



# Program & Abstracts

Making Liveable, Sustainable  
Systems Unremarkable

53rd Meeting of  
The International Society  
for the Systems Sciences  
July 12-17, 2009

The University of Queensland  
Brisbane, Australia  
*Hosted by*  
The School of Integrative Systems  
and ANZSYS

Timothy FH Allen  
President



# Co-Sponsors & Affiliated Organizations

The following organizations have provided various levels of support for the ISSS 2008 conference. All have agreed to publicize the conference through their institutional networks. In addition, those so designated have provided either financial or in-kind support through participation in conference planning and facilitation.



## ANZSYS

Australian and New Zealand Systems Society



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# Welcome

## ISSS 2009

There have been towering figures of our discourse, and some have created or at least led some great institutions of systems science. These great figures notwithstanding, there are remarkably few institutions in systems science that have proven to be stable and robust enough to outlive their creators for long. Deans step in and dismantle what they do not understand, taking the money for their discipline-centred favourites. Perhaps the University of Florida, Gainesville will have the wisdom to continue the thrust of H. T. Odum, but these are early days after our having lost his personal presence. But then to give the lie to the fragility of systems programs stands the University of Queensland, Brisbane, the setting of our upcoming meeting. Is it something in the water of Northern Australia? Or is it the great demand from businesses and a “dry-continent-society” under climate change that makes Australia systems sympathetic? Anyway Queensland is a great centre for systems sciences. Better than that, it appears robust. While we do have our own distinctive systems scientists in Ockie Bosch and Kambiz Maani playing critical roles, the whole systems effort in Queensland is wonderfully broad across the University. The systems leaders in Queensland of this generation will surely have a legacy to leave behind, in contrast to other programs that have proven to be fragile when the founders retire. In Brisbane there is a full set of energetic systems scientists running a broad curriculum of excellence in the field. I see here a set of schools and a university at large pressing forward on general system thinking on a broad front. Deans and administrative leaders will welcome us and have sagely supported the effort of our members as they planned a great meeting. Our thanks go out to our hosts.

Systems education has always had its place, but let's give it a big push this time. We need global systems thinking to be normal, so that each local spot on the planet is not blindsided by unexpected global information. The stability and sheer size of the systems movement in Queensland is important in principle, and for the circumstances in which we find ourselves. I am not alone in feeling I have been waiting for the systems movement to occupy its proper central role in both planning and normal science. Somehow we systems people are odd ducks, respected but often kept at the margins. We on the inside know how important and distinctive is the systems approach. One only has to read the Presidential Address of my personal hero, Robert Rosen, where he says that systems thinking rises above paradigms to be something more substantial than a mere point of view or disciplinary posture. We have a session at our meeting on Rosenian modelling relations. Robert Rosen was a great teacher on which we might model ourselves.

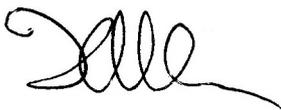
The time often appears right for systems thinking but then it turns out we still have to wait. And that is whence comes the notion of “unremarkable” in the meeting title. Queensland may just be that beachhead from which systems thinking can break out, so that it is taken for granted, normal, indeed unremarkable. It will be remarkable indeed if we can achieve that. In Queensland systems thinking is unremarkable, it is the normal thing to do; other places must follow. Joe Tainter wrote recently of Epirus in Greece and the Rio Grande Valley, on two continents a couple of hundred years apart. He shows an eerie parallel between the detail of the local collapses of both places because of information coming at them from outside their respective local worlds. He saw parallels in stunning detail in the change in both places from self-sufficient subsistent peasantry to unemployment in a tourist economy. The

common cause for the unfortunate twin outcomes was the intrusion of new information from outside. At the end of his paper, Tainter suggested that all parts of contemporary humanity from the First to the Third World face similar predicaments. The economic meltdown of the world economy was a complete surprise to United States where it started, and everywhere else has been hit just as hard. Tainter's solution is global systems thinking, which he says can only be achieved by education from a very early age. Only in that way can humans come to see global systems thinking as unremarkable. Tainter's choice of the word "unremarkable" stimulated me to include it in the theme for the meeting over which I will preside. We all live somewhere locally, with particular problems, cultures and resources, but we all also live in a whole world that is undergoing huge change. To equip those who will run things in a quarter of a century it would be very helpful to teach them now while they are young global systems thinking. Put it in the first grade curriculum. To be fair, the recycling movement in the US has come significantly from kids coming home from school and shaming their parents with what school has taught them, so we have a start. Let's get them to find systems thinking unremarkable. We want them to say incredulously, "Global systems, of course, what else?"

The other theme of our meeting is cutting edge. It focuses on sustainability and livability, a double stage launch into the future. That theme addresses an issue that has been central to my own development as a system scientist: scale. Scale is the issue at the centre of hierarchy theory, my own passion. We cannot get to a planned rational future without both long and short term perspectives. In the end it is a grand vision of a happy long term for our planet and ourselves. But we cannot get there without going through a series of local times with people in them. The unfolding long plan must always be acceptable, or better still embraced, by the people who must live at that time while planning for their respective futures. In the realm of livability human values keep changing, but must be continually met, their transience notwithstanding. The path to sustainability must pass through all of the differently valued livabilities until over the long term a desired sustainable outcome is achieved. As the values for what is livable change, sometimes they must include accepting what might have been seen as unacceptable and a failure in the past, but is in the respective present the best realistic outcome. It took gasoline prices to double in months for livability in the United States to include rejecting SUVs and trucks. The change in values was reflected in sales of those vehicles as they plummeted. The price of a second hand Cadillac is so low now that an opportunist might buy one and pay the higher fuel prices. So the dual issues of sustainability and livability together are very much a complex systems issue that invokes more than one level of analysis. There is plenty for systems theorists and practitioner to bite on.

There is always the tussle in ISSS between those who embrace an ontology of what systems really are as opposed to those who insist on a constructed epistemology where values are at the forefront and what is ultimately real is moot. With the latter point of view, I am postmodern or at least post-normal myself, and that position is important when addressing sustainability. While we cannot sustain impossible material situations, sustainability is not a material issue. There will be a material something in the end, but it is the values that we use in choosing to influence outcomes that count. One is not talking sustainability until one has asked the following: Sustainability of what? For whom? For how long? And at what cost? In general livability is a matter of pressing necessity not planning. Would that we could get the movers to plan and the rank and file to appreciate responding before brutal necessity presses, but we cannot. So we systems folks must plan that there will not be much planning done in choosing livability. Preaching restraint is self-satisfied and never works; Ken Boulding said so. And this applies in microcosm to ourselves. How responsible are we to jet participants around the world from a Northern Hemisphere summer into a Southern

Hemisphere winter, in the middle of a flu pandemic? There have been efforts in the last year to network across systems societies. We are not very good at that yet, but in the light of limited fossil fuel and pandemics we must work at putting more effort into electronic meeting. Of course there are wonderfully valuable things about face to face meeting, and so let us take full advantage face to face at this spectacular meeting to set up systems and relationships so that we can do most of our systems communication in the future without getting on an airplane. I fear that the constraints of real time shortage will press a livability that will make meetings like this one increasingly rare events. We, and the planet, have paid the price for us to come here, so it is our deep responsibility to make the very most of this great setting and the excellent fellowship to move on to a sustainable future for the ISSS. This is a great professional society, and a force for good in a world that really needs some goodness. If we can't plan, who else is going to do it? What a unique place Brisbane is for us all to move forward in a way that really matters. I look forward to meeting face to face with you all here.

A handwritten signature in black ink, appearing to read 'T Allen', with a long, sweeping underline.

Timothy Allen,  
President of the ISSS.

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# Conference Program and Schedule

## INTERNATIONAL SOCIETY FOR THE SYSTEMS SCIENCES 53<sup>RD</sup> ANNUAL CONFERENCE BRISBANE ISSS 2009

### Pre-Conference Workshops

#### 1. Systems Thinking for Complex Problem Solving

Sign-up separately, contact [isssoffice@dsl.pipex.com](mailto:isssoffice@dsl.pipex.com) for details

July 9-11 2009

#### Presenters:

**Professor Kambiz Maani**, Chair in Systems Thinking and Practice, School of Integrative Systems, The University of Queensland, Australia

**Professor John Bliss**, Oregon State University, USA

**Dr Carl Smith**, School of Integrative Systems, The University of Queensland, Australia

**Professor Ockie Bosch**, Head, School of Integrative Systems, The University of Queensland, Australia

#### Venue:

Collaborative Learning Centre

Room 219 Building 14 on St Lucia Campus, The University of Queensland

#### Workshop Brief

This workshop introduces Systems Thinking as an integrating paradigm and set of tools for complex problem solving in general, and natural resource management and sustainability in particular.

The workshop integrates Systems Thinking theory and tools in the context of a real-life case. The selected case attempts to address policy, planning and organisational issues related to sustainable tourism in Cambodia using integrated and systemic frameworks. It is expected that key officials from Cambodia will participate as informants for this workshop.

Thus over 2 and ½ days workshop participants will be exposed to and engage in a real multi dimensional decision-making/problem-solving challenge. The case will be used as a learning platform throughout the workshop.

#### Pre-Conference Workshops PROGRAM

**Day 1** (Thursday 9 July)

##### 9-5 Problem structuring - Professor John Bliss

After a round of introductions we will invest the morning in sharpening our research skills, with special emphasis on case study research. We'll cover articulating effective research questions, designing an efficient research approach, and selecting appropriate methods. We'll

review case study design and application, data collection and analysis. The remainder of the day will be dedicated to applying case study design concepts to a real-world issue involving natural resource management and sustainable tourism in Cambodia.

## **Day 2 (Friday 10 July)**

### **9–12 Systems Thinking for Managing Complexity– Theory and Practice (Professor Kambiz Maani)**

This session will introduce Systems Thinking concepts and its qualitative modeling tool known as Causal Loops Diagrams (CLD) as a common 'language' for stakeholder communication and problem solving. The Iceberg Model will be discussed as a framework for integration and complex multi-stakeholder problem solving. The UNESCO biosphere project in Viet Nam (Cat Ba Island) will be discussed as a demonstration case of application of Systems Thinking in multi-dimensional multi-stakeholder problems- in this case the role of integrated policy and planning in social, environmental, and economic domains.

### **1–5 Bayesian Belief Networks – A tool for group decision Support and Adaptive Management (Dr. Carl Smith & Professor Ockie Bosch)**

This session will focus on the application of Bayesian Networks as a knowledge integration tool for natural resource management. The first part will include an introduction to Bayesian Network models and examples of how they have been applied to natural resource management problems. The second part will involve a practical session in which you will build your own Bayesian Network model for a chosen case study topic.

## **Day 3 (Saturday 11 July)**

### **9-12 Integrating Tools for Strategic Thinking (J Bliss, C Smith, facilitated by Kambiz Maani)**

This session will pull the concepts and tools learned in the first two days and will provide guidelines as how to integrate these and other relevant tools for problem solving and strategic thinking in complex domains.

# BRISBANE ISSS 2009

## Program of Sessions

**Sunday July 12 2009**

**REGISTRATION OPEN 13:00 – 17:00 (Abel Smith Lobby)**

<b>13:00 – 17:00 Opening Workshops</b>		
<b>1.</b>	The System of Systems Processes Theory (SoSP) – A Workshop on How Systems Work (or Don't Work) Room 212 Building 35, (General Purpose North)	<b>Professor Len Troncale</b>
<b>2.</b>	Relational Theory Workshop – Fundamentals of Relational Theory Part II Rosen's Anticipatory Systems Room 213 Building 35, (General Purpose North)	<b>Dr John Kineman and Judith Rosen</b>

**Evening: 5–7pm**

Welcome Cocktail Reception by The University of Queensland Vice Chancellor and Traditional Welcome

General Purpose North 4 (Building 14) Terrace Room, St Lucia Campus

# Monday July 13 2009

## Unremarkable, Liveable, Sustainable Systems

REGISTRATION OPEN 08:00 – 17:00 (Abel Smith Lobby)

8:00 to 9:00 ISSS Roundtable Discussion (Abel Smith Building Rm1)

<b>9:00 Opening session (Abel Smith)</b>		
<b>9:30</b>	<b>Chair: Professor Ockie Bosch</b> Setting the Scene: Unremarkable, Liveable, Sustainable Systems	<b>ISSS President, Professor Tim Allen</b>
<b>10:00</b>	The positive attractor: the role of the holistic worldview in the evolution of a sustainable societal system	<b>Graeme Taylor</b>
<b>10:30</b>	Analysing Liveability - More than Constructive Ambiguity	<b>Robert Kerr</b>
<b>11:00 Tea (Holt Room)</b>		
<b>11:30</b>	<b>Chair: Professor Tim Allen</b> Liveability as a constraint on sustainability or sustainability as a constraint on liveability? Defining terms and mapping relationships to separate scaled hard constraints from soft preferences –	<b>Dr Jacqui de Chazal</b>
<b>12:00</b>	Hunting, gathering, investing, globalizing: the evolutionary roots of economic behaviour –	<b>Professor Martin Burd</b>
<b>12:30</b>	Inclusive well-being: a systemic view of development	<b>Professor Richard Bawden</b>
<b>13:00 Lunch (Holt Room) – Posters for Viewing</b>		

**14:00 1- 6 Parallel Sessions**

1	2	3	4	5	6
<p><b>Gordon Greenwood Building (32) Room 207</b></p> <p><b>Cybernetics and VSM</b> Chair: Allenna Leonard</p> <p><b>1097 Bai</b> A Sociocybernetic Model of Liveable and Sustainable Social Systems</p> <p><b>1111 Stephens J</b> The Application of Stafford Beer's Viable Systems Model to Strategic Planning</p> <p><b>1173 Tejeida-Padilla</b> In Search of a Viable System Model for After-Sales Spare Parts Service in Telecom Firms</p>	<p><b>Gordon Greenwood Building (32) Room 211</b></p> <p><b>Critical Systems Theory and Practice</b> Chair: Jennifer Wilby</p> <p><b>1287 Dean</b> Expense Accounts, MPs and Accountability in the British Parliament: An Autopoietic Perspective</p> <p><b>1163 Foote</b> Systemic Evaluation of Community Environmental Management Programmes</p> <p><b>1122 Smith, T</b> Using Critical Systems Thinking to Help Development Practitioners Foster Sustainable and Liveable Communities</p>	<p><b>Gordon Greenwood Building (32) Room 213</b></p> <p><b>Socio-Ecological Systems</b> Chair: Jon Li</p> <p><b>1116 Painter</b> Sustainable Water Allocation for Families, Fish and Farming: a Wicked Problem Or a Wicked Solution?</p> <p><b>1200 Eriyatno</b> Model of Regional Policy Strategy in Sustainability Irrigation Management</p> <p><b>1267 Ross</b> A Systems Framework for Integrated Water Resource Management</p>	<p><b>Gordon Greenwood Building (32) Room 214</b></p> <p><b>Designing Educational Systems</b> Chair: Ockie Bosch</p> <p><b>1252 Love</b> Using Variety Analyses to Improve Educational Sustainability and Liveability</p> <p><b>1274 Nguyen</b> Capacity Building for Learning Laboratory for Sustainability: the Case of Cat Ba Biosphere Reserve (Viet Nam)</p>	<p><b>Gordon Greenwood Building (32) Room 215</b></p> <p><b>Organizational Transformation and Social Change</b> Chair: Tamar Zohar Harel</p> <p><b>1284 Harel</b> Livability and Sustainability Are They Contradictory? A Social Organizational Perspective on Participatory Action Research Oriented Response</p> <p><b>1085 Taylor</b> Systems Thinking: The Key to Survival</p> <p><b>1167 Dos Santos Martins</b> Sustainable Development Requires An Integrating Discipline to Address Its Unique Problems - Design Thinking</p>	<p><b>Able Smith Building (23) Room 1</b></p> <p><b>Open Room</b></p>

**15:30 Tea (Holt Room) – Posters for Viewing**

**16:00 1 - 6 Parallel Sessions**

1	2	3	4	5	6
<p><b>Gordon Greenwood Building (32)</b> Room 207</p> <p><b>Evolutionary Development Chairs: Alexander and Kathia Laszlo</b></p> <p><b>Laszlo A</b> What Lies <i>beyond</i> Chronocentric and Homocentric Notions of Sustainability?</p> <p><b>1106 King</b> Nature for Nurture: Using Ecological Systems to Design Resilient Communities and Sustain Learning</p> <p><b>1179 Orduñez-Zavala</b> Conceptualization of the Consciousness Field, from the Perspective of Systems Science</p>	<p><b>Gordon Greenwood Building (32)</b> Room 211</p> <p><b>Hierarchy Theory</b> Chair: Jennifer Wilby</p> <p><b>1135 Galbrun</b> Fostering Innovation System of a Firm with Hierarchy Theory: Narratives on Emergent Clinical Solutions in Healthcare</p> <p><b>1293 Hilton</b> Hierarchy Theory and Socio-Environmental Ethics</p> <p><b>1100 Cottam et al.</b> Getting (Empirically) Back To(Wards)(Pre-) (Existential) Basics</p> <p><b>1307 Solomons</b> Understanding Multilingual Trends – Demand and Supply</p>	<p><b>Gordon Greenwood Building (32)</b> Room 213</p> <p><b>Socio-Ecological Systems</b> Chair: Jon Li</p> <p><b>1147 Adams</b> <b>Systems</b> Thinking in the Forestry Value Chain - a Case Study of the New Zealand Emissions Trading Scheme</p> <p><b>1224 Ing A</b> Biobased Lubricants: a Viability Study</p> <p><b>1092 Garg</b> Phytoremediation Potential of Raphanus Sativus L., Brassica Juncea L. and Triticum Aestivum L. for Copper Contaminated Soil</p> <p><b>1186 White</b> Systems Thinking and Participation in a Bio Fuels Project</p>	<p><b>Gordon Greenwood Building (32)</b> Room 214</p> <p><b>Monetary Systems</b> Chair: Debora Hammond</p> <p><b>1275 Hammond</b> Money Matters in Liveable Sustainable Systems</p> <p><b>1136 Kusmuljono</b> Public-Private Partnership Policy: System Approach to Microfinancing</p> <p><b>1260 Mulej</b> Social Responsibility as a Way of Systemic Behavior and Innovation Leading out of the Current Socio-Economic Crisis</p> <p><b>1277 Takahashi</b> Democracy Makes Peace? The Possibility of Systems Thinking</p>	<p><b>Gordon Greenwood Building (32)</b> Room 215</p> <p><b>Organizational Transformation and Social Change</b> Chair: Tamar Zohar Harel</p> <p><b>1193 Frias</b> Politics, Society and Synergy At Complex Environments</p> <p><b>1184 Pusztai</b> Learning for Sustainability: An Empirical Study of Local Governments in Hungary</p> <p><b>1099 Tepe</b> World View and Implications for Practice. Occup-ational Health and Safety as a Model</p> <p><b>1223 Peon-Escalante</b> Complex Model of a Transdisciplinary Action-Research Program on the Environment, Through Interinstitutional Networks</p>	<p><b>Able Smith Building (23)</b> Room 1</p> <p><b>Open Room</b></p>

**18:00 Dinners available at UQ Campus facilities**

<b>18:00</b>	ISSS Board Meeting	<b>ISSS Board Members</b>
<b>18:30 to 20:30</b>	Workshops: 1. Making the Soft Sciences Hard and Making Systems Science Relevant  2. Systems Education Workshop: How the Integrated Science General Education Program (ISGE) can be used for Systems Education “Stealth” Systems Science At Every University	<b>James Simms</b>  <b>Len Troncale</b>

**Tuesday July 14 2009**

## **Progressive Plenary Session**

**REGISTRATION OPEN 07:30 – 08:30 (Abel Smith Lobby)**

**8:30 – 17:00 Bus pick up from St Lucia Campus (pick-up spot TBA)**

### **Progressive Plenary Session**

**Facilitated by Alexander and Kathia Laszlo**

Three stops with keynote speakers at each point (Identify issues; working groups select two or three issues and identify possible systemic interventions to address problems during conference. Presentations and discussion during Friday morning session).

1. 9:00 – 10:30 – Venue: Brisbane River (TBA)

**A Voice for Waterways: An integrated approach to managing catchments and waterways in Australia’s fastest-growing region** (UQ Vice Chancellor

**Professor Paul Greenfield);**

2. 11:30 Venue: Mt-Cootha Botanical Gardens  
**Peri-urban Food systems – (Martha Sheppard)**

**13:00 Lunch Lakeside Gardens Café**

3. 15:00 – 16:30 Venue: Queensland State Planning & Infrastructure, Brisbane CBD  
**Infrastructure for a fast growing State (John Larcombe)**  
**Driving back to St Lucia Campus, experiencing traffic of a fast growing city (faint hearted to take calming medicine before the journey)**

**17:00 St Lucia Campus Closing Remarks and next steps - Alexander and Kathia Laszlo**

## Wednesday July 15 2009

### Enhancing Governance with Systems Thinking and Practice

REGISTRATION OPEN 08:00 – 17:00 (Abel Smith Lobby)

7:30 to 8:30 ISSS Roundtable Discussion (Abel Smith Building Rm1)

8:30 Day 3 (Abel Smith)		
8:30	<p><b>Chair: Assoc. Professor Bob Cavana</b>            People First: How to make environmental sustainability something we want to live with.</p>	<p><b>The Hon. Steve Maharey</b>, Vice Chancellor Massey University, New Zealand</p>
9:00	<p>Contemporary Government Challenges: Delivering performance and accountability' and the intersections with 'wicked policy problems</p>	<p><b>Lynelle Briggs</b>, Australian Public Commissioner</p>
Tea	<p><b>9:30</b></p>	<p>Café Style Interactive Plenary Session facilitated by ANZSYS (Australian and New Zealand Systems Group):</p> <ol style="list-style-type: none"> <li>1. Conversation Mapping coordinated by <b>Prof Ray Ison</b> (Open University, UK &amp; Monash University, Australia) – examining issues raised by keynote speakers</li> <li>2. Panel discussion between the 2 keynote speakers &amp; organisers of conversation mapping workshop</li> <li>3. Discussions &amp; Feedback</li> </ol>
12:30 Lunch (Holt Room) – Posters for Viewing		

13:30 1-5 Parallel Sessions				
1	2	3	4	5
<p><b>Gordon Greenwood Building (32)</b> <b>Room 207</b></p> <p><b>Evolutionary Development</b> <b>Chairs: Alexander and Kathia Laszlo</b></p> <p><b>1297 Blachfellner</b> Innovators for Sustainability – Designing a Learning Journey</p> <p><b>1228 Briones-Juarez</b> Toward the Evolution of the Tourism’s Conceptual System</p> <p><b>1151 Avalos</b> An Evolutionary National Telecommunication System Through Knowledge Management</p>	<p><b>Gordon Greenwood Building (32)</b> <b>Room 211</b></p> <p><b>Medical and Health Systems (and Systems and Mental Health)</b> <b>Chair: Thomas Wong</b></p> <p><b>1134 Monypenny</b> Which Systems Thinking Framework?</p> <p><b>1219 Metcalf M</b> Analyzing Benefits and Risks in Medicine, to Whom and for Whom?</p> <p><b>1291 Ngana</b> Achieving a Sustainable Health System - a Conceptual Framework for Holistic Decision Making</p>	<p><b>Gordon Greenwood Building (32)</b> <b>Room 213</b></p> <p><b>Systems Applications in Business and Industry</b> <b>Chair: David Ing</b></p> <p><b>1268 Gregory W</b> Serving the Public Sector: a New Approach for Co-Created Value</p> <p><b>1084 Ing D</b> Envisioning Innovation in Service Systems: Induction, Abduction and Deduction</p> <p><b>Continuing into:</b> Conversation on an Emerging Science of Services Systems Facilitator: David Ing</p>	<p><b>Gordon Greenwood Building (32)</b> <b>Room 214</b></p> <p><b>Systems Modelling and Simulation and Agent-based Social Systems</b> <b>Chair: Gerhard Chroust</b></p> <p><b>1299 Okayasu</b> Game Theoretical Analysis on Service System Interaction</p> <p><b>1137 Sato</b> Design of Fuzzy Neural Network Based Multi-Variables Controllers for Manipulator</p> <p><b>1121 Fielden</b> Local E-Government in New Zealand: Digital Strategy, Social Inclusion and Liveability</p>	<p><b>Gordon Greenwood Building (32)</b> <b>Room 215</b></p> <p><b>Balancing Individualism and Collectivism</b> <b>Chair: Janet McIntyre</b></p> <p><b>1169 McIntyre-Mills</b> Balancing Individualism and Collectivism: User Centric Policy Design to Enhance Evolutionary Development and to Address Complex Needs</p> <p><b>1160 McGillivray</b> Turning Leadership Outside In: Boundary Spanners' Internal Boundary Work</p>
<p><b>13:30 Session 6 - Workshop (Abel Smith)</b></p> <p><b>Systems Education Workshop</b></p> <ul style="list-style-type: none"> <li>• Introduction <b>Professor Ockie Bosch</b>, Chair International Committee for Systems Education</li> <li>• Systems education in Vietnam – from none to excitement <b>Assoc Professor Hoang Tri</b></li> <li>• Establish a Systems Education Network - Facilitators: <b>Professors Kambiz Maani &amp; Ockie Bosch</b></li> </ul> <p><b>15:00 to 15:30 Information Meeting with the International Federation for Systems Research (IFSR) in Gordon Greenwood Building Room 214, Gerhard Chroust, Matjaz Mulej, Gary Metcalf</b></p>				

<b>15:30 Tea (Holt Room) – Posters for Viewing</b>				
<b>16:00 1-5 Parallel Sessions</b>				
<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<p><b>Gordon Greenwood Building (32) Room 207</b></p> <p><b>Evolutionary Development</b> Chairs: Alexander and Kathia Laszlo</p> <p><b>1176 Badillo-Pina</b> Systems Science as a System of Knowledge: An Exploration Research of Its Structure</p> <p><b>1263 Varey</b> Apithological System Dynamics in Strategic Sustainability Conversations</p> <p><b>Castro Laszlo</b> Addressing Poverty in the Context of Evolutionary Development</p>	<p><b>Gordon Greenwood Building (32) Room 211</b></p> <p><b>Systemic Approaches to Conflict and Crises</b> Chair: Dennis Finlayson</p> <p><b>1259 Finlayson</b> Access to Systems Ideas and Application to Crisis and Conflict Situations: Some Initial Thoughts?</p> <p><b>1149 Sim</b> Toward the Living Systems Analysis of Two Korean Relations</p> <p><b>1180 Barrera</b> Crisis! Jobless and Small Business: Danger and Hope</p> <p><b>1222 Yu</b> Problematizing Problem-Solving Methods for Exploring the Management of Social Enterprises</p>	<p><b>Gordon Greenwood Building (32) Room 213</b></p> <p><b>Systems Applications in Business and Industry</b> Chair: David Ing</p> <p><b>Conversation on: An Emerging Science of Services Systems</b> Facilitator: David Ing</p>	<p><b>Gordon Greenwood Building Room 214</b></p> <p><b>Systems Modelling and Simulation</b> Chair: Gerhard Chroust</p> <p><b>1295 Lane</b> The Carrying Capacity Imperative: Assessing Regional Carrying Capacity Methodologies for Sustainable Land-Use Planning</p> <p><b>1174 Matamoros</b> Fractal Analysis of Epilepsy</p> <p><b>1194 Chroust</b> Training and Supporting First Responders by Mixed Reality Environments</p> <p><b>1105 Vega</b> Planning Model for Continuous Improvement of the Communication System in Mexico</p>	<p><b>Gordon Greenwood Building (32) Room 215</b></p> <p><b>Organizational Transformation and Social Change</b> Chair: Thomas Wong</p> <p><b>1227 Mendez-Diaz</b> The Value Equation</p> <p><b>1155 Stephens A</b> Towards a Feminist-Systems Theory - An Overview of Method, Emerging Results and Implications for Practice.</p> <p><b>1178 Allan</b> Uptake of Networking Technology- An 'Emergent' Phenomenon</p> <p><b>1104 Ghasemi</b> Toward a Spiritual System in Organization Through Spiritual Leadership</p>
<b>16:00 Session 6 - Workshop (Abel Smith)</b>				
Systems Education Workshop continued				
<b>18:00 Dinners available at UQ Campus facilities</b>				
<b>18:00</b>	ISSS Council Meeting, Room TBA		<b>ISSS Council Members</b>	
<b>19:00 to 20:30</b>	Past-Presidents Fireside Chat, Room TBA		<b>Past Presidents of ISSS</b>	

**Thursday July 16, 2009**

**Systems Expressed in Everyday Life – Art, People, Tourism, Planning, Management, Journalism, Cultural Heritage Development**

**REGISTRATION OPEN 08:00 – 17:00 (Abel Smith Lobby)**

**7:30 to 8:30 ISSS Roundtable Discussion (Abel Smith Building Rm1)**

<b>8:30 Day 4 (Abel Smith)</b>		
<b>8:30</b>	<b>Chair: Professor Helen Ross</b> Art & Systems Thinking– Floating Lands	<b>Christine Ballinger &amp; Ben McMullen, Noosa Biosphere</b> <b>Professors Ockie Bosch &amp; Kambiz Maani, The University of Queensland</b>
<b>9:00</b>	Indigenous Perspectives on Sustainability: Connectedness	<b>Michael Williams, The University of Queensland</b>
<b>10:00</b>	Getting our act together: a systems change in everyday decision-making	<b>Professor Val Brown, Australia National University, Canberra</b>
<b>10:30 Tea (Holt Room) – Posters for Viewing</b>		
<b>11:00</b>	<b>Chair: Professor Kambiz Maani</b> The role of Systems Approaches in the sustainable management of Biosphere	<b>Dr Ishwaran Natajaran UNESCO, Paris</b>
<b>11:30</b>	Systems Thinking in Planning and Managing Hai Phong City, Vietnam	<b>Dr Nguyen Van Thanh , Vice Chairman, People’s Committee of HaiPhong City, Vietnam</b>
<b>12:00</b>	Role of Systems Thinking in Journalism and media coverage of complex issues	<b>Professor Michael Bromley (Including short presentations of three journalism students), The University of Queensland</b>
<b>12:30</b>	Cua Van – A Culture in Sustainable Development Transformation	<b>Professor Amareswar Galla The University of Queensland</b>
<b>13:00 Lunch (Holt Room) – Posters for Viewing</b>		

<b>13:30 1-5 Parallel Sessions</b>				
<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<p><b>Gordon Greenwood Building (32) Room 207</b></p> <p><b>Critical Systems Theory and Practice</b> Chair: Jennifer Wilby</p> <p><b>1301 Midgley</b> How Should We Present Systems Thinking to People With Little Prior Knowledge of the Field?</p> <p><b>1270 Nakamori</b> Knowledge Construction Systems</p> <p><b>1096 Velez-Castiblanco</b> The Need for Exploring Alternatives in Systemic Interventions: Two Intentional Arguments</p> <p><b>1145 Sheffield</b> Design Theory for Collaborative Technologies: Electronic Discourse in Group Decision</p>	<p><b>Gordon Greenwood Building (32) Room 211</b></p> <p><b>Socio-Ecological Systems</b> Chair: Jon Li</p> <p><b>1152 Faggian</b> Systemic Regional Development - A Systems Thinking Approach</p> <p><b>1170 Bellamy</b> Regional Governance in Rural Australia: An Emergent Phenomenon of the Quest for Liveability and Sustainability?</p> <p><b>1142 Wedderburn</b> Rural Futures': a Social-Ecological Systems Perspective on New Zealand Farming Futures</p> <p><b>1233 Kingi</b> Iwi Futures: Integrating Traditional Knowledge Systems, Cultural Values and Agricultural Development Pathways</p>	<p><b>Gordon Greenwood Building (32) Room 213</b></p> <p><b>Systems Applications in Business and Industry</b> Chair: David Ing</p> <p><b>1138 Molineux</b> Macro-Cycles of Change - Learning from An Organisation's History</p> <p><b>1139 Nakamura</b> A Methodology to Prolong System Lifespan and Its Application to IT Systems</p> <p><b>1119 Klein</b> Balancing Cross-Cultural Complex Project Management: Untying Gordian Knots of Social Complexity, Or Towards An Ecology of Paradigms</p>	<p><b>Gordon Greenwood Building (32) Room 214</b></p> <p><b>Spirituality and Systems</b> Chair: Carl Swanson</p> <p><b>1298 Swanson</b> A Systems Analysis of Spiritual Disciplines</p> <p><b>1124 McGill</b> Towards a Systems Based Spiritual Philosophy for the 21st Century</p> <p><b>1276 Wong</b> The Liveable and Sustainable Spirituality System - the Buddha's View and the Systemic View on Heaven, Earth, Hell, and Liberation</p> <p><b>1165 Peric</b> The Decline of Astrology: a Symbol of Man's Disconnection With Nature, Self and The Cosmos</p>	<p><b>Gordon Greenwood Building (32) Room 215</b></p> <p><b>What is Life and Living?</b> Chair John Kineman and Judith Rosen</p> <p><b>1183 Kineman</b> Relational Theory and Ecological Niche Modelling</p> <p><b>1266 Cottam</b> Identity Survival: Grounds for Life?</p> <p><b>1226 Rosen J.</b> Robert Rosen's Anticipatory Systems Theory: the Art and Science of Thinking Ahead</p> <p><b>1286 Wong</b> Which Came First, the Chicken Or the Egg? - The Investigation With Ancient and Modern System Theories for the Origin of Existence</p>
<b>13:30 Session 6 - Workshop (Abel Smith)</b>				
<p><b>Workshop: User-centric policy design to address complex wellbeing needs</b> Refer to software to address wellbeing; proposing to adapt software for local government to address climate change. <b>Assoc Prof Janet McIntyre (Flinders University, Adelaide Australia), Dr David Hope, Dr Denise de Vries &amp; Peter Turner</b> - Aboriginal elder taking part in a systemic conversation on social, economic and environmental challenges in Alice Springs</p>				

**15:30 Tea (Holt Room) – Posters for Viewing**

**16:00 1-5 Parallel Sessions**

1	2	3	4	5
<p><b>Gordon Greenwood Building (32)</b> <b>Room 207</b></p> <p><b>Critical Systems Theory and Practice</b> <b>Chair: Jennifer Wilby</b></p> <p><b>1262 Gregory A.</b> Scoping a Systems-Based Method for Organisational Evaluation</p> <p><b>1110 Haslett</b> Applying Multi-Methodological Systems Theory to Project Management</p> <p><b>1093 Jeppeson</b> Decision Simulation Technique (DST) as a Scanning Tool for Exploring and Explicating Sustainability Issues in Transport Decision Making</p> <p><b>1120 Blanc</b> "The General Theory of Meta-Dynamics Systemicity"</p>	<p><b>Gordon Greenwood Building (32)</b> <b>Room 211</b></p> <p><b>Socio-Ecological Systems</b> <b>Chair: Jon Li</b></p> <p><b>1114 Nguyen</b> The importance of Systems Thinking and Practice for Creating Biosphere Reserves as Learning Laboratories for Sustainable Development</p> <p><b>1250 Li</b> Surviving the Economy</p> <p><b>Followed by 60 minutes discussion of Economy and Sustainability</b></p>	<p><b>Gordon Greenwood Building (32)</b> <b>Room 213</b></p> <p><b>Systems Applications in Business and Industry</b> <b>Chair: David Ing</b></p> <p><b>1141 Daniel</b> Workplace Bullying in American Organizations: the Path from Recognition to Prohibition</p> <p><b>1133 Sun</b> Systems Thinking, Relationship Management and Supply Chains</p> <p><b>1146 Mai</b> System Thinking Approach as a Tool for Sustainable Tourism Development</p> <p><b>1101 Pan</b> Improving the 'Cyber Lemons' Problem With the Counteracting Mechanism in Chinese E-Commerce Market: Based on the Data from Taobao.Com (China)</p>	<p><b>Gordon Greenwood Building (32)</b> <b>Room 214</b></p> <p><b>Research Towards a General Theory of Systems</b> <b>Chair: Len Troncale</b></p> <p><b>1278 von Schilling</b> Entropy Debt: a Link to Sustainability?</p> <p><b>1210 Metcalf G</b> A Case for System-Specific Modeling</p> <p><b>1107 King</b> The Theory of Social Learning for Change in Complex Environments: Adding the People-Environment Interface</p> <p><b>1131 Abel</b> A General Model of Information: the 'Information Cycle' of H.T. Odum and Its Application to 'Culture'</p>	<p><b>Gordon Greenwood Building (32)</b> <b>Room 215</b></p> <p><b>Information Systems Design and Information Systems</b> <b>Chair: Roberto Kampfner</b></p> <p><b>1154 Low</b> Data, Information, Knowledge: a Semiotic-System's View for Database Design</p> <p><b>1094 Lind, B</b> Communication - a Platform for Mutual Message Exchange</p> <p><b>1188 Kampfner</b> The Architecture of Computer-Based Information Processing and Effectiveness and Adaptability of Systems</p> <p><b>1095 Lind A</b> Uses and Gratification Theory in Virtual Network Analysis</p>

**16:00 Group Workshops (Abel Smith)**

Systemic Interventions, Issues identified during progressive plenary session on Tuesday

**19:00 ISSS Conference Banquet**

"Paddock to Plate" Venue: Holt Room

## Friday July 17 2009

REGISTRATION OPEN 08:00 – 12:00 (Abel Smith Lobby)

### 7:30 to 8:30 ISSS Roundtable Discussion (Abel Smith Building Rm1)

8:30 Final Day (Abel Smith)		
8:30	<b>Chair: Professor Len Troncale</b> Group Presentations – Systemic Interventions for addressing issues identified during Tuesday's progressive plenary session	<b>Facilitated by Alexander and Kathia Laszlo</b>
9:30	Student session	<b>Facilitated by Assoc. Prof John Herbohn The University of Queensland</b> (5 X 10min presentations from PhD students in UQ School of Integrative Systems)
10:30 Tea (Holt Room) – Posters for Viewing		
11:00 Plenaries		
11:00	<b>Chair: Gary Metcalf</b> Tying together any loose strings Presentation by Vickers Award Recipient	<b>Professor Tim Allen, ISSS President 2008/09</b>
11:15	Incoming President Invitation and presentation: <b>Next Conference</b>	<b>Allenna Leonard Incoming ISSS President, 2009/10</b>
12:00	Annual General Meeting	<b>All ISSS Members</b>
12:30 Close of Conference		

Breakout rooms will still be available for any groups who want to continue conversations into the afternoon.

# Plenary Speakers

## Monday, July 13, 2009: Unremarkable, Liveable, Sustainable Systems

### Professor Timothy FH Allen, University of Wisconsin, Madison USA



Timothy Allen is President of the ISSS. He is Professor of Botany at the University of Wisconsin, Madison. His degrees are from the University College North Wales in 1964 – 1968. After two years at the University of Ife, Nigeria, he joined the faculty at the University of Wisconsin in 1970. He has been applying notions of complex systems and hierarchy theory to ecology for thirty-five years. His first book, *Hierarchy: perspectives for ecological complexity*, Chicago Press, 1982, established hierarchy theory and scaling in ecology. His four other hierarchy theoretic books either specialize in ecosystem analysis, or broaden across all types of ecology and beyond to the life and social sciences in general. He has published over 60 scholarly works in journals on plant community data analysis, agricultural systems, issues of scale, sustainability and narrative in complexity theory. His latest work is a book with J. Tainter and T. Hoekstra, *Supply side sustainability*, CUP, 2003. It enters the emerging field of economic ecology, and identifies that we must manage the whole ecosystem that makes resources renewable, not natural resources themselves. His present research push is a general theory of switches in resource quality for ecology and society.

### Graeme Taylor, Best Futures, Brisbane, Australia



Graeme Taylor is the coordinator of BEST Futures ([www.bestfutures.org](http://www.bestfutures.org)) a project using evolutionary systems theory to model societal change, analyse global problems and develop viable solutions. He is the author of *Evolution's Edge: The Coming Collapse and Transformation of Our World*, which won the Independent Publisher's 2009 Gold Medal for the book "most likely to save the planet". Graeme is also an Adjunct Reader with the School of Integrative Systems, University of Queensland; an Adviser to the 2010 World Peace Festival; an Honorary Research Adviser to the Australian Peace and Conflict Centre; and a PhD Candidate at the Griffith School of Environment in Brisbane.

## **Robert Kerr**



Robert Kerr was appointed as a Commissioner of the Victorian Competition and Efficiency Commission in 2004, responsible for conducting public inquiries and regulation reviews, most recently into 'Liveability'. He is currently presiding on an inquiry into shared facilities. He served many years as a senior executive with the Australian Government, in the Treasury portfolio, advising on foreign investment, overseas borrowing and structural reform, as well as serving in Tokyo. From 1996 to 2004 he was head of the staff of the Productivity Commission. He is a graduate of Cambridge University and the Royal College of Defence Studies.

## **Dr Jacqui de Chazal, Australian National University, Canberra, Australia**



Jacqueline de Chazal began as an ecologist however a hyper-enthusiasm for the indisputability and gravity of multiple perspectives has led to unremitting ventures into most other areas including philosophy, ecological economics and politics. This appears to well suit her core business, being the development of conceptual models and practical methods for working with multiple and shifting perspectives on assessments of change in socio-ecological systems. Jacqui has contributed to the 2007 Working Group II Impacts, Adaptation, and Vulnerability, the Fourth Assessment Report of the Intergovernmental Panel of Climate Change (IPCC), the Millennium Ecosystem Assessment (MEA), lived and

worked in Australia, France, Belgium, England and Africa, has considerable experience in community engagement in environmental management and has collaborated with engineers in philosophy underpinning multi-disciplinary problem solving.

## **Professor Martin Burd, Monash University, Victoria, Australia**



Assoc. Professor Martin Burd received his B.Sc. and M.S. from the University of Wisconsin and Ph.D. from Princeton University, and is currently an Associate Professor at Monash University in Melbourne. His research interests include a variety of topics in behavioural evolution, and he is currently studying the evolutionary basis of economic decision making in humans and other animals, and the dynamics of panic behaviour in large crowds and pedestrian traffic behaviour using ant colonies as model systems.

## **Professor Richard Bawden, Michigan State University and Open University**



Until his recent retirement from four decades in academia, Richard Bawden was a Visiting Distinguished University Professor at Michigan State University (MSU). Prior to going to the USA in 2000, he had had a long career at Hawkesbury Agricultural College thence the University of Western Sydney (UWS) as Dean of Agriculture and Rural Development and Professor of Systemic Development. He is currently a Director and Fellow of the Systemic Development Institute based in Sydney Australia, an Emeritus Professor of UWS, and an Adjunct Professor at

MSU..

## **Tuesday, July 14, 2009: Systemic Interventions**

*Facilitated by Drs Alexander and Kathia Laszlo*

### **UQ Vice Chancellor Professor Paul Greenfield AO, BE(Hons), PhD NSW, BEcon Qld., FTSE, FIEAust, FIChemEng, FAICD, MAIChE**



Professor Greenfield was appointed Vice Chancellor from 1 January 2008 and was Senior Deputy Vice-Chancellor from 2002 to 31 December 2007. Previously he was Deputy Vice-Chancellor (2001), Deputy Vice-Chancellor (Research) (1997-2000), Executive Dean of the Faculty of Engineering, Physical Sciences and Architecture and Pro-Vice-Chancellor (Physical Sciences and Engineering). Professor Greenfield has extensive experience as a Board Director and has consulted and worked widely with industry. His interests lie in biotechnology, environmental management and R&D management and commercialisation. He is currently Chair of the Scientific Advisory Group of

the South East Queensland Healthy Waterways Partnership. He is also Chair of the Riversymposium Strategic Planning Committee, the Thiess International Riverprize Committee and the International Water Centre.

### **Martha Shepherd, Galeru, Queensland, Australia**



Following a 30-year career in the food industry in the USA and Australia—in particular Director of International Operations with Mrs. Fields Famous Brands which involved managing the company’s international franchise network in 37 countries as well as new product research and development--Martha founded Galeru with her partner David Haviland in 1997. Galeru produces a range of unique products using native Australian rainforest fruits grown on their property in the Sunshine Coast hinterland north of Brisbane. The trees were purpose grown as a high value niche crop, with the farm developed to be both environmentally sustainable and commercially viable. Martha’s work in developing a value chain model for sustainable use of small parcels of land earned her the inaugural National RIRDC Rural Women’s Award in 2006. She was appointed Innovator in Residence in 2007 by the Centre for Rural and Regional Innovation QLD, where her focus was innovation & sustainability in peri-urban agriculture. Martha was recently made an Honorary Senior Fellow of the University of the Sunshine Coast for her contributions to agriculture, and is a Director of Australian Native Food Industry Ltd, the peak industry body for native foods in Australia.

### **John Larcombe, Queensland State Planning and Infrastructure, Brisbane, Australia**



John Larcombe has more than 30 years experience in economics, transport and infrastructure planning. He is Executive Director in the Planning Group of the Queensland Department of Infrastructure and Planning. He was responsible for developing the South East Queensland Infrastructure Plan and Program. He has a key role in the development of this process that ensures the delivery of key infrastructure to support the SEQ Regional Plan. John Larcombe was awarded a Churchill Fellowship to study mass transit systems in the USA and Canada. The main objective of the study tour was to investigate how transit systems have developed and are being developed to support the development of major cities. This issue is very topical in Australia as governments strive to deal with the transport issues resulting for urban growth.

## **Wednesday, July 15, 2009: Enhancing Governance with Systems Thinking and Practice**

### **Hon. Steve Maharey, Vice Chancellor Massey University, New Zealand**



Steve Maharey is the Vice-Chancellor of Massey University. Prior to this he was the fourth-ranked Minister in Government for nine years holding the positions of Minister of Education, Minister Responsible for the Education Review Office and the New Zealand Qualifications Authority, Minister of Research, Science and Technology, Minister Responsible for Crown Research Institutes, Minister of Broadcasting, Minister Responsible for Television New Zealand, Chair of the Cabinet Social Development Committee and Member of Parliament for Palmerston North from 1990 until 2008. Mr Maharey was responsible for the reforms of the tertiary education sector that began in 2003 and oversaw the establishment of the New Zealand's

Tertiary Education Commission. Prior to entering Parliament he was a senior lecturer in sociology. Earlier in his career he was a junior lecturer in business administration, and a lecturer in sociology. His academic interests include social policy, media, cultural studies, social change and politics. He is currently working on a book examining public policy responses to change in the 1980s, 90s and the 21st century.

### **Lynelle Briggs, Australian Public Commissioner, Canberra, Australia**



Lynelle Briggs has been with the Australian Public Service for 29 years. Her career has involved time in the former Department of Social Security, the Department of the Prime Minister and Cabinet, the Treasury and the then Department of Health and Aged Care. Lynelle also lived in Wellington NZ for two years in the late 1980s, while working with the New Zealand Treasury. During her career, Lynelle has covered most of the social policy field – social security, health and community services, external territories, employment and labour market support and veterans' affairs. She has been closely involved in unemployment and

retirement incomes policies, health care agreements, private health policy and health care delivery. She spent two years as a policy adviser to the Minister for Community Services in the mid-1980s, and found that her time in PM&C provided an excellent grounding in government. Lynelle joined the Department of Transport and Regional Services as Deputy Secretary in June 2001. She had responsibility for overseeing rail and road transport, territories, maritime, wider infrastructure policy such as AusLink, transport planning, local government and the portfolio's budget and information technology. Achievements included the AusLink White Paper, the ARTC rail track lease with NSW and the Energy White Paper. In November 2004 Lynelle was appointed to the role of Australian Public Service Commissioner. Ms Briggs is responsible for the ethical and employment leadership of the Australian Public

Service. She administers the Public Service Act, and provides a range of support services to the Australian Public Service. She is most well known for her annual State of the Service report.

Plenaries will be followed by a Cafe Style Interactive Plenary Session facilitated by ANZSYS (Australian and New Zealand Systems Group), coordinated by **Professor Ray Ison** (Open University, UK and Monash University, Australia)

## **Thursday, July 16, 2009: Systems Expressed in Everyday Life - Art, People, Tourism, Journalism**

### **Christine Ballinger, Noosa Regional Gallery, Queensland, Australia**



Christine is the Director of the Noosa Regional Gallery. She is currently a committee member for Visions Australia, judge for the Australian Business Arts Foundation, industry expert for Arts Queensland and Manager, Noosa Biosphere Cultural Board. Her previous positions and responsibilities include the Executive Director Craft Queensland, Chair Australia Craft and Design Organisations and Board member Craft Australia. Her M.A. (Research) QUT involved intellectual property and visual artists. Christine's creative professional practice spanned 25 years and included solo exhibitions in the art of contemporary paper in Australia, Japan and Europe. Her consultancy practice includes cultural policy development and cluster dynamics in Queensland and the establishment of Indigenous creative businesses in Queensland and NSW.

### **Ben McMullen, Environmental Services Manager, Sunshine Coast Regional Council, Noosa, QLD, Australia**



Ben McMullen is the Manager of Environmental Services at Sunshine Coast Regional Council. His academic background is in science and planning. Ben holds a Bachelor of Science degree from Griffith University in Australian Environmental Studies and a Graduate Diploma of Urban Regional Planning from Queensland University of Technology. Ben has 15 years work experience in the fields of environmental management and ecologically sustainable development. Ben has worked in a variety of roles in Local and State Government, including Natural Area Management, Community Education and Consultation, Fisheries Management and environmental auditing. In this

role, Ben is also involved in promoting all of these activities with higher levels of government and the boarder community. Ben is a past winner of the Queensland Local Government Managers Association's "Young Manager of the Year" award.

## **Professor Ockie Bosch, University of Queensland, Brisbane, Australia**



Professor Ockie Bosch is Head of the School of Integrative Systems at The University of Queensland, Australia; Chair of the International Committee for Systems Education (under auspices of ISSS and IFSR); member of the Noosa Biosphere Education and Research & Development Board; member of the Academic Board of his University; Vice-President Conferences and Membership of the International Society for the Systems Sciences and represents The University of Queensland in the Australian Universities Council for Environmental Deans and Directors. Professor Bosch specialises in the area of Systems Thinking for Sustainable Development; the application of systems theory in practice; the development of evolving information systems as mechanisms for knowledge dissemination and collaborative learning; and the development of processes for linking science with management and policy making. In his current role he leads and co-ordinates several initiatives for developing inter-disciplinary educational and research programmes. The educational programs focus especially on linking various fields of study (e.g. sustainable agricultural production systems, Food Safety and Security, Business, Resilient Communities, Systems Engineering and Natural Resource Management systems) to a systems core.

## **Professor Kambiz Maani, University of Queensland, Brisbane, Australia**



Kambiz Maani is the holder of UQ-AgResearch Chair in Systems Thinking and Practice at the University of Queensland. Professor Maani's academic and consulting career spans over 25 years in the USA, Asia, Australasia, and South America. He is an internationally acknowledged expert in systems thinking, organizational learning and leadership. Kambiz has lectured internationally and has held visiting positions at a number of universities including MIT, London Business School, Boston University, Cornell and Helsinki School of Economics. He is the recipient of several research and publication awards from international academic journals.

He has published widely and has consulted to numerous organisations in Australasia and around the world. He is co-author (with Professor Robert Cavana) of internationally acclaimed book: Systems thinking, Systems Dynamics - Managing Change and Complexity. The book, now in second edition, is used widely at universities and corporations around the world.

## **Michael Williams, University of Queensland, Brisbane, Australia**



Michael Williams (MPhil [Qual.] Griffith) is a member of the Gooreng Gooreng Aboriginal community from the country between Gladstone and Bundaberg in southeast Queensland. He has been involved in the broad area of Aboriginal and Torres Strait Islander affairs for over 30 years, including service on various boards and committees in community organisations and government bodies. For the past 20 years he has worked in the tertiary education sector, lecturing in mainstream history and, more particularly, involved with programs that provide support for Indigenous Australian students. He is Director of the University of Queensland's Aboriginal and Torres Strait Islander

Studies Unit. He is formally trained in anthropology and history and his special academic interests include Indigenous language use, cross-cultural communication and methods that ensure that Indigenous intellectual traditions and ways of managing knowledge are understood on Indigenous terms and respected equally alongside other intellectual traditions. In this regard, more recently, he has been articulating these interests within the emerging field of Indigenous Knowledge. He has served on the Council and Research Committees of the Australian Institute of Aboriginal and Torres Strait Islander Studies in Canberra for most of the last 20 years where he has developed a broad understanding of research from many different academic disciplinary perspectives. His career in teaching and research at tertiary institutions has included serving on academic boards, faculty boards, equity committees and other working parties concerned with Indigenous and non-Indigenous student interests. Michael's career has taken him into interests beyond Indigenous affairs. He has served on the Board of the Special Broadcasting Services (SBS), a national television and radio broadcaster, specifically devoted to broadcasting material of particular interest to ethnic communities represented in Australia.

## **Emeritus Professor Valerie A. Brown AO, BSc MEd PhD, Australian National University, Canberra, Australia**



Professor Brown is currently Visiting Fellow and Director of the Local Sustainability Project at the Fenner School of Environment and Society, Australian National University. She works in collaborative action research with communities Australia-wide and overseas. Her research aim is to advance collective decision-making in moving towards a just and sustainable future. In 1999 Valerie was appointed an Officer of the Order of Australia for policy, research and advocacy for sustainable development. In 2008 she was a participant in the sustainability section of the Prime Minister's 2008 Summit. Her most recent books are

Leonardo's Vision. A guide to collective thinking and action and an editor of Social Learning and Environmental Management.

## **Dr Ishwaran Natajaran, Director, Division of Ecological and Earth Sciences, UNESCO, Paris**



Dr Ishwaran Natajaran is Sri Lankan and holds a BSc (Zoology) and MSc (Ecology) from the University of Peradeniya, Sri Lanka; and Ph.D. (Wildlife Biology and Management) from Michigan State University, USA. Thirty years of experience in teaching, research, wildlife/protected areas planning and management, multi-lateral environmental and biodiversity treaties, and co-ordination and management of international co-operation in environment and development. More than 25 publications in refereed journals; co-author of two edited volumes on ecology, biodiversity conservation and protected area management themes. Working in UNESCO since 1986, on programs and activities linked to ecological sciences and biodiversity conservation in co-operation with intergovernmental forums, national and international NGOs, funds and foundations, and private sector institutions. Work experience and achievements in negotiating significant technical and financial benefits, particularly for less developed countries, for biodiversity conservation, protected area management, ecological sciences research and capacity building.

The Division of Ecological and Earth Sciences of UNESCO is the focal point for all UNESCO relations on biodiversity. It oversees two of the many intergovernmental scientific programmes of UNESCO directly related to sustainable development; namely the Man and the Biosphere (MAB) and the International Geological Sciences (IGCP) Programmes. The Division promotes ecosystem, biodiversity and earth sciences and remote sensing applications for sustainable development. Capacity building in less developed countries, particularly strengthening ecological and earth sciences applications in sustainable use of biodiversity in Africa, is a major emphasis. The Division also advocates and supports the use of biosphere reserves designated under the MAB Programme as laboratories and learning sites for sustainable development. The implementation of the Madrid Action Plan (2008-2013) will emphasize the use of biosphere reserves as learning places for sustainable development to generate knowledge resources for the last five years (2010-2014) of the UN Decade of Education for Sustainable Development (UNDESD).

## **Professor Michael Bromley, Professor of Journalism and Head of the School of Journalism and Communication at the University of Queensland, Brisbane, Australia**



Michael Bromley is professor of journalism and head of the School of Journalism and Communication at The University of Queensland. He was a daily newspaper journalist mainly in the UK for more than 20 years. He has since taught in the UK, the USA and Australia.

**Professor Amareswar Galia, University of Queensland, Brisbane, Australia**



Born and educated in both south and north India including the prestigious Jawaharlal Nehru University in New Delhi, Professor Galia provides strategic cultural leadership in Australia and the Asia Pacific Region as the Professor of Museum Studies at the University of Queensland in Brisbane. (<http://www.emsah.uq.edu.au>) Until recently he was the Professor and Director of Sustainable Heritage Development, Research School of Pacific and Asian Studies, the Australian National University in Canberra. He is the Guest Curator of International Projects with the Vietnam National Department of Cultural Heritage; and Founding Convener of the Pacific Asia Observatory for Cultural Diversity in Sustainable Heritage Development in partnership with several bodies including UNESCO. ([www.pacificasiaobservatory.org](http://www.pacificasiaobservatory.org) – web page under redevelopment) His recent work on the use of ecomuseology as a methodological tool for sustainable development and poverty alleviation has won him outstanding conservationist of the year award from the Vietnamese government in 2002 and the European Best in Heritage Award in 2008. He is also the Editor-in-Chief of three academic journals dealing with Sustainable Heritage Development: International Journal of the Inclusive Museum ([www.museum-journal.com](http://www.museum-journal.com)) Chicago/Melbourne; International Journal on Intangible Heritage ([www.ijih.org](http://www.ijih.org)) Seoul/Paris; International Journal on Environmental, Cultural, Economic and Social Sustainability ([www.sustainability-journal.com](http://www.sustainability-journal.com)) Chicago/Melbourne.

**Friday, July 17, 2009: Systemic Interventions and ISSS 2010**

**Drs Alexander and Kathia Laszlo**

**Professor John Herbohn, University of Queensland, Brisbane, Australia**

**Dr Allenna Leonard, President ISSS 2009-2010, Complementary Set, Toronto, Canada**

# Plenary Abstracts

## Monday, July 13, 2009: Unremarkable, Liveable, Sustainable Systems

### **Setting the scene: unremarkable, liveable, sustainable systems**

***Timothy F H Allen***

Systems approaches are challenging enough that thinkers inside disciplines find them too difficult to be useful. Scholars generally ignore systems. But we who are used to systems thinking find the ideas intuitive and appealing. I take it as self-evident that systems approaches are crucial for a liveable and sustainable future, but how to make them unremarkable, so that lay stakeholders will be accepting even though disciplinary academics at present are not? To get a working majority open to global systems thinking we must start teaching it in kindergarden. In the meantime, we can get more acceptance by driving our concepts to a high enough level so they become intuitive. Starting with arcane differential equations we can make phase diagrams showing looping lines of force on a surface. Cut a section of that landscape and it becomes a cup with a ball rolling around in it. Even children can get that analogy. In that spirit my group has been researching a landscape around which organisms and societies may be followed as they seek or ignore liveable paths to a sustainable future. We find societies track the same paths as does termite and ant evolution.

### **The positive attractor: the role of holistic worldview in the evolution of a sustainable societal system**

***Graeme Taylor***

Our industrial societal system is designed for constant expansion. The global economy is now consuming more resources and discarding more waste than our planet's ecosystems can sustainably produce and recycle. In the coming decades a combination of global warming, resource shortages and species loss will create growing environmental, economic and social crises.

If we continue with business as usual major ecosystems will collapse by mid-century. But disaster is not inevitable. At the same time as industrial civilization has outgrown its biophysical limits, a new type of sustainable societal system has begun to evolve. Systems-based views, values, social structures, technologies and economic processes are rapidly emerging.

The survival of our species is now at stake. If we recognize that a holistic worldview is the key to the organization of a sustainable society, we can help develop congruent social structures and technologies. Once a new system attractor has evolved, rapid structural transformation will be possible.

### **Analysing liveability – more than constructive ambiguity**

***Robert Kerr***

Liveability reflects the wellbeing of a community and comprises the many characteristics that make a location a place where people want to live now and in the future. Composite international measures of liveability, with subjective weightings and coverage, give limited insights for policy development.

A public inquiry into liveability in Victoria, and its connections with competitiveness and planning, found the main drivers to be: economic strength and markets; governments and decision-making; and communities and human rights. These drivers are sensitive to information for efficient decisions, best practice regulation, and governance architecture (including subsidiarity) that promotes integrated planning. Liveability and competitiveness are interdependent. Legitimate tensions in planning need to be managed.

## **Liveability as a constraint on sustainability or sustainability as a constraint on liveability? Defining terms and mapping relationships to separate scaled hard constraints from soft preferences.**

***Jacqueline de Chazal***

Using the short overview elaborating on the conference theme as presented on the ISSS website as a starting point this presentation will critically examine characterisations of the terms 'liveability' and 'sustainability' and attendant (observer) assigned relationships. Relationships will be examined in terms of assigned hierarchy as well as their flanking associations. A schema will be presented that proposes to be fundamental to all that follows: once definitions of and relationships between these terms are satisfactorily established questions of desires and constraints, markets, mechanisms and choices, timescales and trade-offs, critical concerns, conflicts and contingencies and other aspects mentioned in the overview start falling into place.

I will draw on a range of work I have undertaken with others to conceptualise and develop methods for working with multiple and shifting perspectives on assessments of change in socio-ecological systems. Terms discussed will include ecosystem health, vulnerability, ecosystem services, biodiversity, land-use change, resilience and biosecurity. I draw out some common themes that critically examine these terms as well as represent some applications. The first theme is the primacy of perspective, determining how the socio-ecological system at hand is characterised, measured and assessed, irrespective of the assigned term label. The second theme is the limited recognition of typically implicit values that underpin many of these terms as used in the literature. The third theme presents several methods we have developed to assess change in 'socio-ecological' systems in relation to multiple, often conflicting stakeholder perspectives. Material drawn on includes both ecological and social studies undertaken in Australia, France, Portugal, Sweden and Italy.

## **Hunting, gathering, investing, globalizing: the evolutionary roots of economic behaviour**

***Martin Burd***

Whether we can fashion sustainable, liveable environments will depend in part on the behaviour of the billions of economic agents that participate in the global economy. The emerging discipline of behavioural economics has established that humans do not follow the canonical rules of rational utility maximization that were the foundation of neoclassical economics. Economists now face the task of understanding of how actual, "irrational" behaviours of individual economic agents affect the function of economic systems. Rarely in this endeavour do economists ask why humans behave as they do. Biology offers an hypothesis: humans tend to make economic decisions in a way that maximized their long term reproductive success in the economy in which they evolved. In this talk, I will introduce this evolutionary perspective on three features of economic decision-making: context dependence of preferences, assessment of risk and the value of the future, and cooperation. In each case, "irrational" decisions are less surprising when we recognize the evolutionary roots of the behaviour. Cultural effects remain relevant in an evolutionary perspective on economic behaviour; indeed, using the evolutionary principle of fitness maximization may help us anticipate economic behaviour in the novel, globalized economy that we face, especially with respect to the production of social goods.

## **Inclusive well-being: a systemic view of development**

***Richard Bawden***

In the late 1970s, a group of agricultural scientists at the (then) Hawkesbury Agricultural College on the outskirts of Sydney, set off on an endeavour to explore the application of systems principles to agricultural and rural development in Australia. Their essential motivation was concern at a host of emerging complex and messy issues that seemed to be

threatening the sustainability of the well-being both of rural people and of the environments in which they were operating. The initial focus of this work was the design of undergraduate curricula which would use the systems theories and practices of the day as an intellectual framework for helping students learn how these complex socio-economic and bio-physical issues might be improved in an integrated manner. Over subsequent decades, this systemic initiative extended to embrace a wide diversity of practices, in agriculture and beyond, within the rubric of what came to be called systemic development. There are a number of pertinent lessons from this long intellectual, moral and aesthetic journey, that are of considerable relevance to today's discourse about liveability, sustainability and the future of life on the planet.

## **Tuesday, July 14, 2009: Systemic Interventions**

*Facilitated by Drs Alexander and Kathia Laszlo*

### **A voice for waterways: an integrated approach to managing catchments and waterways in Australia's fastest-growing region**

***Paul Greenfield***

The South East Queensland (SEQ) Healthy Waterways Partnership (the Partnership) framework illustrates a unique integrated approach to water quality management whereby scientific research, community participation, and policy/strategy development are done in parallel with each other. It focuses on water quality and the ecosystem health of our freshwater, estuarine and marine systems through the implementation of actions by individual partners and the collective oversight of a regional work program that assists partners to prioritise their investments and address emerging issues.

The Partnership represents a whole-of-government, whole-of-community approach to understanding, planning for, and managing the use of our waterways. The Partnership has led to significant cost savings by providing a clear focus on initiatives towards achieving the healthy waterways:healthy catchments vision which is: By 2026, our waterways and catchments will be healthy ecosystems supporting the livelihoods and lifestyles of people in South East Queensland, and will be managed through collaboration between community, government and industry.

South East Queensland has one of the fastest growing populations in Australia, with just over 2 million people, increasing by 2.9% per annum. These increases in population are expected to result in 75 km<sup>2</sup> of bushland, agricultural land and other rural land being converted annually to housing and other urban purposes. Initial scenario runs using the Partnership's decision support tools have enabled us to understand the potential impacts in 20 years' time from the predicted population growth.

While this population growth will drive significant changes in SEQ, the issues relating to water are focused around adequacy of good supply and the significant demands urban growth will place on water allocation, water quality and waterways quality. Water supply, water quality, waste water treatment, urban use and reuse and healthy waterways are inextricably linked, and the strategic planning for these needs to be tightly linked. The sustainability of our rural sector and industrial growth, as well as achieving good ecosystem health in our waterways are all essential for water-sensitive and livable cities. Hence planning for water needs to be done in a whole-of-systems context, embracing the SEQ region overall and embodying natural resource management in the broadest sense and not just water resources in isolation. Inherent in the SEQ Healthy Waterways Partnership model is demonstrable proof that we can take a regional approach and have singular success. Guided by sound scientific and planning advice we have been able to improve the standard of wastewater discharged to our waterways. About 80% of the nitrogen and 60% of the phosphorus now is removed from the wastewater with consequent improvements in water quality for Moreton Bay and other waterways. From a healthy waterways perspective, the next major challenge is to effectively address the pollutant loads coming from non-point (diffuse) sources, if environmental targets are to be met. The Partnership estimates that within three years, diffuse pollution sources will contribute three quarters of the total nitrogen load, one third of the phosphorus load and up to

90% of the sediments coming from our catchments into our waterways. Clearly this remains a priority, but it is equally as clear that this issue now needs to be addressed in concert with a wider set of issues relating to sustainable water futures for urban and rural growth. As such, the South East Queensland Healthy Waterways Strategy (SEQ HWS), developed through extensive consultation amongst partners, includes a set of ~ 500 actions to be implemented over the next 20 years to maintain and improve the health of SEQ's waterways, and achieve the Healthy Waterways Vision.

One of the hallmarks of the Partnership has been the development of a comprehensive and defensible aquatic ecosystem health monitoring program (EHMP) to provide an objective assessment of the health of waterways throughout South East Queensland. The EHMP releases an Annual Report Card, which provides a timely reminder to local and State Governments and the broader community as to how well we are tracking in terms of protecting the health of our waterways.

The Partnership's 'public face brand', the Healthy Waterways Campaign, provides an essential portal to communicating the understanding of environmental issues to the stakeholders. Healthy Waterways as a brand currently enjoys around 50% "brand" recognition in the South East Queensland regional community. The Healthy Waterways tagline 'because we are all in the same boat' reinforces the need for everyone to take responsibility for their local environment.

There is already a strong focus within SEQ to deliver through a "whole of water cycle" philosophy that gives a strong weighting to water quality planning and management. Key regional planning initiatives have been established in anticipation of the rapid population growth expected within SEQ over the next 20 years. What is not clear is how each of these initiatives will knit together to ensure a strong framework for the management of water as a potentially limiting resource, in ensuring security of supply for all sectors and the environmental outcomes we are also seeking for our catchments and our waterways. The opportunity and the challenge that faces us now is how to best evolve the Partnership model, with its attributes of strong regional integration, critical technical skills, track record and a strong "brand" presence to help deliver on our future needs for water and waterways health.

## **Peri-urban innovation: features of sustainable agri-food enterprises**

### ***Martha Shepherd***

The peri-urban zone has been defined as the transitional zone between rural and urban landscapes that mediates between the competing pressures of agriculture and urbanisation. While a great deal of primary production currently exists in peri-urban Southeast Queensland—and other metropolitan areas—many forces are impacting the future viability of agri-food enterprises where properties sized between 1-100 hectares predominate. These include rapidly increasing population, land subdivision, rising property values, zoning restrictions, and changing expectations of a large number of 'sea- & tree-changers' who are living longer and may commute to work in the urban centre while living in the rural environment. Much of the literature is based upon the assumption that agricultural production will slowly disappear, giving way to urban land uses—and more houses.

This presentation questions this assumption, through an exploration the future of agri-food enterprises in the peri-urban, describing some of the features, which are necessary for future sustainability. Two case studies are utilised in the presentation—the first, a closed aquaculture system, and the second, the commercialisation of a new crop: Australian native rainforest fruits.

In the aquaculture case study, all of the elements of the system are well known and traditional—the innovation is in the integration of these traditional elements into a highly productive closed system, in which even the waste products create further value. By contrast, in the native rainforest fruit case study, every element of the system is new, from the re-vegetation of cleared land in a new form or orchard production, to creating a new range of high value consumer products. A new system is built connecting growing of a new crop with the retailing of new products.

The common element that unites the two case studies is that, for these agri-food enterprises to exist, the innovator/entrepreneur had to conceptualise the entire system at its genesis,

build it, and manage it. The two case studies not only fit in the peri-urban, but encompass innovative features to ensure future economic, social and environmental sustainability in this highly contested landscape. With these exciting new forms of agri-business—highly productive on small land footprints—why assume that new housing developments are the ultimate conclusion for the peri-urban?

***John Larcombe***

## **Infrastructure for a Fast-Growing State**

## **Wednesday, July 15, 2009: Enhancing Governance with Systems Thinking and Practice**

### **People first: how to make environmental sustainability something we want to live with**

***Hon. Steve Maharey***

New Zealand is often identified as a nation committed to environmental sustainability. Unfortunately, commitment has not always been supported by action. Indeed, in recent months many policies aimed at advancing sustainability have been discontinued. A Parliamentary Committee has even been established to review the evidence for climate change on the understanding that it is misleading.

My comments will focus on why it has proven so challenging for New Zealand to turn talk into action. The answer may lie in the narrow agenda put forward by those promoting environmental sustainability. They usually argue that New Zealanders must limit their impact on the environment. People have supported this agenda where they can. However, telling people what they can not do fails to show them how they can live their lives in a sustainable way.

I want to suggest that people need to be put at the centre of the sustainability message. Once this is done, the complex and interrelated nature of people's lives has to be taken into account. They need to be shown what they can do as well as what they can not do.

For those interested in systems this approach is likely to make sense. Yet, when resistance to the environmental message is met the most likely response is to talk more insistently about pending disasters as if this will change behaviour. It will not."

### **Contemporary government challenges: delivering performance and accountability and the intersections with 'wicked policy problems'**

***Lynelle Briggs***

This talk will set the scene in relation to the 'wicked problems' that are emerging between the competing interests of liveability and sustainability in many walks of life. Professor Maharey of New Zealand intends to focus on education: Ms Briggs will focus on the recent work of APSC especially in relation to 'Contemporary Government Challenges: Delivering performance and accountability' and the intersections with 'wicked policy problems' as outlined in the APSC's 2007 paper (see <http://www.apsc.gov.au/publications07/wickedproblems.htm> ). In her talk she will reflect on why systemic approaches for dealing with wicked problems have been so slow to gain influence and traction within the public sector.

## **Thursday, July 16, 2009: Systems Expressed in Everyday Life - Art, People, Tourism, Journalism**

### **Art and systems thinking: floating lands**

***Christine Ballinger, Ben McMullen, Ockie Bosch and Kambiz Maani***

A key challenge for scientist is to communicate with people from a multitude of disciplines (eg engineers, policy makers, planners, politicians, health carers, economists and the wider community) about the complex and interconnected nature of natural systems and their responses to human induced pressures. Climate change presents just such a challenge. The global climatic system is a highly complex set of interdependent biophysical relationships that incorporates chaotic events, force drivers and nested feedback loops. Many of the most disciplined minds in science grapple daily with the complexity of the system and the sensitive relationships that govern its behaviour. Human induced climate change is now an accepted phenomenon. It adds considerably to the complexity of the global climatic system, and it is imperative that humanity takes action to mitigate its affect on the earth's climate.

In order to achieve a global response to the threats of climate change, it is important that we are able to communicate about the problem and the potential solutions in a meaningful way. The "Floating Land, Rising Seas and Changing Climate" project is an attempt to approach the dialogue about the complex system of global climate and human induced climate change in a novel and creative way. This event is the forth instalment of a biennial creative arts program hosted by the community of the Noosa Biosphere Reserve. The program seeks to bring creative minds together from within the biosphere reserve area with guests from across Australia and the Asia Pacific region to develop a series of art works set in the local environment that respond to a chosen theme. The art works are produced through a process of discussion, cultural exchange and engagement between the artists, scientists and the local community.

The 2009 Floating Land Program has adopted the theme of "Rising Seas and Changing Climate" in an attempt to create a forum for dialogue about the challenges that climate change and sea level rise will have on coastal communities. The website at [www.floatingland.com.au](http://www.floatingland.com.au) <<http://www.floatingland.com.au>> is already 'seeding, growing and documenting' the system.

This project recognises that artists are often seen as fulfilling the roles of story tellers, reflective mirrors and clarifying lenses for their societies. Artists use their insight and creative inspiration to provide images, words, movement and music that tell us about ourselves and how we behave. Artists also use their skills to show us our faults and blind spots. They create works that communicate to our hearts and souls, as well as our minds in ways that are often more subtle that provocative that can be achieved through the expression of logic.

The inspiration for this project is to use the create process of the artistic community to develop works of art that help to communicate the complex systems knowledge of scientists to the broader community through a range of artistic mediums. In doing so the project will attempt to analyse and evaluate the benefits of creative arts as a mechanism to developing broad understanding and appreciation of complex systems.

The project will run in the Noosa Biosphere Reserve in June 2009. The outcomes of the dialogue that it generates and the creative projects will form the basis of the presentation and discussion at this session.

### **Indigenous perspectives on sustainability: connectedness**

***Michael Williams***

The world's oldest known society – my people – has always taken a 'systems' approach to understanding and looking after our world. You could call us the original 'systems thinkers'. Our systems view is a particularly comprehensive one. Key ideas are that the spiritual world is fully integrated with the tangible world; people are in every sense part of their 'country' and relate closely to the species there, and people are closely related through their country relationships., Our knowledge system developed, like other human societies, understandings of the entire known world. We have understanding of ecology, religion, spirituality, philosophy

– the full range of what humans do in terms of expanding their intellects. We take a ‘systems’ approach to understanding and intervening in environmental processes. This is how our ancestors thrived in a land of sometimes limited resources. We do not think of ourselves as owning property or the earth, but as having responsibilities to manage it well – with rights to take resources responsibly in order to survive. We thus also evolved sustainable approaches to managing our country. I will explain our version of systems thinking, and illustrate from two variants: arid land cultures in central Australia and peoples of coastal areas. Our way of knowing our world may help others to develop their systems thinking.

## **Getting our act together: a systems change in everyday decision-making**

***Professor Valerie Brown***

In our everyday decisions we are forced to create a workable synthesis out of the available evidence. This means that we are constantly needing to make sense of the complex system of multiple knowledges presented to us by our society. Studies of integrated decision-making have found that even everyday decisions require the synthesis of evidence from five different knowledge domains: our personal experience, our local knowledge from living in our community, as a specialist trained in our occupation, as a member of our employing organisation and from our ability to think holistically. We can easily become caught in the conflict between the different domains, particularly when we have to balance immediate personal well-being with scientific projections on the future of the planet. As individuals and in groups the urgency of such decisions is creating a system change in the way we think. A systemic view which brings individuals together in collective social learning offers one pathway to this change.

## **Systems thinking and sustainability: lessons from and learning opportunities in UNESCO biosphere reserves**

***Natarajan Ishwaran***

International co-operation in the sciences has been tending towards inter-disciplinarity since the 1970s. More recently governments, who are the principal stakeholders in the UN and its intergovernmental programmes for scientific co-operation such as UNESCO’s Man and the Biosphere (MAB) Programme have begun to stress for closer dialogues not only amongst scientists but also between scientists, planners, decision makers, resource management practitioners, local communities and other publics.

The World Network of Biosphere Reserves (WNBR) of the UNESCO-MAB Programme currently includes 531 sites in 105 countries and has attempted to position itself as laboratories, platforms and places for promoting interdisciplinary science and for co-operation between science, policy and practice. Particularly within the context of the UN Decade of Education for Sustainable Development (2005-2014), these biosphere reserves could serve as learning “laboratories” for sustainable development.

This paper outlines the experience and outcome of visioning biosphere reserves as learning “laboratories” for sustainable development since 2005 and the role that systems thinking and applications have played in articulating the “learning laboratories” notion in biosphere reserve management. Opportunities for further application of systems thinking and tools in drawing lessons from biosphere reserves management for sustainable development are also outlined

## **Role of systems thinking in journalism and media coverage of complex issues**

***Michael Bromley***

Journalists, who are chiefly generalists, are routinely called on to analyse and interpret complex issues – from global economic crises to pandemics – for lay but increasingly critical audiences. This leads to ‘spot reporting’ (reductionism) in which only individual incidences are

addressed as they ebb and flow in the news cycle. Can systems thinking help journalists build better public understanding through a more sophisticated holistic yet still accessible scrutiny of events and trends?

## **Cua Van – a holistic culture in sustainable development transformation**

### ***Professor Amareswar Galla***

The challenges of reconciling the conflicts between conservation and development in the Ha Long Bay World Heritage Area are through the adoption of a holistic conservation ethic. This ethical underpinning facilitates the bringing together of people and their heritage. Moreover, the post-colonial heritage understanding is from a Vietnamese and Asian perspective and does not impose the binary of nature and culture from an outside hegemonic discourse. The process is informed by the Ha Long Ecomuseum development, which has won several national and international awards for its innovative approach. The Ecomuseum is realised through demonstration projects such as the Cua Van Floating Museum and Cultural Centre. It enables the sense of ownership by the fishing communities that live in the heart of the World Heritage Area. Integrated local area planning takes on a new meaning on the waterscapes and for heritage conservation. This paper provides an analysis based on ten years of on-going fieldwork. Supporting documents will be uploaded onto the web page:  
[www.pacificasiaobservatory.org](http://www.pacificasiaobservatory.org)

## **Friday, July 17, 2009: Systemic Interventions and ISSS2010**

**Drs. Alexander and Kathia Laszlo**

**Professor John Herbohn, University of Queensland, Brisbane, Australia**

**Dr Allenna Leonard, President ISSS 2009-2010, Complementary Set, Toronto, Canada**

# Workshops

**SUNDAY JULY 12<sup>TH</sup>**

**1 p.m. to 5 p.m.**

## **Workshop One:**

**Relational Theory Workshop: Fundamentals of Relational Science, Part II**

**John Kineman and Judith Rosen**

Since our 2008 ISSS pre-conference workshop on fundamental concepts of Relational Complexity Theory (which we have been referring to as "Relational Science"), based on the work of Dr. Robert Rosen, there have been more developments and applications. The goal of this second half-day workshop is to expand beyond mere review of the basic concepts with new insights into the theory, and to move closer to the production of a clear public statement of how the theory and its principles generate an expanded paradigm for science, generally. We hope to do this, in part, by pointing the way toward urgently needed practical applications.

The principles of relational complexity that Robert Rosen developed during his lifetime apply universally, despite the fact that his original application was for biological systems. However, he was able to show compelling proof that no complex system – and therefore no living system (as one categorical example of a complex system) – can be completely known (formalized) or predicted from formalizations. This is not a consequence of human limitations or current scientific knowledge, but a consequence of nature-- the nature of our universe, in fact. We have seen something like this discovery before, with "quantum uncertainty" in the sub-atomic world. We naturally observe this kind of uncertainty in our attempts to predict organisms, ecosystems, intelligent organisms such as human beings, and behavior of living societies as well. In fact there is only one class of systems where this uncertainty is not observed – simple (non-complex) systems. An example of this is the class of systems known as "machines". Current mainstream science is still predominantly based on Cartesian/Newtonian foundations, which include a bedrock assumption that "all systems in the universe are just like machines" (the machine metaphor). Clearly, a science based entirely around mechanism/reductionism is not going to be adequate unless Descartes was right. However, we are fairly confident that systems thinkers have already reached the conclusion that Descartes was missing something-- something *essential*. Robert Rosen supplied the formal proof of this conclusion.

The view we presented at our Madison workshop in 2008 was, therefore, that the natural world can be best studied, approached, and understood from a science expanded to include the aspect of causality represented by "system-hood": that there are times when it is appropriate to fractionate in order to learn useful information and there are also times when fractionation loses useful information. When dealing with the latter category of systems, we need to develop more productive modes for learning essential information without destroying it; hence, the requirement for an expanded paradigm, minus the machine metaphor.

We also concluded that scientific disciplines involving biology/ecology were the areas in which to initially develop and demonstrate applications of these theoretical concepts. Biology is the science of living organisms, the class of systems to which human beings belong. Therefore, medical science will be one of the main beneficiaries of an expanded paradigm (which means human health will, also). Ecology studies the relationships between living systems and the environment in which they reside-- *AND with which they are in constant interaction*. The mutual dependence of system and environment has been treated as special or unusual; and in keeping with Descartes rejection of Aristotle's philosophy, we have separated 'material systems' from the overall system properties that define and constrain their potential form.

Cartesian dualism has thus stymied theoretical development in the living sciences, and has accepted a serious omission generally in science. The possibility of discussing a systemic 'whole' or unity in nature is obviously appropriate, and increasingly needed, at the foundation of ecology.

We will discuss some recent developments in relational theory and its applications such as relational models of ecosystems that can be coupled with traditional dynamic models. One is not replaced by the other in the expanded paradigm, but an appropriate complementary relationship is recognized and explicitly described.

In the 2009 workshop we will again focus on fundamental concepts. Of particular importance is the relationship between epistemology (the knowable/observable and operative/behavioral aspects of a system) and ontology (the originating and generative aspects of a system). This relation is critical to all of science and rational thought. To avoid issues of ontology is to decide for a status-quo where assumptions, world views, and beliefs are not questioned. But to go into it rationally requires some rigor and must adhere to clear principles of inquiry. We will spend some time on discussing that relation -- because it is fundamental to relational thinking.

We will present new ideas in the development of relational theory. The workshop format will be an approximately equal emphasis on presentation and discussion. Prior knowledge of Rosen's theories would be useful, but it is a hard thing to obtain without misunderstanding. One thing we are trying to do with these workshops is to help people clarify that understanding, or perhaps even obtain the "ah-hah moment" in shifting the mind's eye to a more relational view.

#### **Workshop Two:**

#### **The System of Systems Processes Theory (SoSP)**

#### **A Workshop on How Systems Work (or Don't Work)**

#### **Len Troncale & Student Fellows**

Dept. of Biology and Institute for Advanced Systems Studies, California State Polytechnic University, Pomona, California, 91768

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How can one apply the new "system of systems" (SoS) knowledge to design or "heal" "human" or hybrid "human-natural" systems & improve their *sustainability* without a detailed knowledge of how systems work? Just as modern medicine requires a very detailed knowledge of how your normal body system works, an astonishing array of measures, a deep understanding of cell and molecular interactions, a panoply of treatments, and a philosophy of "not doing harm when intervening," so also will systems science need a detailed SoSP-based systems pathology to solve systems problems. Where will you as a student of systems get such a detailed knowledge?

Even the most recent generation of systems science approaches still does not have the unified theory necessary to approach solution of SoS crises. Yet large-scale crisis problems such as breakdown of international financial stability, pandemics, global warming, weather disasters, world hunger, species extinction, energy systems will not wait. The need is great; the need is now. "In each of these cases, fundamental understanding concerning the evolution of interacting subsystems into a mature system was missing. This lack of understanding prevented the prediction of now-obvious outcomes with information that was, in hindsight, clearly available."<sup>(1)</sup>

The SoSP model provides systems researchers with an alternative approach. This model is a candidate general theory of systems that emphasizes detailed knowledge of a hundred systems processes (or mechanisms) by which systems work (or don't work when the processes go awry). Unlike other candidate general theories, the SoSP model focuses on

many systems mechanisms. In fact, the SoSP proposes numerous “Linkage Propositions” that describe & formalize how the many systems processes interact to produce key systems structures & behaviors.

This four-hour, pre-conference workshop presents and discusses 20 aspects of the SoSP. During this time, you will gain a comprehensive overview of the underlying theory that may best inform you in solving systems problems. We need to have students who have the knowledge & tools to more effectively deal with these challenges now & in the future. If you have not been trained in a wide range of systems mechanisms, or more importantly how those processes interact in a network of complexity, this may be where you can begin to get that vital training. Join us also if you want to get in on the ground floor of the Institute for Systems-Integrated Sciences (ISIS) or the Federation of Pacific Rim Complex Systems Institutes (PARCSI).

Some of the topics we will cover include:

- Defining what we face & what we need: sustainability & crisis SOS human problems,
- Tenets & initial findings of the SoSP
- What is a Systems Process (SP)? Lists & Descriptions of 100<sup>+</sup> isomorphic SP's
- Case Studies across 7 natural sciences & social science of selected Systems Processes
- Twenty things that should be known about each Systems Process & how to get that info to student users
- Defining hundreds of Linkage Propositions; the crucial difference in the SoSP
- How the SoSP naturally generates useful new disciplines like Systems Pathology, Artificial Systems Research, Systems Allometry, & Comparative Systems Analysis (CSA)
- Computerized tools for building, sharing, and using SoSP, and much more ...

**Registration and Arrangements:** Instead of hardcopy handouts, we will issue two-month subscriptions to our CSA Wiki site for the Workshop Registration fee of \$100. As soon as registration is received, a user name and password will allow participants access to the 200 slide power points, foundation research articles, & the electronic versions of the 25 SoSP introductory posters shown at the ISSS conference. Two alternative registrations would be: (a) only \$35 if no handouts or Wiki password, just witnessing attendance, or (b) “your proposal” of “long term participation” in the project via the internet for \$25. Send your selected option and payment as soon as possible to the ISSS Office.

[1] System of Systems Colloquium: *Exploring the State-of-the-Art of System of Systems: Theory, Applications, and Vital Issues* (Sponsored by and a Report to the National Science Foundation Washington, D.C.)

## **MONDAY JULY 13<sup>TH</sup>**

**6:30 p.m. to 8:30 p.m.**

### **Workshop One:**

#### **MAKING THE SOFT SCIENCES HARD AND MAKING SYSTEMS SCIENCE RELEVANT**

**James Simms**

Significant advances have been made in making the soft science hard and therefore making systems science more relevant. The natural sciences, such as physics and chemistry have specific characteristics. The universal phenomena of the sciences are identified, characterized, and have formal objective measures. These characteristics provide these sciences with a precise and invariant language that is used to create hypotheses that can be tested and verified, or not, by others in the science. Systems science currently does not have

these characteristics. Information is a universal phenomenon of life, yet it does not have accepted objective measures.

Identification of the universal phenomenon of life and their objective measures will be presented in the workshop. These phenomena and their measures are equivalent to those of the natural sciences and thereby provide a basis for hardening systems science. They also provide the basis for the development of a precise and invariant language for systems science like those of the hard sciences.

Proposals will be made on how to develop and promulgate a precise and invariant language. For example, there can be an organization within the ISSS with the responsibility to develop and standardize this language. The need for such a language is obvious. There are many ways the word information is used, but none are precise or invariant.

### **Workshop Two:**

#### **How the Integrated Science General Education Program (ISGE) can be used for Systems Education**

“Stealth” Systems Science At Every University

#### **Dr. Len Troncale**

Institute for Advanced Systems Studies and Biology Dept.  
California State Polytechnic University  
Pomona, California, 91768  
lrtroncale@csupomona.edu

This workshop is packed with flashy computerized illustrations, animations, graphics, stunning ideas, and data from both the natural and systems sciences to update progress on a curriculum that will be available to any university worldwide on CD or the Internet.

ISGE is a year-long series of self-paced multimedia computer lessons combined with face-to-face cooperative learning techniques that satisfies the entire, conventional 16-unit science requirement for non-science majors at most universities. We call the program “stealth” systems science because we use a dozens of key systems processes as the central integrative themes to unify the material. The 2.5 million students that potentially might take ISGE each year to cover their standard science requirement would learn a substantial amount of natural & systems science simultaneously. This huge programming effort has received support from 14 grants totaling \$1 million, including two from the National Science Foundation, because it attempts to solve a dozen generic problems with conventional interdisciplinary and general education. These will be cited & explained.

ISGE completely reorganizes the conventional topics of science GE to help students achieve a deep understanding of the most important theories and mechanisms of seven sciences. Astronomy, Physics, Chemistry, Geology, Biology, Computer Science, and Math are presented, *not as separated disciplines, but rather as a unified whole by stressing common features across the disciplines*. We use nine clusters of systems processes as “universal” Integrative Themes to integrate and compact the topical material. ISGE further integrates the material using “*domain integrators*,” “*linkages* between phenomena,” “*connections* between the sciences,” “*bridges* between science and human systems,” and “*applications* to human concerns.” Students must learn the details of >150 specific case studies of phenomena from the seven sciences to ensure that depth accompanies the extensive breadth of ISGE coverage. These science-based case studies are organized in ISGE completely according to systems mechanisms as will be shown.

This demonstration will emphasize the identifying features, identifying functions, and case studies for each of nine major “clusters” of systems mechanisms used as integrative themes. These include hierarchies & emergence, flows, networks & fields, cycles, feedback, chaos,

origins, boundaries, limits, & phase states, and stability/equilibrium. This presentation will also show how these systems science processes are very effective integrators to teach students about key similarities between the usually separated sciences. We will show the following features common to all lessons: many beautiful graphics, dynamic animations, multiple levels of student interactivity, stepwise refinement, student-directed virtual interviews of systems investigators, student-directed selection and viewing of pertinent internet sites, and built-in learning games. It will also cite quantitative and qualitative results from over 30,000 evaluation questions submitted by 126 students who experienced the “test” course in seven course offerings on three different California State University campuses.

## **WEDNESDAY JULY 15<sup>TH</sup>**

**1:30 p.m. to 3:30 and 4:00 p.m. to 6:00 p.m.**

### **International Network for Systems Education Workshop**

**Professor Ockie Bosch**

**Head, School of Integrative Systems, The University of Queensland, Australia**

**ISSS and IFSR Chair of International Committee for Systems Education**

At The last meeting of the ISSS in Madison a Chair of the International Committee for Systems Education was appointed (the under-signed). However, there is not yet an official committee. Our intention is to establish such a committee during ISSS 2009 in Brisbane, by creating a network that will represent systems educators around the world.

**You are hereby invited to attend and participate in the Systems Education Workshop to be held on Wednesday 15 July 2009 during the conference.**

Three short presentations on the a **systems education matrix** created during the 2008 Fuschl discussions (Professor Ockie Bosch), how systems education in Vietnam developed from “**nothing to excitement**” (Professor Hoang TRI) and **Systems Education at The University of Queensland** (Professor Kambiz Maani) will be followed by a facilitated session to

- Establish a network (involving people/institutions who attend)
- Define steps towards actively extending the network
- Determine how the network will operate, e.g.
  - sharing of knowledge and tools?
  - sharing of course material?
  - availability of web-based e-courses?
  - summer Schools in different localities?
  - systems training in industry and communities (creating a demand where necessary)?
- Enhance the ISSS website for improving communication and networking and to serve as a major mechanism for keeping the International Committee for Systems Education fully active and alive.
- With the Systems Education Matrix as a basis, determine broad guidelines for curriculum development for instilling systems skills in different types of students (from helping reductionist scientists to contextualize their work in the bigger picture to systems integrators and pure systems scientists.

The participation of all people interested in systems education is essential to achieve the above. Your attendance will therefore be highly appreciated.



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# Paper Abstracts

2009-1184

## **ENVISIONING INNOVATION IN SERVICE SYSTEMS: INDUCTION, ABDUCTION AND DEDUCTION**

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An initiative to transform or redesign a service system can be centered on envisioning a future that may be explicit or implicit, shared or tacit. When that future represents a discontinuous change from the current state, detailed analysis from a single frame (e.g. process modeling) may mislead or confuse collective choices and priorities.

Four envisioning engagements – across a variety of service businesses – are reviewed as case studies to surface commonalities in approach. Success in the engagements has largely been attributed to the sequencing of consultations into sequential phases of induction, abduction and then deduction. Challenges to adoption of this three-phase approach are outlined, as a departure from current practice in envisioning innovations.

Following an inductive style of description, conclusions are presented with theoretical saturation of research concepts based on the philosophy of phenomenology.

Keywords: service systems, innovation, system envisioning, induction, abduction, deduction

2009-1085

## **SYSTEMS THINKING: THE KEY TO SURVIVAL**

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While most people support sustainable development, many believe that its benefits must be weighed against other objectives such as economic growth and consumer desires for recreation, comfort and status. However, sustainability is not an option but a requirement. Any economy that is not sustainable will go bankrupt: any biological system that is not sustainable will die.

Human societies are living social systems that completely depend on their environments for the resources needed to survive. But evolution is a ruthless process: most of the species and human societies that have ever existed are extinct because they either destroyed their environments or could not adapt to changing conditions.

Our industrial societal system is designed for constant expansion. While this model was viable in a world of few people and many resources, it is now obsolete because the global economy is consuming more resources and discarding more waste than our planet's ecosystems can sustainably produce and recycle. In the coming decades a combination of global warming, resource shortages and species loss will create growing environmental, economic and social crises.

This is a global emergency. If we continue with business as usual major ecosystems will collapse by mid-century. This will destroy the global economy and end our complex civilizations. But disaster is not inevitable. At the same time as industrial civilization has outgrown its biophysical limits, a new type of sustainable societal system has begun to evolve. Systems-based views, values, social structures, technologies and economic processes are rapidly emerging. The future is our choice: if we fail to act our children will be

doomed to live on a dying planet; if we make the right interventions we can accelerate the evolution of a holistic societal system.

Constructive intervention is possible because societal systems do not have random designs. Human societies have evolved through distinct stages (historical "ages"). Societal systems with similar worldviews and structures emerge and endure in each age because they have environmentally relevant configurations. Their congruent and stable patterns constitute system attractors. For example, similar conditions and stages of development created the long-lasting agrarian kingdoms of Egypt, China, and Central America.

Societal systems are unified and organized around worldviews, which are overarching conceptions of reality that explain the place of humans in the world. Worldviews and cultures (learned traditions of thought and behaviour) provide meanings and symbolic tools for organizing the social institutions that in turn organize and regulate group and individual behaviours. For this reason the key to the evolution of a sustainable global system is the spread of a holistic worldview – a systems perspective that recognizes the interdependence of all life on Earth.

Evolution always involves both individual and group selection—since the survival of a species depends on group fitness, competition between individuals usually occurs within a wider framework of group (and ecosystem) cooperation. Most people are willing to make sacrifices for their children, community or faith. In times of war entire societies are asked to subordinate their personal desires to the needs of their nations. In the long history of humanity, the individualism of our consumer culture is an aberration.

The survival of our species is now at stake. This threat has the potential to unite humanity around a common task—developing a sustainable culture and economy. Our challenge is to clearly explain the global emergency and provide alternative pathways to a viable future. If we recognize that a systems-based worldview is the key to the organization of a sustainable society, we can help develop congruent social structures and technologies. Once a new system attractor has evolved, rapid structural transformation will be possible.

2009-1092

#### **PHYTOREMEDIATION POTENTIAL OF RAPHANUS SATIVUS L., BRASSICA JUNCEA L. AND TRITICUM AESTIVUM L. FOR COPPER CONTAMINATED SOIL**

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Phytoremediation is an emerging technology that employs the use of higher plants for the clean up contaminated environment. Phyto-extraction, the use of plants to extract toxic metals from contaminated soils, has emerged as a cost- effective, environment- friendly clean up alternative. The present study aimed to find a suitable plants species for use in cleaning up the soil in an industrial regions. In this work we were studied crop species, which are cultivated by farmers of North-India. The effects of different concentration of copper were studied in two varieties of wheat (*T. aestivum* L., var. UP-2338 and var. PBW-373), mustard (*Brassica juncea* L.) and radish (*Raphanus sativus* L.) plants. Our study included an assessment of heavy metal accumulation in root, shoot and leaf, effect of copper stress on growth parameter (root length, root and shoot dry weight), photosynthetic pigment content, bio-accumulation coefficient (BAC) and the activity of anti-oxidant enzymes. The experiment was conducted under controlled condition. Seven days old seedlings with similar size were selected and transferred in plastic pots having artificially polluted soil of different concentration of Cu (25µM, 50µM and 100µM). Four plants were cultured in each pot. Nutrient solution were added as per requirement. Plants were grown in a green house illuminated with natural light, temperature regime of 25/18°C day/ night, 14/10 hrs. light/dark period and relative humidity of 70-80%. Growth parameters (root and shoot dry weight, and root length), photosynthetic pigment content (total chlorophyll), statistical analysis of Bio-accumulation coefficient and the activity of anti-oxidant enzymes (catalase (CAT) and

peroxidase (POD)) were analysed 45 days after sowing (DAS). Our results demonstrated that plant species were differ significantly in Cu uptake and translocation. Efficient Cu uptake was observed by the roots in all plants. A high metal content in roots, due to localization of ions in the apoplasm. The highest Cu<sup>++</sup> ions accumulated in the roots of radish plant. Root growth was higher in brassicaceae-plants (i.e. mustard and radish), as compared to both the plants (T.aestivum) of poaceae family. Thus plants of brassicaceae show susceptibility to elevated levels of copper metals. High concentration of copper (50-100 µM) had a negative effect on growth of all plants. Copper exposure also influenced biochemical and physiological parameters. Administration of excess of copper was followed by an increase of Cu accumulation in leaves, and associated symptoms of toxicity. Typical symptoms of Cu toxicity developed 30 days after the beginning of treatment. Chlorophyll concentration was decreased in response to heavy metal toxicity. Activity of anti-oxidative enzymes e.g. peroxidase and catalase were increased in response to oxidative stress. Atomic absorption spectrophotometer (AAS) was used for analysis of heavy metal in soil and plant samples, then tested plant species were grouped on the basis of their accumulation capability of heavy metal. The results of this research showed that radish and mustard plants of family brassicaceae are hyper accumulator plants that can concentrate heavy metals in their different parts, thus they can be used for remediation of polluted area. Study also showed that potential of metal accumulator plants for extraction of metal from soil occur up to a certain level of concentration, after that when the concentration of metal increased, the phyto-extraction rate of metal or bioaccumulation coefficient (BAC) were decreased.

2009-1093

#### **DECISION SIMULATION TECHNIQUE (DST) AS A SCANNING TOOL FOR EXPLORING AND EXPLICATING SUSTAINABILITY ISSUES IN TRANSPORT DECISION MAKING**

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This paper sets focus upon explicit consideration of sustainability issues in transport decision making by presenting and using a developed "Decision Simulation Technique" (DST). This technique can be used by an analyst to 'scan' a transport planning problem with regard to what in DST terms is called a sustainability strategy. This scanning can serve the purpose of informing a group of decision makers before they actually have to deal with, for example, the choice among a number of alternatives that have all been formulated as being relevant. The main focus of the paper is to illustrate how the DST can indicate which one from the set of alternatives will in fact be the 'best' seen from the viewpoint of adopting a sustainability strategy, before they are all scrutinised by the decision makers. The paper has three parts. The first part describes the various concepts and elements of the DST together with the principal steps that have to be followed when applying it on a concrete case. In the second part is the potential of the DST demonstrated by its use within an ongoing study. Thus the DST is applied on a new rail investment study on a section with four alternatives being part of a proposed new high speed rail line in Southern Sweden. The third part of the paper is concerned with a principal discussion of incorporation of sustainability in transport planning. It is argued that 'explicating'-techniques such as the DST compared to more traditional ways of doing this – here denominated as implicit consideration of sustainability – can be useful for many different planning problems where the treated rail case is just one example. Finally, the paper gives some conclusions and a perspective on future use and development of the DST.

Keywords: Sustainability, decision support, simulation of preferences, semi-soft methods, decision simulation technique (DST)

2009-1094

## **COMMUNICATION – A PLATFORM FOR MUTUAL MESSAGE EXCHANGE**

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Information is available and all around us as never before. At the same time we experience changes – changes that has a great impact on the whole society, companies and institutions as well as on individual human beings. But changes is nothing new. Already Herakleitos told us *panta rei* – everthing is floating. The changes today occur however more rapidly than before. The production life cycles are shorter and many companies experience that the information about their products soon becomes outdated. That makes it necessary to find communication channels that facilitates frequent contacts between providers and customers. During the last decade information technology has provided us with new possibilities for communication. Using the Internet companies can reach customers all over the world just as easily as the next door neighbour. Internet has thus changed the communication pattern and also opened a global target area for the companies. Also customer behavior has been greatly influenced by information technology. Previously customers were more dependent on initiative from the vendor where the vendor sent messages to the customer. The vendor was thus active and the customer had a more passive role. The customer was in that way exposed to vendor activities without any possibility to escape or defend himself or herself. Today the situation is different. The relationship between vendor and customer is regarded from another perspective where the customer has a more active role. It is the customer who has the power to decide when and what to buy and from what vendor. In this way the initiative is to a great extent transferred from the vendor to the buyer. The role of the vendor is to make his or her merchandise available to the customer and expose the products and their qualities to the customer. Communication between the vendor and the customer could thus be seen as taking part on a kind of arena where the vendor puts messages for the customer to take up or leave at his or her discretion. Nevertheless most communication models do not picture that aspect. They tend to be more related to the previous perspective whith an active vendor and a passive buyer. The purpose of this paper is to look further into the character of vendor-customer communication and to evaluate some contemporary communication models in relation to such communication. Using this evaluation the paper presents and argues for models that are built on a communication between vendor and customer taking place on an arena where messages are displayed and picked up.

Keywords: Communication, vendor-customer relationship, communication models

2009-1095

## **USES AND GRATIFICATION THEORY IN VIRTUAL NETWORK ANALYSIS**

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The changes of the conditions in the society that we have experienced during the last twenty years are extensive. The transition is characterized by the conversion of our materialistic culture into a new technological paradigm dominated by information technology. There are several important characteristics for the societies that are created by the new technology, such as for example digitalization, miniaturization and deregulation. Another important characteristic is that networks of different kinds are created within most different areas. To compete with other entities, many companies cooperate in networks when they find that their own resources are insufficient. Geographical distances between the companies in a network are less important than cultural or organizational proximity to develop social practices. There are many advantages with cooperation in networks. The cooperation offers a possibility to share costs and risks and facilitates the work to keep a jour with constantly new information. The networks also have a role as door keepers. It is advantageous to be part of the network, but it is increasingly difficult to survive outside the networks. The basic entity is thus no longer an individual company but a network. My focus in this paper is on specific kind of virtual

network, Solution Sharing Networks. In such networks organizations share knowledge and resources around a solution to a specific problem in their environment. The problem is thus a central demand that serves as a basis for the social practices that are formed within the network. But what is it really that encourages people to cooperate in a solution sharing network? Uses-and-gratification-theory may be used to explain how people use different media to complete their needs. The theory may be seen as a paradigm that originally was used within media and communication research to determine motivation by studying the use of mass media, but some researchers have also suggested that the theory may be used to clarify how people use electronic communication environments to fulfill their needs. Several aspects of needs have been presented, such as for example cognitive needs, affective needs, personal integrating needs, social integrating needs and tension releasing needs. Cognitive needs may be one of the most important motivation factors to take part in the cooperation of a virtual network. This means that the kind of information available in the network as well as its quality must be a most important success factor for the cooperation in the network. But the evolution of the network may also lead to that other kinds of needs may also be fulfilled. The purpose of this paper is to take uses-and-gratification-theory as a basis for analysis of cooperation in a Solution Sharing Network. Using that analysis some models illustrating the cooperation will be presented.

Keywords: Virtual network, Solution Sharing Network, collaboration, co-design

2009-1096

### **THE NEED FOR EXPLORING ALTERNATIVES IN SYSTEMIC INTERVENTION: TWO "INTENTIONAL" ARGUMENTS**

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A recurrent guideline in many of the systems approaches to intervention is the need for exploring different alternatives. This guideline is present despite the different types of tools, the different paradigms or the arguments behind it. The purpose of this paper is not to contradict this, but to provide new arguments to this need that can be applied to the whole range of tools. The arguments shown here use ideas from language pragmatics and a combination of philosophy of action and complexity theory. What is central to the arguments presented is the concern with the intentions of the agents. In light of those, it is claimed that the advantages in the exploration of alternatives are hindered if they are not used in an intentional way.

Keywords: Complexity theory, Emergence, Intention, Intervention, Facilitation guidelines, Critical systems thinking, Multi-methodology, Language pragmatics, Meaning.

2009-1097

### **A SOCIOCYBERNETIC MODEL OF LIVEABLE AND SUSTAINABLE SOCIAL SYSTEMS**

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The ongoing economic crisis world around has asked for a theoretical understanding and deep analysis of what have been wrong in our economic system in specific and social system as whole. Discussions in many forums and mass media have mostly focused on a level of first order casual-effects such as bank and credit system in relation to house loans and car industries, and where and how much the stimulating packages should be distributed, etc. This is what I called a liveability level problem. A second order understanding of fundamental systems structure and social subsystems relationships however, have not been much addressed properly. This is what I called the sustainability problem.

This paper will propose an epistemological model based on cybernetic feedback principle and the Activity Theory to interpret the second order problems that deeply embed in our social-economic system structure. So the liveability and sustainability are coherently discussed within a socio-cybernetic system.

The first part of the paper introduces the Activity Theory and related concepts from social autopoietic theory. The aim of introducing those concepts is to provide the basic elements/components to the construction of a double-loops feedback model in the second part. In the last, the current economic crisis is interpreted based on the constructed model, and some systemic suggestions to migrate or prevent similar crises in the future are also provided.

Key Words: Feedback, Social Activities; liveability; Sustainability; Autopoeisis.

2009-1099

### **WORLD VIEW AND IMPLICATIONS FOR PRACTICE. OCCUPATIONAL HEALTH AND SAFETY AS A MODEL**

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In many countries, particularly Australia, there has been a steady decline in the number of workplace injuries, but the number never seems to reduce below a certain level, approximately 10 compensable injuries per 1000 employees.

A mantra of systems dynamics states that the structure of a system is ascertained by understanding the pattern of observable events that result from that system. However, one's understanding of the pattern of events is influenced by the world view that underpins one's view of the pattern. Pepper's four world views or hypotheses offer a framework for discerning a system's patterns: If one views the world through a Formism lens, one sees categories of similar and different events. A Mechanistic world view causes one to see controllable machines with inputs, outputs, processes and feedback. An Organicism world view sees the world as an organism evolving in response to the environment while a Contextual world view sees operators in the world who influence the environment and are influenced by it in a continuous cycle.

The events of significance to occupational health and safety (OHS) are workplace injuries. The pattern of events is used to determine the causes of injuries and to elucidate the structure of the system that caused the injury. The causes of the injuries determine how you structure your control systems to prevent further injuries, how you establish your management system, even what risk equation is needed to calculate the risk associated with the injury events. Yet how, or whether, you recognise the pattern is determined by your world view.

This paper describes how the various world views influence the practice of OHS and suggest a framework for a pluralist approach to the control, management and research of OHS issues.

2009-1100

### **GETTING (EMPIRICALLY) BACK TO(WARDS) (PRE-) (EXISTENTIAL) BASICS**

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In the Hierarchy Theory SIG of the 2006 ISSS meeting in Sonoma we presented a paper entitled "Living in Hyperscale: Internalization as a Search for Reunification", which concluded as follows:

"We view our universe's evolution, and its entire post-'big bang' history, as an assembly of interacting individual attempts to 'turn back the clock' to the intimate unification of a pre-'big bang' state."

The core underlying hypothesis of our argument was that the essential process of Nature is its evolution from the 'big bang singularity' of global unification towards the 'ecosystemic multiplicity' of local differentiation. But why has this evolution taken place? And why is Nature still evolving all around us?

The following sentence of the paper stated that:

"Relativity – the cause of localization and differentiation, and of the inevitability of inter-locational delay and informational incompleteness – precludes any 'factual' achievement of this aim, leaving only the surrogate possibility of virtual reunification through environmental internalization."

Relativity certainly precludes any complete 'factual' achievement of reunification, but not a partial shift from 'factual' analog quasi-unification towards 'factual' digital quasi-unification. We now believe that the 'attractor' of unification is not only responsible for environmental internalization, but that it is the driving force behind evolution. Attempted reunification is not only 'virtual'; it lies at the root of natural survivalist pragmatism: it is the very nature of reality itself!

Everything around us, and in us, is a process of, or the result of an attempted (systemic) reunification. We present the image of an initially analog universe, perturbed by the 'injection' of asymmetry at the 'big bang', which progressively builds more complex structures in a mistaken bid to regain its undifferentiated wholeness. At every stage of its evolutionary localization, in the creation of strings, of fermions and bosons, of atoms and molecules, of biochemicals and organisms, of scale, hierarchy and hyperscale, its target is to re-establish homogeneity of communication, through the development of energy-based digitality in place of peaceful analog communion.

We do not presume that the universe is a 'living entity', but point out that life is a natural emergence from the low-level identity-retaining awareness of elementary Newtonian interactions.

Rather than exposing the historical endeavors which led up to the acceptance of this expanded point of view, we present in this paper an empirical justification for its adoption, through many examples from a multiplicity of natural science, systems science, ecological, sociological, technological, psychological and neurological domains.

2009-1101

**IMPROVING THE 'CYBER LEMONS' PROBLEM WITH THE COUNTERACTING MECHANISM IN CHINESE E-COMMERCE MARKET: BASED ON THE DATA FROM TAOBAO.COM (CHINA)**

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As the e-commerce of the limit of space and bring up the virtual reality in the e-commerce market, the 'cyber lemons' problem resulting from the informational asymmetry of the qualitative uncertainty is getting worse, which is restricting the useful and profitable business. Based on the data from Taobao.com (China), this paper demonstratively analyzes the characteristics of 'cyber lemons' problem in Chinese e-commerce market and discuss the function of counteracting mechanism such as credit evaluation system, quality-intermediary and reputation. Finally, this paper offers some strategic thought for eliminating the cyber 'lemons' problem with the counteracting mechanism.

Keywords: cyber 'lemons' problem, counteracting mechanism, credit evaluation system, reputation, quality-intermediary

2009-1104

## **TOWARD SPIRITUAL SYSTEM IN ORGANIZATION THROUGH SPIRITUAL LEADERSHIP**

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Leadership has a key role in organization by developing and directing structures and systems. Spiritual leadership is an emerging approach in organizational leadership literature. In context of spiritual leadership, there are many models and patterns that each them describe a kind of spirituality in leadership of organizations. Spirituality has a unity in itself but different people understand it in different ways. Here, there is a question: how we can classify them or identify their type? How can organizations use spirituality through leadership to develop a system?

This paper reviews some spiritual leadership models, and provides a typology about them. The typology includes identifying meanings, motives; definitions and typification of different spiritual leadership models in management, in prevent literature of organization and management. This does through a typological analysis.

2009-1105

## **PLANNING MODEL FOR CONTINUOUS IMPROVEMENT OF THE COMMUNICATION SYSTEM IN MEXICO**

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Communication systems are used to send information from one place to another through different media: the space, optical fiber, metallic wiring, etc. The most common systems are television, radio, infrared, satellite, telephone, and voice on IP, just to name a few. The general idea is to continuously improve the way of transmission, in order to assure that the addressee gets the information generated by the source in a fast, cheap, safe and truthful way. The model used in this article consists of five stages: first is the Reference Projection, in which a problem in the system is detected, using the techniques of Kawakita Jiro (TKJ), analytical hierarchal structuring and the principle of Pareto; in the normative planning the mission of the system is established; in the strategic planning a solution for the detected problems is proposed; the organizational planning describes the resources needed for the problematic case to be solved; and the fifth stage is an evaluation about the feasibility of the solution.

2009-1106

## **NATURE FOR NURTURE: USING ECOLOGICAL SYSTEMS TO DESIGN RESILIENT COMMUNITIES AND SUSTAIN LEARNING**

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Over the past 10 years I have been learning from nature, particularly about the processes that are inherent in nature that enable it to persist over time, and be sustainable. These are particularly apparent in pristine ecosystems, such as rainforests and islands. These include processes such as interdependence, flexibility, ecological cycles, resilience, adaptability, self-regulation, structural coupling, nesting, diversity, feedback loops, mutual perturbation and symbiosis. I have been using knowledge about these processes to help facilitate learning with people and to build relationships and communities that are also resilient and self sustaining. A large part of this is being able to bring together all people into design processes, to move in directions that they want to move, and enable relationships and patterns within relationship to emerge that enhance collective learning. As with ecosystems,

these processes enable people and communities to adapt and respond to problem situations as they arise.

Managing change processes in complex environments requires purposeful and systematic facilitation. I have also come up with the concept of 'Eco-Ability' to describe how we can use the natural ecosystems around us to enhance our abilities, both psychological and physical, as well as other dimensions, such as spiritual. Biomimicry, uses nature to design 'hard systems' and technologies for the future. 'Eco-Ability, uses nature to design 'soft systems' (people systems, and the people-environment interface). Today, all of us have a dis-ability, our disconnection with nature. I believe we can move from a paradigm of 'dis-ability' to 'eco-ability' to enact change at multiple scales, including individuals, groups, teams, organizations, communities and institutions. In this paper, I present 5 vignettes, where I have used ecological systems principles to design and facilitate people systems. These cut across a range of setting, and include examples from the international arena.

2009-1107

### **THE THEORY OF SOCIAL LEARNING FOR CHANGE IN COMPLEX ENVIRONMENTS: ADDING THE PEOPLE-ENVIRONMENT INTERFACE**

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In the last decade, RD&E theorists have proposed many suggestions about how to deal with problems of sustainable agriculture and natural resource management such as systems thinking, ecological systems, complexity theory, participatory action research, adaptive management and process of knowing and cognition (Bawden, 1995; Capra, 1996; Maturana and Varela, 1987; Holling, 1995; Lee, 1993; Korten, 1980; Parsons and Clarke, 1995; Dash, 1995; Jiggins and Röling, 1997; Norretranders, 1998; Bossomaier and Green, 1998; Ife, 1995). The literature suggests that problems, as well as solutions, are no longer essentially technical, but have to do with the way we relate to each other and the world around us. An understanding that people have different ways of perceiving each other and the world, tells us that values and intentions also matter. There appears to be a lack of feedback between people and their environment (eg. economic market signals do not suffice) and today there is a fragmented lifeworld where there seems to be no common purpose or frame of reference. There is high uncertainty but a recognised need for change of direction.

One way of managing this change is through facilitated purposive change based on learning approaches to enable people to adapt and respond to problem situations as they arise. This paper starts from the premise that managing change processes in complex environments requires purposeful and systematic facilitation of social learning. Providing a concrete definition of social learning is problematic. Social learning has taken on several definitions, which have emerged from a range of disciplines applied in a variety of contexts and for a range of purposes (Lee, 1993; Milbrath, 1989; Friere, 1974; Kolb, 1984; Dangbegon, 1998). Although many definitions do exist there seems to be a mutual premise that facilitating social learning in a more purposeful and systematic way is needed in order to manage change processes that deal with the changing circumstances in complex environments. In the resource management and agricultural domains, social learning addresses systematic learning processes among multiple actors, who together define a purpose related to the agreed necessity of concerted action at a variety of scales. This tends to differ from some other domains, such as psychology where learning is depicted in terms of what an individual learns for him or herself, and social learning is seen in terms of what an individual learns from someone else. Roling and Wagemaker (1998) emphasise the importance of social learning in the context of agriculture in the following,

In agriculture, the process [of social learning] requires that farmers become experts, instead of 'users', receivers' or adopters' of other specialists' wisdom and technologies. They must learn to apply general ecological principles to their own locality and time specific situations. They must be able to manage complex agro-ecosystem systems as businesses in competitive markets. But, as eco-systems do not stop at the farm boundaries, local

communities and wider consortia of interest groups and resource users also need to engage in learning how to manage landscapes and resources.

Previous theories of social learning are human-centric and in this paper I present my work on developing the theory of Social Learning to include the people-environment interface and a theory which tries to enable learning from nature as a way forward in addressing change in complex environments.

2009-1110

### **APPLYING MULTI-METHODOLOGICAL SYSTEMS THEORY TO PROJECT MANAGEMENT**

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This paper proposes that project managers are dealing with complex systems. Complex systems are defined as systems with numerous stakeholders, nonlinearities, multiple interdependencies and feedback systems. Typical nonlinearities are often the dismissal of project managers, shedding people with critical labour skills or the termination of credit arrangements with banks. The interdependencies are the relationships between project management, the supplies and contractors, the clients and the stakeholders. The feedback systems most common to the success and failure of project management are the rework cycles and their impact on both the demand for labour and the final completion date.

The paper outlines a methodology for project management that integrates a number of systems thinking tools into the project management process. The project management processes as described constitutes what is commonly known as a "wicked problem". Such problems require a multi-methodological approach because they are often not amenable to solution with a single methodology. Lee and Miller (2004) document a multi-methodology approach combining System Dynamics with Critical Chain Project Management to simulate a multi-project environment where the focus is on interactions between projects. The approach taken in this paper is broader and examines a series of methodologies, primarily from Soft Systems Methodology (SSM), System Dynamics (SD), and Viable Systems Methodology (VSM). Howick et al (2006) reported on a case where a team of modelers designed and implemented modelling guidelines to link semantically rich scenario maps to a formal causal influence diagram of a running simulation model.

2009-1111

### **THE APPLICATION OF STAFFORD BEER'S VIABLE SYSTEMS MODEL TO STRATEGIC PLANNING**

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This paper outlines a sequence of sixteen management diagrams that demonstrate both the rationale of the specific Action Research change method and the underpinning structure of the strategic planning process that has emerged at Greyhound Racing Victoria the body responsible for regulating the \$3b industry in Victoria. The management diagrams are devotedly and unashamedly based on Stafford Beer's (1972; 1979; 1985) original drawings. Managers who follow the philosophy and methodology outlined here, do need to discover their own diagrams and the levels of understanding that they might need to transform their thinking into a strategic planning platform for their own businesses. The required levels of understanding of any theory-based method will vary according to organisational hierarchy. And so while this paper is aimed at the upper levels of management, it must be as clearly understood that according to the structure of the method, its fundamental principles should

apply recursively, at all hierarchical levels of the organisation. It is for this reason that the diagrams start at an elementary standard and aggregate to differing levels of complexity.

The first eight diagrams trace how employees at GRV came to an understanding of the structures that lead to the formation of the PICCO formats. The terminology used is simple and uncomplicated. With absolute respect to Beer, this level of simplicity is nonetheless required for three very important reasons. The first reason is that the fundamentals of the diagrams need to be comprehensible for a broad range of employee competency levels. The second reason is that these diagrams need to be both practical and useful at differing hierarchical levels of management. The third reason is that in keeping with the first two reasons, employees are able to focus on a single method. In accord with Argyris and Schon (1974) employees can then make conscious<sup>1</sup> use of the diagrams and the PICCO formats to learn and manage their responses to organisational issues in practice.

2009-1114

**THE IMPORTANCE OF SYSTEMS THINKING AND PRACTICE FOR CREATING BIOSPHERE RESERVES AS “LEARNING LABORATORIES FOR SUSTAINABLE DEVELOPMENT”**

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UNESCO has recommended the launch of pilot projects to use Biosphere Reserves as learning laboratories or spaces to address the gap between Biosphere Reserve knowledge systems (scientific, experiential, indigenous) and the imperative for wider sustainable development. In this regard, a pilot project in the Cat Ba Biosphere Reserve (CBBR) in northern Vietnam has been initiated. The project has three major aims that address:

- the needs of UNESCO/MAB and the Decade of Education for Sustainable Development (DESD) initiative by contributing to sustainable development knowledge and education globally;
- the environment (e.g. biodiversity), livelihood of people (e.g. poverty alleviation) and economic benefits (such as sharing in the revenue from a booming tourism industry); and
- the adoption of policies and processes by Government and management bodies to ensure that long term sustainable management will become institutionalised and ongoing.

This paper discusses the use of systems thinking concepts and tools in creating learning laboratories for sustainable development. The Cat Ba Biosphere Reserve and sustainable development literature will be briefly described. The importance of systems thinking methodology and applications to deal with ever-increasing complexities of sustainable development will be discussed. A Causal Loop Model of Cat Ba integrating government, social, environmental, and economic dimensions has been developed to identify key leverage points and where systemic interventions will be most effective (potential research projects). This model also serves as a platform for research collaboration through alliances and multi-disciplinary teams to address the various domains, leverage points, and interventions identified. The model and approach will have high potential as pilot to be applied to other Biosphere Reserves in Vietnam and globally.

Keywords: Biosphere Reserves; UNESCO/MAB; DESD; learning laboratories; sustainable development; systems thinking; causal loop modelling; systems models; leverage points; Cat Ba Biosphere Reserve.

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<sup>1</sup>Argyris and Schon (1974) say Organisational Learning is the logic that learning is a primary process affecting the way in which successful organisations consciously learn and manage their responses more successfully than those who do not.

2009-1116

## **SUSTAINABLE WATER ALLOCATION FOR FAMILIES, FISH AND FARMING: A WICKED PROBLEM OR A WICKED SOLUTION?**

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This presentation describes an example of integrated socio-ecological systems management that is underway in Central Canterbury, New Zealand. Canterbury is New Zealand's largest region comprising approximately 17% of the country's land area. The region currently accounts for approximately 60% of all water allocated for consumptive use in New Zealand and 70% of the nation's irrigated land. The 'wicked' problem greeting researchers was a community divided over the sustainable development of its water resources as these resources approached full allocation potential. The context for this situation is resource management legislation (the Resource Management Act 1991) with integrating intent but fragmented and under-resourced implementation, which has not resulted in an integrated understanding of relevant social, economic, cultural and ecological systems before the pressures escalated in processes to allocate a resource now deemed scarce and valuable.

As an alternative to policy development through current adversarial water allocation processes, a multi-disciplinary group of researchers and stakeholders of place, interest and regulation embarked on a collaborative approach in 2004 to consider the challenges of sustainable water allocation in Central Canterbury. Significant progress has been made despite participation challenges for those also involved in the continuing adversarial processes and those requiring quick answers to complex questions. Collaboration has occurred via meetings of various scale and focus, written research reports, meeting reports, peer reviewed literature and a website.

A key achievement to date has been the assimilation of a wide variety of knowledge and information for a catchment/watershed-focussed historical information project. One output from this process involves the combination of qualitative local knowledge on a key intermittent river in the catchment with computer modelling results, well records, river flow records and rainfall records to identify river connection potential prior to the commencement of river flow recording. This extended river connection record was then analysed alongside multiple scales of climatic drivers (annual, El Niño–Southern Oscillation, Interdecadal Pacific Oscillation) to address an information gap relating to the rise and dramatic decline of New Zealand's greatest brown trout fishery. Trout are particularly relevant to water allocation due to a section of the resource management legislation that seeks to protect trout (and salmon) habitat for a sustainable balance between water abstraction and fishable/swimmable water bodies.

The new hydrosystem information was then added to other relevant information and utilised in a system resilience assessment based on the Panarchy framework. This information is currently being structured in a way that enables analysis of interconnections with other relevant socio-ecological systems such as riparian zone functions, the opening regime of a large lake at the base of the catchment, and potential institutional arrangements for increasing the efficiency and effectiveness of currently allocated water. At the same time, the statutory agencies with responsibilities in the catchment are working with a community trust to poll the community on a choice between three potential futures for the lake and its catchment. The long term aim for these processes is the creation and implementation of an integrated catchment management plan which is significantly supported by regulatory agencies and the community. This would indeed be a wicked (in the best sense of the word) solution to a 'wicked' socio-ecological system problem.

Keywords: integrated socio-ecological system; wicked problem; water allocation

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2009-1119

## **BALANCING CROSS-CULTURAL COMPLEX PROJECT MANAGEMENT: UNTYING GORDIAN KNOTS OF SOCIAL COMPLEXITY, OR TOWARDS AN ECOLOGY OF PARADIGMS**

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### *Managing cross-cultural complex projects*

Projects nowadays turn out to be cross-cultural and complex projects. Project management has to deal with increasingly different expectations and cultural perspectives of stakeholders, clients, project managers and team members. Cross-cultural complex project management tries to handle the connectivity between the different views and expectations inside and outside of projects. If it fails, communication goes havoc, expectations run out of balance and behaviours become peculiar. It is the familiar catastrophe: schedules collapse, costs are running and quality deteriorates. – Wouldn't it be nice to just execute to the plans best? "Projects fail on the human side", they say.

### *Balancing technical and social complexity*

We are quite advanced to manage technical complexity, the scope, the scale, and the dynamics. We master engineering at its best, day by day. However, there is again this undecided client, this nagging NGO, this lousy project manager and this bean counting controller and all the others who sprout all kinds of peculiar behaviour. Handling the human side, managing social complexity is not our pride and joy. In fact we are used to look away, to avoid any kind of systematic approach. Yet, how long can we afford to continue? Balance is needed.

### *Towards an ecology of paradigms*

And yet, social complexity is nothing new or special. It comes with the territory. It seems to be a Gordian knot. Dealing with it and managing social complexity shows up as a key-competence for any successful project management. All these expectations and views within any complex projects cannot be untied technically or violently without causing more damage than benefit. Engineering is for technical systems; it is not an adequate paradigm for social systems. It is not a one size fits all kind of case. Additional models, methods and instruments are required refereeing to an alternative paradigmatic background. And it will never be an either or, it will always be a as well as. The next society's practices will be based on an ecology of paradigms.

### *Tools to untie Gordian knots of social complexity*

Models, methods and instruments referring to social sciences, or even Niklas Luhmanns Theory of Social Systems, will create the practice of cross-cultural complex project management. The paper will give some examples like Stafford Beers Viable system model, Peter Checklands Soft Systems Methodologies and Noel Tichys GRPI instrument. They all provide successful approaches which can pay into a larger understanding of an ecology of paradigms that is able to meet cross-cultural complex project management requirements.

### *Resume*

It is a shaky sea of change ahead. If we really want to improve on cross-cultural complex project management it will move us outside our comfort zone. Yet, the reward is tremendous: we will win commitment and contribution money cannot buy, cooperation and creativity will flow together into co-creation: and not only efficiency and effectiveness in cross-cultural complex projects will rise.

2009-1120

**"THE GENERAL THEORY OF META-DYNAMICS SYSTEMICITY"  
PART THREE: BIOLOGICAL META-DYNAMICS SYSTEMICITY**

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The "cosmo-planetary and terrestrial meta-dynamics systemicity", "life's meta-dynamics systemicity", and "biological meta-dynamics systemicity" are the core of a general theory resulting from a "bioethism's transdisciplinary approach" of the whole set of dynamics that make life to exist throughout the atomic universal cycle systemicity. Part four, "the biological intra-dynamics systemicity" will be published by 2010. It will develop the systemicity mechanisms that physiologically occur inside a creature's organism particularly referring to biochemical interactions and endogenous fluxes appropriately participating in the milieu metabolism sustainability for survival.

Ever since 1996, J.-J. Blanc, the author, made an extensive research on "Systems science" that induced to his developing a new systemic<sup>2</sup> paradigm in terms of a transdisciplinary approach to "Living systems" that he named "The Bioethism" (see note 1). It is meant to support the acquisition of a large understanding of living systems' origin, of their natural structure and their adaptive behaviors meanings. Their species bonds and evolution trends, while permanently interacting with environmental events for survival, require actions-reactions from ago-antagonistic signals and stimuli. Endogenous within their body milieu and exogenous while confronted with conditions of ecosystemic and sociosystemic environments, living beings are closely linked with and affected by - a) cosmo-planetary and terrestrial meta-dynamic forces, - b) their specific biological individuality and social traits and statuses accounting for the biodiversity of species behavioral and evolutionary trends emerging from the set of the biological metadynamics systemicity. For example the drastic extinction of species, except some bacteria, when the Earth became a "snowball" from a nearly total glaciation (-600 Mo/y) and, on the contrary, an extraordinary explosion of marine species bearing new functions (- 545Mo/y)

The survey in the different scientific disciplines concerned with the actual "Science of Systems", shows too many scientists developing the living systems' knowledge of reality in the strict philosophy of human "reason" (logic and metaphysics) under an anthropocentric practice. Excepted are, of course, those works directly concerned with biological disciplines, biochemistry and physicochemical physiology and when individual and societal emotions are taken into consideration so as to support a paramount and pragmatic understanding of survival rules and necessities. An adequate learning for a sustainable development of societies, respecting the required survival diversity needs, is here based on a new general theory the author called "The general theory of meta-dynamics systemicity". A new theory that relies on the whole body of forces and dynamics that made and makes physicochemical and biological moves and objects to exist and sustain at the different dynamics levels of the Universe.

By essence, the dynamics levels are: atomic and cosmic, galactic, stellar, planetary, terrestrial and biological. Though diverse in structure and mechanism, they are all interrelated and provoke intricate moves and fluxes of differential retroactions from which emerge various object "postures" (behaviors). Bound to adapting their behaviors to permanent environmental changes, objects (eg. the planet Earth) and living beings survive within the constraints and effects of dynamics differential retroactivity. These feedbacks, in cycles, induce to the repetition of moves and fluxes, the "meta-dynamics systemicity", a term analogous to "velocity", referring to dynamical behaviors. However, systemicity must be understood as successive and/or parallel retroactive ago-antagonistic, convergent differentials moves

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<sup>2</sup> - **Systemic (adj.):** nature of a dynamic and retroactive process pertaining to or affecting an organ or the body of an organism.

making emerge whole bodies of adaptive results while confronted and coevolving with environmental changes.

At Life's level, the set of meta/intra-dynamics systemicity sustains survival at biological, physiological and psychological intricate sublevels. Consubstantial and interrelated with the cosmic<sup>3</sup>, galactic, stellar, planetary and terrestrial meta-dynamics, the biological "metadynamics systemicity" is participating in the whole of universal systemic effects feedbacks. Thereby, universal forces and fluxes permanently influence physicochemical reactive dynamics and permanently affect the biological world within its intra-dynamics systemicity moves. A world that is retroactive from emergent results affecting living creatures' survival choices so as to adapt their behaviors supporting their temporal sustainability.

Consequently, an overview upon the entire body of universal interdependent bio-physicochemical mechanisms, moves, processes and streams, interwoven within "3D networks", shows that survival abilities and performances are epigenetically provided with meta-dynamics resulting effects of systemicity. The convergence of cosmo-planetary forces (thermodynamic, magnetic, gravitational...) and terrestrial conditions (geologic, geochemical, geophysical, geo-climatic...) is retroactively sustaining the Earth and the living's own meta-dynamics survival means (biotope equilibrium, local ecosystems biodiversity, food chains,... sustainable behaviors, reproduction , ...) thanks to processes that have a "re-seeding" ability.

Furthermore, the biological world of individuals and societal systems (family, group,...) cannot survive but within dynamic equilibriums that are inevitably interdependent. Social groups are subject to chaotic effects of the thermodynamic entropy and by their meta-dynamics, intradynamics and subdynamics drives, which make permanently emerge and temporally sustain differential behaviors.

This work, having required several communications, describes largely here the general systemicity of principles that support living beings survival. A large work that refers to the complexity of cosmo-planetary, terrestrial and (in this part three) the biological meta-dynamics systemicity, a meta-driver that participated in the origin of Life. And, for billion of years, participated in the building up of the Earth's and a Life's adaptable sustainability confronted with fluxes and moves of universal forces. The set of meta-drivers with synergetic moves sustaining systemicity cycles, were and are permanently adapting to changing environmental events occurrence, which values have to be viewed in the short and long term.

At the stage of this work process, the communication stands for "The biological meta-dynamics systemicity" and, in the conclusion, assumes the fundamental objectivity and realism of a "General Theory of Systemicity".

Keywords: Systemicity, Bioethism, dynamics, meta-drivers, synergy, cosmic physics, emergence.

2009-1121

## **LOCAL E-GOVERNMENT IN NEW ZEALAND: DIGITAL STRATEGY, SOCIAL INCLUSION AND LIVEABILITY**

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In 2006, 98 percent of New Zealand residents lived in households with telephones - either landline or cell phone or both. In 2006 New Zealand's population was just over 4 million people. Therefore 80,000 (2% of 4 million) did not have telephone access. If we consider that dialup access is the minimum internet standard required to be part of a digital world, these people are less likely to be served by the New Zealand government's digital strategy.

The questions addressed in this paper are: (i) What issues arise for those people who live in the margins of society when considering New Zealand Government's national digital strategy;

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<sup>3</sup> - **Cosmic**: the essence of the general relativity is in the space-time that has a dynamic cause and its effect properties,

and (ii) How does the New Zealand Government's national digital strategy address issues that arise for those people who live in the margins of society.

These issues will be explored by considering four hypothetical cases:

**Psychological disability.** In this case subject A, who has bipolar disorder but has the intellectual capacity, the knowledge and skills to access the internet is considered. This particular psychological disorder places A in a lower socioeconomic status as A can only work during the small personal windows of opportunity between mood swings.

**Impaired intellectual ability.** In this case subject B has family support, but learning disabilities, lack of life skills, and lives in the family home with financial support.

**Homelessness.** Subject C is considered to belong to the invisible homeless population – moving between temporary accommodation and living – but not sleeping on the street.

**The elderly.** Subject D has never even used an ATM, owned a cell phone, or operated a computer and lives on a pension.

These four hypothetical cases will be analysed systemically using a Sustainability to Liveability model (STLM) that incorporates core systems properties: communication, control, emergence and structure (Checkland, 1984); and four other properties: whole system, socioeconomic status, ICT access and personal coping mechanisms.

Results from this study suggest that both sustainability and liveability have different meanings for each subject studied.

2009-1122

## **USING CRITICAL SYSTEMS THINKING TO HELP DEVELOPMENT PRACTITIONERS FOSTER SUSTAINABLE AND LIVEABLE COMMUNITIES**

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Critical systems thinking originated with the purpose of questioning power imbalances and facilitating a reflective and systems oriented approach to some of the most complex issues we face. Sustainability is one such issue. The questions of power and the extent to which moves toward liveability might compromise sustainability are particularly acute in the developing country context. This paper explores some of the clashes between liveability and sustainability in developing country contexts and utilizes and expands upon critical systems thinking to suggest how development practitioners might play a role in moving our communities into a space which is both sustainable and liveable.

Interventions undertaken by development agencies of various kinds have a tremendous influence on whether power imbalances are rectified or reinforced and on whether increases in liveability move us toward or away from sustainability. There is increasing recognition of links between the environment and aspects of development such as poverty alleviation, health, income generation and conflict. However, this paper suggests that development practice, whilst furnished with a diverse range of perspectives and approaches, is in need of ways of conceptualizing the interaction between sustainability and liveability that emphasise the opportunities for improvement in human and ecological wellbeing that exist in this space.

The contribution which critical systems thinking can make to realizing these opportunities is explored in this paper. The paper draws on aspects of experiential learning theory, theories of cognition and adult learning theory with a view to enlivening the three commitments of critical systems thinking for use by development practitioners. In addition, the consideration of the application of critical systems thinking to development practice results in a list of questions to prompt consideration of sustainability and liveability implications of development interventions. Modelled on Ulrich's critical systems heuristics these questions are offered as a step toward the inclusion of critical systems thinking in a field which has elements of CST, but

perhaps needs to be more explicit about the presence of these elements so that a productive discussion on further improvement of both critical systems thinking practice and development practice can be fostered.

2009-1124

### **TOWARDS A SYSTEMS BASED SPIRITUAL PHILOSOPHY FOR THE 21ST CENTURY**

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In the Western World over the last 300 years or so, spirituality has become a casualty in the development of human knowledge. Traditional Christian religion has tended to become rigid in its formulation, maintaining a worldview that sees the earth as the centre of the universe and 'man' as God's special creation given dominion over the earth and everything in it. Reductionist science has taken us to the opposite extreme, seeing the world as a mere rock in an obscure and unimportant part of the cosmos brought into being by sheer random events. Both traditional religion and reductionist science separate us from the world we live in and see the earth and everything in it as available for our use as we please.

These views have led to immense levels of pain and destruction at all levels of being. We need a new vision that returns our dignity as human beings so we can truly play our role as integral parts of a bountiful planet and a meaningful universe.

There are many other spiritual visions that have been with us for thousands of years that retain our links to the environment and have much to offer us and may help us regain our balance. We can incorporate aspects of these forms of ancient wisdom into our vision for this new century.

Systems Theory introduces a new way of looking at the world where we recognise the old ways of separating ourselves from our world will no longer work. We must accept our place in nature and acknowledge and work with the complexity that is inherent at all levels of our existence.

The new science of Systems Theory may help provide a framework for such a worldview and guide us as we co-create a spiritual vision to lead us into the extremely challenging 21<sup>st</sup> century. A systems view embeds us firmly within nature and places a responsibility on us to work appropriately with each other and with our natural environment. It gives us a place of dignity in our world. A systems based approach recognises the place of chaos in our lives and gives us the hope of emergent possibilities of what we can become. This paper explores these ideas and develops some principles that may help see how Systems Theory might play its role in redefining ourselves for the coming years.

Keywords: spirituality, philosophy, worldview, chaos, emergence, complexity,

2009-1131

### **A GENERAL MODEL OF INFORMATION: THE 'INFORMATION CYCLE' OF H.T. ODUM AND ITS APPLICATION TO 'CULTURE'**

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H.T. Odum's 'information cycle' is a general model for the production, selection, and use of information in all forms. In practice, however, it was only demonstrated in a limited number of examples, each focused on genetic information. This paper attempts a reappraisal of the information cycle in terms of current social theory. Because of Second Law depreciation, information may not be produced and copied in simple repetition through time. Instead, it must be maintained in information cycles that generate many copies and select among them within the larger scale human-ecosystem. This paper applies Odum's model to a range of information types, including enculturation, cognition, discourse, ritual, education, journalism

and academia, which were never attempted by Odum in any detail. There are a number of implications for social science, evolution theory, and general systems. Genetic information extends self-organization in space and time. Cultural information can be understood in exactly the same terms, if its fit to the information cycle is recognized. As information cycles, the production of cultural information leads to a hierarchy of diverse cultural forms that exhibits the common characteristics of all hierarchies, as proposed in Odum's theory of energy transformation hierarchies.

2009-1133

### **SYSTEMS THINKING, RELATIONSHIP MANAGEMENT AND SUPPLY CHAINS**

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Managed supply chain systems typically begin from business-to-business relationships which over time expand to encompass more and more parts of the chain. Harland (1996) first classified supply chains in terms of four sequential levels of management and integration: a firm's internal integration (level 1); buyer - supplier integration (level 2); through - chain integration (level 3); and network integration (level 4). Globalization has spawned cross hemisphere and cross country supply chains that operate in a far more dynamic and influential external environment than ever before. Evidence is accumulating that this external environment significantly impacts on supply chain performance at all four levels of integration, but in different ways at each level. It impacts least at level 1, and most at level 4. This paper shows that in level 2 and 3 China-Australia agrifood supply chains, the influence on whole-of-chain performance of the external environment of the country itself is more powerful than the influence of within-chain relationships. This finding suggests that firms engaging in relationship management at the chain level need to take a more holistic approach. Managing within-chain relationships is necessary but insufficient unless it is done in the context of the chain and its external environment as a dynamic system.

Keywords: system performance; supply chain management; external environment; agrifood chains; relationship management.

2009-1134

### **WHICH SYSTEMS THINKING FRAMEWORK?**

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Aim of this presentation is to obtain input and feedback from the participants in the SIG that will help design an overall systems thinking framework to make sense of the system called the on-going improvement in the operation of the Townsville Super Clinic. This system has most, if not all, of the complexities that a system can have. Thus, a sophisticated systems thinking framework to help guide the on-going improvement is a must.

Background to the aim of the presentation: The Australian Government is implementing a number of Super Clinics. There is considerable government expectation that these Super Clinics will do well. Townsville is one of the locations for a Super Clinic.

The presenter's interest is: How can we achieve on-going improvement in the operation of the Townsville Super Clinic so that the Townsville Super Clinic is one of those that does very well?

To achieve this on-going improvement, we first need to design an overall systems thinking framework to make sense of the system called the on-going improvement in the operation of the Townsville Super Clinic.

*In the presentation:*

- The presenter will outline the key aspects of the system called the on-going improvement in the operation of the Townsville Super Clinic.
- The participants will be asked to discuss the following three questions:
  - What are the 3 areas of systems thinking, leading authors, seminal papers that are most likely to be most appropriate or most useful in developing the overall systems thinking framework to make sense of the system called the on-going improvement in the operation of the Townsville Super Clinic?
  - What are the advantages and the disadvantages of each of these and what aspects of the system called the on-going improvement in the operation of the Townsville Super Clinic are specially suited to each of these?
  - What are the main systems questions that the presenter has not asked?

*Some aspects of the System are:*

- 1) The on-going improvement will operate within an organizational context; thus the on-going improvement is an organizational process.
- 2) The on-going improvement process will be managed as a series of projects.
- 3) Each project will be identified, developed and implemented collaboratively by a small team of representatives from the main stakeholders in the Townsville Super Clinic.
- 4) The outcomes of each project will be monitored and evaluated by representatives not directly involved in the project.
- 5) Each project will be separate but inter-related with the other projects.
- 6) The outcomes from some projects will change the focus of projects that follow.
- 7) The on-going improvement process will be iterative: Identify; improve; evaluate; reflect; identify etc.
- 8) The on-going process will be over 5-10 years.
- 9) The on-going improvement will come from at least the following two sources:
  - a) Narrow sources: For example improvements in the physical layout of the vaccination room to increase the through-put. These narrow sources projects will be important in achieving on-going improvement in the operation of the Townsville Super Clinic. However, other people are working on these narrow sources projects. I am not interested in the narrow sources.
  - b) Systems sources: For example interactions, non-linearities, complementarities, known relationships, suspected relationships. I am interested in systems sources.
- 10) Data for systems sources: The establishment of the Townsville Super Clinic will include computer facilities and security and privacy processes that can be used to collect virtually any type of data, thus let us assume that data is not the usual limiting factor.

2009-1135

**FOSTERING INNOVATION SYSTEM OF A FIRM WITH HIERARCHY THEORY:  
NARRATIVES ON EMERGENT CLINICAL SOLUTIONS IN HEALTHCARE**

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A central finding in innovation research is that firms seldom innovate in isolation. Interaction with other agents such as customers, suppliers, competitors, regulators and various other private or public organizations contributes to the search of novelty by firms. A 'system perspective' is useful in understanding and analyzing such interactions. As shown by research scholars of innovation, the concept of system has been intensively explored but it arises several issues: first, the appropriate level of analysis and the closely related issue of identifying the actors or components, second, the measurement of the system. These issues are discussed with the respect to the interpretative hierarchy theory that adequately deals with complexity through a self-reflective process of observation and description. It provides us with some possible associated solutions, (i) the multi-level architecture of order and (ii) narratives on technological innovation. In turn, it fosters the hierarchical deployment of the 'innovation system' concept at the firm level and its empirical illustration through the emergence of clinical innovations in medical imaging in particular. Finally, we suggest that firm managers need an appropriate holistic approach to closely capture these emergent clinical solutions associated with lead user interactions.

Keywords: evolution, emergence, innovation systems, hierarchy, narratives.

2009-1136

**PUBLIC-PRIVATE PARTNERSHIP POLICY: SYSTEM APPROACH TO  
MICROFINANCING**

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More than 95 percents of business units in Indonesia are small and micro enterprises (SME). Problem facing by SME beside market and human resource is lack of investment support and less access to the banking sector. A closer investigation of the microfinancing problems reveals that rather than being technological, they are complex combinations of social, economic, cultural, psychological as well as legal and communications factors.

This research using system approach, aims to analyze and design the public-private partnership policy to establish microfinancing for less developed regions. The system methodology is philosophically committed to serve as a guide to action and primarily concerned with providing information relevant to a policy decision. Case study and face validation was carried out in model building process.

This research produced a conceptual framework (BSK model) related to the finding about the importance of institutional linkage between banking and Microfinance Institution (MFI) to set up sustainable SME financing. The linkage structure should be support by government budget for MFI empowerment and SME loan guarantee. Private companies roles is providing low interest credit for SME and CSR-fund to reduce its transaction cost appropriately. This linkage was found useful for smallholder's farmers and work effectively to reduce rural poverty.

The partnership policy must be planned and coordinated well by local government administration with local banks involvement. This study recommend independent MFI rating agency to facilitate capital formation of MFI by the bank. The BSK model was verified in the case of micro credit-KUR scheme linked to saving and loan cooperative units. In conclusion, microfinancing must be viewed as holistic efforts on system that can not be reduced to components that are separable.

Keywords: Microfinancing, Small Micro Enterprises (SME), Linkage System, Policy Model.

2009-1137

## **DESIGN OF FUZZY NEURAL NETWORK BASED MULTI-VARIABLES CONTROLLERS FOR MANIPULATOR**

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This paper proposes robust multi-variables control design by intelligent control, which uses Fuzzy-Neural Network. Proposal methods are as follows. To constitute a robust and capable of automatically gain controlling against the conventional fixed PID control system. It is a structural feature that the proposed controller has the nonlinear deviation compensator formed by the fuzzy-neural networks. For this reason, in the multidimensional case, the inverse dynamic model portion of the control law is called a linearizing and decoupling control law. This method is time to change the parameters of nonlinear damping and always will be critical to gain control of adaptive changes in the law is devised. As a result, the system in multivariable non-interference in each axis will be able to interfere.

Keywords: Fuzzy Neural Network, multi-variables control, decoupling, manipulator control

2009-1138

## **MACRO-CYCLES OF CHANGE - LEARNING FROM AN ORGANISATION'S HISTORY**

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The paper reviews the macro-political and economic cycles impacting a large government agency in Australia and its change processes using the theory of punctuated equilibrium. The paper extends original work published in 2002 to include the current global economic crisis and change in the Australian federal government. It analyses problems in the corporate support area of the organisation, which seemingly has not heeded lessons learnt from its history and earlier major change programs. The paper reviews proposed changes in the light of systemic thinking, systems archetypes, and a causal loop diagram. Conclusions are drawn that the organisation did not take into account the macro-cycles of change, nor the unintended consequences arising from decisions to change. Recommendations for improvement are made.

2009-1139

## **A METHODOLOGY TO PROLONG SYSTEM LIFESPAN AND ITS APPLICATION TO IT SYSTEMS**

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A system failure model to prolong system lifespan is proposed, for the purpose of preventing further occurrence of these failures. The authors claim such a methodology should have three features. First it should clarify the structure of failure factors, second it should surface hidden failure factors using statistic method especially corresponding analysis and finding the way to change. The proposed methodology is fundamentally different from the one to identify the root cause of the system failures in the sense of that it encompasses system failures as a group not as a single event. An understanding system failure correctly is crucial to preventing further occurrence of system failures. Quick fixes can even damage organizational performance to a level worse than the original state. In this sense the proposed methodology is applicable over the long time spans and therefore could be useful to confirm the effectiveness of the counter measures without introducing any side effects. Then an application example in IT engineering

demonstrates that the proposed methodology proactively prolong system life learning from previous system failures.

Key words: system failure model, structuring methodology, double loop learning, ISM, risk management

2009-1141

**WORKPLACE BULLYING IN AMERICAN ORGANIZATIONS: THE PATH FROM RECOGNITION TO PROHIBITION**

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Incidents of workplace bullying are on the rise in the American workplace. Researchers have compared recent concerns about bullying to those expressed about sexual harassment twenty years ago. Statistically, though, bullying occurs far more often than does sexual harassment; in fact, the U.S. Workplace Bullying Survey (2007) reported that bullying is four times as prevalent as illegal, discriminatory harassment.

This paper explores the evolution of employee legal rights in American organizations, with a specific focus on parallels between the serious organizational problems of workplace bullying and sexual harassment. It also examines the legal, legislative and policy protections currently available to employees both in the United States and internationally, proposed systemic changes, as well as likely prospects for change in the immediate future.

Keywords: workplace bullying, sexual harassment, discrimination, legal protection, legislation, policies

2009-1142

**'RURAL FUTURES': A SOCIAL-ECOLOGICAL SYSTEMS PERSPECTIVE ON NEW ZEALAND FARMING FUTURES**

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As a developed country New Zealand has a unique profile in having a high dependency on the agriculture industry for its economic well being. This contribution is based primarily on pastoral agriculture where social-ecological systems that include human behaviours co-evolve with ecosystem properties to sustain a particular set of functions. The functions acknowledged and subsequently demanded from these systems are changing from food, fibre, and employment to now also include greater emphasis on environmental quality, and aesthetic appeal. These changes have occurred in response to community aspirations that have led land managers to balance farming for production against outcomes more commonly aligned to public good. Recent Foresight reports have commented that new and emerging technologies, social and economic changes and policy reforms will shape the future agricultural economy, creating a complex, unpredictable and challenging environment. These pressures converge at the farm scale and offer both risks and opportunities for the industry, dependant on the response of the decision maker. The ability to adapt to these drivers against a background of a finite natural resource base and access to inputs (such as energy, fertiliser and skilled labour) is vital to the continued success of NZ's agricultural industry. New Zealand farmers along with industry advisors and policy agents will need to continue to extend their ability to learn, plan and innovate to proactively and effectively respond to current and potential pressures.

This paper describes a research programme 'Rural Futures' that takes a social-ecological systems approach to develop tools and processes that will allow farmers, industry advisors and policy agents to simulate, explore, interrogate and gain insights of future farming systems and associated value chains. An interdisciplinary team has been assembled with expertise in bio-physical and social science and quantitative and qualitative methodologies. In linking 'hard' and 'soft' systems we will build a collective learning environment that will enable adaptive strategies to be designed to cope with complex, unpredictable and challenging pressures that operate simultaneously to deliver multiple outcomes. Much prior research has struggled to achieve this kind of insight by addressing only single pressures on farming systems or multiple pressures on only part of the farm system. The strength of this research design is in its ability to develop a highly innovative and challenging methodological synthesis between three distinct but interrelated systems: complex on-farm human dynamics, bio-physical response at the farm level and industry behaviour. The research will deliver a framework where farmer decision making is informed by the insight of the biological behaviour of farm systems, and industry responses. These outputs are then interfaced within a 'learning platform' where the end-users of the framework can focus on the strategic horizon to learn about and understand current and future issues, explore possible operating environments and identify the consequences of chosen scenarios.

2009-1144

### **ACHIEVING A SUSTAINABLE HEALTH SYSTEM - A CONCEPTUAL FRAMEWORK FOR HOLISTIC DECISION MAKING**

***Jean-Paul Ngana***

Sustainability has since the late 1990s dominated the debate on health system. The current economic and financial crisis is currently adding to the already existing concerns of accelerating costs and increasing doubts regarding the system capacity and resources in meeting the health services needs of aging population. In this debate health system and health care system are often used interchangeably. The health system has therefore been approached from the traditional view, which equates the level of health with the quality of medicine. In the traditional view, the improvements in health status are achieved through the public health care and individual care provided by public health professionals, medical practitioners, nurses and hospitals (acute treatment). This paper challenges the traditional view of health system and explores its components. It differentiates between health system and health care system. A definition of a sustainable health system is proposed based on the interconnectedness of the components of a health system. A conceptual framework is then proposed for holistic decision making towards achieving a sustainable health system.

Keywords: Sustainable Health System, health system, health care system, traditional view of health system.

2009-1145

### **DESIGN THEORY FOR COLLABORATIVE TECHNOLOGIES: ELECTRONIC DISCOURSE IN GROUP DECISION**

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This paper proposes a theory based on pragmatism and multiple discourses for the design of technology-enabled collaboration. The practical value of the theory is explored in the context of an intervention enabled by Group Support Systems (GSS) in regional governance and comprehensive urban planning. Qualitative measures were obtained of the degree of confusion (lack of understanding) and conflict (lack of trust) before and after the meeting, and participant performance and satisfaction with electronic discourse. The focus question is "Do electronic discourses enhance participant's understanding and trust in scenario planning?"

Keywords: Communicative action; Critical interpretive case study; Facilitated collaboration; Inter-organizational conflict.

2009-1146

**SYSTEM THINKING APPROACH AS A TOOL FOR SUSTAINABLE TOURISM DEVELOPMENT**

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Tourism is not simply an industry, but is an open, dynamic, and complex system. It includes many interacting components, and involves many different stakeholders. The development sustainable tourism impinges on and is subjected to many different factors. The limitation of traditional approaches in tourism research are now becoming apparent as they often only explore particular parts of the bigger tourism picture.

This is a conceptual paper that will provide an overview of using a systems thinking approach in dealing with the dynamic and complex nature of the tourism industry on the Cat Ba Islands Biosphere in Vietnam. An overview will be given of the interdependencies and interactions between the constituent parts, focusing on the causes of complexity and dynamic behaviour of the system. The way in which systems thinking has radically changed the way in which research problems are addressed, and its usefulness as scientific method in defining problems and formulating and testing potential solutions will be described.

2009-1147

**SYSTEMS THINKING IN THE FORESTRY VALUE CHAIN – A CASE STUDY OF THE NEW ZEALAND EMISSIONS TRADING SCHEME**

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A systems thinking group model building workshop, based on the qualitative system dynamics approach, was held to discuss the effects of an Emissions Trading Scheme on the New Zealand forestry value chain. Issues were identified from a group of stakeholders, and based on these a set of causal variables were identified. These variables showed a strong bias towards an economic viewpoint of the issue. Causal loop diagrams were made from these, and the dominant loops briefly analysed. This paper, which represents work in progress, will discuss some of the insights gained to date from this project.

2009-1149

**TOWARD THE LIVING SYSTEMS ANALYSIS OF TWO KOREAN RELATIONS**

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Recently, two Koreas try to improve relations with each other in many subsystems. The exchange of matter-energy and information in non-political areas appears to have developed significantly in recent years. This development is very significant to take a close look at the subsystems that process the energy and information in the current relations between South and North Korea. The main objective of this study is to examine the efficiency in living systemic analysis of two Korean relations to overcome the predominant frameworks in South Korea. And it is to suggest the merit of living systemic analysis of two Korean relations data

Key words: Subsystems, matter-energy, information, living system theory, South-North Korean relations

2009-1151

## **AN EVOLUTIONARY NATIONAL TELECOMMUNICATION SYSTEM THROUGH KNOWLEDGE MANAGEMENT**

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A telecommunication system is one of the most important kind of infrastructure to support a country national development. That is why is convenient to design an evolutionary system in order to have a system which has the ability to evolve according the changes of technology, social needs and better knowledge. The complexity of this system makes necessary to apply system thinking, strategic thinking, knowledge management and many techniques for achieving the participation of the community. A system approach allow us to identify the main subsystems that should be considered: from the technical point of view, radio, television, telephone, satellite and data communication. In this paper it is proposed to modify the present telecommunication system (TCS) of Mexico to achieve the biggest increase in its value for Mexican people. Almost always the formulation of strategies and public policies of the system are defined in public institutions without the participation of the telecommunication community. In this case, the proposition is that knowledge management should be considered in stock and in practice for solving the problem. In the first solution all the available information is put together in a center place, for every one to access on demand. The second application is based on a evolutionary conversation to create new ideas and new knowledge for the future system. Besides of that it is necessary focus how the information is going to be sent from one place to other through different media: The technical requirement is to improve the way of transmission, in order to assure that the information generated by the source gets the address in a fast, cheap, safe and truthful way. The proposed schema is a solution for implementing the application of the main principles and techniques of Knowledge Management. This schema is enough flexible to use different planning models and many different techniques for assure the participation of people.

Keywords: Knowledge Management, Evolutionary system, Planning models

2009-1152

## **SYSTEMIC REGIONAL DEVELOPMENT - A SYSTEMS THINKING APPROACH**

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Rapid change is occurring in regional (non-metropolitan) areas in relation to a wide range of natural and human-mediated forces and is taking place at various temporal and spatial scales. Attempts by governments of different persuasions to confront the challenges have partially succeeded or failed altogether. A novel and integrative approach is required to analyse, plan and manage the sustainable use of ecosystems, resources and biodiversity in regional systems. Based on systems thinking concepts, especially from cybernetics and complexity science, the approach, termed systemic regional development, is put forward in this article.

Key words: systems thinking, sustainable development, regional system, systemic intervention, boundary critique, methodological pluralism, essential variables

2009-1153

**THE DECLINE OF ASTROLOGY; A SYMBOL OF MAN'S DISCONNECTION WITH NATURE, SELF AND THE COSMOS**

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Throughout history astrology has functioned symbolically to represent Man's attitude to and understanding of Nature. When Man disconnects himself from Nature, Self and the Cosmos, this disconnection is made evident through a decline or dismissal of interest in astrology. The paper argues that this disconnection makes astrology at times seem like a 'superstitious vulgarity', to use St Augustine's view of astrology. Many others over the centuries have discounted astrology in a similar manner. Yet, at other times in history, astrology has been held in high regard and recognised to be serving an important role in reconnecting Man to Nature, Self and the Cosmos. The present ecological crisis is perhaps a reflection of a psychological crisis - a sign that the modern decline of astrology has progressed too far. The paper concludes with suggestions for how the emerging interest in systems thinking might enable modern man to reconnect with astrological thinking, and therefore Nature, Self and the Cosmos.

2009-1154

**DATA, INFORMATION, KNOWLEDGE: A SEMIOTIC-SYSTEM'S VIEW FOR DATABASE DESIGN**

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In this paper, the concepts data, information and knowledge are examined and linked with Charles S. Peirce's semiotic categories. The overall aim of the paper is to propose a Peircean semiotic framework that can be applied to database design generally. The more specific ideas developed in the paper are discussed in relation to a database being developed in the area of weed risk assessment at the Victorian Department of Primary Industries (DPI) in Australia. The argument runs as follows: For a database to be used effectively as a learning resource by its target audience(s), a designer needs to distinguish between the concepts data, information and knowledge. These concepts, it is suggested, can be linked with Peirce's 'three grades of clearness', which in turn, are derived from Peirce's triadic categorical framework, that is, his semiotic. Following Peirce, then, it is argued that if the logical role of each of categorical concepts is muddled, strategic action and organisational learning by the target audience(s) will be made increasingly difficult, if not impossible. Thus, in communicational terms, the author notes first that data falls into the category of Firstness, and as such, it has no meaning at all. In terms of the application examined, weed risk assessment data must be combined with an organisational structure if it is to become information. Information is therefore linked by the author to the category of Secondness – a resisting structure is identified which defines the data's relevance and makes it something that is useable. Along similar lines, information can be put to use where it is deemed necessary, but its strategic value is entirely uncertain. Thus, it is only at the level of knowledge, which is linked by the author to the category of Thirdness, that we can apply information strategically, that is, with a real-world outcome in mind. Thus, it is argued that while each grade of clearness is necessary to database design, it is only at the third grade of clearness, or at the knowledge stage, that a weed risk assessment database can be used effectively to construct and communicate an ongoing community of enquiry around weed risk science.

2009-1155

**TOWARDS A FEMINIST-SYSTEMS THEORY – AN OVERVIEW OF METHOD, EMERGING RESULTS AND IMPLICATIONS FOR PRACTICE.**

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This paper provides the findings of a current study to locate the similarity and/or differences between two epistemologies: Critical Systems Thinking (CST) and cultural ecofeminism. Selected texts from authors in each field were coded and compared using the Constant Comparative Analysis (CCA) Grounded Theory method. The texts revealed a multitude of similarities between the two bodies across a range of concepts including systems thinking language; challenges to positivist science, reason and instrumentalism; ethics and morality and praxis. From the initial synthesis of the data, several principles towards one feminist-systems theory of practice are emerging.

2009-1160

**TURNING LEADERSHIP OUTSIDE IN: BOUNDARY SPANNERS' INTERNAL BOUNDARY WORK**

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Many leaders, organizations and communities wrestle with complex problems, where work needs to span boundaries. Those boundaries can be external and socially constructed around administrative units, jurisdictions or cultures. They can also be internal, segmenting leaders' roles and identities so that they feel they need to shift behaviours in different environments. For leaders who have chosen to work horizontally and span boundaries, such identity management can be challenging.

This paper draws from a recent, larger study that explored ways in which respected, boundary-spanning leaders understood and worked with boundaries. These participants were selected through a referral process in which nominators described how nominees fit the study's criteria. In addition to being respected for their work in complex, boundary-spanning environments where they had relatively little or no positional authority, participants needed experience as formal leaders in hierarchies so they could compare the two types of environments. Participants came from fields including environmental sustainability, counter-terrorism and knowledge management.

Midgley is one of the authors who has described boundaries as fundamental to systems thinking. One of the findings from the larger study was that participants collectively used 10 inter-related strategies for their work with boundaries in complex environments. These strategies were presented through a lens of Midgley's theory of boundary critique.

This paper adds to that study by exploring key informants' perspectives about internal boundary work and identity management. It assesses whether there were links to the overall strategies used for external boundary work. Although this exploration is preliminary, it appears there are many parallels between external and internal boundary work. These parallels can be understood as turning leadership outside in: using leadership strategies suited to work with external boundaries in order to learn and develop as a person and leader through the management of multiple identities.

Keywords: Leadership, Boundaries, Identity, Complex Systems

2009-1163

### **SYSTEMIC EVALUATION OF COMMUNITY ENVIRONMENTAL MANAGEMENT PROGRAMMES**

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Community environmental management (CEM) is increasingly seen as a solution to complex environmental issues facing regulatory authorities. Little is written in the literature about how CEM programmes should be evaluated given the complex relationship between community participation and environmental outcomes. CEM programmes have much potential, but the lack of evidence-base means that their role in resource management is not necessarily well understood. This paper reports on action research that developed and trialled a systemic CEM evaluation methodology that blends three evaluation paradigms: stakeholder, goal-based and organisational.

Keywords: Systemic evaluation, Community Environmental Management, Soft Systems Methodology, Developmental Work Research, New Zealand

2009-1167

### **SUSTAINABLE DEVELOPMENT REQUIRES AN INTEGRATING DISCIPLINE TO ADDRESS ITS UNIQUE PROBLEMS – DESIGN THINKING**

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Sustainable development has taken centre stage in our global conscience. Until recently, we have been focused on economic prosperity, driven by the mechanistic worldview of the scientific method. Once the cracks appeared, as a society, we have been looking for a deeper meaning and approach to life. Through a literature review, the paper proposes that current 'experts', using the engineering profession as an example, are not able to address the wicked problems confronting us, since they prevail within the reductionist mode of knowledge production. We need design thinkers - who are natural systemic practitioners - to solve systemic problems, which is characterised by sustainable development.

Keywords: design thinking; sustainable development; systems thinking.

2009-1169

### **BALANCING INDIVIDUALISM AND COLLECTIVISM: USER CENTRIC POLICY DESIGN TO ENHANCE EVOLUTIONARY DEVELOPMENT AND TO ADDRESS COMPLEX NEEDS**

***Janet July MacIntyre***

Do we have a choice between isolation in zero sum competitive nation states or multilateralism? I argue that based on an understanding of our common, intermeshed fate (Held et al 1999) that rational responses need to be systemic. This paper is exploratory. It considers the implications of ongoing research on the relevance of participation for testing out ideas for science, ethics, and democracy.

Testing enables the better match of development responses to context, thus enabling 'evolutionary development', rather than 'development for growth'. This is the difference between:

- Development for growth which is unsustainable, because it 'forgets' the 'externalities of poverty' and pollution.
- Evolution that is based on responding to the environment, adapting and evolving designs that are socially, economically and environmentally sustainable.

2009-1170

## **REGIONAL GOVERNANCE IN RURAL AUSTRALIA: AN EMERGENT PHENOMENON OF THE QUEST FOR LIVEABILITY AND SUSTAINABILITY?**

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Change is intrinsic to both social and natural systems. Emerging insights from the literature on linked social-natural systems emphasize that societies that depend closely on natural resources need to enhance their capacity to adapt to the uncertainty and change they currently, and will continue to, face and to better shape their futures. The complexity relating to the dynamics of change in these linked systems is recognised as adversely impacting on liveability and sustainability in many rural contexts. Institutions and policies that have traditionally had responsibility for managing our social and natural systems are being challenged by the complexity of the 'wicked' problems now being faced as well as the growing pace and magnitude of change and the uncertainty that it embodies. An important element of the response to this change is an emerging shift in public policy from uncoordinated hierarchical top-down sectoral or program-specific approaches to more 'holistic' regional approaches that emphasise inter-sectoral coordination and cross-scale co-operation. Several disciplines and inter-disciplinary fields have shown an interest in the dynamics of this change identifying the complex, multi-level and nested nature of the governance of linked social-natural systems at the regional or territorial level. Much of this work however has focused on sector-specific issues or particular programmatic policy initiatives, and seldom provides a more holistic examination of the complexity of the overall system of multi-level governance in practice at the regional level and the related challenges and opportunities for supporting livability and sustainability more effectively. Drawing on the concepts of complex systems and adaptive governance in a regional policy context, this paper addresses this gap and reports on the first of three case studies examining the current nature and future options for regional governance in Australia.

Australia's federal system involves three spheres of government – national, state and local; there is no formal regional sphere of government. In this context, 'regional governance' is a loose descriptor of the structures, processes and relationships by which decisions are made, and power exercised and shared, at spatial levels larger than localities and smaller than the States in most parts of Australia. Focused on rural and remote Central Western Queensland, the study confirms firstly the significance of the 'region' as a spatial governance unit and, secondly, the complex nature of 'regional governance' as an emergent property of multi-level governance in a linked social-natural system context; most commonly through decentralisation of policy administration and, more rarely, through either public policy design to the regional level or the emergence of self-organised 'bottom up' regional initiatives. It records the complex, relational, ad hoc and emergent nature of regional governance systems in rural Australia; systems supported by only weak regional institutional frameworks and blurred spatial boundaries. It locates the strengths of regional governance as including the dynamic, relational and responsive nature of partnerships, collaboration and networks involving public, private and voluntary sectors in the development and implementation of local and regional policies. Finally the paper considers the potential of the emergent phenomenon of regional governance for enhancing regional capacity to adapt to and shape change and better support liveability and sustainability in rural Australia.

Keywords: social-ecological systems, wicked problems, change, regional governance, sustainability

2009-1173

### **IN SEARCH OF A VIABLE SYSTEM MODEL FOR AFTER-SALES SPARE PARTS SERVICE IN TELECOM FIRMS**

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After-sales spare part service is a competitive differentiator and a source of profit enhancement in OEM (Original Equipment Manufacturer) telecom firms. By seeking greater differentiation, more loyal customers, and higher margins and profits, the OEM needs to develop a more effective service-to-profit supply chains. But, predicting service requirements, inventory needs, supply chain parameters, etc. is extremely challenging. In order to tackle and mitigate this kind of problems and to have a more holistic approach of the system, this paper shows how to build the structure of the after-sales service supply chain going from strategic to operational issues using a Viable System Model (VSM) approach.

Keywords: Viable System Model, after-sales spare parts service, telecom industry.

2009-1174

### **FRACTAL ANALYSIS OF EPILEPSY**

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A complex system has constituents interacting in a nonlinear way. A complex biological system is the human brain, which function is based on the communication between neurons, if there is a mistake in the communication between them, it can cause epilepsy. Epilepsy affects from 1% to 2% worldwide population.

Fractal Geometry is used to analyze electroencephalograms (EEG) from epileptic patients to determine where the epileptogenic region is located to make a surgery to the epileptic patient. In this work fractal geometry is applied (using four self-affine trace methods: R/S analysis, Roughness-Length, Variogram, and Wavelets), to study temporal series generated by EEG from data that refers to people that do not have epilepsy but have had a neurological problem and epileptic patients.

After doing the fractal analysis, it is concluded that for all complex signals (EGG) under studying, the best methods to analyze epilepsy are R/S and Variogram, because they were the solidest to every analyzed channel, in addition to be the nearest to the average values from the four self-affine trace methods.

Keywords: fractal analysis, complexity, epilepsy, complex system.

2009-1176

### **SYSTEMS SCIENCE AS A SYSTEM OF KNOWLEDGE: AN EXPLORATION RESEARCH OF ITS STRUCTURE**

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This paper presents a brief exploratory research work on the structure of Systems Science. To guide the exploration through the jungle of domains, concepts, theories and methodologies, the Domain of Science Model developed by John Warfield was used as a compass.

Given that Systems Science is itself a system, it is researched like a conceptual/real system, considering the consensual points of view expressed by theoretical and practical systemists in congresses as well as in traditional and recent research documents.

The exploration research helped to identify and elucidates the main components of the body of knowledge, which integrate the Systems Science as a whole, such as:

- The domain of the Systems Science
- The conceptual space and language of Systems Science
- The theoretical relations inside the Systems Science
- The methods of the Systems Science

Keywords: Science Model, Domain of Systems Sciences, Concepts, Theory, Methodology

2009-1178

### **UPTAKE OF NETWORKING TECHNOLOGY– AN ‘EMERGENT’ PHENOMENON**

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The benefits of saving time, money, and reducing carbon footprint entailed in using e-conferencing technologies for collaborative research and teaching has been appreciated by individuals, industry, universities, and governments [1]. Organisations and individuals express wishes to utilise the technology for establishing sustainable research and teaching practices in which increased use of e-conferencing technologies leads to reduced travel [2, 3]. However, in spite of substantial investment in the development and installation of network infrastructure and other technical equipment, uptake is lower than anticipated [4-10]. Brooklyndhurst [11] argue that to encourage sustainability there is a need to facilitate a liveability of ‘here and now’, which will enable to take specific actions towards increasing the levels of use of e-conferencing technology and working towards more sustainable models of collaborative research and teaching. Such attempts have been made, however, the paper argues that the problem lies in the ways in which specific actions are identified and addressed.

More often than not organisations take the two variables approach of “if you build it they will come which assumes that the provision of technology in itself will trigger change in practices, and increase the use of e- conferencing tools and the lowering of travel [8-10, 12]. However, literature shows that the adoption of new technologies entails multiple technical and non-technical factors [2, 3, 13], and raises questions about what shapes uptake and how technology is used [14-16]. Although the acknowledgement of multiple factors opens up the two variables model, it does not guarantee a break away from the binary model. Literature shows that in cases where a variety of factors is being considered these are classified into two categories drivers, and barriers the former needing to be facilitated and the latter resolved in order for uptake to be successful [17-19].

The paper argues that there is a need to break away from any binary models, and that processes of adopting technology should be viewed as complex systems comprised of interdependent relationships between various factors. Accordingly, success or failure of uptake does not rely on isolated factors acting as ‘drivers’ or ‘barriers’, but on clusters of interrelating factors comprising the systems entailed in the process of uptake.

The paper argues that attempting to isolate factors within the system leads not only to a limited but at times misleading view of what is driving the uptake and what is contributing to its effectiveness, hence hindering the ability to identify what ‘specific actions’ need to be taken. On the other hand, it is acknowledged that tackling multiple factors embedded in one or more systems all at once poses an impossible task for organisations.

In an attempt to provide a solution the paper proposes a new approach, which enables to prioritise rather than segregate factors and address them as elements within the system in which they operate. The new approach enables to identify the many levels comprising the process of uptake, and as each factor is prioritised the larger system is dissected hence offering a clearer view of what is entailed in the emergence of the process as a whole, but at the same time informing of how the system is created through its various interrelating parts [20].

The prioritisation of factors is achieved using Centrality measures adopted from Social Network Analysis, and the identification of Semantic relations of factors associated with systems of perceptions, practices and the manifestations of these.

The paper demonstrates the new approach using data of a case study in which uptake of e-conferencing tools for conducting remote collaborative research was investigated. The data was used to chart factors operating within systems of perceptions and systems of practices. Factors are then prioritised to provide organisations with manageable steps towards increasing uptake of technology and creating 'here and now' practices that will lead to a wider transformation of sustainable research practice.

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2009-1179

### **CONCEPTUALIZATION OF THE CONSCIOUSNESS FIELD, FROM THE PERSPECTIVE OF SYSTEMS SCIENCE**

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The main purpose of this paper is to propose the concept of the consciousness field with two aspects: individual and collective. This is carried out by taking into account the similarity among the external environment, perceptible to the corporal senses, that surrounds a human being and the internal environment, perceptible only by reason, that surrounds the same individual in his subjectivity aspect.

It is proposed that the consciousness field is an energy field as any other physical field only that this energy is of ad hoc nature. This field has its own characteristics and supposedly very similar to a quantum field.

The development of the argument conceptualize the consciousness field using concepts of Systems Sciences, Psychology and Sociology and analogies of physical and psychic processes.

The concept of field of individual consciousness is proposed and then the field of collective consciousness is inferred as a result of synergy between two or more individual consciousnesses. Two facts emerge from this collective consciousness field: on one side, a collective consciousness, which is more complex than anyone of the individual consciousness and, various mutual influence relationships among collective and individual consciousnesses.

Finally, some reflections are given to show how the concept of collective consciousness field could be applied in problem situations concerning with social life, organizations and communities.

Keywords: consciousness, collective consciousness, consciousness field.

2009-1180

### **CRISIS! JOBLESS AND SMALL BUSINESS: DANGER AND HOPE**

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The world lives a systemic global crisis. This year put 52 million working-age populations out of a job, and in addition, some 90 million people will enter the labour market worldwide in 2009-10.

To change or minimize that, it is necessary to place employment and social protection at the center of fiscal stimulus measure, because it needs to build a fair and sustainable globalization providing opportunities to all.

ILO proposes providing credit lines and direct access to government loans to small businesses (important drivers of innovation and employment growth) so they can maintain operations (and seize potential new opportunities) until demand is restored.

The statement that the small businesses drives the innovation and employment growth is a common place, but there are finding, amongst firms in the smallest size categories, the vast

majority do not exhibit any significant growth, and many have a conscious strategy of refusing to grow. This led to the, perhaps, initially perplexing finding that whilst the smallest size of firms are on balance growing faster than other sizes of enterprise, comparatively few firms are contributing to that growth.

Growth firms, therefore, are “special”. They are unusual, but hugely important. Given the continuing desire of politicians, in most economies, to promote job creation, they are a focus of public policy attention. Politicians want to know how to create more of them, and how to convert slow-growing into fast-growing firms.

The goal of this paper is to highlight the challenges of the small firm’s owner-manager to change the management style or the nature of the organization, the strategy and his role as owner, to make growth successfully. Also, highlight how to increase the human capital and/or the knowledge enterprise.

Keywords: small business, growth, knowledge management, collective intelligence.

2009-1183

### **RELATIONAL THEORY AND ECOLOGICAL NICHE MODELLING**

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Relational theory is an extension of Robert Rosen’s relational complexity. Its development implies a fundamental, four-quadrant ‘holon’ structure in nature based on nested modeling relations and their structure-function epistemology. Holons comprise and are comprised of other holons, thus providing a robust holistic analysis of nature at all scales. The four quadrants of the holon correspond with Rosen’s theory, Aristotle’s four causes, Ken Wilbur’s analysis of social hierarchies, and Vedic principles employed in quantum physics. Two quadrants of the holon define mechanistic science while the other two account for complexity. To use this view of nature as an analytical method and informatics architecture, each quadrant must have its own methods and tools. The mechanistic components are well developed but the relationistic ones are not. Quadrant II represents intrinsic potentials in nature, and it corresponds with the concept of the ecological niche in Ecology. The ecological niche is thus indicated as having central importance in ecology and relational theory. We are in a good position for rapid development of Quadrant II, which requires a robust and general method for ecological niche modeling. Such a method is being developed and is described here as the General Ecological Niche (GEN) model. Once this general method is established in Quadrant II, development of Quadrant III methodology for interactions of niche potentials and their aggregation into system attractors, may also be accomplished. Coupling models in all four quadrants of the relational holon will provide an entirely new form of analysis and informatics that is appropriate for studying complex and living phenomena. Urgent development of this architecture is recommended to address ecosystem problems.

Keywords: Relational Theory, Niche Modeling, Theoretical Ecology, Complexity

2009-1184

### **LEARNING FOR SUSTAINABILITY: AN EMPIRICAL STUDY OF LOCAL GOVERNMENTS IN HUNGARY**

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This paper presents the findings of an empirical study on local authorities in Hungary and how they develop knowledge that is relevant for managing urban sustainability. The conceptual model used in the study is based on the argument that sustainability as a complex policy problematique requires a qualitatively different way of approaching urban policy issues. Sustainability calls for flexible management practices based on continuous learning on behalf

of both authorities and other societal actors. Learning for sustainability involves both substantive and strategic aspects. Substantive aspects concern the development of 'systemic', 'holistic' or 'integrated' models (or problem frames) which are more capable of harnessing the complexity of the interconnectedness of urban sustainability issues and also including a greater awareness of spatial and temporal scales. Strategic learning entails a greater appreciation of the interdependence of actors (stakeholders) in addressing urban sustainability. Traditionally governments tended to own problems unilaterally as they possessed the necessary authority. The new governance discourse, however, suggests that governments (including local authorities) need to reposition themselves more as facilitators and manage societal actors more and more via horizontal arrangements as well. The changing reality of policy formation and necessitates strategic learning on how to interact with parties and how to coordinate efforts to deliver improved solutions for local sustainability.

The objective of the study was to explore whether and why different municipal departments are more capable of developing meta-knowledge relevant for sustainability. What factors enable or inhibit learning at the municipal level? Also, how does the emphasis on interaction with societal actors and more intensive networking influence the capacity to learn for sustainability? Explanatory variables included organizational structure, organizational culture (with special emphasis on a 'learning' culture), knowledge management practices and social networking patterns of municipal departments. The study was based on quantitative data collected via an online survey administered in all county seats in Hungary, which are 23 largest cities (excluding the country capital). The sample included responses from 136 departments.

2009-1186

#### **SYSTEMS THINKING AND PARTICIPATION IN A BIO FUELS PROJECT**

***Leroy White***

Carbon footprinting has become a 'buzz' word in industry and the public domain. Consequently, there is a lively activity worldwide on developing methodologies for estimating carbon effects of products and supply chains. However, there is also a lot of confusion as to what carbon footprinting means, what it should be about, how the system boundaries should be defined and how the information obtained should be communicated.

This paper will explore some of the issues surrounding carbon footprinting by discussing a recently completed project exploring the viability of biofuels in the South West of England. Developing biofuels, such as bio-diesel, has been suggested as a way to tackle the problem of renewable energy. Of particular importance to ensure that stakeholder involvement is facilitated so that a coherent biofuels policy can be developed that address and balance all the range of factors if there's going to be agreement that biofuels are to make a sustainable contribution to reducing climate change. In particular, the paper will describe the systems methodologies used to widen the participation in the project. It will also discuss the potential implications for sustainable development of focusing on carbon alone and ignoring other social issues.

2009-1188

#### **THE ARCHITECTURE OF COMPUTER-BASED INFORMATION PROCESSING AND THE EFFECTIVENESS AND ADAPTABILITY OF SYSTEMS**

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The effectiveness of a computer-based information system can be defined in terms of its ability to support effectively the functions of the system it serves. In fact, a basic principle for the design of computer-based information systems stated earlier (Kampfner, 1997) asserts that in order to provide effective function support, a computer-based information system must be compatible with the structure, dynamics, and adaptability of the system it supports. The effect of computer-based information processing on adaptability can be associated with its effect on the interdependence of the subsystems of the system it serves. In fact, a basic

architecture design principle favors the adaptability of the system as a whole (Kampfner, 2008) by appropriately reducing subsystem interdependence (Conrad, 1983). In this paper we propose a top-down approach to the design of computer-based information systems in which the architecture design principle is applied first in order to find an architecture that favors the adaptability of the system being supported by the information system. The effective support of function support must then be achieved on the basis of this architecture.

Keywords: architecture, computer-based information processing, adaptability, subsystem interdependence, functional subsystems, effective function support.

2009-1193

## **POLITICS, SOCIETY AND SYNERGY AT COMPLEX ENVIRONMENTS**

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We know the laws, ordinances, decrees and other normative acts that regulate the community life in contemporary societies, are issued by many state agencies, which generally try to give answers to people's needs. The democratic states produce and issue rules that create rights and obligations for members of a given society. These laws are generated by a number of agencies and institutions, leading to a very complex regulatory environment, where often jurisdictions are overlapped and more than once the same subject is regulated, sometimes coherently and other contradictory.

That is why the main purpose of this paper is to sketch the idea of a tool that provides a holistic point of view for the issuing process regulations and laws to regulate community life.

It is expected that, if this tool is implemented with an appropriate legal instrument, all the draft or proposed legislation should count with a preliminary study on the impact that this rule will have on the environment where will be applied. And here we understand that the meaning of environment as such broad is possible: the natural environment and the social one.

With this proposal, urgently we try to reduce the asymmetries that are currently generated by the current regulations process; even by considering the asymmetries produced by the current economic system.

2009-1194

## **TRAINING AND SUPPORTING FIRST RESPONDERS BY MIXED REALITY ENVIRONMENTS**

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The perception and awareness of the possibilities of chemical, biological, radiological, and nuclear ("CBRN") emergencies is constantly growing. These dangers are in most cases not directly detectable by human senses and as a consequence no inborn or trained reflexes of reaction exist. One has to explicitly design and validate(!) special procedures ('Best Practices') to detect and to counter such dangers. These Best Practices have to be specifically trained, especially under near-realistic yet safe conditions. Modern technology allows to simulate actual situations (including the use of simulated tools) and the consequences of various courses of action in a realistic way.

The overall goal of the SimRad.NCB project is the development and utilization of training tools for First Responders for all aspects of an intervention in emergency situations, including technical procedures, management, team coordination, etc.

By taking a process view these interventions can be dissected into individual emergency processes and their subprocesses. This allows a pin-pointed substitution of some individual activities by a simulation, ranging from coarse approximations up to near-realistic simulations using Mixed Reality technology.

This paper is an evolution and expansion of [Chroust et al., 2008] and will specifically emphasize the process point of view of these response actions and the corresponding simulation possibilities.

2009-1200

### **MODEL OF REGIONAL POLICY STRATEGY IN SUSTAINABILITY IRRIGATION MANAGEMENT**

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At present, Indonesia's regional economic growth strategy and related sectoral policies still do not adequately consider sustainable environmental management aspects. The empirical consequences of this condition are the emergence of negative impact in the form of ecosystem degradation due to increasing exploitation of natural resources. In the case of deforestation, excessive soil erosion and degradation of the watershed catchments area could decrease risk of catastrophic landslides, excessive sediment transport reduced irrigation conveyance capacity. All of those contribute to decreased water availability for irrigation and public utility as well as increased public goods losses. In the paddy fields, there is a tendency of the effective productivity of irrigated lands becoming smaller over time.

This research aims to develop a strategic regional policy model for rice production through maintaining sustainability of local irrigation systems. The integrated model includes governmental functions as well as social institutions. This research uses the 'Soft System Methodology for Policy Research' to analyze current irrigation policies, applied Strategic Assumption and Surfacing and Testing (SAST) and Focus Group Discussion (FGD). Expert Survey was conducted to implement Interpretative Structural Modeling (ISM) technique and was supplemented with farming surveys and field observations.

The result of this study is expressed as conceptual model, which is the strategic policy for sustainability in regional irrigation management covering both rice cultivation and watershed areas. The model of sustainability development used Comhar principles which are Good Decision Making, Satisfaction of human needs by the efficient use of the resources, and Equity between countries and regions. The effective application of the model requires better regional regulation and supervision, as well as community participation supported by coordinated efforts of various technical departments in the region. Sources of various funding should be adequately available for infrastructure rehabilitation, re-forestation, irrigation maintenance costs and farm credits. Monitoring and evaluation activities will be carried out by local Irrigation Commission.

Keywords: Sustainable irrigation management, Regional Policy, and Soft System Methodology.

2009-1205

### **THE "30-MINUTE ROUNDTABLE": ACCELERATING CLASSROOM LEARNING AND SYSTEMIC SCHOOL RENEWAL**

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Public education needs a valid, reliable, and user-friendly plan for systemic school renewal or continuous whole school improvement. Traditional approaches in educational reform have proven to be short-lived, as they address only one part of the school community. Systemic approaches aim to involve the whole community but are considerably more complex, often unintentionally demoralizing and oppressive, as they are costly and require all system members to be at the same level of readiness for change. What is needed is an enrichment or intervention program that is (a) inclusive--providing equal learning opportunities for the whole class (each and every student) and the whole school community (e.g., students, teachers, parents) rather than a select group (e.g., only disadvantaged/gifted; only math; only students; only staff); (b) sustainable--a low-cost, user-friendly part of the regular class or meeting,

rather than an after school workshop; and (c) emancipatory--accelerating positive learning and development for all, at each person's own pace--rather than lowered morale.

The 30-Minute RoundTable, designed to address these concerns, draws from organizational change systems methods, instructional methods, and group learning models currently in use. It is the Swiss army knife of participatory group processes in that it accomplishes multiple purposes in a small amount of space. Briefly, a classroom RoundTable is a 30-minute weekly activity which allows all students to: give a brief learning report on a selected topic; hear 30 learning reports from all their classmates; and have a turn at being RoundTable leader. It develops two subject matters at once, the agenda/lesson of the teacher's choice, and aural/oral language arts. The RoundTable accomplishes this because it is cued by a carefully designed script: 5 minutes of readings/reviews and 25 minutes of learning reports, time distributed among all equally. An adaptation is also proposed for use monthly in faculty meetings and Parent Teacher Association meetings. In this way, all school participants have access to this new participatory group process.

The RoundTable model draws from organizational change systems methods, instructional methods, and group learning models currently in use. These group learning models include the lecture model, cooperative learning, whole language, ongoing and advance-organizer approaches, dialogue, design conversation, and the learning system observed in the recovery program of Alcoholics Anonymous (AA). Pilots studies in professional organizations of educational and systems scholars allowed a refinement of the RoundTable model. The RoundTable has since been implemented, and proven promising, in several schools in Los Angeles and Chicago, as well as in the International Society of System Sciences.

In this project, we will introduce and study a 30-minute "Roundtable" in a dozen or more classrooms and in several school meetings. The study question is: "In what ways and to what degree are the RoundTable applications inclusive? sustainable? and emancipatory?" Data sources and instrumentation include: observation of RoundTable sessions, RoundTable cassette recordings, users' views in questionnaires, and State test scores at the end of the year.

Keywords: education, systemic school renewal, participatory group process

2009-1210

### **A CASE FOR SYSTEM-SPECIFIC MODELING**

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The field of systems grew out of, and then parallel to, science in many ways. In continuing its focus on general principles and the unification of science, though, through a search for isomorphies, much of the value of work in systems may have been missed. Systems are formed around patterns of organization, and the ability to affect specific systems ultimately lies in the ability to recognize and affect those patterns. Despite the early rejection of reductionism, most models and many principles used in systems still rely on characteristics applicable to physics. Softer forms of design and modeling have tended to be vague and non-specific. This paper recommends a next advance in systems, focusing on basic principles of organization at the level of unique systems.

2009-1219

### **ANALYZING BENEFITS AND RISKS IN MEDICINE, TO WHOM AND FOR WHOM?**

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The audience is often not explicitly named as part of a research study, but the framing of the research and the written results tend to be targeted toward particular addressees, without recognition of the impact of the boundaries. As researchers, we often think of this issue as

one of “communication.” We acknowledge that if our studies are to be understood more broadly, we must learn to write the results in non-scientific terms for a different audience. We do not often consider that research aimed at our traditional audiences may fail to consider the factors that could be the most crucial for the broader objectives our research is trying to achieve. It is within this context that a case study in benefit / risk illustrates the impact of framing and boundaries on the outcomes included in research. A current public debate in the UK and, to a lesser extent, in the US over the use of mammography screening for breast cancer reveals a great deal of well-intended information but not very much clarity. On its surface, defining the outcome of mammography as a benefit or risk would seem to be a straightforward exercise. However, the relative merits as discussed below would suggest otherwise.

Keywords: benefit, risk, health, healthcare, applied research

2009-1222

### **PROBLEMATIZING PROBLEM-SOLVING METHODS FOR EXPLORING THE MANAGEMENT OF SOCIAL ENTERPRISES**

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A new form of strategic management is required for developing the social enterprise and appreciating the management of social enterprise from systemic perspectives. In this paper, we argue that participatory action research should focus on the process of problematization that explores the nature of the social enterprise (SE) in order to explore new sorts of “questions and problems” in given situations. Systemic perspectives enable us to appreciate systemic knowledge, which is the holistic understanding of complex nature of management of communities and organisational learning. In this paper, the process of problematization is demonstrated through the application of problem-solving approaches, that is, Beer’s Viable System Model (VSM) and Checkland’s soft systems methodology (SSM) to understand and create a business model for SE, facilitate debate amongst participants, and generate systemic knowledge about the transformational processes of social enterprise in Korea.

Keywords: Strategic management; social enterprise; participatory action research, problematization; problem-solving approach; Viable System Model; SSM

2009-1223

### **COMPLEX MODEL OF A TRANSDISCIPLINARY ACTION-RESEARCH PROGRAM ON THE ENVIRONMENT, THROUGH INTERINSTITUTIONAL NETWORKS**

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We propose a complex integral model of environmental transdisciplinary action-research processes through interinstitutional networks for the National Polytechnic Institute, NPI (Instituto Politecnico Nacional, IPN), a large and influential Mexican public university.

The great quantity of interrelated factors which characterize turbulent socio-environmental phenomena in today’s world, need to be observed and studied as processes of great complexity, from different worldviews as cognitive phenomena that require a transdisciplinary gaze. The program of the interinstitutional research network is being designed and implemented, through a gradual participative integral or systemic action-research or iterative cybernetic process.

Today, at the NPI, there are several research and action networks working on environmental problem situations. This program, links research networks with action networks through a systemic transdisciplinary process, in which a heterogeneous group of professors, students, authorities and administrators participate with research-action projects at different units within the institution. The results of the projects can also be applied in public, private and social organizations. The environmental action-research network program is comprehensive, it is oriented towards research, design, implementation, and diffusion of a series of integrated synergic technological solutions or ecotechniques, to solve water, energy food, waste, housing, education and health problems under a conscientious vision of integral and sustainable quality.

2009-1224

### **BIOBASED LUBRICANTS: A VIABILITY STUDY**

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Biobased lubricants are an attractive alternative to conventional petrobased lubricants due to a number of their physical properties including: renewability, biodegradability, high lubricity and high flash points. Biobased lubricants have not replaced petrobased lubricants due to their higher cost, oxidative and thermal instability and limited temperature applications.

Research has been done to improve the physical properties of biobased lubricants. Dupont has bioengineered soybean seeds to yield soybean oil that is more oxidatively stable. The Prileshajev Epoxidation Process was developed to increase the oxidative stability of soybean oil. The Amberlyst 15 Catalyst was used to Reduce Pour Point of Vegetable Oil.

Biobased lubricants are generally more expensive than petrobased lubricants, but their increased lubricity allows for monetary savings through a decreased energy input requirement. As biobased lubricants are derived from vegetable oil, careful work must be done to balance the allocation of crop used to make lubricant. Currently there is not enough arable land to support the widespread use of biobased lubricants, so a collaboration of industry and government policy must be used to promote the use of biobased lubricants.

2009-1226

### **ROBERT ROSEN'S ANTICIPATORY SYSTEMS THEORY: THE ART AND SCIENCE OF THINKING AHEAD**

***Judith Rosen***

Science, at its best, is supposed to be a set of tools, constructed by humanity for use in improving our quality of life, our chances for survival, and the survival and welfare of our progeny. In all of those pursuits, sustainability really is not optional; it is required. Sustainability must be the cornerstone for any kind of planning for future outcomes that we want to use our science to achieve. To do other than that is both irresponsible and foolish.

However, even when our intentions are planted firmly on the tenets of sustainability, we still need to be able to trust the tools we intend to use to do the jobs we are asking of them. Chief among those jobs is scientific modeling and prediction. Any proposed therapy we want to consider implementing in local or global ecosystems, for example, will need to be tested in models first—before we decide to risk implementing such a therapy in the natural world. We need to know that the models used are actually capable of accurately predicting what would happen in ecosystems, in social systems, physiologies, psychologies, etc. All of these systems involve living organisms and/or interactions between living organisms in critically important ways.

Currently, our science is based on a presumption, buried deep in the foundational theory upon which all science rests, that all systems in the universe are “just like machines” and, therefore, have only the behavior potentials that machines have. All machines are purely reactive in their behavior potentials: In such a world, causality flows from past through present towards future—just as time is also presumed to do—in a linear, unidirectional fashion. In that scenario, there is no way for the future to act, in any causal way, on the present. But, that is

clearly not how life works (The fact that this paper is being written now, months before the conference it is to be presented at, offers one proof of that.)

If life is not “purely reactive”, what does that mean for science? Do we hold on to our scientific presumptions about the universe and conclude that aspects such as life and the human mind must therefore be supernatural in origin and potential? Or do we turn around and take a hard look at our tools, instead. What happens if we discard the notion of “The Machine” as an appropriate model for all systems in the universe? The reactive paradigm of science need not be discarded: It will remain just as applicable to certain types of systems as it ever was— BUT—we are no longer limited to ONLY that. We are then free to expand our scientific capacity in order to study relations between interacting “things”, study the impact of changes in such relations on causal outcomes, and to develop some new tools that will be capable of helping us truly learn about the anticipatory nature of living systems. This will allow us to build far better models of them, as individual organisms or as populations within environments, which can accurately represent their true capabilities in interactions of myriad types, in the natural world.

Only then will we really have a hope of being able to trust in the predictions our tools offer us as we try to decide how to proceed. In short: We need to think ahead, individually and collectively—more so now than ever before in human history. The margin for error is growing thinner as our population increases. The old dictum from carpentry applies: Measure twice, cut once. Just as importantly, we will need the right tools for the job. It is a salient truth that the issue of “sustainability” is not a reactive concept; it is an anticipatory one.

2009-1227

#### **THE VALUE EQUATION**

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Value, from the point of view of customer, is defined as the customer’s subjective evaluation, adjusted for cost, of how well a good/service meets or exceeds expectations. Nevertheless, some aspects must be considerate, such as: quality, speed, and flexibility; these factors are considered in the value equation. In this work are explained what it is the value equation.

Keywords: value, operations management, performance, value equation.

2009-1228

#### **TOWARD THE EVOLUTION OF THE TOURISM’S CONCEPTUAL SYSTEM**

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Tourism is an important generator of economic spill and represents one of the main economic activities in the world. The study of this phenomenon at the present time requires a reevaluation of the conceptual models that have been used for this aim, with the purpose of generating a holistic vision in its analysis. In this paper, some contributions and applications made to Tourism from the Theory of Systems, are approached and discussed. In the end we aiming to generate a new conceptual model of the tourist system under the perspective of the contemporary Science of Systems, considering that tourism has evolved toward more dynamic and more complex postures where the elements of the system that emerge of its interior, are integrated to different scales, and show a coherent structure when they are compared with the whole. It is concluded that the Science of Systems provides new elements and tools for the theoretical and praxiological approaches of the tourism.

Keywords: evolution, systems, tourism, paradigm of systems.

2009-1233

**IWI FUTURES: INTEGRATING TRADITIONAL KNOWLEDGE SYSTEMS, CULTURAL VALUES AND AGRICULTURAL DEVELOPMENT PATHWAYS**

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Maori landowners face a number of challenges when it comes to agricultural development. New Zealand's 140-year old Maori land tenure system has resulted in a proliferation of owners that collectively own thousands of land titles. The vast majority of owners do not live or work on their ancestral lands but instead elect representatives to administer their interests. These entities range in size from small trusts with a few hectares at one end of the spectrum right up to multiple-enterprise incorporations that control tens of thousands of hectares. While the scale of these entities varies the owners often share many common viewpoints that are based on traditional values and customary practices. The difficulty of balancing these values and aspirations along with economic and environmental imperatives has identified the need for a set of tools to improve organisational governance, and in particular, decision-making processes. This paper describes the research programme 'Iwi Futures: A decision support framework for Maori landowners' that is mid-way through its 3-year timeframe. This programme involves a large multi-disciplinary team drawn from a range of research institutions. One objective of the programme applies a collaborative modelling approach with 4 Maori case study organisations. Underpinning the viability of these organisation's farming systems is a complex mix of factors that include the indigenous values, traditional practices and customary knowledge that are not only important to the owners but also influence the priorities of their elected representatives. Therefore, a key focus of the programme is the development of framework that integrates customary knowledge and owner values with bio-physical and economic models of their agricultural systems. This paper will outline the programme's conceptual framework and discuss some of the epistemological and methodological challenges that the team has had to work through.

2009-1250

**SURVIVING THE ECONOMY**

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There is a shift in economic thinking from a growth model with its constellation of competition, scarcity and deficiency, to a co-operation model that emphasizes steady-state, abundance and satisfaction. The dominant economic paradigm of corporate capitalism went from recession into meltdown on September 12, 2008, when the Cheney/Bush administration let Lehman Brothers fail. The new Obama administration is transforming the way people talk and do politics. Following both orthodox Milton Friedman monetarism and conventional Keynesian fiscal thinking, the Federal Reserve and the Obama administration are throwing trillions of dollars into the economy in an attempt to stop the bank hemorrhaging enough to create new lines of credit. If the entire economy is severely deflating, as housing foreclosures continue, driving down the value of assets of large banks, the Obama administration will have to shift to a more pragmatic analysis than traditional Keynesianism. The next economic system needs to focus on masses of people living in large cities and small towns. Components of a viable social information structure in a computer age include: using public sector employee salaries as the benchmark for private sector wages, the tax structure, and the pricing structure for housing, transportation, utilities and other necessities; adequate public light rail transportation; computa, a personal economic grid to manage an individual's personal data, and create a confidential aggregate database for social policy analysis and evaluation; local governance via a socio-economic-environmental plan; and local decision taking based on information developed through the Viable System Model of Stafford Beer.

2009-1252

## **USING VARIETY ANALYSES TO IMPROVE EDUCATIONAL SUSTAINABILITY AND LIVEABILITY**

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This paper reports research into application of Ashby's Law of Requisite Variety in tertiary education. The paper describes two approaches that apply variety analysis to convention curriculum design to address shortcomings both in relation to developing sustainable course designs and educational processes that improve the livability of education-related activities for academics and students.

This work builds on and continues the author's' (and colleague's) development of extensions to Ashby's Law of Requisite Variety that extend its role into the socio-cultural dimension of socio-technical systems.

The paper describes two new systems analysis techniques in the realm of sustainable curriculum design. It illustrates each through a brief real-world case study and derives from the analyses two new generic extensions to Ashby's Law of Requisite Variety.

The paper concludes by outlining how changing curricula and course designs in the above manner, in addition to promoting sustainability, improve liveability in relation to the educational activities of academics and students.

2009-1259

## **ACCESS TO SYSTEMS IDEAS AND APPLICATION TO CRISIS AND CONFLICT SITUATIONS: SOME INITIAL THOUGHTS?**

***Dennis Finlayson, Derbyshire***

The January-February 2009 edition of Systems Research and Behavioral Science has two articles and a Research Note that illustrate the wealth of ideas offered by systems thinkers as well as the problem of accessibility. Despite the creative use of graphics in these and other contributions many even within the systems community will find some at least of the papers inaccessible and especially when some simple mathematics are introduced in the second research note. Much as I have raised this issue in the past I make no apology for returning to the discussion yet again, as I feel that the time is right, and more especially in the context of approaches to conflicts and crises, for systemic thinkers to make a significant impact in enriching the discussion of major global issues.

First, much more emphasis needs to be placed on making access to key ideas to all sections of societies around the globe in their own everyday languages. This involves creative use of the vocabularies of 'first' languages and affect in a wide range of cultural contexts.

Second, ESOL and formal first language skills need to be addressed and the concept of 'third' spaces in between school and work and home communities expanded to other contexts such as between disciplines and so on. Third, recognition of the role of ICT both in the widening of international access and across generations needs to be actively encouraged. Fourth, mathematics and (bio) sciences need to make greater use of ICONS (based on key board symbols?) as well computer graphic presentations of mathematical functions (e.g. in applications of chaos theory or non-linear dynamics ideas). Finally, simpler forms of 'soft' models with say, three stages, need to be presented before moving to the usual 8 or 9 stage models.

In the conference presentation I will attempt to illustrate how these points could be applied in crisis and conflict contexts.

**SOCIAL RESPONSIBILITY AS A WAY OF SYSTEMIC BEHAVIOR AND INNOVATION LEADING OUT OF THE CURRENT SOCIO-ECONOMIC CRISIS**

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For several recent centuries the so called free market economy has been found more efficient and providing for more economic development and higher living standard of its users than any other socio-economic model of so far. It was in a deep crisis in 1930 (resulting in the WWII, not Keynesian measures only, which Hitler's Nazis used, too), and is facing it now again under the name of big depression, financial crisis, etc. These labels are too narrow: it is a general social crisis due to a lack of requisitely holistic values/culture/ethic/norms (VCEN) and behavior (made of monitoring, perception, thinking, emotional and spiritual life, decision making, and action) rather than one-sided and short-term behavior of the influential people and their organizations, including enterprises and governments. This narrowness is based on failure of many to use systemic thinking and behavior due to their over-specialization with a poor capability of interdisciplinary creative co-operation. Consequences include the frequent limitation of the term innovation to the technology innovation alone. Consequences might be dangerous: good technology serving bad/evil/unclear purposes. They can still be avoided – by innovation of culture of one-sided behavior to the one of requisite holism. The current humankind is moving from routine via knowledge to creative society. This is based on a new economy and requires new values/culture/ethic/norms – self-interest realized by socially responsible and therefore requisitely holistic behavior. Social responsibility can and must reach far beyond charity toward the end of abuse of power/influence of the influential persons/organizations in their relations with their co-workers, other business and personal partners, broader society, and natural environment as the unavoidable and terribly endangered precondition of human survival, at least in terms of the current civilization. Social responsibility supports innovation also by upgrading criteria of business excellence, by supporting requisitely holistic behavior and thus it means also a form of innovation of human values/culture/ethic/norms and knowledge, resulting in a requisitely holistic behavior. In a most optimistic scenario, social responsibility can also provide a way toward peace on Earth. It can lead to covering all these urgent humankind's needs by making co-workers and other people more happy, because it provides to them more feeling of being considered equal and creative rather than abused and/or misused by power-holders. In synergy with ethics of interdependence, because every specialist is complementary to all other specialists as a professional and as a human being, and with the fact that one lives increasingly on creativity, including innovation, social responsibility may innovate society to include social efficiency, social justice and similar VCEN that, among other references, lie at the core of all social teaching called religions, philosophy of moral and ethical behavior, etc. Technology supports rather than creates future and development into it, and can be used with social responsibility or abused/misused with detrimental consequences. The choice depends on the most influential people and their definition of their self-interest as a background of the new

economy and humankind's future. Innovation of values/culture/ethic/norms is unavoidable for the current civilization to survive.

Key words: innovation, new economy, requisite holism, social responsibility, technology

2009-1262

### **SCOPING A SYSTEMS-BASED METHOD FOR ORGANISATIONAL EVALUATION**

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In this paper a systems approach to evaluation is proposed. It is argued that many evaluations fail to achieve a comprehensive assessment because they are essentially reductionist in nature; only focussing on limited aspects of an organisation and/or they emphasise the performance of the parts over the whole.

The argument is advanced in this paper that a systems-based approach to evaluation must put the study of the whole before that of the parts. It should stimulate an organisation's ability to learn by reflecting on the efficiency and efficacy of the interactions between its parts and the effectiveness and ethicality with which it engages with other systems in its environment. A systems approach will use a variety of different systems models to ensure that the evaluation is comprehensive, knowing that any one will be limited in terms of what it enables us to see. It is argued that at least four types of systems model are relevant. The first two can be called 'mechanistic' and 'organic' and they concentrate on building the internal capacity of an organisation. The second pair, 'stakeholder' and 'ethical' models are focussed more upon aspects of the organisation's external relationships.

Having established the four generic categories of evaluation, a summary is given of some 'emerging' forms of evaluation that may be drawn in to help us better achieve our aim of creating a truly systemic form of evaluation.

Moving closer to the ideal of being truly systemic demands more than simply adding new and emerging forms of evaluation to our tool-kit. A commitment to holism requires that we take a more critical look at how we might implement systemic evaluation in practice and critical systems thinking offers some guidelines for managing methodological pluralism in practice.

2009-1263

### **APITHOLOGICAL SYSTEM DYNAMICS IN STRATEGIC SUSTAINABILITY CONVERSATIONS**

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When facilitating social learning processes in multi-disciplinary strategic conversation groups for societal sustainability the dynamics of knowledge diversity, identity framing, values conflicts and information inequality will often surface. These can result in both generative and dissipative constructions in the formation of information, collaboration and meaning.

This paper records learning experiences in forming two strategic conversation groups involving twenty six multi-disciplinary participants to examine macro-sustainability issues in ten distinct sustainability impact spheres. After identical and joint initial formation processes, the participants were divided into two groups of equal diversity in gender, age and background disciplines to work on identical programs. One group was selected for its homogeneity in operant levels of consciousness the other for its diversity in cognitive frames and perspectives. Distinctly different results occurred in the processes and outputs of the two groups.

The reasons for this apparent divergence highlighted contrasts in individual learning intentions, self-perception of information and the commitment to collaboration. The initial productive performance of the homogeneous group was in contrast to the initial dysfunction of the heterogeneous group. Following intervention and the introduction of a specifically designed inquiry process using principles of integral methodological pluralism, the heterogeneous group learned to become process proficient and highly productive even though the conditions for conflict remained essentially unchanged.

The study raises questions about the significance of information paucity, knowledge humility and the perceived value of collaborative inquiry in generating meaningful multi-stakeholder solutions to complex sustainability challenges. The apithological (generative) and non-apithological (non-generative) dynamics of the two groups altered over the ten strategic conversations held. The presence of an emergent trichotomy of formative conditions in the structures of information, communication and intention was concluded as being significant. Various observations are made on the formation of generative conditions to enable successful multi-disciplinary collaborations for sustainability outcomes.

2009-1266

***IDENTITY SURVIVAL: GROUNDS FOR LIFE?***

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Robert Rosen [1] has demonstrated that the analytic and synthetic models of a natural system are not necessarily equivalent. This has far-reaching implications for any development of system theory, most particularly when related to living systems. As Rosen points out, conventional Science "... has been tacitly predicated on the coincidence of the analytic and synthetic approaches...", which would lead many to agree with Stephen Hawking's suggestion [2] that, as soon as all fundamental laws of the Universe are understood, we will in principle be able to explain all macroscopic phenomena. Pragmatically, non-equivalence between the analytic and synthetic models of a system means that its analytic disassembly and synthetic reassembly will be asymmetric, and implies that although it may be easy to take the system apart, it may be impossible to put the pieces back together again 'correctly'.

In correspondence with Rosen's view that analytic disassembly does not retain previously existing relationships between integrated systemic components, we have noted elsewhere [3] that this omission shows up in informational differences across a system's different spatio-temporal scales. A macroscopic crystal 'contains' little more information than would an unassembled collection of its constituent atoms; the informational 'content' of a multi-cellular organism, however, is massively more substantial than a hypothetical informational summation of its individual cells. Although Rosen does not explicitly refer to scale in his book, he establishes his distinction between 'machine' and 'organism' as the extremes of this informational difference, couched in terms of systemic elemental interrelations.

We propose in the Hierarchy Theory session of this conference that a generalized evolution, and therefore the 'construction' of reality itself, is grounded in local 'directionally mistaken' attempts to return to Universal pre-big bang unification. We now suggest that this is the result of primitive elemental awareness and the 'wish' to protect identity through survival, and that life itself is an unavoidable consequence. In an extension of Rosen's arguments, we propose that identity is inversely proportional to the difference between an entity's analytic and synthetic models of itself, and that evolution in its most general guise is an attempt to minimize this difference. Simplistically coupled elemental information networks – for example that of a crystal – are very successful in this quest, but gain little leverage in controlling their own integrated survival. Living organisms, however, although exhibiting far lower 'brute' spatio-temporal stability than crystals, have developed recursively to increase their environmental reactivity and control, and to metaphorically extend the 'survival' of their individual identities through reproduction, through society, and now through addressing sustainability.

[1] Rosen, R.?. Life Itself. Columbia U. P., 1991.

[2] Hawking, S. W. *Is the End in Sight for Theoretical Physics?* Cambridge U. P., 1980.

[3] Cottam, R., Ranson, W. and Vounckx, R. "The Mind as an Evolving Anticipatory Capability". *Mind Theory*, 0, 1, 37-92, 2009.

2009-1267

## **A SYSTEMS FRAMEWORK FOR INTEGRATED WATER RESOURCE MANAGEMENT**

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Integrated water resources management (IWRM), and its sister field integrated catchment management (ICM), recognise the systemic connections between biophysical environments, land use practices, management arrangements by multiple stakeholders, and water outcomes. However while participatory practices and governance arrangements for IWRM and ICM are well established in many developed countries, conceptual frameworks for understanding how these complex social-ecological systems work are scarce.

This paper presents an integrative conceptual framework designed to enable interdisciplinary understanding of the dynamic linkages between the ecological, social and economic components of human-environment systems associated with water resource management, and a synopsis of results from case studies conducted in the Solomon Islands and Vanuatu.

The framework is underpinned by theory from the field of environment-behaviour studies, concerning the ways in which environments affect people by constraining or enabling various forms of behaviour, and people affect environments through their actions, at various scales. The framework can be used purely conceptually, identifying the nature of systems connections within a catchment system, or numerical and spatial data can be attached to the conceptual framing. Following analysis of cause-effect relationships throughout the complex system constituted by any catchment, the framework can help users to focus on specific management issues in awareness of their contexts.

The framework is built up in three stages, considering the water cycle and catchment in spatial and temporal terms, systems analyses of people-environment relationships, then applications such as planning or risk assessment. The basic framework can be populated with combinations of qualitative and quantitative data, and the systems analyses can be elaborated using conceptual and mathematical models including causal loop modelling, systems dynamics modelling, or Bayesian belief networks.

The framework is intended for use in a variety of societies reflecting differing cultures and where quantitative scientific data may be scarce.

The paper then documents participatory case studies conducted in the Solomon Islands and Vanuatu. The first analysed the systems factors in water supply problems for one of the catchments supplying Honiara, the capital city. Here a karst limestone environment affected reliability of supply, and limited relationships between customary owners and government (affected by a poorly designed and ageing agreement) also influenced water management. Earthquakes, land use practices, occasional inter-ethnic violence, and financial structures also influenced affected both quantity and quality of water. As well as building a shared system understanding, the project built relationships between government departments, customary landholders and NGOs, and helped the parties to develop shared priorities for addressing the problems. A Bayesian Belief Network model assisted the government parties to model risks.

The Vanuatu case study was conducted on an outer island, Santos, in the catchment surrounding Vanuatu's second largest city, Luganville. Here multiple issues affected safe water supply for the peri-urban poor, and river water quality. Systems analysis showed that past planning failures had led to settlement on unsuitable, waterlogged land, where well water was contaminated due to lack of sanitation. River water quality was threatened by various industries, as well as customary farming too close to steep river banks, and informal

settlements. We worked primarily with a newly formed catchment group (consisting of some 10 villages), and its mentor, the NGO Live and Learn Environmental Education to build capacity in preparation for Integrated Water Resources Management in Vanuatu. We helped to strengthen their links to village constituents, and through the three levels of government the catchment group would need to collaborate with in IWRM. We thus helped all parties to prepare for the IWRM which is due to commence shortly under national policy, and established initial work which will be continued by others under a European Union project.

2009-1268

### **SERVING THE PUBLIC SECTOR: A NEW APPROACH FOR CO-CREATED VALUE**

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Public sector organisations worldwide strive to deliver services that are valued both by recipients of the services, and by the wider community who indirectly benefit from services being provided. Public services therefore have to manage evaluations of their services from both macro and micro perspectives – that is, how do individual recipients judge the value of the service provided and how does the broader community judge the value of the service provided? Therefore, of growing concern to public service organisations is how to work with individuals and communities to co-create value through service delivery.

The Institute of Environmental Science and Research (ESR) is a New Zealand government owned Crown Research Institute whose mission is to protect people and their environments through research. Our main clients are two public sector organisations charged with delivering safe and healthy communities in NZ. ESR's services therefore support these public sector organisations in providing value for money services to the NZ public.

During 2007, ESR and IBM NZ began discussions about ways in which we could collaborate in undertaking research that would both build capability in novel and emerging systems and social science methods and would contribute to the development of an academic field termed "service science". Since July 2008, we have been undertaking a funded project that will:

- develop capacity in service science methods and concepts;
- undertake theoretical and methodological research on service science and the contribution systems thinking and social science can make to the wider field of service science; and,
- undertake a pilot project with Police on how to respond to the role of alcohol and drugs in enabling violent behaviour, with a view to providing 'proof of concept' of a particular approach to service science.

In this paper, I will: explain some of the key ideas and drivers behind IBM's investment in the development of the field of service science; and, report on progress in the Police case study, showing how insights from service and systems sciences have influenced the project direction.

2009-1270

## KNOWLEDGE CONSTRUCTION SYSTEMS

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The main principle of the theory of organizational knowledge creation proposed in Nonaka and Takeuchi (1995) is that new knowledge is created by the interaction of explicit and tacit knowledge. An important concept in this theory is Ba which is a Japanese word meaning place. They call the dynamic context which is shared and redefined in the knowledge creation process Ba, which does not refer just to a physical space, but includes virtual spaces based on the Internet, for instance; and more mental spaces which involve sharing experiences and ideas. They state that knowledge is not something which can exist independently; it can only exist in a form embedded in Ba, which acts as a context that is constantly shared by people.

Similar ideas exist in systems theory: for instance, Churchman (1970) states that all knowledge is dependent on boundary judgments. We follow this idea in such a way that our theory chooses three important dimensions from the high-dimensional Creative Space and require actors to work well in each dimension in collecting and organizing distributed, tacit knowledge. These are Intelligence (a scientific dimension), Involvement (a social dimension) and Imagination (a creative dimension). When our theory is interpreted from a viewpoint of sociology, the Creative Space is considered as a Social Structure which constrains and enables human action, and consists of a scientific-actual front, a social-relational front and a cognitive-mental front corresponding respectively to the three dimensions.

Our theory introduces two more dimensions: Intervention and Integration, which correspond to social action and knowledge from a sociological point of view. We follow the definition of systemic intervention in Midgley (2000) that it is purposeful action by an agent to create change in relation to reflection upon boundaries. Our actors collect knowledge on all three structural dimensions or fronts, with a certain purpose, and synthesize those distributed knowledge to construct new knowledge. In this sense, Intervention together with Integration corresponds to Midgley's systemic intervention. As Wang Yang-Ming the 14th-century Confucianist contends that knowledge and action are one, for purpose, and with consequences (Zhu, 2000).

Our theory aims at integrating systematic approach and systemic (holistic) thinking; the former is used in the dimensions Intelligence, Involvement and Imagination, and the latter is required in the dimensions Intervention and Integration. Leading systems thinkers today often emphasize holistic thinking (Jackson, 2003; Mulej, 2007), or meta-synthesis (Gu and Tang, 2005). They recommend and require systems thinking for a holistic understanding of the emergent characteristic of a complex system, and for creating a new systemic knowledge about a difficult problem confronted. Our theory aims at synthesizing objective knowledge and subjective knowledge, which inevitably requires intuitive, holistic integration.

With a similar idea, Wierzbicki et al. (2006) proposed an informed, creative systemic approach, named Informed Systems Thinking, which should serve as the basic tool of knowledge integration and should support creativity. This systemic thinking emphasizes three basic principles: the principle of cultural sovereignty, the principle of informed responsibility, and the principle of systemic integration. If the first is a thesis, then the second is an antithesis and the third is a synthesis.

The problem here is: how are we to fulfil a systemic integration in the context of knowledge synthesis? One of the answers to this is: Theory of Knowledge Construction Systems which consists of three fundamental parts: a knowledge construction system with the above five dimensions (Nakamori, 2003), a structure-agency-action paradigm (Nakamori and Zhu,

2004), and evolutionally constructive objectivism (Wierzbicki and Nakamori, 2006). The main characteristics of this theory are: fusion of the purposiveness paradigm and purposefulness paradigm, interaction of explicit knowledge and tacit knowledge, and requisition for knowledge coordinators.

2009-1274

**CAPACITY BUILDING FOR LEARNING LABORATORY FOR SUSTAINABILITY: THE CASE OF CAT BA BIOSPHERE RESERVE (VIET NAM)**

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This paper describes a problem-based learning approach to develop systems thinking and capacity building for a team of interdisciplinary mid-career professionals, engaged in management of the Cat Ba Biosphere Reserve (CBBR) in Vietnam. Following a preliminary workshop in Viet Nam in 2007, which indentified a number of crucial areas for capacity building, an integrated multi-dimensional program was designed for a select group of managers and technical officers from different levels of government and cross sections of agencies working in the CBBR. A general introduction to systems thinking concepts and tools, including causal loop modelling and Bayesian Belief Networks, was followed by skills development courses and field trips. The training courses were evaluated weekly and at the end, followed-up six months after the completion of the program, using some of the participatory methods taught during the course. A recent visit to Viet Nam and discussions with the program participants revealed significant adoption and continued practice of the tools and concepts covered in the program, as well as further applications of the concepts within the participants' teams and areas of responsibilities. The paper will conclude by drawing generic lessons for capacity building for learning laboratory for sustainability in other biosphere sites around the world.

Key words: systems thinking teaching; problem-based learning; qualitative evaluation; complexity management; Cat Ba Biosphere Reserve

2009-1275

**MONEY MATTERS IN LIVEABLE, SUSTAINABLE SYSTEMS**

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The student posters on applications and sources for current global economic crisis highlights the critical role of monetary policy in supporting a more livable and sustainable future. A number of writers have addressed the inherent problems of a debt-based, interest-bearing monetary system, perhaps most notable among them being Bernard Lietaer (The Future of Money, 2001), who has been a strong proponent of local currencies. Indeed, there has been a considerable interest in re-localizing economies during the past decade or so, which has only been accelerated by the economic downturn. However, local initiatives alone cannot address some of the underlying dynamics that have led to the current impasse.

Perhaps the most significant trend that has led to our demise is the dramatic shift from productivity to speculation as the primary motor of economic activity. This in turn reflects three decades of increasing pressures toward deregulation of the banking and investment sectors. Even more fundamental, however, is the mechanism by which money is created, with its inherent tendency toward concentration of wealth and widening gaps between rich and poor. This paper will outline the problems with the current monetary system, as well as some solutions that have been proposed. In addition, it will explore the relationship between monetary policy and national accounting systems, inspired by the four pillars of "gross national happiness" as proposed by the leadership of Bhutan: "the promotion of equitable and sustainable socio-economic development, preservation and promotion of cultural values, conservation of the natural environment, and establishment of good governance."

2009-1276

**THE LIVEABLE AND SUSTAINABLE SPIRITUALITY SYSTEM: THE BUDDHA'S VIEW AND THE SYSTEMIC VIEW ON HEAVEN, EARTH, HELL, AND LIBERATION**

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All cultures have similar believe of where human come from before birth, and where they go to after death. A better place is Heaven and a worse place is Hell. Heaven is certainly liveable but is it sustainable? Buddha said that even life in Heaven will come to an end after a very very long time. Buddha said that human continuously reborn in Heaven, Earth and Hell because of the defilements of craving, ignorance, and aversion. Liberation from these three defilements will result in a state called Nibbana (Nirvana) which is stable and will not reborn in any other states again.

In this paper we employed the ancient and modern system theory to investigate the liveability and sustainability of these four states. The actual Heaven and Hell is not easily detectable but the human view of Heaven and Hell are analyzed.

We employed the definition of spirituality as being the characteristics of our spirit, our mind, our mental contents, our conscious, which are detectable and can hence be analyzed. How then does our mind transit from one of these three states to another? System theory is employed for the investigation together with the teaching of Buddha.

Even if the life in Earth is not the best sustainable state, but we are all here. So how can we make our lives remarkable while thy are still liveable?

2009-1277

**DEMOCRACY MAKES PEACE? THE POSSIBILITY OF SYSTEMS THINKING**

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Last year I proposed the concept of complex currency or network money in Asia (ISSS2008 at Madison). It should be basket money, made by private companies, and it would circulate between nations in Asia. It is conceived to avoid depression or currency crisis. It especially became very important since last autumn.

It is also the realization of the idea of I. Kant. He advocated the federation of free states, which leads to perpetual peace. His idea is also realized as EU, but it may be difficult for Asia to establish such a federation. The alternative is the network of nations in Asia, controlling the above complex currency. The other idea of perpetual peace of Kant is as follows: The civil constitution of every nation should be republican. It also provides the only foundation for perpetual peace.

M.W.Doyle (American political scientist) maintains that liberalism is not inherently peace loving, but between liberal societies, there has never been war. Even though liberal states have become involved in numerous wars with non liberal states, constitutionally secure liberal states have yet to engage in war with one another.

B.Russett (American political scientist) proposes democratic peace. He arguably demonstrates that there have been relatively rare cases of violent conflict between democracies.

E.Todd (French demographer) criticizes them, but finally reinforces them. He suggests that education is a central factor within history. The literacy of the masses is the independent explanatory variable at the heart of the advances in democracy and individualism.

However, the U.S., Great Britain, France (and I would like to add Japan here) are transforming into oligarchical systems. Here secondary education and especially higher education reintroduce the notion of inequality into the mental and ideological organization developed societies. It affects universal suffrage.

This maintains some paradox. At the very moment of when the world is discovering democracy, the U.S. and other developed countries are beginning to lose their democratic characteristics.

Now I would like to introduce Systems Thinking. According to Luhmann, an individual is not a factor of a social system. An individual is a system of meaning and a social system is a system of communication. A system is defined by a boundary between itself and its environment. It is a self-referentially closed system, but (therefore, as Luhmann puts it) open to the environment.

The term socialization is used as inducting all individual members of society into its moral norms, attitudes, values, motives, social roles, language. But as Luhmann puts, socialization is the integration of an individual system and a social system, a process of an individual system through interpenetration between them. I extend his conception. Democratization is also the integration of a social system and an individual system, a process of a social system through interpenetration between them.

The operation of an individual system is consciousness and the operation of social system is communication. Both systems are closed in these operations. But both are related through interpenetration. When a system is meaningful to other, interpenetration is formed.

The development of an individual system is transmitted to a social system through the interpenetration of both systems and vice versa.

The intervention between an individual system and a social system, the intervention between social systems and the intervention of individual systems should be limited. The concept of interpenetration should be highlighted.

Then, how to fulfill the meaning system of an individual through literacy should be highlighted. And how to fulfill the meaning systems of an individual through lessening inequality should be important. To take measures for fulfillment of intellectual property of an individual should lead to the fulfillment of social systems. It could make society democratic, and it could reduce the possibility of war.

Keywords: democratization; systems thinking; interpenetration

2009-1278

### **ENTROPY DEBT: A LINK TO SUSTAINABILITY?**

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Despite popular awareness of our human impact on the natural environment, anthropogenic environmental degradation continues today. Yet, a science of sustainability is emerging that seeks to better understand the relationships between humans and the natural environment. Some of this research views municipalities, cities, and nations through the conceptual lens of open systems thermodynamics, and specifically, the theory of dissipative structures. The theory of dissipative structures holds that the 'structure' of open systems, i.e. complexity, requires a constant throughput of energy, which 'dissipates' energy gradients in the environment external to the system. This is the 'entropy debt' of system complexity, which is necessitated by the Second Law of Thermodynamics.

The theory of dissipative structures provided this research with a conceptual opportunity to highlight and, using surrogate measures, analyze the relationship between municipal

'structure', the energy drawn from the natural environment required to maintain the structure, and the resulting cost to the natural environment of doing so. Five similarly constrained British Columbia municipalities with similar population sizes were investigated to determine a) how the theory of dissipative structures could effectively be operationalized, and b) if doing so could elucidate systemic drivers of anthropogenic environmental degradation. Examples of surrogate measures included, population characteristics (i.e. structure), fossil fuel consumption (i.e. energy throughput), and air contaminants (i.e. entropy debt). An analysis of the surrogate data revealed that some structural characteristics, such as population density and infrastructure type, appeared to correspond with higher or lower surrogate measures of entropy debt. The findings encourage researchers to further develop the analogical model of this research into an applied model capable of measuring progress toward or away from sustainability.

Key words: entropy debt, municipalities, open systems, theory of dissipative structures, energy throughput, complexity, sustainability, environmental degradation, conceptual framework

2009-1284

**LIVABILITY AND SUSTAINABILITY ARE THEY CONTRADICTORY ?  
A SOCIAL ORGANIZATIONAL PERSPECTIVE ON PARTICIPATORY ACTION  
RESEARCH ORIENTED RESPONSE**

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Are the concepts: livability and sustainability contradictory? Can they coexist? Or even exist in collaboration? The associations between livability and sustainability are not clear. Their mutually exclusive or independent relationship to each other is often debated. (Bosch, 2009) The purpose of this paper is to make implicit notions about the links between livability and sustainability explicit. The emergence of such awareness is possible as evidenced by transformation of interpersonal interactions among those engaged in a conscious process of systemic knowledge acquisition through Action Research methods (McTaggart, 1990, McNiff, 1996, Argyris, 1999) for the purpose of responsible self management in daily living on multiple levels of social organizations: dyadic, family, community, workplace organization, etc. Such awareness can contribute to accountable behavior among those individuals and communities that learn how to implement and practice System oriented Action Research behavior as a life approach and skill set for daily living. The integration of system knowledge acquisition and Action Research methods in the service of sustainable livability development will be demonstrated through case examples of individual, family, homeless shelter, school and hospital organizations as learning organizations. All case examples involved a learning process that stemmed from different crisis etiologies. They are discussed in systemic conceptualizations that illustrate the connections between systemic thinking, livability and how sustainability notions (Gibson, 2005) and accountable practice emerged as an integral component of daily living practices on all levels of organizations. Both quantitative and qualitative data that demonstrate this developmental process and change from living to sustainable living will be presented.

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2009-1286

**WHICH CAME FIRST, THE CHICKEN OR THE EGG? - THE INVESTIGATION WITH ANCIENT AND MODERN SYSTEM THEORIES FOR THE ORIGIN OF EXISTENCE**

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The chicken or the egg question has been unanswered for Gods knows how long, but formally recorded by the Greek historian Mestrius Plutarchus, born in 46AD. Could this question be investigated from a System theory point of view? It is found in the analysis that the origin of existence, the system, the boundary, the observer, and even the origin of existence of the observer are all inter-connected. In this paper the quest for this adventure is presented according to the Taichi Yin-Yang system theory which is expressed in modern terminologies. Through the understanding of the possibilities of the origin of existence, it is hope that the excessive desires of human being could reduced, making our own existence to a liveable and sustainable system, and hopefully a remarkable one.

Keywords: Ancient system theory, Taichi Yin-Yang system theory, Chicken or Egg, origin of existence, liveable and sustainable system, Systems Philosophy and Ethics

2009-1287

**EXPENSE ACCOUNTS, MPS AND ACCOUNTABILITY IN THE BRITISH PARLIAMENT: AN AUTOPOIETIC PERSPECTIVE**

***Dianne Dean, Hull University Business School***

***Amanda Gregory, Hull University Business School***

The aim of this paper is to examine the recent controversy regarding British Parliamentary MPs and their expense claims. Since their initial exposé the Daily Telegraph has continually highlighted irregularities in the manner in which MPs make claims for their homes and living expenses. Clearly this has been immensely damaging to the notion of democracy and government, particularly when turnout is a particular concern. Using autopoiesis as a theoretical framework the paper critically evaluates how this system of reimbursement has developed; how the system was justified internally; and why MPs have now turned on the system in order to protect their own self interest. Autopoietic systems are predisposed to looking after their own interests but when this is to the cost of the environment that sustains them they are said to have become pathologically autopoietic (Beer 1985). To avoid this some kind of control function needs to balance the demands of the subsystems and punish those that err towards pathological behaviour. Hence the final section of the paper will explore how the two main political parties attempt to address this issue both from within their own parties and also how they would change the remuneration system when in government.

2009-1293

**HIERARCHY THEORY AND SOCIO-ENVIRONMENTAL ETHICS**

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This paper examines the raison d'etre for a new hierarchy of ethics and morality to emerge for the socio-environmental systems now re-emerging post the era of enlightenment. These are significant to post-modern human leadership in a 21<sup>st</sup> Century world. In this world knowledge creation (epistemology) and distribution plays an increasingly significant part in the process of extracting and distributing the useable energy that ontologically exists both on and off our planet.

Ethics and morality arise from our need to give defensible meaning to the choices we take in relationships relevant to these processes whither it be epistemologically in conjunction with others of our own kind, our in ontologically supporting the real planetary and universal resources in which we are embedded. Rationality alone is insufficient to resolve the conflicts

of choice then faced. Ethical challenges have a huge role to play in stabilizing the sustainability of our planet and ourselves. The choices so faced are never between the clearly right and the clearly wrong. Then there is no choice. True choice comes faced with the apparently right and the apparently wrong or more complexly with choices between the apparently wrong and the apparently wrong.

We simply do not have the omnipresence to distinguish between these. Yet, frequently we are faced with such choices. Such conceptual choices are at the very heart of Hierarchy Theory. This stems as Ahl & Allen, (Ahl and Allen, 1996) tell us from the necessity we feel to observe and order the universe in a manner useful to our understanding in support of action. As hierarchy theory makes evident the “hierarchical structures” then observed are more a function of our capacity to observe than of any real ontologically accessible “processes” underlying them.

This paper presents a hierarchy of ethics that can be totally compatible with each other provided they are applied at the appropriate level with the hierarchy we describe. If applied outside their own level they are self destructively incompatible. Ethical standards in our sense are not only not universals but necessarily different for different position in the hierarchy. However this is not ethical relativism for the standards required are not flexible within a particular level of the described hierarchy.

Keywords: Business Ethics, Moral Compass, Knowledge, Individual Enterprise, Community, Planetary Guardians, Social Guardians

2009-1295

### **THE CARRYING CAPACITY IMPERATIVE: ASSESSING REGIONAL CARRYING CAPACITY METHODOLOGIES FOR SUSTAINABLE LAND-USE PLANNING**

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The global impact of an ever-increasing population-base combined with dangerously depleted natural resources highlights the urgent need for changes in human lifestyles and land-use patterns. To achieve more equitable and sustainable land use, it is imperative that populations live within the carrying capacity of their natural assets in a manner more accountable to and ethically responsible for the land which sustains them. Our society's very survival may well depend on worldwide acceptance of the carrying capacity imperative as a principle of personal, political, economic, educational and planning responsibility.

This theoretically-focussed research identifies, examines and compares a range of methodological approaches to carrying capacity assessment and considers their relevance to future spatial planning. It also addresses existing gaps in current methodologies and suggests avenues for improvement. A set of eleven key criteria are employed to compare various existing carrying capacity assessment models. These criteria include whole-systems analysis, dynamic responses, levels of impact and risk, systemic constraints, applicability to future planning and the consideration of regional and local boundary delineation. This research finds that while some existing methodologies offer significant insights into the assessment of population carrying capacities, a comprehensive model is yet to be developed. However, it is suggested that by combining successful components from various authors, and collecting a range of interconnected data, a practical and workable systems-based model may be achievable in the future.

2009-1297

### **INNOVATORS FOR SUSTAINABILITY – DESIGNING A LEARNING JOURNEY**

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Members of the Global Marshall Plan Initiative <http://www.globalmarshallplan.org/>, the Coalition for the Global Commons <http://www.coalition-global-commons.org/> and the Change the Game Initiative <http://www.changethegame.org/> started to envision a vehicle for

seasoned, emerging and potential leaders to implement sustainable change in their organizations launches, new products and service designs, or organizational designs. The learning experience should facilitate innovation spaces connecting participants and leading experts, sharing knowledge and vision to create a better and more sustainable world. Hence we are still looking for radically new ways of learning about Stewardship, Leadership, Entrepreneurship, Innovation and Sustainability on the path towards the envisioned “Eco-social Entrepreneurship”.

Today I have more questions than answers. Traveling to Brisbane and the ISSS conference 2009 is part of my personal learning journey. Being a co-founder of the Change the Game Initiative and a PhD student with Prof. Wolfgang Hofkirchner at the University of Salzburg, I am heavily involved in the design of the program. Parts of the design will be integrated in the Doctoral thesis and vice versa, the theoretical insights gained within the academic work will influence the design of the program.

I received an introduction to the ideas of systems thinking and evolutionary development through my thesis adviser. I am already confident, that insights in Evolutionary Development will be one of the foundations of the “ThinkCamp – Innovators for Sustainability”. But how can the ideas, concepts and theories be shared and brought forward? How can we pragmatically integrate the economic, ecological, social, cultural, and spiritual aspects of evolutionary development? Is it necessary and / or possible to integrate systemic and systematic approaches to be effective? We are currently designing a program “without a curriculum” combining self organizing processes, dialog and the vision of an almost completely flexible learning environment in which the learner is enabled to choose his/her learning objectives, modules and mentors on demand depending on the problem to be solved, the individual capabilities and pace of learning. The learner him/herself designs the learning environment in collaboration with his/her learning group. Learning sustainability capabilities as an evolutionary process itself? And yes, we have already faced a lot of constraints, but we are still eager to walk the extra mile (in this year to Brisbane, Australia) to meet, to connect, to listen, to think, to share, to create, to co-evolve.

2009-1298

#### **A SYSTEMS ANALYSIS OF SPIRITUAL DISCIPLINES**

***Dr. Carl T. Swanson, Jr.***

Associate Professor, Computer Science, University of Guam, Mangilao, Guam, USA

Although there are often great differences between the various religions and spiritual traditions of the world, a systems analysis of these traditions is performed to identify their Input-Process-Output components revealing great commonalities. System's Science is thus shown to provide a framework for reconciling these differences leading to greater global cultural understanding—thereby promoting world peace and harmony over war, discord and conflict.

2009-1299

#### **GAME THEORETICAL ANALYSIS ON SERVICE SYSTEM INTERACTION**

***Hidetoshi Okayasu***

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Service is an interaction among systems to co-create value by applying supplier's competence to a consumer. Trust relationship between suppliers and consumers plays an important role in service interaction. To design productive service system, we should understand how to construct trust relationship effectively. ISPAR model, proposed by Spohrer et al. is a model expressing service interaction process - proposing service, agreement to service, realizing service value. In this paper, regarding ISPAR model as a kind of expansion form games, we make a game theoretical analysis for finding conditions to realize service value. Through this analysis, demonstrating supplier's long-term commitment and appropriate variety of proposals for realizing service interaction. At last, we refer possibility of applications for agent base simulation and social network theory as further study.

2009-1301

## **HOW SHOULD WE PRESENT SYSTEMS THINKING TO PEOPLE WITH LITTLE PRIOR KNOWLEDGE OF THE FIELD?**

**Gerald Midgley**

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This paper tackles a dilemma that faces us when trying to explain systems thinking in a single presentation to people with little prior knowledge of the field. It is possible to offer a strong 'story' from a relatively narrow methodological perspective, but this inevitably omits significant insights from other perspectives. Alternatively we can offer an overview of different systems perspectives and methodologies. This approach offers a wider range of insights, and is more faithful to the breadth of the systems field, but usually fails to communicate a clear message about what systems thinking actually is: it tends to present multiple viewpoints on systems thinking, which is a lot for an uncommitted audience to take on board. If we want to present a clear message about systems thinking and a map of the wide range of methodological resources available to the systems practitioner, we need a theory or framework that presents some generic systems concepts and organizes the methodological resources in relation to these. Just such a framework is offered in this paper. It allows us to tell a coherent 'story' about what systems thinking actually is, and can also show how multiple systems methods (drawn from different methodologies) can be harnessed into an effective systems practice. Therefore, it provides a stronger basis for communicating with people who have little prior knowledge of the field than either narrower systems methodologies or overviews of multiple systems perspectives.

2009-1307

## **UNDERSTANDING MULTILINGUAL TRENDS - A DEMAND AND SUPPLY PERSPECTIVE**

**Leonie Solomons**

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Unlike mono-lingual countries, multilingual countries are called upon to address some fundamental constitutional and investment mix questions involving language. In countries like Sri Lanka, Belgium and Canada, political debate focuses on constitutional issues pertaining to language. However, conversations which address the demand and supply for different languages are much rarer.

If demand for the various languages is to be satisfied, it calls for recognition of future trends as cultivating language skills is implicitly affected by lag time. Furthermore, each language will have different drivers that multifariously interact to produce its own pattern of potential demand and supply.

At the recursion level of a country, it is that combination of the pattern of curves, (meaning, the demand and supply over time of each of the languages) that needs to be considered when designing the investment mix for language training. This is particularly important where 'S curves' are evident as it indicates the need for a shift in product investment, in this instance a change in the emphasis from one language to another.

Using the example of Sri Lanka, this paper poses and seeks to answer the question of what needs to be considered in order to detect the trend of the demand and supply of each of its three languages - Sinhala, Tamil and English. This is particularly complex given a) the vernacular and international status of the languages, b) each language has its own script, and c) the grammatical sophistication required which depends on the purpose which drives the demand for each of the languages.

Applying Ashby's Law of Requisite Variety, this is done from an economic and social perspective whilst bearing in mind the different language training philosophies and in that context the training technique options.



# Poster Abstracts

## POSTERS ON SUSTAINABILITY USING SYSTEMS THEORY

ISSS'09 Poster #1.

### **ENTROPY DEBT: A LINK TO SUSTAINABILITY?**

**(excerpts from a M.S. Thesis)**

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Despite popular awareness of our human impact on the natural environment, anthropogenic environmental degradation continues today. Yet, a science of sustainability is emerging that seeks to better understand the relationships between humans and the natural environment.

The theory of dissipative structures may be a link to sustainability. The theory of dissipative structures provides this research with a conceptual opportunity to highlight and, using surrogate measures, analyze the relationship between municipal 'structure', the energy drawn from the natural environment required to maintain the structure, and the resulting cost to the natural environment of doing so.

Five similarly constrained British Columbia municipalities with similar population sizes were investigated to determine a) how the theory of dissipative structures could effectively be operationalized, and b) if doing so could elucidate systemic drivers of anthropogenic environmental degradation.

ISSS'09 Poster #2.

### **TOWARD A GENERAL SYSTEMS MODEL OF CALIF. KELP FOREST ECOSYSTEM REGENERATION**

**(excerpts from a M.S. Thesis)**

***Brian Meux***

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The modeling and simulation tools of Odum's systems ecology and Troncale's comparative systems approach can be combined to synthesize a general systems EMERGY model of ecosystem regeneration. Measurements that give static knowledge of ecosystem structure, such as giant kelp density and species diversity are commonly used in kelp forest ecosystem analysis. In attempting to understand and affect complex ecological systems it is also useful to qualify and quantify how energy organizes into components and processes. In the case of the kelp forest, a complex network, the system can oscillate between a simple attractor state (empty urchin barren) and a complex attractor state (diverse, productive kelp forest). J.T. Lyle's regeneration demands knowledge of a set of interacting processes that comprise a sustainable ecosystem. How might humans interact with other components synergistically in particular processes to maximize ecosystem self-organization? Energy flow and energy storage can be affected to attain and sustain the ecosystem in the complex attractor state.

Used as a case study, the Santa Monica Baykeeper and other community-based restoration programs in the California Coastkeeper Alliance interact primarily in the processes of sea urchin removal and giant kelp recruitment. General systems concepts (e.g. hierarchy) can be integrated with the empirical knowledge from this restoration effort to create a more comprehensive model. How do we know what general systems concepts apply? How is this an improvement? This model might be used for reference in goal-seeking feedback to guide ecosystem regeneration. Using a general systems approach might allow this EMERGENCY-based top-down methodology to be applied to many types of ecosystems. Ultimate goals are to discover and improve general systems modeling tools and the application to ecological systems.

ISSS'09 Poster #3.

**INTRODUCTION TO A SYSTEM OF SYSTEMS PROCESSES: THE SOSP MODEL AS A BASIS FOR STUDENT RESEARCH & APPLICATION POSTERS**

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This poster introduces the main features of a candidate general theory of systems -- the System of Systems Processes (SoSP) -- which serves as the basis for many of the following posters. It begins with a description of the need for consensus and integration of systems theories. It concludes from past history that there has been an inadequate focus on systems processes (SP) or mechanisms, an inclusion of far too few mechanisms, and a lack of explicit description of how one systems' process influences another. In contrast, the SoSP proposes individual Linkage Propositions (LP's) in the form of explicit dyad statements to describe the influences of one SP on other SP's. Recognition of numerous such LP's results in a meta-level of interacting isomorphies that satisfies some of the most important criteria for a general theory of systems. It also yields a much more detailed understanding of systems dynamics. The poster continues with a description of a number of Association Classes of Linkage Propositions, tools for using the complex network that results, and alternative ways to represent that network. The poster ends with several practical uses and applications of the SoSP from systems education to systems design and problem solving.

ISSS'09 Poster #4.

**CATALOGUE OF LINKAGE PROPOSITIONS OF THE SOSP (SYSTEM OF SYSTEMS PROCESSES): A CANDIDATE GENERAL THEORY OF SYSTEMS**

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This poster presents the most critical element of Troncale's System of Systems Processes' (SoSP) as a candidate general theory of systems (GTS). It begins by describing the limits and assumptions constraining any GTS. It uses these to identify the central unsatisfied need of most GTS's -- that they tend to focus on just a small number of processes, not the full set, and even then they do not explicitly describe the interactions among the processes. The concept of Linkage Propositions (LP's), first introduced by the SoSP in 1978, is defined using several characteristics. Some sample Linkage Propositions that describe the particular influence of one systems process on another are analyzed. These multiple interactions result in a meta-level, but still very detailed view of how systems work. A graphic of the network established by showing these Linkage Propositions connecting 70 systems processes is presented. A hierarchical outline listing 174 sample Linkage Propositions is also presented. How to find evidence for a new Linkage Propositions in the natural systems literature is suggested. The poster concludes that LP's are interdependent and ends with citation of several practical uses and applications of the LP network of the SoSP.

ISSS'09 Poster #5.

**TENETS OF THE SOSP: PREREQUISITES, DISCINYMS, DISCRIMINATIONS  
& MUTUALITY IN THE SOSP MODEL**

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This poster begins with a concise description of the “tenets” of the System of Systems Processes Theory or Model and how those tenets distinguish it from other candidate general theories of systems. It continues with several specific examples of systems processes prerequisite for other systems processes resulting in a series of prerequisite “chains” or “flows.” These chains result in the “mutuality” conjecture in SoSP that is then explained. The poster continues with a definition of “discinyms” and why their recognition is thought to be important to building general theories or to improve communication among those who study different disciplinary phenomena at different scales. The poster includes specific citations of six clusters of examples of discinyms. It also describes several key discriminations that often interfere with communication between candidate systems theories and theorists. Finally, it describes some insights that come from recognizing prerequisite chains, discinyms, and discriminations.

ISSS'09 Poster #6.

**COMPARATIVE SYSTEMS ANALYSIS OF THE SOSP:  
OTHER CANDIDATE GENERAL THEORIES AND TOOLS**

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This poster attempts to “compare” several extant systems theories in a detailed and compelling manner. It begins by explaining the pressing need for unification of candidate system theories. It relates these needs to the original purposes stated by the Founders of the International Society for the Systems Sciences (ISSS) in its constitution -- needs that are even more relevant today than when they were formulated in the 50's. The poster explains that the “comparative systems analysis” introduced here would continue in the great tradition of the contributions of comparative taxonomy, comparative anatomy, comparative physiology, and comparative genomics. The core of the poster is its At- A-Glance, process-based, 2-D comparison matrix. The matrix lists 100 systems processes on the Y-axis and six different candidates system theories on the X-axis (Troncale, Klir, Odum, Miller, Bertalanffy, and Prigogine). The intersects thus created are colored in various shades of white to grey to show whether each systems process is “well covered,” “partially covered,” or “not covered at all” in each theory. One then can compare overall the breadth of coverage of each theory relative to the others. Several advantages and disadvantages of this processed-based comparison are described. The SoSP is described as a unique effort in “integrative eclecticism” that uses all systems processes equally. It continues by explaining why a candidate systems theory should focus on systems processes and further defines them. Finally the poster ends with the distinctions between structure and process and the “ structure is slow process, and process is fast structure” resulting in a concept of “structurprocess” as one indivisible entitation like matter:energy.

ISSS'09 Poster #7.

**USE OF THE NATURAL SCIENCES AS A SOURCE:  
TEST OF THE SOSP & TYPES OF ISOMORPHIES**

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This poster describes the use of the conventional, reductionist natural sciences (specifically astronomy, physics, mathematics, chemistry, geology and biology, and computer science) as a "*sine qua non*" source of knowledge about the systems processes of the SoSP. Their empirical data presents the possibility of actually testing for isomorphy of systems process across the above named domains. The peer-reviewed literature of these disciplines could also be used to discover Linkage Propositions describing mutual influences between the different systems processes at different scalar levels. In this way, the entire cumulative experience and resources of the natural sciences becomes a database for system theories. The poster includes two tables that attempt to quantify this possibility. The first lists the number of case studies or phenomena our team has identified in each of the cited sciences that exemplify each of a dozen systems processes. The second table is an outline listing the names of the phenomena studied by each science organized not by the science that describes that phenomenon, but rather by the systems process exemplified by each phenomenon. The poster then suggests how the various scales of "manifest" system (material world objects) and the disciplines that study them emerge naturally from one another in an unbroken sequence of origins from the beginning of the universe. The main intent of the poster is to suggest a new way to empower systems theory to become more rigorous by testing general theories through "empirical refinement" made possible by the conventional sciences. A corollary of this approach is that the core of systems theory will be tied to the tools and the language of the sciences improving communications and mutual respect.

ISSS'09 Poster #8.

**THE GENERAL SYSTEMS LIFE CYCLE:  
STAGES OF SYSTEMS DEVELOPMENT USING SYSTEMS PROCESSES OF THE SOSP  
MODEL**

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Users of the SoSP general theory of systems have requested simplifications of the length and complexity of the alphabetical listing of 100+ isomorphic systems processes. Previous papers used hierarchical clustering of similar or more intensely linked systems processes. This hierarchical clustering reduces the first-level entries to a dozen. This poster presents five additional ways to organize the long list of SP's. First, the SP's can be clustered by the higher level "functions" that the processes perform for systems in general. This strategy will be compared with the clustering of physiological networks by function in the new field of systems biology. Second, it describes how some systems processes are necessary or included within other SP's. We call these "prerequisite relations." The third organization of SP's suggests that some are more elaborate versions of others as they are employed in higher scalar levels of manifest systems. The fourth organization of SP's places them in order of "prerequisite" knowledge for learning and understanding. Some must be known to be used to teach about others. Finally, the SP's are organized according to their participation in "stages" of a proposed general systems "lifecycle." This organization suggests that many manifest systems go through the same stages in a particular required order.

ISSS'09 Poster #9.

**INSTITUTIONAL STRATEGIES FOR FURTHER RESEARCH ON THE SOSP  
& HUMAN SOS PROBLEMS: ISIS & FPARCSI**

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The Institute for Advanced Systems Studies is scheduled to terminate at its current university home with the retirement of its founder and present director. Before that time, and in coordinated manner, two new organizations are being proposed. One would continue the concept of convocations and research projects conducted by Faculty Fellows, Associate Fellows, and Student Fellows who have joined together to form an Institute for System-Integrated Sciences (I.S.I.S.). ISIS would be a system-wide unit with its Fellows drawn from all 23 campuses of the California State University System. Its function would be to bring together the small numbers of scientists and engineers who are faculty of the Colleges of Science and of Engineering who are active in complex systems research. ISIS would have its own curriculum with courses ranging from Comparative Systems Analysis to Systems Theory to Systems Biology and Earth Systems Science. ISIS would then form the basis for a Federation for Pacific Rim Complex Systems Institutes (fPARCSI). The Pacific Rim nations are linked by their rapidly-growing economies. fPARCSI would provide a base for cooperation in external grant proposals, conferences, publications, education, and research.

ISSS'09 Poster #10.

**SOS (SYSTEM OF SYSTEMS) ENGINEERING PROBLEMS: SOS AS FUNDABLE  
SCIENCE:**

**A REPORT TO THE U.S. NATIONAL SCIENCE FOUNDATION**

**SoS-NSF Commission**

This poster summarizes the final report to the National Science Foundation of a Colloquium given the task of deciding whether or not the new field of system of systems engineering (SoS) is mature enough for funding. It first defines the meaning, characteristics, and importance of System of Systems (SoS) problems. It lists examples of SOS problems such as those involving healthcare systems, warfare systems, homeland security, resource management, global warming, complex diseases, pandemics, species extinction, and many more. The poster uses these case studies to suggest the importance of SoS research and funding. Panel discussions tried to identify central problems of the new field and how our underlying natural science knowledge could be used to help solve these crisis societal problems. Significant questions were formulated such as, "Is there currently a science of SOS or can one emerge?" The panelists agreed that the most vital current deficiency was the difficulty that different systems modeling tools (e.g. dynamic modeling using mathematics vs. new tools like agent-based modeling) have in "talking" to each other as they must to examine any SOS problem. Several agencies were identified as potential funders of SOS. Although the conclusion of the panelists was that the field was still too immature for funding, minority reports countered that until significant funding occurred, the field would remain immature.

ISSS'09 Poster #11.

**ISOMORPH FUNCTIONS WITHIN AN INFORMATIONAL FRAMEWORK: - SYSTEM  
PROCESS FUNCTIONALITY IN THE BATTLE AGAINST ENTROPY**

***LUKE FRIENDSHUH***

Seagate Corporation and  
GSRDC Co., Systems Workshop Series

The universe is full of complex order (information). How did this come about? How does a material universe find and create interesting order when it is dominated by the 2nd law of

thermodynamics, that is, ever increasing entropy, usually defined as lack of order. There are far more “unstructured” possible configurations of the universe than structured ones - like what exists. If unstructured high entropy configurations are more probable, how did we end up with this one? What fundamental system concepts allow the universe to find/create and hang onto all this order (information)? This poster explores some possible answers and in the process generates some additional questions.

ISSS'09 Poster #12.

### **INTEGRATION OF SOURCES ON SELF-ORGANIZATION AS A SYSTEMS PROCESS IN THE SOSP**

***Matthew Piper***

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(send questions to [lrtroncale@csupomona.edu](mailto:lrtroncale@csupomona.edu))

This poster will concisely report on a multi-year literature search for articles on the SoSP systems process “self-organization” comparing the results obtained from physical science, biological science, and social science search engines. The intention was to assess the extent of usage (penetration) of these ideas across disciplines and the feasibility of integration of widely separated sources of information to test their isomorphy. The poster presents a sample of “linkage propositions” of the SoSP Model that describe the influences between “self-organization” and other systems processes which is the key innovation of SoSP studies. The poster will also show a sample of the working definitions, identifying features or functions, position of “self-organization” in the SoSP general systems lifecycle, sample information bits on “self-organization” from the literature, types and taxonomies of “self-organization”, as well as a sample of institutions and workers involved in research on “self-organization”. It will also suggest how a general knowledge of “self-organization” in systems could be applied to practical studies (This abstract follows the “formula” prescribed in CSA group-study assignments, thus the text similarities).

ISSS'09 Poster #13.

### **INTEGRATION OF SOURCES ON EMERGENCE AND HIERARCHIES FOR A SYSTEM OF SYSTEMS PROCESSES (SOSP MODEL) AND APPLICATION TO SOCIAL SYSTEMS**

***Nate Benesi***

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This poster will concisely report on a multi-year literature search for articles on the SoSP systems process “hierarchies” comparing the results obtained from physical science, biological science, and social science search engines. The intention was to assess the extent of usage (penetration) of these ideas across disciplines and the feasibility of integration of widely separated sources of information to test their isomorphy. The poster presents a sample of “linkage propositions” of the SoSP Model that describe the influences between “hierarchies” and other systems processes which is the key innovation of SoSP studies. The poster will also show a sample of the working definitions, identifying features or functions, position of “hierarchies” in the SoSP general systems lifecycle, sample “hierarchy” information bits from the literature, types and taxonomies of “hierarchies”, as well as a sample of institutions and workers involved in research on “hierarchies”. It will also suggest how a general knowledge of “hierarchies” in systems could be applied to the study of social systems. (This abstract follows the “formula” prescribed in CSA group-study assignments, thus the text similarities).

ISSS'09 Poster #14.

**INTEGRATION OF SOURCES FEEDBACK AND REGULATION FOR A SYSTEM OF SYSTEMS PROCESSES (SOSP) MODEL AND APPLICATION TO TRANSPORTATION**

***Anthony Jusay***

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(questions about this poster to lrtroncale@csupomona.edu)

This poster will concisely report on a multi-year literature search for articles on the SoSP systems process “feedback” and “regulation” comparing the results obtained from physical science, biological science, and social science search engines. The intention was to assess the extent of usage (penetration) of these ideas across disciplines and the feasibility of integration of widely separated sources of information to test their isomorphy. The poster presents a sample of “linkage propositions” of the SoSP Model that describe the influences between “feedback” and other systems processes which is the key innovation of SoSP studies. The poster will also show a sample of the working definitions, identifying features or functions, position of “feedback” in the SoSP general systems lifecycle, sample “feedback” information bits from the literature, types and taxonomies of “feedback”, as well as a sample of institutions and workers involved in research on “feedback”. It will also suggest how a general knowledge of “feedback” in systems could be applied to the study of transportation systems. (This abstract follows the “formula” prescribed in CSA group-study assignments, thus the text similarities).

ISSS'09 Poster #15.

**INTEGRATION OF SOURCES ON VARIATION, DEVELOPMENT AND EVOLUTION FOR A SYSTEM OF SYSTEMS PROCESSES (SOSP) MODEL AND APPLICATION TO ENVIRONMENTAL BIOLOGY**

***Rene Escobedo***

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California State Polytechnic University  
(questions about this poster to lrtroncale@csupomona.edu)

This poster will concisely report on a multi-year literature search for articles on the SoSP systems process “development” and “evolution” comparing the results obtained from physical science, biological science, and social science search engines. The intention was to assess the extent of usage (penetration) of these ideas across disciplines and the feasibility of integration of widely separated sources of information to test their isomorphy. The poster presents a sample of “linkage propositions” of the SoSP Model that describe the influences between “systems evolution” and other systems processes which is the key innovation of SoSP studies. The poster will also show a sample of the working definitions, identifying features or functions, position of “systems evolution” in the SoSP general systems lifecycle, sample “systems evolution” information bits from the literature, types and taxonomies of “systems evolution”, as well as a sample of institutions and workers involved in research on “systems evolution”. It will also suggest how a general knowledge of “systems evolution” in systems could be applied to the study of environmental biology. (This abstract follows the “formula” prescribed in CSA group-study assignments, thus the text similarities).

ISSS'09 Poster #16.

**INTEGRATION OF SOURCES ON CYCLING FOR A SYSTEM OF SYSTEMS PROCESSES (SOSP) MODEL AND APPLICATION TO ENVIRONMENTAL SYSTEMS - THE GENSYSML TOOL**

**Brian Meux**

Lyle Center for Regenerative Studies and  
Comparative Systems Analysis Courses  
Institute for Advanced Systems Studies  
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This poster will concisely report on a multi-year literature search for articles on the SoSP systems process “cycling” and “oscillations” comparing the results obtained from physical science, biological science, and social science search engines. The intention was to assess the extent of usage (penetration) of these ideas across disciplines and the feasibility of integration of widely separated sources of information to test their isomorphy. The poster presents a sample of “linkage propositions” of the SoSP Model that describe the influences between cycling and other systems processes which is the key innovation of SoSP studies. The poster will also show a sample of the working definitions, identifying features or functions, position of cycling in the SoSP general systems lifecycle, sample cycling information bits from the literature, types and taxonomies of cycling, as well as a sample of institutions and workers involved in research on cycling. It will also suggest how a general knowledge of cycles in systems could be applied to the study of ecosystems. (This abstract follows the “formula” prescribed in CSA group-study assignments, thus the text similarities).

ISSS'09 Poster #17.

**INTEGRATION OF SOURCES, FLOWS-INTERACTIONS AND NETWORKS FOR A SYSTEM OF SYSTEMS PROCESSES (SSP) MODEL AND APPLICATION TO ECOSYSTEMS**

**Madelena Serra**

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Institute for Advanced Systems Studies  
California State Polytechnic University  
(questions about this poster to ltrtroncale@csupomona.edu)

This poster will concisely report on a multi-year literature search for articles on the SoSP systems process “flows” and “networks” comparing the results obtained from physical science, biological science, and social science search engines. The intention was to assess the extent of usage (penetration) of these ideas across disciplines and the feasibility of integration of widely separated sources of information to test their isomorphy. The poster presents a sample of “linkage propositions” of the SoSP Model that describe the influences between “flows” and “networks” and other systems processes which is the key innovation of SoSP studies. The poster will also show a sample of the working definitions, identifying features or functions, position of “flows” and “networks” in the SoSP general systems lifecycle, sample information bits on “flows” and “networks” from the literature, types and taxonomies of “flows” and “networks”, as well as a sample of institutions and workers involved in research on “flows” and “networks”. It will also suggest how a general knowledge of “flows” and “networks” in systems could be applied to the study of ecosystems. (This abstract follows the “formula” prescribed in CSA group-study assignments, thus the text similarities).

ISSS'09 Poster #18.

## **INTEGRATION OF SOURCES ON SYSTEMS CHAOS AND ORIGINS FOR THE SOSP**

***Len Troncale***

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This poster will concisely report on a multi-year literature search for articles on the SoSP systems process “chaos” and “origins” comparing the results obtained from physical science, biological science, and social science search engines. The intention was to assess the extent of usage (penetration) of these ideas across disciplines and the feasibility of integration of widely separated sources of information to test their isomorphy. The poster presents a sample of “linkage propositions” of the SoSP Model that describe the influences between “chaos” and other systems processes which is the key innovation of SoSP studies. The poster will also show a sample of the working definitions, identifying features or functions, position of “chaos” in the SoSP general systems lifecycle, sample information bits on “chaos” from the literature, types and taxonomies of “chaos”, as well as a sample of institutions and workers involved in research on “chaos”. (This abstract follows the “formula” prescribed in CSA group-study assignments, thus the text similarities).

ISSS'09 Poster #19.

## **USING BOUNDARIES IN THE SOSP TO UNDERSTAND AND DESIGN DATA STORAGE SYSTEMS**

***Luke Friendshuh***

Seagate Corporation and  
GSRDC Co., Systems Workshop Series

Troncale's System of System's Processes (SoSP) theory can be a powerful tool for understanding and designing systems. Understanding of Isomorphs in one system and systems in general on a theoretical level can lead us to better understanding of and applications to other manifest systems. So far there are 80+ possible isomorphs in the SoSP that may be able to be used in this way. This poster and platform presentation picks the isomorphic structur-process of boundaries and boundary conditions to use for this particular example design space problem. It attempts to show how better understanding of boundaries and boundary conditions in systems in general can help in the understanding and design of data storage systems.

ISSS'09 Poster #20.

## **USING HETEROPOIESIS IN THE SOSP TO DESIGN DATA STORAGE SYSTEMS**

***Luke Friendshuh***

Seagate Corporation and  
GSRDC Co., Systems Workshop Series

This poster explores the isomorphy of hierarchical structure and the dynamics that leads to clustering of information into hierarchies. This systems process is just one of nearly 100 in the SoSP that hold the possibility of suggesting innovations in the design of computer data storage systems. First the poster describes the features and functions of hierarchical structure and processes and then gives examples of them in data storage systems. A specific improvement in data storage system design is then highlighted for this process. The title uses the term “heteropoiesis” (literally “origins” of heterogeneity as clustered hierarchies) taken from the SoSP literature to designate the natural processes by which heterarchical or hierarchical structure originate and persist in natural systems across billions of years.

ISSS'09 Poster #21.

**USING FEEDBACK IN THE SOSP TO DESIGN DATA STORAGE SYSTEMS**

**Luke Friendshuh**

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The SoSP, System of System's Processes model, enables an abstract point of view of systems that serves to increase the level of understanding of specific systems and how they work. This in turn allows new insights on how to improve system functioning and why specific system solutions emerge. This poster demonstrates this by exploring only one specific isomorphic process from the 80+ isomorphs of SoSP and applies insights to the design of data storage systems. First, it describes the features and functions of feedbacks and then gives examples of them in data storage systems. A specific improvement in data storage system design is then highlighted resulting from study of the systems processes of feedback and regulation.

ISSS'09 Poster #22.

**USING SOSP TO ASSESS WILBER'S INTEGRAL THEORY**

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This poster begins with a description of Ken Wilber's Integral Theory (IT). Wilber is a philosopher who summarized his lineage of previous work in the book *A Theory of Everything*. It continues with an introduction to Troncale's System of Systems Processes Model. Then it compares the two approaches in terms of the basis for each theory, compares the worldview of each theory, compares their contrasting methodologies, their use of hierarchies, their resulting models of human systems, and finally their applications in terms of practice and the questions each raises.

ISSS'09 Poster #23.

**THE SELF AS A SYSTEM OF SYSTEMS PROCESSES**

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While neuroscience may be able to provide explanations of consciousness from the level of specific sensory information, a description of awareness of the self and other within space/time comes from a level of subjective experience where empirical study is notoriously difficult. Subjective experience is fragmented into disciplines (psychology, philosophy, religion, etc.) Concepts like consciousness, emotion, and cognition lump processes and make collaboration and discussion among researchers difficult. Consistent, accepted theories for systems science are just emerging, even scientists use metaphors to describe processes that are obvious to systems thinkers, and too often researchers are unable to distinguish when they are thinking linearly rather than systemically. This poster compares models from Odum, Miller, Systems Dynamics, and agent-based modeling. A simple model of self is suggested as a framework for the description of processes and integration of findings from the disciplines.

**SoSP DERIVATIVE POSTERS IN SYSTEMS PATHOLOGY, SYSTEMS PHILOSOPHY,  
AND SYSTEMS EDUCATION**

ISSS'09 Poster #24.

**COMPARATIVE SYSTEMS ANALYSIS: A DISTANCED-LEARNING MINOR IN SYSTEMS  
SCIENCE**

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This poster describes the Minor degree in Comparative Systems Analysis available through the Institute for Advanced Systems Studies of the College of Science, and the Continuing Education Program at California State Polytechnic University. It displays the catalogue entries for 14 transdisciplinary courses that can be selected from to achieve the 45 units necessary to earn the degree. These courses essentially constitute studies in the new field of systems sciences, complex systems, or systems analysis. The research associated with the degree and the Institute focuses on further development of the System of Systems Processes (SoSP) as a general theory of systems.

ISSS'09 Poster #25.

**ISGE: THE INTEGRATED SCIENCE GENERAL EDUCATION EXPERIENCE:  
STEALTH SYSTEMS SCIENCE AT EVERY FOUR-YEAR AND COMMUNITY COLLEGE**

***Len Troncale***

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This poster describes the product of a decade of effort funded by the U.S. National Science Foundation, private foundations, and the California State University system to create an innovative curriculum that satisfies all of the usual 12 units of science general education (GE) requirement for non-majors at most universities. The ISGE year of study uses intensive computer-based modules for independent or online, distanced study combined with face-to-face, social methodologies to teach the basic facts & theories of seven conventional sciences organized NOT by the disciplines but by a dozen major systems process themes. The poster states that ISGE solves 20 common obstacles to effective GE. It describes how the vast range of subject matter is synthesized and integrated. It describes how the ISGE methodology for the first time uses transdisciplinary labs, current results of brain and learning science, twenty special multimedia features, and electronic games. The poster also includes a summary of the assessment data collected to date to evaluate ISGE effectiveness.

ISSS'09 Poster #26.

**TOWARD EMPIRICAL INVESTIGATION OF THE SELF:  
APPLICATION OF GENERAL SYSTEMS MODELS TO SUBJECTIVE EXPERIENCE**

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ISSS'09 Poster #27.

### **SYSTEMS PATHOLOGY AS SYSTEMS BIOLOGY & THE SOSP MODEL**

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This poster summarizes the arguments for a new complex systems' specialty as presented in two past paper sessions of the ISSS. It relates the practice of modern medicine as it derives from intensive study of the human body and its pathologies as a complex system to the anticipated fruitful practice of studying ANY system and their observed pathologies. It argues that a quantum leap in the development of systems pathology is possible through emulation of the lessons learned by medicine over its very long and tortuous history. It also suggests that systems' practitioners and interventionists should devise their own version of the Hippocratic Oath (First, do no harm). It suggests that interested parties contact the author and join together in establishing an American Society for Systems Pathologists (ASP) as soon as possible to stimulate work in this area. A Special Integration Group (SIG) of the International Society for the Systems Sciences has already been established as a precursor and sponsor of this intellectual and application innovation.

ISSS'09 Poster #28.

### **NAMING CLUSTERS OF SYSTEMS-LEVEL DISEASES FOR A GENERAL SYSTEMS PATHOLOGY**

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This poster continues to fill out the outline of the proposed new field of Systems Pathology by describing how the established traditions of associating symptoms with specific diseases in medicine could be used to identify the sources of systems' diseases. It posits that the same techniques and rewards used in medicine relative to discovering and subsequently "naming" new diseases could be used for this new field. Systems Pathology could then establish the etiology, diagnosis, prognosis, and treatment standards typical of medicine for other systems in society and systems in nature. This would speed work on regenerative and sustainable systems, and communication among those interested or responsible for a wide range of real systems. The poster defines such "clusters" of systems' diseases as cyclopathologies, heteropathologies, cyberpathologies, and others in order to link symptoms with causes of pathology in systems stability and dynamics.

ISSS'09 Poster #29.

### **GIANT PLANET ORIGINS OF LIFE: ANOTHER APPLICATION OF THE SOSP MODEL AND GENERAL MORPHOLOGY**

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This poster uses ideas from general theories of systems and techniques from the General Morphology practiced by the late Caltech Professor of Astronomy Fritz Zwicky to assess the possibility of origins of life on the most common extra solar system planets found to date – giant planets. It reviews the conditions on such planets relative to terran conditions. It suggests how the conditions on giant planets could be simulated on earth to attempt lab experiments on origins of life that are quite unique from the original Miller-Urey experiments. It reviews arguments for and against the search for earth-like water and DNA as prerequisites

of life. The poster suggests some attributes of life systems other than these commonly assumed prerequisites from the perspective of general theories like the SoSP Model. These arguments are a case study of how general theories can suggest or stimulate creative new areas of conventional science investigation.

ISSS'09 Poster #30.

## **PROPOSAL TO USE SYSTEMS METHODOLOGIES IN UNDERSTANDING PATHWAYS TO CLIMATE ADAPTATION**

**Emma Yuen**

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In 2007, the IPCC Fourth Assessment (IPCC, 2007) concluded that “warming of the climate system is unequivocal” and for the next two decades we are likely to experience a warming of about 0.2°C per decade (IPCC, 2007). It is inevitable that communities need to adapt to changes in climate and the resultant changes in resource availability. In planning for these changes, questions are raised around “what impacts do we need to prepare for?” and “what information do we need to make decisions?”. Traditionally, information has focussed on a top down, biophysically driven positivistic approach where vulnerability assessments are used to highlight priority investment areas at the national or regional scale. However, emphasis is shifting to bottom up approaches aimed at improving resilience around questions of “how can we facilitate adaptation?” (Dessai and van der Sluijs, 2007). As the question is reframed around adaptive capacity, expertise from the ‘soft’ sciences, politics and local knowledge are seen as increasingly important components. This paper proposes a process for understanding various world views and assumptions around what should be done as well as facilitating mutual understanding between science practitioners and decision makers in the climate change arena.\

CSIRO has conducted a number of vulnerability assessments for biophysical systems, geographical places, sectors and communities which will be evaluated during the first phase of the project. This evaluation of past assessments of vulnerability and adaptive capacity will consider whether the chosen methodologies were effectively implemented and achieved the espoused project outcomes. The second phase is a broader assessment beyond individual projects to consider if and how vulnerability assessments inform decision making process around adaptation. This phase explores the overarching conceptual model of how adaptation planning progresses from multiple perspectives and considers how to achieve not only identification of vulnerable places but facilitate adaptation at multiple scales.

Key informant interviews, qualitative and quantitative surveys, a review of the literature and development of a theory of action will be used in phase one to evaluate the implementation and outcomes of 5 vulnerability assessments. The second phase of the project will use a systems methodology yet to be decided but potentially including either Soft Systems Methodologies or Strategic Assumption Testing to explore the broader ‘wicked’ problem of how science, values and beliefs inform decision making within the pathway to adaptation. This process involves reframing the outcomes and identifying ways to improve the process. The process is likely to include key informant interviews followed by a series of half day workshops attended by stakeholders from government, policy, science and the broader community. Workshops will be used to define what different stakeholders want to achieve and key issues and opportunities around adaptation planning.

Outputs will include articulation of various conceptual models used in the Climate adaptation debate and a map of potential actions to improve the process. This process will help understand the types of knowledge that can be used to inform decision making as well as promote awareness amongst participants of the diversity of climate adaptation pathways.

Dessai, S. and van der Sluijs, J.P. (2007). *Uncertainty and Climate Change Adaptation - a Scoping Study*. A Copernicus Institute and Tyndall Centre Report for the Netherlands Environmental Assessment Agency (MNP).

IPCC, (2007). *Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment, Report of the Intergovernmental Panel on Climate Change* [core writing team, Pachauri, R.K and Reisinger, A. (eds.)]. IPCC, Geneva, Switzerland.

ISSS'09 Poster #31.

**THE QUEST FOR A GENERAL SYSTEM THEORY FOR ANY PARTICULAR PERSPECTIVE - DOES IT EVER EXIST OR HAS IT BEEN THERE ALL THE TIME?**

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Sciences have been developed throughout human history in order to search for a set of basic components and their relationships to one another within a certain field. 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.

In this paper, the properties of a general theory which can be applied in any particular perspective are analyzed. Some of the existing fundamental theories in different fields are investigated; including set theory in mathematics, relativity in physics, differential diagnosis-cure process in Traditional Chinese Medicine, Taichi Yin-Yang theory in Taoism, and Five Systems theory in the teaching of Buddha.

Keywords: General System Theory, Taichi Yin-Yang System Theory, Set theory, Relativity, TCM Differential diagnosis-cure process, Traditional Chinese Medicine, the teaching of Buddha, Differentiation, Govt Futures, Environment, Security, Sciences Education, System Thinking in a Virtual World

ISSS'09 Poster #32.

**SYSTEM THEORY AGAINST SARS AND H5N1- THE SYSTEM VIEW OF THE HUMAN BODY BY TRADITIONAL CHINESE MEDICINE DIFFERENTIAL DIAGNOSIS-CURE PROCESS**

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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. The recent breakout of the super germs and virus like SARS and H5N1 shows that we are already living in a turbulent world. How can we ensure the breakdown of such an antibiotic medical system will fail "gracefully"?

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 four components of each system in human body. The recent remarkable results in the battle against SARS is supported by the guidance of this ancient theory, rather than a particular effective Chinese

herb. In this paper the research of this success in the viewpoint of system theory will be presented. It is hope that this will inspire us of how to apply this ancient system theory into different areas in our turbulent world to build resilience regardless of the source of instability.

ISSS'09 Poster #33.

**LIVING WITH THE ENVIRONMENT, NOT AGAINST THE ENVIRONMENT- THE ANCIENT CHINESE SYSTEM THEORY ON SUSTAINABILITY**

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The sustainability of our turbulent world is again questioned by the recent years of flooding and associated devastation of our ecosystem. However in 2000 years ago, Traditional Chinese Medicine has already established the practice of living with the environment, rather than living against the environment. This ancient Chinese system theory on sustainability stressed on the holistic point of view between human and the environment, and said that human is part of the environment rather than the master of the environment. TCM healthcare ensure the health of human by identifying the rules of regulation to live harmoniously with the environment at different places, different influence seasons, and different situations.

In this paper, the research on analyzing this ancient system theory using Aristotelian logic and set theory will be presented. Research has been done to extend the TCM healthcare theory into the healthcare of our ecosystem and our social systems. The Taichi Yin-Yang system theory could be used to identify the four fundamental components of our environment, and the corresponding influences on human biological and social systems. The classification of strategies according to the COLD-HOT spectrum ensures resilience is built into the rules of regulation of systems.

ISSS'09 Poster #34.

**BUILDING RESILIENCE BY BALANCING THE TURBULENT WORLD - THE ANCIENT TAICHI YIN-YANG SYSTEM AND CONTROL THEORY**

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New system theories are desparately required to build resilience for the ever changing nature of today's turbulent world. However a forgotten ancient system and control theory may be a good solution. The Taichi Yin-Yang system theory was the mainstream "theory of everything" in China for 2000 years. However it was abandanded due to Western scientific theories because they resulted in industrial revolution which bring powerful weapons and living convinences. Fortunately this ancient theory was preserved in Traditional Chinese Medicine and Taichi exercise.

Research using modern system theories reveals that the ancient theory is logical and practical. In TCM, the daily application of this ancient theory is called the Differential Diagonostic-Cure process. It could identify the complete set of imbalanced (turbulent) states, and implement the proper strategies to bring a system back towards the ideal balanced state (resilience), in order to achieve stability, efficiency, longevity, and possibly growth.

The beauty of the theory is that no modification is required when applying it to modern physical, social or biological science, thoughtful matching is the only key. With this new view we hope that the fundamental structure, behaviors and strategies of our systems can be better understood, so that we can be better prepared for any possible problems that may arise.

Keywords: Ancient System theory, Tao, Balancing system, Taichi Yin-Yang system and control theory, Traditional Chinese Medicine Differential Diagonostic-Cure process, Research towards a General theory for systems, set theory, Buddha's teaching.



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## NOTES



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