue in other forms at other places? Or will it just terminate totally? What are the possible new system states and are they sustainable? In this workshop we will investigate the sustainability of Heaven, Hell, Earth and Nibbana (null). And we investigate the way to prepare ourselves to transit into these states.
Keywords: Reuniting Nature and Humanity, Heaven and Hell, Nibbana(Null), Life and Death, happiness and harmony, purification of our mind, Vipassana mental healthcare, Buddha, organizational force, entropy, second law of thermodynamics, energy matter life and information, ourselves, Spirituality systems
Supporting Agencies: Ancient Balance Medicine Research and Education Fund Foundation Ltd.

2866

SYSTEMS BASICS IN UNDERSTANDING SYSTEM WHOLENESS “REUNITING NATURE AND HUMANITY”: THE ORIENTAL SYSTEMS THINKING IN TRADITIONAL CHINESE MEDICINE 系統論基礎工作坊之二：中醫藥學的東方系統思維 - 以天人合一理解系統完整性

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The systemic thinking of the unification of nature and man 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. The traditional Chinese system theories under investigation include the Taichi yin-yang system theory, the Five systems theory of the human mind, and the Traditional Chinese Medicine differential diagnosis-cure process. These theories are found to be related to different modern system theories compared including Viable system model.

Taichi yin-yang system theory describes the relationship between any two entities (element/process) at any level of interest. It concerns the quantitative and qualitative changes between the entities. This is related to causal loop diagram (CLD) in system dynamics which uses reinforcing loop and balancing loop. The observer is not specified in the theories, but the perspectives of the observer actually determine the entities, the unit of quantitative changes, and the ratio of qualitative changes.

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

The Traditional Chinese Medicine differential diagnosis-cure process is a practical systemic process that has been used daily for more than 2000 years. It is believed that the whole macroscopic-microscopic spectrum of systems 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.

Keywords: Reuniting Nature and Humanity, Buddhism, Causal loop diagram CLD, Confucianism, Five systems of human mind, General System Theory, Health and system thinking, quantitative and qualitative changes, Spirituality and Systems, System dynamics, Taichi Yin-Yang System Theory, Taoism, Buddha's teaching, Traditional Chinese Medicine differential diagnosis-cure process, Unification of nature and man, Viable system model VSM. |
Supporting Agencies: Ancient Balance Medicine Research and Education Fund Foundation Ltd.

2880

PROSPECTS FOR A NEW SYSTEMIC SYNTHESIS (DISCUSSION)

Panel:
David Rousseau (Chair); Bill Schindel; Lenard Troncale; John Kineman; Jennifer Wilby

In a plenary session before lunch, five experts in different aspects of Systems Science (philosophy, engineering, science, theoretical exploration, methodology) reported on their current work and presented their views on the prospects of a new synthesis that could establish Systemology as a mainstream academic presence. In this break-out session they will answer audience questions about their work and their views, and discuss opportunities and challenges for the maturation and establishment of Systemology is a discipline. All conference attendees are invited to join in this wide-ranging discussion about the prospects and future of Systems Science.

2886

2016 SYSTEMS RESEARCH TEAM

Chair: Mary Edson

This workshop will further develop the initiatives of the Systems Research Team (SRT), which met for the second time at the 2016 IFSR Conversation in Linz, Austria. This workshop furthers the development of the SRT’s work by integrating the 2014 and 2016 teams into a collaborative cohort of researchers, scholars and practitioners in the Systems Sciences. The combined SRT consists of: Mary Edson (team leader), Pam Buckle Henning, Tim Ferris, Debora Hammond, Andreas Hieronymi, Ray Ison, John Kineman, Louis Klein, Gary Metcalf, George Mobus, Nam Nguyen, David Rousseau, Shankar Sankaran, and Will Varey with consulting team member, Peter Tuddenham. Some of the primary goals of the SRT are to educate, inform, and invite engagement by interested individuals and institutions from diverse fields and disciplines in the Systems Sciences through Systems Research and Systems Literacy.

Background

The two meetings of the SRT have developed two streams of value to the Systems Sciences. The first stream, started in 2014, focused on development of systems researchers and the body of knowledge. The second stream, started in 2016, focuses on role of Systems Research in the Systems Literacy Initiative. The 2014 SRT's focus was answering the question, "What distinguishes Systems Research from other types of research," an internal focus intended to provide grounding for researchers new to the Systems Sciences. The outcome of this phase of the SRT's work was the publication of a book, A Guide to Systems Research: Philosophy, Processes and Practice (Springer, 2016). The 2016 SRT's focus is on reaching out to a broader community to provide a foundation for Systems Literacy. The team's Conversation revolved around the question, "How can Systems Research be in service to Systems Literacy?" The team's conversations were directed into two essential aspects, separate and integrated, of this question. In one aspect, Systems Research serves Systems Literacy by providing a credible foundation for the principles and practices of Systems Science and Systems Thinking in both systematic and systemic modes. In the other aspect, Systems Research provides a neutral frame for development of ethical applications of those principles and practices. The development of Systems Research in support Systems Literacy is the ongoing collaboration of the SRT. This workshop focuses on that development.

Workshop Description

The workshop will be conducted in two parts. In the first part, the SRT will review and revisit the team's work to date, creating a foundation for development during this session. Two of the three hours of this workshop will be a working session devoted to unpacking the eight critical factors identified during the 2016 IFSR Conversation. These factors will serve as a basis for a Knowledge Base (KB) and an Investment Portfolio (IP) for Systems Literacy (SL). This portion of the workshop will be guided by David Rousseau (KB) and Ray Ison (IP). A Systems Analysis, guided by George Mobus, will further define and distinguish these critical factors as part of a SR/SL KB and IP. Further details of this process are provided in the following description (see Background). In the second part (the third hour) the SRT invites students, as well as researchers and other interested participants, to join a discussion about the newly published, Guide to Systems Research (see above). In this part of the session, how Systems Research contributes to establishment of a reliable KB from which SL can create a set of foundational principles will be explored, as well as identify systemic sensibilities for a broader audience.

Why: Systems Research in Service to Systems Literacy

Motivation for development of a KB through SR for SL comes from theoretical and practical sources. The SRT recognizes the exigency in development of foundational principles of Systems Science and Systems Thinking that can be effectively adopted and disseminated through Systems Literacy. The team's narrative begins with an understanding the urgency for application of Systems Sciences and Systems Thinking to wicked problems (Malik, 2016; Churchman, 1967; Rittel, 1973) and messes (Ackoff, 1974/97). Systems Research is typically a slow generation of results; however, the body of knowledge gained through this process can be confidently used to address complexity in timely ways. The criticality of the need for salient approaches to complexity is shown in a graphic representation of some possible trajectories of applying or not applying these Systems principles in practice.

The Approach

The choice of how we respond to these issues relates to a process model that can be applied. Through understanding the relationship of the process model to the trajectory, the team directed its focus to developing a MindMap of eight essential aspects or features of how Systems Research can support Systems Literacy. These include: Systems Science knowledge base, roles and personas, maturity models, role profile, ontology/vocabulary, perspective/framing choice, frameworks, and political ecology. Each of these eight has its own process of unpacking, which was demonstrated to the Conversation participants using the knowledge base. The eight relate to unpacking the Systems landscape in a coherent but loosely coupled investment portfolio (economic, social, and relational) for building systemic sensibility in such a way as to be dis/aggregated for different audiences.

After identifying eight, critical factors or components that form the structural aspects of the process our team decided to explore these factors further. The team developed a mind map of the critical factors (or ways of knowing) and developed separate mind maps of each of the factors. These factors need further unpacking (clarification, definition, and distinction), as well as systems analysis, to refine the process model that was developed during the Conversation. The purpose of this process is not about increasing the amount of systems books and papers in the KB, but to connect the relevance of this KB in supporting SL toward effecting change in the world as ethically determined through stakeholder engagement. As a natural result of this discussion, a cascade of more questions emerged such as, "How can we bridge the perceived gap between academic knowledge and real-world practice," and "What are the necessary intermediary factors from insight to impact?"

Systems Landscape and Systemic Sensibilities

Ray urged the team to frame the next steps of the contribution of the SRT (or rebranded as the 'Landscape of Systems Knowing Inquiry') as we devised a 'first-cut' model (Figure 2 and Table 1) of an 'investment portfolio' as a device to aid on-going inquiry by us, as well as a means to organize and report on our work and that of other groups committed to supporting transitions to systemic literacy (systemic sensibility + [systems science + systems thinking in practice or STiP]) (Blackmore, C., Reynolds, M., Ison, R. & Lane, A., 2015).

We understand investment to include financial, individual, intellectual, group, organizational, philanthropic, among other characteristics or attributes, and the 'portfolio' to be designed drawing on concepts of self-organization, open-source protocols, and easy refinement for different purposes/investors. As outlined earlier we identified eight elements of a possible system to enhance the quality of systems knowing, though the possible systemic relations among these eight are yet to be established, understood and articulated (e.g. there may need to be more or less). We suggest that in a 'first-cut' portfolio design each of these eight elements needs to utilize/complete the following template:

What is the element - characterize it?

Why is it important?

What is a story (narrative) or case study about it - of need, failure, success, etc.?

Suggest possible 'investment' agendas or pathways - who; how; when?

Monitoring and evaluation systems against agreed, yet adaptable, measures of performance are needed 'in service' of moving towards systemic literacy. Controlling action will also be needed. These 'systems' will also require a conducive institutional/organizational platform from which to operate and thrive.

Conclusions and Recommendations

The SRT's Conversation focused on the question, "How can Systems Research be in service to Systems Literacy?" To reiterate, discussions were coalesced into two essential aspects. First, Systems Research serves Systems Literacy by providing a credible foundation for the principles and practices of Systems Science and Systems Thinking in both systematic and systemic ways. Second, Systems Research provides an impartial, dispassionate frame for development of ethical and effective applications of those principles and practices.

In the team's view, successful programs in Systems Literacy will be grounded in Systems Research encompassing: 1.) a history of systems thinking (context, sources, and development of key ideas – principles expressed in clear language); 2.) literature of systems (a canon of essential theory, results of practice, and criticism); and 3) transdisciplinarity (shared relations and effects of systems sciences with other disciplines). The SRT's role is to foster the relationship between these aspects of Systems Research with Systems Literacy in timely and relevant ways.

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2905

UNITY IN DIVERSITY IN HEALTH AND SYSTEM THINKING - DISCUSSION PANEL

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System thinking is about seeing things as a whole, as unity. However the seeing could happen from different points of view according to their corresponding perspectives. As a result, there is a diversity of system thinking. This diversity provides the foundation to unite the different perspectives in order to advance to the next level of system thinking, the special systemic properties of the observers and decision makers. In this discussion panel, we present the Health and System Thinking from different perspectives, both theoretical

and clinical, both microscopic and macroscopic, as well as both Eastern and Western. These include system thinking from Energy medicine, Traditional Chinese Medicine, Indian Ayurvedic Medicine, Micro-systemic environment of cancer cells, and Mathematical systemic view of acupuncture
Coordinators:
1. Traditional Chinese Medicine: Thomas WONG
2. Energy medicine: Dr Dominique Surel https://www.linkedin.com/in/dr-dominique-surel-2a081b
Invited practitioners for in person or on video discussion:
1. Indian Ayurvedic Medicine by Dr. Shim
2. Micro-systemic environment of cancer cells by Gary Smith https://uk.linkedin.com/in/gary-smith-5338aa4
3. Mathematical systemic view of acupuncture by Kent Palmer https://www.linkedin.com/in/kent-palmer-95bb767 Each speaker will have a 5-10min talk about their work relating to health and system thinking. Then we will have discussions and questions concentrating on the theme of how "Unity in Diversity" may apply.

2930
MULTICULTURAL WORLD VIEWS ON SUSTAINABILITY
Organizers: Prof. Dominique Surel and Prof. Vijay Gupta
The workshop is focused on introducing sustainability through the world view of
Ancient, Native, Indigenous and Tribal cultures. A 2 hour documentary film "Force of Nature"
produced by David Suzuki Foundation, CA, will be shown as the main event for the workshop. The film builds on Dr. Suzuki's personal experiences and contrasts the main stream Western world view with the Indigenous world view for the survival of all life on our planet. An opinion letter to be published
in Ancient Science titled "conscious world view Transforming Individuals, Science, its Education and Research"
By V. Gupta, I. Gupta and J. Saldarriaga, will be distributed to the participants well before the workshop.

2932
TUTORIAL: SYSTEMS PROCESSES THEORY AS A GST, PROTOTYPE SYSTEMS SCIENCE, AND KNOWLEDGE BASE FOR SYSTEMS ENGINEERING & SUSTAINABILITY
Sunday, July 24th, 10-12 am & 1 to 5 pm
Len Troncale, 29th ISSS President, 1990
ISSS VP & Managing Director ~1982-89
The goals of the ISSS include researching a general theory of systems (GST) by discovering isomorphies, unifying science, and transferring models between disciplines. For 45 years, this speaker has been contributing to a Systems Processes Theory (SPT) which some have described as the most advanced and detailed, science-based theory of systems extant in attempting to fulfill that dream of ISSS Founders. This tutorial will condense several graduate, university-level core courses on SPT into one presentation. It will begin with the differences between the popular and widely known "systems thinking" and "systems philosophy" found in ISSS and the criteria for a true science of systems. It will then describe why study of isomorphic systems processes is of fundamental importance, how this school of thought teaches & provides evidence that systems processes are isomorphic between widely different systems, how studies of natural systems using the scientific method leads to strong evidence of how systems work in general, and how to find such GST isomorphies in the voluminous science literature. The results is a science-based theory having both unprecedented descriptive and prescriptive power. While the early Founders of GST focused mostly on the natural sciences and math, the present workers in ISSS mostly ignore the natural sciences and profess that belief in and awareness of systems alone is sufficient to guide applications. This line of research is an antidote to that approach. It will present many more candidate isomorphies than any other extant program of study. It will describe how data is being collected on 110 such candidate isomorphies to fill 26 information categories and produce a massive data base and bibliography. It will add the critically important additional step, not taken by ISSS Founders, of showing how these isomorphies impact and influence each other to achieve systems stability and dynamics (how systems work). It will try to show how such detail can be used to improve systems design, understand the new field of top-down systems pathology (how systems don't work) to enhance systems repair & curation. It will show how this detail can be used as a stronger, more scientific knowledge base for new fields like sustainability and systems engineering which are themes of this conference. It will also indicate how this overall theory and knowledge base has been used for several funded programs in Systems Education in preparation for a Friday presentation on assessment of those attempts.
Format: for each hour there will be 40 min of presentation followed immediately by 20 min of open discussion. Lunch will be brought in so that noon to 1 pm can also be used for open discussion. These basics can be supplemented by >17 hours of streaming video. This Pre-conference event will be cancelled if at least seven participants do not contact speaker at lrtroncale@cpp.edu stating intention to attend before the conference.

2934

$5M LATER … ASSESSMENT OF FOUR SYSTEMS EDUCATION PROGRAMS: WHAT WORKS, WHAT DOESN'T & WHY

Len Troncale, 29th ISSS President, 1990

The ISSS in the distant past sponsored national and international meetings solely on Systems Education that is the theme for this fifth day of ISSS'16. This resulted in publications and comparisons of as many as 107 national and international past and existing systems education programs, most at the university level. This tutorial will mention and cite products of those past deliberations as a source for understanding what works and doesn't for systems education. But the main focus of this tutorial will be a brief description of and hard-nosed, data-based student evaluation of four particular programs initiated at California State University, Pomona across a four decade period and supported by numerous and diverse funding agencies including the National Science Foundation (3 grants), the U.S. Dept. of Education, HEW, Special Innovative Programs of the CSU Chancellor's Office, as well as private foundations such as Keck, HHMI, and Kellogg. Lessons or conclusions about funding, starting, maintaining, and improving systems education will be attempted. Clearly many of these maxims are unknown or forgotten by those just now starting systems education programs.

From 1972 to 2007 the Institute for Multidisciplinary Programs (IMP) and the Institute for Advanced Systems Studies (IAS) designed, tested, and delivered four different systems education programs that will be evaluated in this tutorial.

The first was an unconventional UG major for a bachelor's degree that was rigorously interdisciplinary and housed in the College of Science at California State Polytechnic University, Pomona. Comparative Systems Analysis (CSA) consisted of 14 systems-based, transdisciplinary courses offered as a Minor in the Dept. of Biological Sciences. The 14 courses were irregularly offered and assessed by IAS Fellows. The tutorial will present an overview of the courses and the ultimate fate of the Major/Minor as an example of campus politics and systems education.

The second was designed to become a National Model for Environmental Education based on systems science. Again a modular organization of lessons organized by system isomorphies was utilized. Although a curriculum was completed and offered at pre-collegiate levels for testing, it was never adopted as a national model.

IAS also was awarded several grants from the National Science Foundation and others to design an Integrated Science General Education (ISGE) Program. This year-long set of three courses were entirely based on systems isomorphies as unifying teaching themes across the natural sciences. The courseware used a hybrid methodology combining multimedia computer-based lessons and face-to-face activities and labs. It was designed to satisfy ALL of the General Education requirements for science courses that are normally part of most college majors. As such it was "stealth" systems science education for the masses. A prototype ISGE course was offered seven times on three different CSU campuses to more than 300 students. The tutorial will present the many innovative multimedia and pedagogical features of ISGE, describe how it is essentially systems science education, and how it was evaluated by the students using multiple assessment criteria. Future ISGE implementations will be suggested.

More recently, graduate courses titled "Systems Science and Sustainability" and "Intro to Systems Science for Systems Engineering" were offered and assessed. Descriptions of the courses will be presented in the tutorial and well as assessment data from the students. Posters produced by these students that attempt to assess the utility of systems science for their problem areas are part of ISSS'16's Poster Session. See the program abstract for these "poster books."

An important part of modern Systems Education programs will not be included in this tutorial. Yet these are the most successful and include the programs most likely to expand. They include special systems and MOOC courses offered by SFI, NECSI and other non-university entities, as well as systems reworking of many established conventional science knowledge bases such as Systems Biology, Earth Systems Science, Systems Chemistry, and Physics of Complex Systems. It is very interesting that such systems-based programs are spreading, advancing, and are more successful than direct systems science education. Yet they have a rather shallow understanding of true systems science to date.

2937

SYSTEM LITERACY AND SYSTEMIC INNOVATION FOR THRIVABLE FUTURE.

Chair: Pavel Luksha

This workshop will be organized in partnership with Global Education Futures and Protopia Labs community. Global Education Futures is an international collaborative platform that brings pioneers of global education to discuss and implement the necessary transformations of educational ecosystems for the thrivable future. Protopia Labs is a community of evolutionary learning laboratories that emerged based on GEF vision in order to prototype new educational paradigm today.

Our standpoint
There is a clear need for systemic redesign of education in order to give humanity tools to deal with rising volatility, uncertainty, complexity and ambiguity of the world. The system science, especially systemic thinking and evolutionary system design, should play a key role in the emerging transition. International System Science Society has the ability to foster this process. There is a clear need for systemic redesign of education in order to give humanity tools to deal with rising volatility, uncertainty, complexity and ambiguity of the world. The system science, especially systemic thinking and evolutionary system design, should play a key role in the emerging transition. International System Science Society has the ability to foster this process.

Our goal
We are inviting leading system scientists to explore the new paradigm for education and co-design a federated course on systemic thinking and systemic innovation. Our vision for this course is not limited to offering a popular understanding of any particular domain of system science, nor to just giving an overview of existing fields in system science. The course itself should be designed to manifest a new educational paradigm.

Our vision
Systemic change can be acheived only when the ends and the means are aligned.
The course itself should foster the evolution of education into collobarative eco-system for thrivable wisdom-based society.
We do not claim to have the full and “correct” vision for the new paradigm, but here are some elements that we believe are essential:

Collaboration – the course should be design for study groups rather then individuals.
Hybrid – while part of the content should be provided on-line, at the same time groups should be engaged into off-line activities: discussions, games, collective idea explorations.
Glocal – the course should be offered around the globe, to engage different worldviews and not be limited to Western, educated, industrial, rich and democratic (WEIRD) culture. Engaging different people we should connect global ideas with local reality.
Diversity – the groups should be multidisciplinary and offered to mixed age groups.
Community – the groups should not be limited to academia institutions, but may also engage non-academia communities interested in systemic thinking.
Direct dialogue – we want to engage leading scientists into direct dialogue with students of this course through a series of webinars
Synthesizing – the course should not be limited to any particular field of system science but rather provide a framework for a systemic thinking
Practice oriented – apart from learning theory students should be asked to practice system thinking to describe systems around them.
Tangible result – such result may be a global systemic map of some particular domain of human culture.

Those ideas are not set in stone but open to further development.

The process
The workshop will be a collaborative exploration of the following questions:
What should be essential elements of the new educational paradigm?
How those elements may be included into the design of the course?
What is essential system literacy?
Which skills are necessary for system thinking and systemic innovation?
Who are key partners for such a course?

The following people will deliver the opening statements and then we will engage into collective vision building.
Alexander Laszlo, Phd, ISSS ex-president, head of Board of Trustees, ITBA, Buenos Aires, Argentina
Dino Karabeg, PhD, co-founder of Knowledge Federation, University of Oslo, Oslo, Norway.
Pavel Luksha, PhD, GEF director, Skolkovo School of Management, Moscow, Russia.

2946
CET SIG WORKSHOP: COLLABORATION FOR IMPACT – THE EDUCATION STRATEGY
Annette Grathoff, Samuel Hahn, Dino Karabeg, Alexander Laszlo, Pavel Luksha, Leah MacVie, Ivan Ninenko, Sasha Mile Rudan, Sinisha Rudan
Correspondance: Dino Karabeg, Institute for Informatics, University of Oslo, POB1080 Blindern, Oslo, Norway, dino@ifi.uio.no
We cordially invite you to join us in a collaborative action workshop. By collaborating on three strategically chosen social-systemic prototypes, we will develop a way of working which allows systemic insights to bear directly upon technological innovation, and social-systemic change.
We will begin by very briefly introducing the CollaboFramework (CollaboScience) collaboration platform, and the three systemic change prototypes, which are already embedded in practice
(details will be shared beforehand on KnowledgeFederation.org/Collaboration_for_Impact_2016):
Collaborology, in education or evolutionary learning
The Lighthouse, for systems research and communication
The Community of Impact, for impactful collaboration and project work in general
Through World Cafe-style collaboration and other dialogical and collaborative behaviors, mediated by CollaboFramework, all participants will have a chance to contribute to all three projects.
Simultaneously, the results of our collaboration will be organized and presented on a screen as a dialog map, by using the CollaboFramework platform. Through this platform, our collaboration will continue after the workshop, leading to co-created action. CollaboFramework will provide us Lego blocks-like technological components for collaborative knowledge work. With the contributors present, it will compose a 'sandbox' in which innovative socio-technical solutions can emerge. CollaboFramework will then also serve as a boundary object enabling communication and collaboration between systems scientists and technology developers.

2948
LSA WORKSHIP
Jim Simms
Living systems analysis includes both qualitative and quantitative sciences. Qualitative living systems are treated well in James Millers Living Systems. Philosophers have been trying since the 18thcentury to develop a science of society based on laws of nature. The physical sciences are based on (1) the identification of universal phenomena, the relation among them and their measures (quantification). The universal phenomena of things that live are: matter, energy, information, and knowledge. These phenomena have been identified and quantified. The quantification of living systems phenomena and their relations provide the basis of quantitative living systems analysis.
The universal phenomena of knowledge and information are recent discoveries. Quantification of knowledge and information are currently at the cellular level. The task before us is quantify knowledge and information at all levels from the cell up to and including humans and their organizations.

2949
ANTICIPATORY SYSTEMS AND GENDER DYSPHORIA:
Judith Rose, Donna Rosen
What is it like to be Trans-Gendered? Is it easier to comprehend through the Anticipatory Systems Lens of Robert Rosen's scientific work?
In this dual presentation, we will explore these ideas and hopefully arrive at a much clearer understanding of what Gender Dysphoria is like to live with as well as a greater comprehension of what causes it, from a model-based, model-guided Systems Science perspective.
Donna Rosen is a trans-gendered woman who has already undergone the process of transition and surgery that is currently the standard of medical care in the United States. She has written a book about her experiences and will share what it's like at the age of 3 to realize you are stuck in a strange situation that other people cannot see but you can't tell anybody about it, either.
Judith Rosen will discuss Anticipatory Systems Theory and show how the human mind and body represent an evolutionary development as a dual-Anticipatory System in one living organism. The interaction between mental models and somatic models can often be dysfunctional, particularly when they are each defining the "self" in conflicting ways. Gender Dysphoria is precisely that situation.

2967
POLICY SUMMIT: SYSTEMIC SUSTAINABILITY POLICY – RECOMMENDATIONS OF THE SYSTEMS SCIENCES COMMUNITY.
Chairs: Paul Sperry and Alec Tsoucatos
Description: A core group of ISSS members will assemble to draft policy recommendations to be endorsed by the Society as a Press release and distributed to governments and international bodies. The recommendations will be discussed in Council, then adopted statements will be finalized and presented for final ratification at the Banquet.
Participants: Sign up at registration desk
Observers: Open

Poster Abstracts

2769

SYSTEMIC INTEGRATION OF SPATIAL KNOWLEDGE IN BUSINESS

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A model to achieve technological development (DT) is proposed, in particular a satellite, with the following sub phases: 1.Analysis of International satellite system; 2. Analysis of the National satellite system; 3.diagnose, using the SWOT (strengths, weaknesses, opportunities, threats); 4. Proposed solution; 5.Mission, vision, values and strategic objectives of the proposal; 6.Strategias using SWOT combinations: FO, FA, OD and AD; 7.Action plan; 8. Technological development.

With analysis and diagnosis it was found that one of the great strengths in this country is the development of scientific research, in particular space, since the forties, but it is isolated, ie, not integrated in the productive industry and therefore state policy proposes establishing humanistic satellite companies to promote and preserve the ecology, self-financing, public, mixed, or private initiative, integrating scientific, basic and applied research, based on the goals, objectives and marketing strategies. Companies call for the design, construction and launch of satellites, thus providing efficient, fast, safe and cheap services to meet the demand of domestic and international users, as developed countries have done through their space agencies, in order to have DT in this area.

2822

A SYSTEMIC MODEL FOR COMMUNICATION INNOVATION

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A Systemic Model for a telecommunications innovation system was designed with the proposal for technological development, to avoid situations that endanger the cancellation, by the International Union of Communications of the satellite orbits assigned to Mexico, and thus promote public and private investment through the integration of basic and applied scientific research in enterprises. The idea is to make appropriate innovations and make significant improvements to products, thus meeting the demands of domestic and international consumers.

Keywords: Systemic model, innovation, and technological development.

2867

HEALTH AND SYSTEM THINKING: PHYSICAL HEALTHCARE

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

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

Reductionism was the major scientific view before world war II, its development leads to industrial revolution and modern medicine. Traditional medicine like Traditional Chinese Medicine, Ayurvedic Medicine, Homeopathy, Naturopathy, and Western Herbal Medicine was then considered as alternative medicine because they are seem incompatible with reductionism and allopathic medicine. However, reductionism was

found to be an incomplete scientific view after world war II and a more holistic scientific view was developed namely system theory.
Systemic thinking is to consider both the system and the environment when analyzing or maintaining a system, or its environment. When analyzing a particular component within a system, all other components should be considered as well but different importance ratio is allowed. Traditional medicine has been analyzed with the incomplete scientific theory for logical explanations of its medical theory and practice, resulting in confusion and misunderstanding. This workshop will demonstrate the application of system theory to investigate the holistic nature of a particular traditional medicine namely Traditional Chinese Medicine. It is believed that all other traditional and alternative medicine could be better understood in this holistic scientific view of system theory.
The Taichi Yin-Yang system theory was developed when combining both the traditional Chinese thinking and the systemic thinking. Taichi is considered as the organizational force in the universe, and the Yin-Yang combo is considered as the information gathering process, the current state determination process, and the steady state regulation process. The system state identification involves three pairs of direction-forming spectrums. The Superficial and Internal spectrum gathers information between the boundary and the system. The Cold and Hot spectrum gathers information between the form and function, or matter and energy within the system. The Deficient and Excess spectrum gathers information between the environment and the system.
The Traditional Chinese Medicine Healthcare Protection Program composed of three components:
1.the TCM diet on how to choose food from the Cold-Hot food spectrum,
2.the Middle-way exercise therapy on how to regulate our body and Chi (Qi) from the fully Open-Close movement spectrum,
3.the TCM 24h healthcare lifestyle on how to use our health wisely for work and fun from the Human-Environment spectrum.
The systemic thinking of the correspondence between nature and human has been the fundamental concept in traditional Chinese culture since around 500BC. The concept is also embedded in the teaching of Confucianism, Buddhism, Taoism, and Traditional Chinese Medicine. It is hoped that the link between TCM healthcare and modern system thinking can be formed. And then the combination of the Ancient system theories could form a General System Theory that could be applied across boundaries into different modern system theories including Viable system model, system dynamics, cybernetics, measurement system, soft and hard systems, anticipatory systems, General Theory of Systems, system of system process, Spirituality and Systems, Health and system thinking, monetary systems.
Keywords: Middle-way exercise therapy, Healthcare Protection Program, Taichi Yin-Yang system theory, Traditional Chinese Medicine, Reductionism, System maintenance, Heath and System thinking, Buddhism, Confucianism, General System Theory, Health and system thinking, Taoism, Traditional Chinese medicine differential diagnosis-cure process, Unification of nature and man,

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HEALTH AND SYSTEM THINKING: 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 Nobel Truth”, guided especially by the “Right View” and “Right Thought” in the “Eight-Fold Nobel Path”, which is the fourth part of the Noble Truth.
Throughout our life we have been looking for satisfaction that brings happiness. Our government have been relying on economics to achieve this but 80% of the time we are dis-satisfied with the people and situations around us, bringing craving, aversion and ignorance into our minds and creating all sorts of problems in our society. This is called suffering in the teaching of Buddha, and he offered us with a three step solution for our mind. We investigate the systemic view of these three steps namely self protection, concentration and purification of our mind. We also investigate a 10 days Vipassana mental healthcare program for people of all religions including scientific communities. It is believed such a program could bring happiness, peacefulness and harmony for our community. Spiritual Healthcare could then be performed within the objective framework of our body.
Keywords: Vipassana mental healthcare, Buddha, Four Nobel Truth, Eight-Fold Nobel Path , Spiritual Healthcare, Spirituality and Systems Science

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HEALTH AND SYSTEM THINKING SIG: A GENERAL SYSTEM THEORY FOR ANY PARTICULAR PERSPECTIVE

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

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

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

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

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

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

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

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 System Theory, Taichi Yin-Yang System Theory, Set theory, Relativity, Traditional Chinese Medicine Differential diagnosis-cure process, Buddha's teaching, Differentiation, unity in diversity

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A SOCIOECOLOGICAL APPROACH TO TRAFFIC SAFETY SYSTEMS MODELING TO ANALYZE PROGRAM EFFECT

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This study furthers the development of a systems model(s) of the social ecology of traffic safety to test intervention effectiveness in reducing motor-vehicle crashes, injuries, and deaths for the State of Texas by assessing the applicability of different systems modeling methods suited to analyze the causal relationships and effectiveness of interventions and developing preliminary recommendations for a systems model(s) of traffic integrating the conditions and relationships perpetuating motor-vehicle crashes, injuries, deaths, and their potential interventions using the Texas Department of Transportation's Highway Safety Plan for 2016. The model(s) will illustrate the potential value of socioecological approaches to traffic safety systems modeling to better understanding of the dynamics driving motor-vehicle crash injuries and deaths.
Social ecological models within public health for injury prevention and community safety for reducing motor-vehicle injuries, crashes, and deaths typically derive from at least one of numerous socioecological models of human development. Social Ecology (the socio-ecological framework) focuses on the dynamic interactions among an individual, the physical environment, and the social environment across specified levels. Generally, these models build upon an individual in a nested set of systems beyond just the psychological or biological ones through levels, where interactions affect development, health, and well-being of the system, and the interactions between elements are paramount to understanding causality. The environment and perception thereof is crucial to behavior and development, though social background and experience are also important. Environments are analyzed through systems terms, wherein recognizing reciprocal relations is crucial to understand developmental changes and ecological transitions almost always derive through a change in role.
Systems approaches are capable of capturing the dynamic complexity inherent within traffic and social systems in ways traditional approaches cannot. This analysis will involve identifying suitable systems approaches for analyzing relationships between the traffic system and interventions, including traditional countermeasures to reduce crash and injury morbidity and mortality, such as Texas traffic policies and regulations for motor-vehicles (e.g., speed limits, licensing and educational requirements for motor-vehicle drivers, road geometry and material requirements, safety belt requirements; indicators of motor-vehicle crashes, injuries, and deaths (e.g., morbidity and mortality data for accidents that involve alcohol, drugs, intersections, large trucks, and pedestrians); and, proposed interventions for increasing the use of such practices (e.g., incentives driving use—or lack thereof—of motorcycle safety gear, monetary discounts for safety training programs). While policy makers, economists, and other constituents have proposed specific goals or targets to decrease motor vehicle injuries, crashes, and deaths, none have been tested using methods that capture the dynamic complexity of real-world social systems to not only understand how and why these problems occur, but also what are the best leverage points for change given the effect and cost of the proposed solutions.
The model(s) will assess the ability of the safety plan's goals given the dynamic complexity within the Texas traffic system with regard to their influence on crash and injury outcomes and quality of life, costs of implementation and effectiveness over time, and their ability to ultimately increase understanding of the causes and the outcomes of motor-vehicle crashes, injuries, and deaths individually, socially, culturally, and economically. Accordingly, the systems model(s) to be developed could be used to conduct virtual experiments to test whether the goals set in the Texas Department of Transportation's Highway Safety Plan for 2016 would be better targeted at one or two specific populations or applied more generally across the state but respective to important social, policy, and environmental factors.
Keywords: systems modeling, social ecology, public health, social systems, traffic safety

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MODELING THREATS TO RESEARCH INTEGRITY & THE EFFECTIVENESS OF REGISTERED REPORTS

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The study tests the hypothesis that research integrity can be improved through changes in the incentive structure of scientific disciplines and that the effects of such changes can be estimated by viewing the production of scientific knowledge as a complex adaptive system. The study conceptualizes research integrity in terms of the use of flexible data analysis practices and distorted reporting of results, and contends that the diffusion of such behaviors through a scientific discipline is a process largely driven by the incentive system existing within it. From a systems perspective, the success of such a change in the incentive structure of a discipline will depend on the initial conditions existing within that discipline (e.g., the relative importance accorded hypothesis testing compared to exploratory research, the number of journals within the discipline, the prestige of journals adopting registered reports, and the flexibility of researchers within the discipline to publish beyond discipline-specific journals not using registered reports). Accordingly, the study develops a system dynamics model capturing the causal relationships between indicators of research integrity (i.e., positive results "manufactured" through use of flexible data analysis practices and distorted reporting); organizational and environmental incentives driving use of flexible data analysis practices and distorted reporting; and proposed interventions for reducing use of such practices.
The study analyzes the Center for Open Science's Preregistration Challenge as an example of an incentive-based intervention to promote research integrity. The goal of registered reports is to remove the incentive to use flexible data analysis practices by making publication dependent on methodological rigor and not the production of positive results. The Preregistration Challenge is designed to encourage researchers to use registered reports by offering $1,000 to 1,000 researchers for publishing the results of studies they have preregistered. Over time, it is hoped these practices will diffuse through the population of researchers within a discipline, thereby becoming common practice and improving research quality and integrity. The financial incentive offered by the Preregistration Challenge to preregister a study with a journal is just one of the incentives that influence researchers' decisions as to how to analyze their data and where to publish their research findings. Consequently, it will not entirely solve the problems that arise through using flexible data analysis practices and distorted reporting but should reduce the flow of manufactured effects. The analysis also examines if it would be better targeted at one or two specific disciplines or offered to researchers irrespective of their academic discipline. If a targeted approach was to be used, the model could help identify which disciplines exhibit initial conditions that favor adoption of registered reports and hence are the best targets for the $1 million initiative. Such an experiment would be time-consuming and costly in the real world, but could be conducted with relative ease in a virtual environment once the basic model had been constructed, further exemplifying the use of systems methods to this budding area of research.
The study provides the nascent field of research integrity studies with a better understanding of the dynamics that drive the use of flexible data analysis practices and distorted reporting and the potential of proposed solutions to curtail the use of these practices. More specifically, develops a theoretically informed system dynamics model of the normative and organizational incentives influencing the use of these practices and identify leverage points for interventions. The ultimate goal of the research is to develop an optimal portfolio of research integrity interventions that can be used to influence the quality of publications, universities and academia, and the betterment of science to guide their activities in this area.
Keywords: systems modeling, system dynamics, research integrity, ethics, academia, higher education

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INNOVATION: FOUR POSTER BOOKS ON SYSTEMS PROCESSES THEORY (SPT)
7 POSTERS ON SPT FUNDAMENTALS
7 STUDENT POSTERS ON APPLYING SPT TO SUSTAINABILITY
6 STUDENT POSTERS ON APPLYING SPT TO SYSTEMS ENGINEERING
7 STUDENT POSTERS ON APPLYING SPT TO HUMAN AREAS
Institute for Advanced Systems Studies
California State Polytechnic University, 1972-2004
Two of the notable themes of this conference are systems engineering & sustainability. This poster session will present 27 posters on 4 poster boards as "books" of posters; 7 by an ISSS Past President, 20 by graduate students in applied degree programs targeted at both these application domains. The first "book" of posters will describe Systems Processes Theory (SPT) as a candidate general systems theory and systems science knowledge base or tool for informing and solving a wide range of human and systems design problems. It will cover: (1) SPT as a GST & SysSci; (2) Comparison with other GST's; (3) SPT Tenets, Prerequisites, Discinyms; (4) Catalogue of Linkage Propositions; (5) Use of Natural Sciences; (6) Organizing for SPT Research; (7) Funding SOS for Systems Engineering. The second "book" of posters will describe attempts by the Center for Regenerative Study (CSU, Pomona) graduate students to research one isomorphy of SPT and apply it to the following sustainability problems: (1) carbon storage in urban forestry; (2) regenerative farming systems; (3) upper newport bay ecological restoration; (4) sustainable indoor environments; (5) Maslow's hierarchy & sustainable development; (6) sustainable construction methods; (7) SPT & regulatory decision making. The third "book" of posters will describe attempts by Master's of Systems Engineering candidates (IME 510; Dept. of Industrial & Manufacturing Engineering, College of Engineering;

CSU, Pomona) to research one isomorphy of SPT and apply it to these SE topics: (1) SPT & Agile Engineering; (2) SPT & Materials Engineering; (3) SPT & Production Line Effectiveness; (4) SPT & Industrial Assembly Lines; (5) SPT & Innovations in Engineering; (6) SPT & Operation of an SE Development System. The fourth “book” of posters will describe attempts by international graduate students taking online systems courses (CSA 411-413; College of Science; CSU, Pomona) to research only one isomorphy of SPT and apply it to the following human problem areas: (1) SPT & Kelp Forest Restoration; (2) SPT & Media Storage 1; (3) SPT & Media Storage 2; (4) SPT & Environmental Biology; (5) SPT & Transportation Systems; (6) SPT & social capital in the underclass; (7) SPT & Wilber’s Integral Theory of self.

These poster “books” will be up and available for perusal throughout the conference. A representative of INCOSE, ISSS, and the Institute for Advanced Systems Studies (IAS) will be available to answer questions and forge alliances at announced times.

Authors Index

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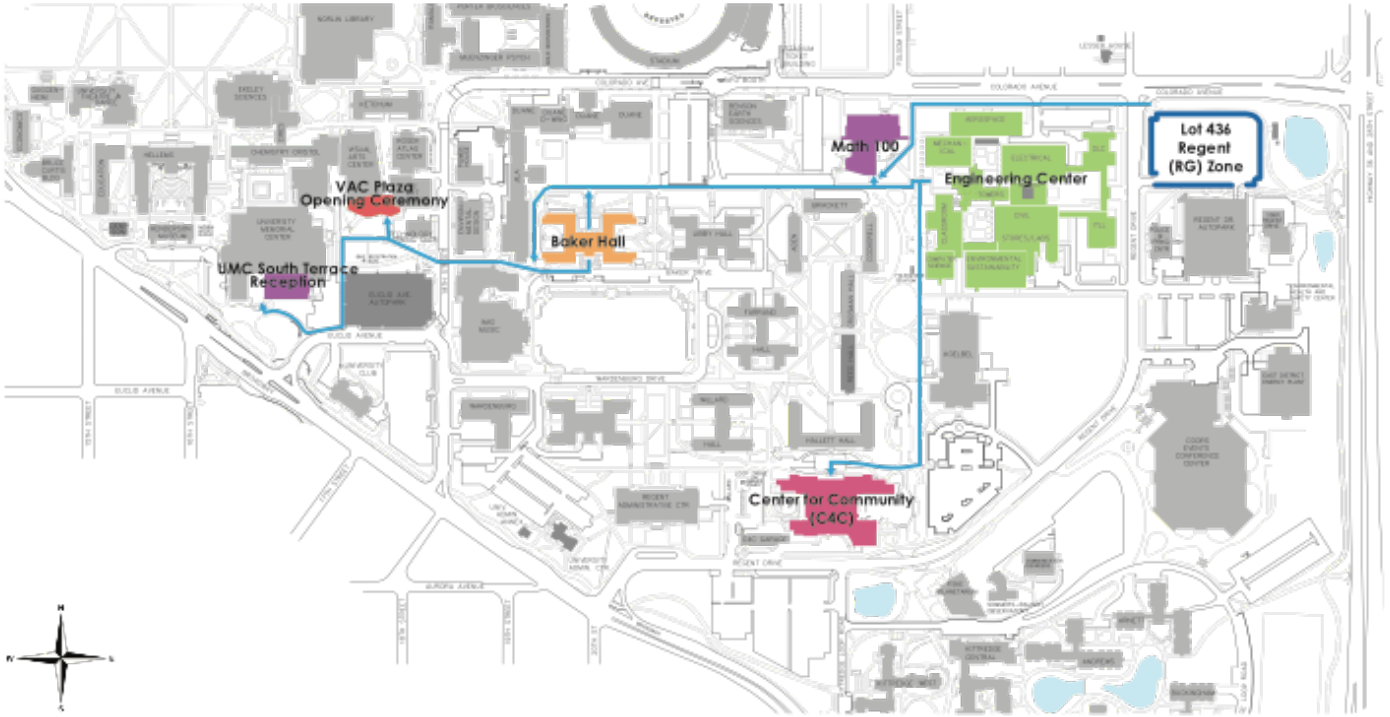
ISSS - WALKING MAP

WALKING DIRECTIONS



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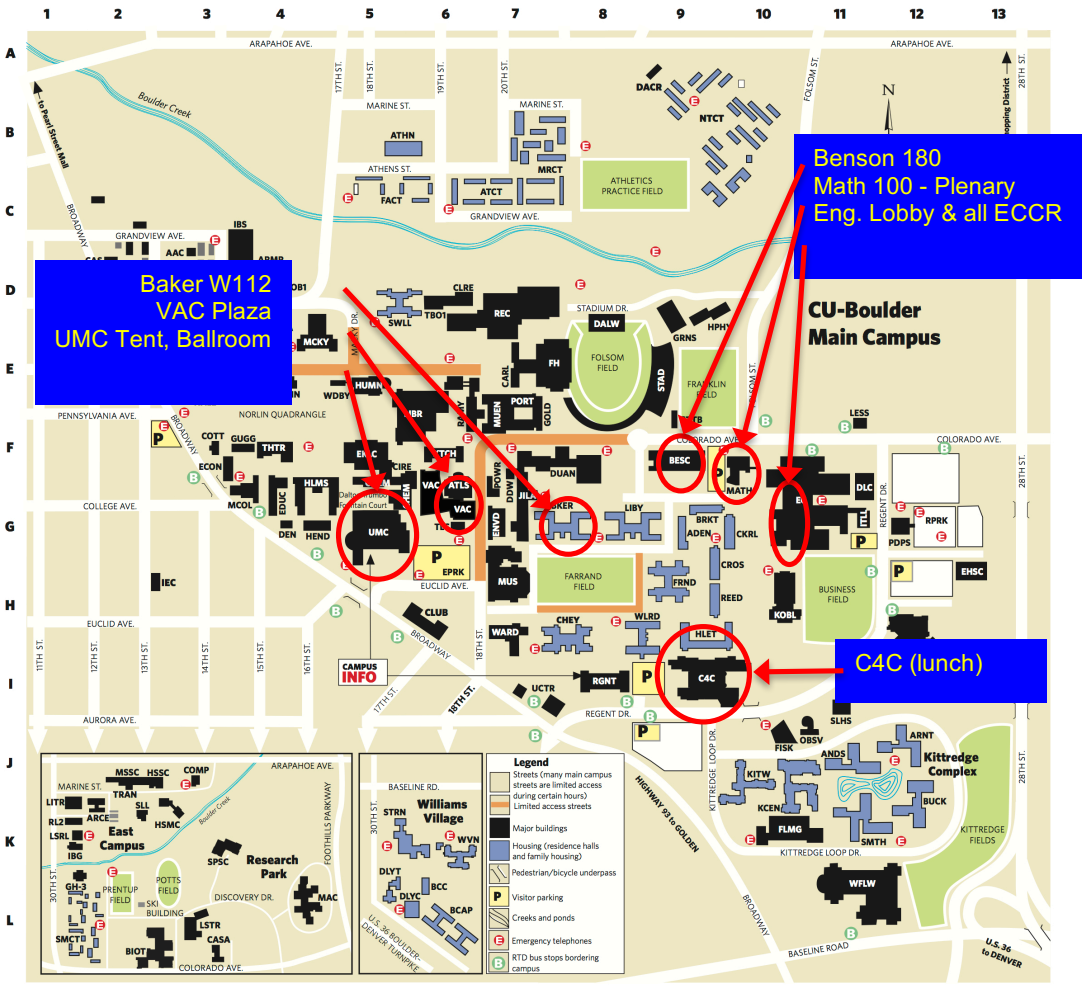

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PRE-CONFERENCE WORKSHOP
SYSTEM THINKING FOR EVERYONE

Date : 20 – 22 July, 2016 Venue: ATF-6 Seminar Hall, U Block

Day 2 Thursday 21 July 2016

09:30	Lecture: Leverage points and systemic interventions for development of strategic and operational management plans
10:00	Practice: Exercise 2, p.46 in Hand Book
11:00	Break
11:15	Lecture: Integrating qualitative and quantitative data in management plans,(using Bayesian Belief Networks (BBNs) modeling Examples: Applications of BBN in real projects
11:45	Tutorial: Using Netica software to develop BBNs
12:15	Lunch
13:30	Practice: Developing BBNs for issues (goals) of interest
14:30	Presentation: Examples of BBNs from the participants (Students may observe)
15:30	Break
15:45	Discussion: Selecting a complex problem for a case-study application of the ELLab (For Day 3)
16:00	Close

Day 2 Outcomes: Awareness and understanding leverage points, short-term fixes vs. systemic interventions, Bayesian Belief Network (BBN) modelling, ELLab process/ framework (stakeholder selection, engagement buy-in, facilitation, the technical details and underlying rationale behind technique selection, application and integration)

PRE-CONFERENCE WORKSHOP
SYSTEM THINKING FOR EVERYONE

Date : 20 – 22 July, 2016 Venue: ATF-6 Seminar Hall, U Block

Day 3 Friday 22 July 2016

09:00	Workshop: Gathering mental models about the issue under consideration (the selected complex problem from Day 2) (Step 1 of the ELLab. Identifying issues) (Students may observe and contribute)
10:15	Break
10:30	Lecture Integration of mental models into a first draft systems model – Refresher
10:45	Workshop: Creating a systems model – Forming themes, creating links, reinforcing and balancing loops, identify main leverage points (Steps 3 & 4 ELLab)
12:15	Lunch
12:45	Workshop: Draft a BBN model for identified main leverages (follow the procedure of the 4 questions p.52 & 53 Hand Book) – Leading to an Influence Diagram on butcher paper (Students may observe)
13:45	Practice Transferring the Diagram into a BBN model using Netica
14:00	Workshop: Ranking factors affecting nodes and populating model (creating Conditional Probability Tables (CPTs) for each node) (Students may observe and contribute)
14:30	Break
14:45	Practice: Scenario testing and refinement of BBN models. Identifying systemic interventions (Step 5. Developing management strategies) (Students may observe)
15:45	Lecture: Reflection and discussion
16:00	Close

Day 3 Outcomes: Understanding diverse mental models around the selected complex problem, sorting out identified issues and primary themes to share with stakeholders, integrating the issues and themes under consideration into a systems model (CLD), identifying potential root causes of issues and leverage points in the system;, using completed BBNs to identify systemic interventions to solve complex problems

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- **Business**
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