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Welcome to ISSS 2017

Vienna is internationally recognized as the cradle of Systems Science by the pioneering achievements and foundational work towards a General Systems Theory by Ludwig von Bertalanffy in the 1950s. After more than 60 years, we offer a unique opportunity to present Vienna again as a strong international hub for the Systems Sciences. We welcome you to Vienna and look forward to your participation and presentations at the 61st Meeting of the International Society for the Systems Sciences.

Transdisciplinarity is the necessary foundation for radical innovations, learning from each other and exploring together. More than 180 contributions by international scientists from a diverse disciplinary background will deal with the present global challenges. Technological, biological and social systems and their design are at the center of this international meeting.

At the interface of science, humanities, engineering and design, this meeting will present the latest insights of the interdependencies between social, ecological and technological systems, as well as practical examples of appropriate design skills for sustainable living concepts and meaningful technologies for a future-oriented humanity.

ISSS2017, designed as a forum to bridge the gap between science and practice, focuses on the current challenges of European and international politics, economy and society, as well as on global change and developments. European and international business and industry representatives, as well as representatives from politics and society, have been invited to join and dive into this science-based dialogue in Austria and experience 'Systems Thinking for Everyone.'

Five thematic areas highlight the creative tensions of humans, nature, organization, and technology in the shared discourse:

1. "Government & Governance": From State Affairs to Viable Democracies in a Changing World to Risk and Crisis Management and the Freedom and Security of Citizens
2. "Economy": From Money to Value Creation to Reinventing Economy in the Energy Transition
3. "Health": From Public Health to Health Systems
4. "Ecosystems": From Living in Smart Cities to Sustainable Agriculture & Environmental Ecology
5. "Innovation & Development": From Science to Innovation to the Development of the Society

In addition, ISSS2017 serves as a platform for young scientists to present their research projects, ideas and solutions to an audience of international specialists and stakeholders. The best student paper awards will be presented at the opening gala. With this event, ISSS and BCSSS set themselves the goal of establishing and expanding Vienna as a crucial international hub for the Systems Sciences. We welcome you and hope you will immerse yourselves in the contacts and presentations of this week, and contribute fully in the work developed at this meeting and taken home.

Professor Ockie Bosch

July, 2017, Vienna, Austria.

Sunday: July 9, 2017 – Pre-Conference Workshops

REGISTRATION DESK OPEN 09:00 – 18:00 (Foyer – Campus Gusshaus, Gusshausstrasse 27-29, 1040 Vienna)

	10:00 – 17:00 Pre-conference Tutorials and Workshops	
1.	**3248 – Ockie Bosch, Nam Nguyen** A New Way of Thinking - Introduction to Systems Thinking & Easy-to-Use Systems Tools	**HI 8**
2.	**3247 – Brigitte Daniel Allegro, Harald (Bud) Lawson, Gary Robert Smith** Towards the Unification of Systems Science and Systems Engineering	**SR121**
3.	**3249 – Maria Lenzi** « Illuminating Patterns for Coping with Complexity with Special Focus on Visualization and Distributed Analytics »	**SR125**
	10:00 – 12:30 Pre-conference Workshops	
1.	**3057 – Thomas Wong** Systems Basics: Systemic Solutions with Evidence-Based Medicine for Better Concentrations - the Systems Thinking for Everyone's Mind Through the Teaching of Buddha On the Eastern Systems Science of Five Aggregates	**SR124**
	14:00 – 17:00 Pre-conference Workshops	
1.	**3058 – Thomas Wong** Systems Basics: Systemic Solutions with Evidence-Based Medicine for Relief from Insomnia - the Systems Thinking for Everyone's Body Through Traditional Chinese Medicine On the Eastern Systems Science of Taichi Yin-Yang Five Elements	**SR124**
2.	**3110 – Len Raphael Troncale** A Broad Survey of the Fragmented Domains of Systems Pathology: GST as a Unifier	**SR384**

19:00 – 21:00 Reception
Formal Evening Gala Opening in Rathaus, Entrance at Lichtenfelsgasse 2, Feststiege 1. Underground Station: Rathaus. Dress code: Minimum smart business dress.

Monday: July 10, 2017

MORNING REGISTRATION DESK OPEN 08:00 – 13:30 (Foyer, Campus Karlsplatz, Building: Karlsplatz 13, 1040 Vienna)
AFTERNOON REGISTRATION DESK OPEN 14:00 – 17:30 (Foyer, Campus Gusshaus, Gusshausstrasse 27-29, 1040 Vienna)

07:15 to 08:30 ISSS Roundtable Discussion (Bertalanffy Center for the Study of Systems Sciences *Paulanergasse 13, 2nd Floor, 1040 Vienna, Austria***).**

08:45 Plenary Session (Campus Karlsplatz, Karlsplatz 13, 4th Floor)	
08:45	Day 1: From State Affairs to Viable Democracies in a Changing World to Risk and Crisis Management and the Freedom and Security of Citizens
	Professor Ockie Bosch, President ISSS 2016-17
09:00	Dr Jennifer Wilby, VP Administration
09:10	Stefan Blachfellner, VP Conferences
09:15	KEYNOTE: Dr Ellen Lewis and Dr Anne Stephens – (3168) Inclusive Systemic Thinking Supporting the United Nations 2030 Sustainable
09:30	Development Agenda
10:00	KEYNOTE: Friedrich Nikolaus von Peter – Member of the Cabinet of the European Commission for Transport –The Need for an Integrated Systems View to Co-Create an Effective European Multimodal Transport System
10:30	Questions for Speakers
10:45 – 11:15 Tea/Coffee (Campus Karlsplatz, Karlsplatz 13, 3rd Floor Foyer)	
11:15	Government & Governance Panel Session
	Moderator: Prof. Dipl. Ing.Johannes Goellner
	Speakers: Dr. Erhard Busek – (3242) Everything is Changing, Especially in Governance Prof. Dipl. Ing Johannes Goellner – (3208) Security, Economy and Digitization Prof. Allena Leonard – (3146) Government and Governance
12:00	Connect and Converse with the Speakers
12:30 Lunch (Campus Karlsplatz, Karlsplatz 13, 3rd Floor Foyer)	

14:00 to 15:30 Parallel Sessions - July 10, 2017 – Campus Gusshaus, Gusshausstrasse 27-29, 1040 Vienna					
1	2	3	4	5	6
Room: SR121 **SIG: Systems Modeling and Simulation** **Chair: Javier Calvo-Amodio** **3033** Applications of Systems Thinking in Sustainability Assessment Methods: The Case for Alternative Vehicle Options *Onat, Nuri Cihat* **3027** Understanding Human Activity Systems: A Study using Systems Principles *Wang, Siqi; Calvo-Amodio, Javier; Rousseau, David* **3028** Integration of Sustainability Performance Indicators and the Viable System Model Toward a Sustainable Systems Assessment Methodology *Tong, Anh; Calvo-Amodio, Javier; Haapala, Karl R.*	**Room: SR124** **WORKSHOP**: **Gabriele Harrer** 'Interconnected thinking for climate protection' In this pilot project, citizens learn to apply and implement systemic approaches on complex issues of all kind. After a playful introduction into systems thinking with the strategic simulation game ecopolicy®, the participants will apply the Malik Sensitivity Model® and develop and validate measures for their municipality on this systemic basis.	**Room: SR125** **SIG: Human Systems Inquiry** **Chair: Daryl Kulak** **3061** A Systems View of Violence and Some Paradoxes in Working with Violent Abusers *MacGill, Victor Ronald David* **3185** I'm Against the Grand Plan *Kulak, Daryl* **3134** The $\infty 2$ Model of Multidimensional Intelligences Theory *Lin, Kingkong*	**Room: HI 8** **SIG: Designing Educational Systems** **Chair: John Vodonick** **2998** Positive Systems Science: Bringing Together Positivity, Complexity, and Temporality *Oades, Lindsay G.* **2997 and 2995 presentations combined** **2997** Systems Science Goes to the Movies: Using Positive Psychology to Bring Systems Science to Everyone *Spong, Cass* **2995** A Re-Envisioning of Leverage Points using Positive Psychology *Siokou, Christine* **2996** From the Science of Positive Psychology to Systemic Solutions for Education: Strategically using Language to Positively Impact Mindsets *Kern, Margaret L.*	**Room: SR384** **WORKSHOP** **Jimm Simms** **3245** Living Systems Science: The Science of Life	**Room: Kontaktraum** **SIG: Action Research** **Chair: Shankar Sankaran** **3013** Maturity Models in Systems Research and Practice *Buckle, Pamela* **3094** Applying System Dynamics: Case Management Implementation in an Argentinean Justice of Peace Court *Castiglioni, Sara Noemi* **3092** A Practical Application of Critical Systems Thinking to Improve a Business Intelligence System's Business Requirements *Venter, Carin; Goede, Roelien*

Offsite: All-day meeting

3119: Joint Meeting Between IIASA and IASCYS, *Umpleby, Stuart A.*
Further details please email Professor Stuart Umpleby, umpleby@gmail.com

15:30 Tea/Coffee (First Floor of Campus Gusshaus and Poster Viewing)

16:00 – 18:00 Parallel Sessions – July 10, 2017 – Campus Gusshaus, Gusshausstrasse 27-29, 1040 Vienna					
1	2	3	4	5	6
Room: SR121 **SIG: Systems Engineering/Systems Modelling** **Chair: Javier Calvo-Amodio** **3000** Systemic Construction of a Space Launching Base in Mexico *León Vega, Cirilo Gabino* **3001** Associative System to Predict Structures in the Ionosphere *Acevedo, Elena; Martinez, Fabiola; Villanueva, Erick; Velazquez, Rodrigo* **3088** State Policies for the Technological Development of the Space System *León Vega, Cirilo Gabino* **3003** From Science to Systemic Solutions *Korn, Janos*	**Room: SR124** **WORKSHOP** **Gabriele Harrer** 'Interconnected thinking for climate protection' In this pilot project, citizens learn to apply and implement systemic approaches on complex issues of all kind. After a playful introduction into systems thinking with the strategic simulation game ecopolicy®, the participants will apply the Malik Sensitivity Model® and develop and validate measures for their municipality on this systemic basis.	**Room: SR125** **SIG: Systemic Approaches to Conflict and Crises** **Chair: Gerhard Chroust and Georg Aumayr** **3140** Socio-Technical System Wholeness: A Theoretical Model Applied to Global Security Problems *Toth, William Joseph* **3145** Analyzing Protracted Conflict Systems: A Comparative Study of State and Non-State Actors *Shemen, Aviram* **3176** Combining the Work System Method and Soft Systems Methodology to Operationalize the Diamond Model of Crisis Management by Mitroff *Petkov, Doncho; Petkova, Olga* **3194** Resilience Management: from Fukushima Disaster to Boiling Oceans and Viral Spread *Atsuji, Shigeo; Chroust, Gerhard; Fujimoto, Ryosuke*	**Room: HI 8** **SIG: Designing Educational Systems** **Chair: John Vodonick** **3059** System Thinking for Global Political Citizenship Education *Shim(Sim), Yeon-soo(Youn-soo)* **3108** University for Business and Technology Knowledge Center: Making Local Knowledge Visible *Mirijamdotter, Anita; Somerville, Mary M.; Salavati, Sadaf; Harjrizi, Edmond* **3002** Generic Early Warning Signals for Critical Transitions: An Assessment of the Signals' Utility as a Predictive Management Tool *Houry, Sami A* **Systems Ethics** **3046** Ethical Regulators and Super-Ethical Systems *Ashby, Mick*	**Room: SR384** **EG2 and EG3:** **Chair: Johannes Goellner** **EG2: Smart Economy and Risks in Global Supply Chain Networks** **3205** Supply Chain Network Risk Management *Goellner, Johannes; Peer, Andreas* **3032** Enlarging the System Boundary of Sustainability Assessment of Production and Consumption: A Global Intra-National Analysis *Kucukvar, Murat; Onat, Nuri Cihat* **3239** RISK Management in SMEs in Czech Republic *Zathurecky, Viliam; Goellner, Johannes* **EG3: Strategic Human Resource Management and Digitalization of the Production** **3206** VR On-Site *Peer, Andreas; Goellner, Johannes*	**Room: Kontaktraum** **SIG: Systems Philosophy** **Chair: David Rousseau** **3020** Liminal Consciousness - A Systemic Theory for "Altered States of Consciousness" *De Pari, Manfred* **3066** What Drives the Systems? From Conatus to Dynamics: Descartes, Hobbes, Spinoza, Leibniz, and Kant *Takahashi, Kazuyuki Ikko* **3080** The Structure of Reality: An Emergent Hierarchy of Autonomous Levels? *Pretel-Wilson, Manuel*
Dinner available at nearby local restaurants – No Organised Evening Programme					

Tuesday: July 11, 2017

MORNING REGISTRATION DESK OPEN 08:00 – 13:30 (Foyer, Campus Karlsplatz, Building: Karlsplatz 13, 1040 Vienna)
AFTERNOON REGISTRATION DESK OPEN 14:00 – 17:30 (Foyer, Campus Gusshaus, Gusshausstrasse 27-29, 1040 Vienna)

07:15 to 08:30 ISSS Roundtable Discussion (Bertalanffy Center for the Study of Systems Sciences *Paulanergasse 13, 2nd Floor, 1040 Vienna, Austria***).**

08:45 Plenary Session (Campus Karlsplatz, Karlsplatz 13, 4th Floor)	
08:45	Day 2: From Money to Value Creation to Reinventing Economy in the Energy Transition Moderator: Mag. Karin Huber-Heim
09:00	KEYNOTE Science: Professor Dr Hardy Hanappi – Social Value and Money
09:30	KEYNOTE Practice: Professor Charly Kleissner – Impact Investors, Changing a Paradigm (tentative)
10:00 10:30	KEYNOTE Science: Professor Andre Martinuzzi – The Global Value Toolkit – Knowledge, Tools and Resources for Impact Measurement and Management (tentative) Questions for Speakers
10:45 – 11:15 Tea/Coffee (Campus Karlsplatz, Karlsplatz 13, 3rd Floor Foyer)	
11:15	KEYNOTE Practice: Dr Olaf Brugman – (3136) Sustainable Development in Business Networks: The Ecology of Dialogue and Narratives in Management
11:45	Economy Panel Session Speakers: DDr. Christophe Thun-Hohenstein – The Commons: Inspiring the For-Profit-Paradigm in Digital Modernity DI Dr. Roland Kuras – Challenging the Energy Transition Ladeja Godina Kosir – The Circular Change and Economy in Slovenia Joséphine von Mitschke-Collande – (3196) Applying Complexity Sciences and Systems Thinking for a Deep Disruption of Our Economic System
12:00	Connect and Converse with the Speakers
12:30 Lunch (Campus Karlsplatz, Karlsplatz 13, 3rd Floor Foyer)	

14:00 to 15:30 Parallel Sessions - July 11, 2017 – Campus Gusshaus, Gusshausstrasse 27-29, 1040 Vienna					
1	2	3	4	5	6
Room: SR121 **SIG: Leadership and SI** **Chair: Alexander Laszlo** **3109** Systemic Innovation in a World of Uncertainty *Laszlo, Alexander* **3169** A Learning Community to Foster an "Economía Amable" *Silvia, Zweifel* **Relational Science** **3060** Taoism: Science-Based Concepts om a More Sustainable Global Eco-System *Pierre, Jean-Claude*	**Room: SR124** **WORKSHOP** **Louis Klein** **3255** **Business Navigation** The Business Navigation workshop translates the role of the navigator into business contexts. On the one hand, it revisits the contribution of a systems and cybernetics paradigm, of models, methods and instruments, and how this profoundly contributes to more challenging business journeys. And on the other hand, it elaborates new aspects to the role of consultants, researchers and strategists.	**Room: SR125** **EG4: Business Lab (SABI)** **Chairs: Gandolfo Dominici, Francesco Caputo, Mario Tani** **3112** Towards the Definition of a Dynamic/Systemic Assessment for Cyber Security Risks through a Systems Thinking Approach *Armenia, Stefano; Ferreira Franco, Eduardo; Nonino, Fabio; Spagnoli, Emanuele* **3178** Context Adaptive Modeling Tool in Service Design *Štěpánek, Petr; Walletzky, Leonard; Ge, Mouzhi* **3044** Social Responsibility and Ethical Issues about Smart Technology Usage *Meško, Maja; Roblek, Vasja; Bach, Mirjana Pejić*	**Room: HI 8** **SIG: Systems Pathology** **Chair: Len Troncale** **Advances in Systems Processes Theory (SPT) as a GST: Formation of a New ISSS SIG** **3152** A Public Database for Systems Processes Theory and Systems Pathology (DB-SP2T) *Emerson, Richard; Martin, Richard; Troncale, Len Raphael* **3141** Using Monterey Phoenix to Model Each Isomorphic Systems Process (ISP) of the Systems Processes Theory (SPT): Test of Concept *Giammarco, Kristin; Troncale, Len* **3154** Systems Processes Theory (SPT) as General Systems Theory (GST) *Troncale, Len Raphael*	**Room: SR384** **IFSR** **WORKSHOP** **3216** Competencies in Systems Work *Metcalf, Gary; Ison, Ray* This workshop, hosted by IFSR (international Federation for Systems Research), will explore commonalities and differences of approaches to professionalization of 'the Systems person' and thus where the identification of systems competencies is needed. Discussions will include how we can establish international foundations on which to continue to build professionalization efforts.	**Room: Kontaktraum** **WORKSHOP** **Christiane Gebhardt and Allenna Leonard** Ecosystem Governance / VSM Intro Ecosystem / Regional innovation Intro VSM Tool Group work VSM Elements / functions Break Case: Solution BSD Governance Discussion: Implementation Research gaps Hands on tips & tricks.
15:30 Tea/Coffee (First Floor of Campus Gusshaus and Poster Viewing)					

16:00 – 18:00 Parallel Sessions – July 11, 2017 – Campus Gusshaus, Gusshausstrasse 27-29, 1040 Vienna

1	2	3	4	5	6
Room: SR121 **SIG: Designing Educational Systems** **Chair: Pamela Buckle** 3117 A Systems Thinking Perspective for Designing an Online Information Security Laboratory *Iqbal, Sarfraz; Brandt, Patrik* 3037 Can We Train Students to Be Systems Thinkers- Additional Results *Frank, Moti; Kordova, Sigal Koral* 3095 Ability to Raise Questions as a Modern Skill *Danylova, Vira; Karastlev, Vadim* 3069 Soft Systems Methodology and Cognitive Mapping: A Linkage Between the Initial Phases of SSM *Salavati, Sadaf; Mirijamdotter, Anita*	**Room: SR124** **WORKSHOP** **Louis Klein** 3255 **Business Navigation** The Business Navigation workshop translates the role of the navigator into business contexts. On the one hand, it revisits the contribution of a systems and cybernetics paradigm, of models, methods and instruments, and how this profoundly contributes to more challenging business journeys. And on the other hand, it elaborates new aspects to the role of consultants, researchers and strategists.	**Room: SR125** **SIG: SABI** **Chair: Andreas Hieronymi** 3038 Tourist Beach Management, a Perspective from the Systems Thinking *Jimenez-Arenas, Olga Lidia; Tejeida-Padilla, Ricardo; Coria-Paez, Ana Lilia; Sánchez-García, Jacqueline Yvette; Núñez-Ríos, Juan Enrique* 3040 Towards a Viable System Model for Mice Tourism in Mexico *Ramírez-Gutiérrez, Ana Gabriela ; Morales-Matamoros, Oswaldo* 3213 Social Inclusion and Competitiveness in Smart Tourist Destinations: a Systemic Perspective *Matamoros-Hernández, Edmundo Omar; José Badillo, Isaias; Tejeida-Padilla, Ricardo; Morales-Matamoros, Oswaldo; Coria-Páez, Ana Lilia;* 3225 Theoretical Proposal from Systems' Thinking for the Intelligent Tourism System *Briones-Juárez, Abraham; Tejeida Padilla, Ricardo; Cruz-Coria, Erika; Badillo-Piña, Isaías*	**Room: HI 8** **SIG: Joint Session of the Systems Pathology SIG and the Systems Biology SIG** **Chair: Len Troncale** 3163 Systems Biology as Systems Pathology *Troncale, Len Raphael* 3151 Caveats and Limits on the Systems Pathology-Biomedical Analogy *Friendshuh, Luke; Troncale, Len Raphael* 3180 The International Society for Systems Pathology (Issp): an Initial Image of Websites *Tuddenham, Peter D.; Troncale, Len* 3161 The International Society for Systems Pathology (ISSP): an Initial Image of Publications *Katina, Polinho* 3164 Status Report on the Founding of ISSP International Society for Systems Pathology *Troncale, Len Raphael*	**Room: SR384** **SIG: Digital Product-Service Systems** **Chair: Anand Kumar** 3070 MS Windows Productivity Research Applied to Theatre *Buckner, Richard Lee* 3133 Study on Innovation Management through a Case Study Based Approach *Reddypogu, Jose Kumar; Kumar, Anand* 3104 Digital Journey in Customer Experience Modelling *Kumar, Anand; Reddypogu, Jose Kumar; Lokku, Doji Samson; Zope, Nikhil Ravindranath* 3096 Industry Needs for Data Warehousing Students: Using SSM as Hermeneutic Data Analysis Tool for Interpretive Interview Data *Mahalepa, Theo; Goede, Roelien*	**Room: Kontaktraum** **WORKSHOP** **Christiane Gebhardt and Allenna Leonard** Ecosystem Governance / VSM Intro Ecosystem / Regional innovation Intro VSM Tool Group work VSM Elements / functions Break Case: Solution BSD Governance Discussion: Implementation Research gaps Hands on tips & tricks.

Dinner available at nearby local restaurants

19:00 Evening	
18:00 – 20:00	**Visit to the MAK, Stubenring 5, 1010 Vienna – Vienna Biennale 2017 Robots.Work.Our Future** **Complete details are on Sched and handout in your conference materials – you must wear your conference badges for entrance.** **Free entrance from 6pm until close (approximately 8 p.m.).**

Wednesday: July 12, 2017

MORNING REGISTRATION DESK OPEN 08:00 – 13:30 (Foyer, Campus Karlsplatz, Building: Karlsplatz 13, 1040 Vienna)
AFTERNOON REGISTRATION DESK OPEN 14:00 – 17:30 (Foyer, Campus Gusshaus, Gusshausstrasse 27-29, 1040 Vienna)

07:15 to 08:30 ISSS Roundtable Discussion (Bertalanffy Center for the Study of Systems Sciences *Paulanergasse 13, 2nd Floor, 1040 Vienna, Austria***).**

08:45 Plenary Session (Campus Karlsplatz, Karlsplatz 13, 4th Floor)	
08:45	Day 3: From Public Health to Health Systems
	Moderator: Prof. Dr. Felix Tretter
09:00	KEYNOTE Science: Dr Patricia Mabry (3257) – Systems Science and Health: Making a Difference in the 21st Century
09:30	KEYNOTE Practice: Dr Clemens Martin Auer – Challenges for the Health Care Systems from the Austrian Ministry of Health Perspective
10:00	KEYNOTE Science: Professor Gerald Midgley – (3149) Systems Thinking for Community Involvement in Public Health and Health Service Design
10:40	Questions for Speakers
10:55 – 11:25 Tea/Coffee (Campus Karlsplatz, Karlsplatz 13, 3rd Floor Foyer)	
11:25	KEYNOTE Practice: Dr Fredmund Malik – (3246) Meta-systems as Master Controls of Management, Leadership and Governance
11:45	Health Panel Session
	Speakers:
	Dr Niki Popper – Development and Implementation of Methods for the Decision Support in the Austrian Health Care System
	Dr Josef Probst – Challenges for the Health Care Systems from the Perspective of the Main Association of Austrian Social Security Institutions
	Professor Dr Markus Schwaninger (3240) – For a Viable Health Care System
	Professor Dr. Dr. Dr. Felix Tretter – (3148) "Understanding" Health Care– Supradisciplinary Options of Systems Science
12:30	Connect and Converse with the Speakers
13:00 Lunch (Campus Karlsplatz, Karlsplatz 13, 3rd Floor Foyer)	

14:00 to 15:30 Parallel Sessions - July 12, 2017 – Campus Gusshaus, Gusshausstrasse 27-29, 1040 Vienna

1	2	3	4	5	6
Room: SR121 **SIG: Designing Educational Systems** **Chair: Peter Tuddenham** **3155** Systematic Thinking in Science Education *Min-hu Shim* **3177** Assessment of Systems Thinking and Systems Analysis Skills in Higher Education: the Case of a Sustainable Resource Management Program. *Kasperidus, Hans Dieter* **3159** A Study on the Career Choice of Late Adolescents in Republic of Korea *Sim, SeYoung*	**Room: SR124** **WORKSHOP** **MacNamara, Delia Pembrey** **3182** The Boundary Triage, Its Objects and Heuristics: Developing Critical Systemic Leadership for the Networked World *MacNamara, Delia Pembrey*	**Room: SR125** **WORKSHOP** **Chair: Stuart Umpleby** **The Influence of History and Culture on Science and Technology** **3190** Advancing Knowledge By Looking Up as Well as Down *Umpleby, Stuart A.* **3144** The Influence of History and Culture on Science and Philosophy – JJH Perspective for 20 Questions *Hu, Jason Jixian*	**Room: HI 8** **SIG: OTSC** **Chair: Louis Klein** **3128** Pilot Case Study: How Two Non-profit Education Foundations Use Social Media to Support Systemic Engagement *Rosencrans, Kendra* **3107** Grounding Transformation in Articulation *Stary, Christian* **3162** A Cybernetic Approach for Changing Vehicular Circulation from Difficult to Smart in Cities of Developing Countries *Rojas-Ramirez, Jorge; Badillo-Piña, Isaías; Trentesaux, Damien*	**Room: SR384** **SIGs: Health and Mental Health** **Chair: Chair(s) Thomas Wong and Pamela Buckle** **Health and Systems Thinking** **3135** Proposal of a Capability Maturity Model for Health and Productivity Management *Takehara, Tomoko; Shirasaka, Seiko* **3166** Proposal of Visualising Model of Customer Demands Sufficiency Degree in Designing Private Life Insurance *Taketani, Fumii; Kobayashi, Nobuyuki; Shirasaka, Seiko; Toma, Tetsuya* **Systems & Mental Health** **3009** An Attempt to Epistemologically Ground Current Psychotherapy. Neither Between Nor Within: On the Eigenform and Viability of Human Complex Systems. *Cheli, Simone*	**Room: Kontaktraum** **DISCUSSION:** **Health Systems** **Continuing Morning Plenary and Panel Discussion:** **From Qualitative to Quantitative Systems Methods and Interventions in Health Care Systems** **Felix Tretter** Patricia Mabry Clemens Martin Auer Gerald Midgley Niki Popper Josef Probst Markus Schwaninger

14:00 to 15:30 External Workshop
Bertalanffy Center for the Study of Systems Sciences *Paulanergasse 13, 2nd Floor, 1040 Vienna*.
By Invitation Only
Part I: Joint Workshop with the Austrian Ministry for Transport, Innovation and Technology on Smart Cities Research
Stefan Blachfellner

15:30 Tea/Coffee (First Floor of Campus Gusshaus and Poster Viewing)

16:00 – 18:00 Parallel Sessions – July 12, 2017 – Campus Gusshaus, Gusshausstrasse 27-29, 1040 Vienna					
1	**2**	**3**	**4**	**5**	**6**
Room: SR121 **SIG: Designing Educational Systems** **Chair: Peter Tuddenham** **3076** The Provide-Pickup Paradigm: The Cornerstone in a General Systems Framework for Agency and Governance in Social Systems *Gabriele, Susan Farr* **3179** Pattern Literacy in Support of Systems Literacy: Learning to Find the Patterns and Create the Models That Represent Systems in Words and Pictures *Helene Finidori, Peter Tuddenham* **3160** Modes of Analogy "What Human Cognitive Abilities Capture Structures from the World?" *Lee, Suehye; Shirasaka, Seiko* **3170** System Thinking Is Not for Everyone – from the Bell Curve 2.0 to the Multi-Level Approach to System Thinking Education *Hu, Jason Jixuan*	**Room: SR124** **WORKSHOP** **3183** Six Degrees of Bertalanffy or Social Media for Scholars *Rosencrans, Kendra; MacNamara, Delia Pembrey*	**Room: SR125** **SIG: Research Toward a General Theory of Systems** **Chair: David Rousseau** **3113** Towards a Generative Formulation of Mechanistic Systems *Natarajan, Swaminathan; Kumar, Anand* **3116** Theoretical Aspect of Systems Methodology for Knowledge Management *Yoshida, Taketoshi* **3089** What Does Constructor Theory Construct? - Knowledge as a Physical Property *Malecic, Aleksandar*	**Room: HI 8** **SIG: OTSC** **Chair: Louis Klein** **3082** Emerging Properties of the Fueguinian Industrial Technological Sector *Gessaga, Tariana Maia* **3090** From Hierarchies to Networks: Changes in Organisation of Public Service Delivery *Kokeš, Richard* **3105** Strategic Alliances Between Independent Participants *Frias, Ricardo Andres* **3244** Paying Attention to the Emotions in the Processes of Change using the VSM *Barrero, Ricardo*	**Room: SR384** **SIG: Critical Systems Thinking** **Chair: Barbara Schmidt-Abbey** **3014** Critical Systems Thinking and Engaged Community Operations Research in Action: An Application to Promote Peace Among Urban and Rural Communities *Pinzon-Salcedo, Luis Arturo* **3024** Developing a Systemic Evaluation Methodology: an Approach Towards Social Program Evaluation *Torres, Maria Alejandra* **3049** From 'Systematic' to 'Systemic' Research and Policy Analysis – Progressing the Application of Systems Approaches to Policy Evaluations at a European Union Research Agency (Eurofound) *Schmidt-Abbey, Barbara* **3031** Green Decision Making: Sustainable Transport and Systemic Planning (SP) *Leleur, Steen*	**Room: Kontaktraum** **WORKSHOP** **Health Systems** **Continuing Morning Plenary and Panel Discussions** **Felix Tretter** Dexhelpp –Decision Support for Health Policy: Methods, Models and Technologies based on Existing Health Care Data to Support the Analysis, Planning and Controlling of the Health Care System *Niki Popper & Dexhelpp Team Members*
16:00 to 18:00 External Workshop – By Invitation Only Bertalanffy Center for the Study of Systems Sciences *Paulanergasse 13, 2nd Floor, 1040 Vienna.* **Part II: Joint Workshop with the Austrian Ministry for Transport, Innovation and Technology on Smart Cities Research**					
18:15 Kontaktraum, 6th Floor Gusshausstrasse 27-29: COUNCIL MEETING for SIG Chairs, Board and Past Presidents. Nibbles available.					
19:30 Evening					
19:30 – 21:00	**Workshop -- Evening with Nora Bateson** Bertalanffy Center for the Study of Systems Sciences *Paulanergasse 13, 2nd Floor, 1040 Vienna.*				

Thursday: July 13, 2017

MORNING REGISTRATION DESK OPEN 08:00 – 13:30 (Foyer, Campus Karlsplatz, Building: Karlsplatz 13, 1040 Vienna)
AFTERNOON REGISTRATION DESK OPEN 14:00 – 17:30 (Foyer, Campus Gusshaus, Gusshausstrasse 27-29, 1040 Vienna)

07:15 to 08:30 ISSS Roundtable Discussion (Bertalanffy Center for the Study of Systems Sciences *Paulanergasse 13, 2nd Floor, 1040 Vienna, Austria***).**

08:45 Plenary Session (Campus Karlsplatz, Karlsplatz 13, 4th Floor)	
08:45	Day 4: From Living in Smart Cities to Sustainable Agriculture and Environmental Economy
	Moderator: Mag. Stefan Blachfellner
09:00	KEYNOTE Practice: Mag. Dominic Weiss – (3147) Smart City Wien – a Systemic Solution in a Systemic World
09:30	KEYNOTE Science: Dr Ian Banerjee – (3254) Impact of Autonomous Vehicles on the Digital City of the Future
10:00	KEYNOTE Science: Dr Robert Dyball – Urban and Regional Studies in Human Ecology Research
10:30	Questions for Speakers
10:45 – 11:15 Tea/Coffee (Campus Karlsplatz, Karlsplatz 13, 3rd Floor Foyer)	
11:15	Ecosystems Panel Session
	Speakers:
	Dr Ramesh Kumar Biswas – Holistic Urban Rejuvenation and Smart Cities
11:45	Professor Ockie Bosch – The Evolutionary Learning Labs in Urban and Regional Developments
	Dr Ing. Christian Walloth – Understanding Complex Urban Systems in Order to Develop Urban Design Strategies
	Thomas Fundneider – Developing the City from the Inside Out: Purpose-Driven Enabling Spaces
	Professor Ray Ison – Empirical, Theoretical and Systemic-Design Research: How to Act in a Climate-Change World
12:00	Connect and Converse with the Speakers
12:30 Lunch (Campus Karlsplatz, Karlsplatz 13, 3rd Floor Foyer)	

14:00 to 15:30 Parallel Sessions - July 13, 2017 – Campus Gusshaus, Gusshausstrasse 27-29, 1040 Vienna					
1	2	3	4	5	6
Room: SR121 **WORKSHOP** **3241** Strengthening the Resilience of Aging Societies' *Sankaran, Shankar; Chroust, Gerhard*	**Room: SR124** **WORKSHOP** Socio-Ecological Systems Research meets Human Ecology Research Continuing Morning Plenary and Panel Discussions Moderated by: *Felix Tretter and Stefan Blachfellner* Presented by the BCSSS.	**Room: SR125** **SIG: SABI** **Chair: Andreas Hieronymi** **3056** Systems Models of Leadership *Metcalf, Gary; Daniel, Teresa* **3102** A Framework for Complex Problem Solving Based on Systems Thinking and Design Thinking *Hieronymi, Andreas* **3132** Can Counterfactuals Help to Enhance the Systemic Thinking of Managers? *Kozak, Yulia*	**Room: HI 8** **SIG: Socio-Ecological Systems** **Chair: Jeffrey Robbins** **3025** Emerging Technologies & Community Resilience (ETCR) *Duque, Richard B* **3035** The Entropocene *Robbins, Jeffrey H.* **3048** Geospatial Assessment of forest Biomass Towards Potential Redd+ Initiative for Sustainable Ecosystem *Sharma, Laxmikant*	**Room: SR384** **SIG: Spirituality and Systems** **Chair: Delia Pembrey MacNamara** **3124 Presentation** TheOAnthropocentric Era *Crespo, Fabiana* **WORKSHOP 1 Hour** **3085** What Is Consciousness *Crespo, Fabiana* **3084 Presentation** A Systemic Abundant Economic Model *Crespo, Fabiana*	**Room: Kontaktraum** **SIG: Critical Systems Thinking** **Chair: Clemencia Morales** **3042** Organisational Structuring: A Systems Approach *Morales, Lilia Clemencia* **3172** The Future of the Peruvian Natural Gas Through the Study of the Power of Influence of Stakeholders: Alternate Scenarios using Social Network Analysis with a Soft Systems Approach *Rodriguez-Ulloa, Ricardo* **3171** Thinking-Activity Scheme as a Communication Bridge Between Systems Thinking and Systems Practice *Maracha, Viacheslav; Reut, Dmitry; Baranov, Pavel*
15:30 Tea/Coffee (First Floor of Campus Gusshaus and Poster Viewing)					

16:00 – 18:00 Parallel Sessions – July 13, 2017 – Campus Gusshaus, Gusshausstrasse 27-29, 1040 Vienna					
1	2	3	4	5	6
Room: SR121 **SIG: Balancing Individualism and Collectivism** **Chair: Janet McIntyre-Mills** **3007** Designing a Policy Response to Populism and the 'Wicked' Issue of Exclusion, Unemployment , Poverty and Climate Change *McIntyre-Mills, Janet* **3008** What Is Problem Represented to Be: Water Scarcity, Water Mismanagement Or Misdirecting the Systems? The Wicked Problem of Water Management in Nauli City – Indonesia *Simbolon, Jackwin; McIntyre-Mills, Janet* **3065** Enhancing the Role of Education in Saudi Secondary Schools: A Critical Systemic Approach to Address Policy and Governance Challenges *Algraini, Saad; McIntyre-Mills, Janet*	**Room: SR124** **WORKSHOP** **The System of Accounts for Global Entropy Production, (SAGE-P): The Accounting of Entropy Production in the Digital Age** Part 1: The theoretical foundation of SAGE-P, *Anthony Friend* Part II: The 'big data' algorithm to construct SAGE-P. *Anthony & Michèle Friend* Part III: The policy algorithms constructed from SAGE-P introducing the Policy Compass for Sustainability, (i.e., minimise the rate of entropy production per unit of consumption), *Michèle Friend.* **Abstracts:** **3215** A System of Accounts for Global Entropy Production *Friend, Anthony; Friend, Michele* **3030** A Policy Compass for Ecological Economics in the Digital Age *Friend, Michèle*	**Room: SR125** **SIG: SABI** **Chair: Andreas Hieronymi** **3064** Innovation as a Strategic Tool: Analyzing the Innovation Types of Most Innovative Companies *Kaygisiz, Esra Gokcen* **3016** Transdisciplinary Research: Methodological Insights in the Emerging Study of Sustainability in Project Management *Pasian, Beverly; Silvius, Gilbert; Sankaran, Shankar* **3036** Complementarity Model of the Organizative System Among Micro, Small and Medium-Sized Tourist Enterprises of Mexico, in a Changing Environment *Sánchez-García, Jacqueline Yvette; Tejeida-Padilla, Ricardo; Morales-Matamoros, Oswaldo; Núñez-Ríos, Juan Enrique; Rojas-Ramirez, Jorge Armando;* **3041** Soft Systems Methodology and AHP to Develop a Conceptual Model for Human Capital Management in Mexican Lodging SMEs *Núñez-Ríos, Juan Enrique; Tejeida Padilla, Ricardo; Badillo-Piña, Isaias; Sánchez-García, Jacqueline Yvette; Morales-Matamoros, Oswaldo; Moreno-Escobar, Jesus Jaime.*	**Room: HI 8** **SIG: Socio-Ecological Systems** **Chair: Felix Tretter** **3091** Performance Management in the Public Sector: The Urgent Need for a Paradigm Shift *Neef, Monika de* **3083** Embracing the Complexity: Multiple Interests and Debated Resolutions in the Pineapple Value Chain in Uganda *Tröger, Katharine; Lelea, Margareta Amy; Hensel, Oliver; Kaufmann, Brigitte* **3106** A Systems Theory of Human and Land Transformations: Systemic Analysis of Land Use Changes and Dynamics in the North-West of Pichincha, Ecuador. *Bokelmann, Wolfgang; Coral, Claudia Stephanie* **3130** Energy and Water in the Earth System: An Integrated Modelling Approach *Breach, Patrick*	**Room: SR384** **SIG: Critical Systems Thinking** **Chair: Pam Sydelko** **3175** From Communities of Practice to Boundary Critique: An Extended Approach *Barros-Castro, Ricardo Abad* **3181** The Boundary Triage, Its Objects and Heuristics: A Synopsis of the development of a Critical Systemic Leadership Development Toolbox for a Networked World *MacNamara, Delia Pembrey* **3019** A Systemic Integration Approach to Designing Interagency Responses to Wicked Problems *Sydelko, Pamela*	**Room: Kontaktraum** **SIG: Systems Philosophy** **Chair: David Rousseau** **3156** The Construction of Sustainability: Study on Production of Knowledge in Social Ecological Systems *Yiyu Liu* **3157** Constructivist View of System in System Dynamics *Fan, Dongping; Fu, Qiang* **3207** From Certainty to Wisdom: The Contribution of Dynamic and Integrative Epistemology to Systemic Leadership *Bigirimana, Stanislas* **3139** System-Purpose Method: Theoretical and Practical Aspects *Dursunov, Ramil*

16:00 to 18:00 External Workshop
Bertalanffy Center for the Study of Systems Sciences *Paulanergasse 13, 2nd Floor, 1040 Vienna.*
SIG: Health and Systems Thinking
Chair: Thomas Wong
3186 – Health and Systems Thinking SIG Discussion Panel
Wong, Thomas Sui Leung; Smith, Gary; Daniel Allegro, Brigitte; Burleson, Deeanna; Huang, Yan E.C.

19:00 Evening	
18:30 – 20:00	**ISSS Annual General Meeting** **Drinks and Finger Food** **Gusshaus 27-29, 1040 Vienna, Room: 6th Floor Kontaktraum** .
Dinner available at nearby local restaurants	

Friday: July 14, 2017

MORNING REGISTRATION DESK OPEN 08:00 – 13:30 (Foyer, Campus Karlsplatz, Building: Karlsplatz 13, 1040 Vienna)

07:15 to 08:30 ISSS Roundtable Discussion (Bertalanffy Center for the Study of Systems Sciences *Paulanergasse 13, 2nd Floor, 1040 Vienna, Austria***).**

08:45 Plenary Session (Campus Karlsplatz, Karlsplatz 13, 4th Floor)	
08:45	Day 5: From Science to Innovation to the Development of Society Moderator: Dr Alexander Laszlo
09:00	KEYNOTE Practice: Gerfried Stocker – ARS Electronica: Re-inventing Art, Technology and Society
09:30	KEYNOTE Practice: Dr Harold (Bud) Lawson, INCOSE Fellow – (3253) Thinking and Acting in Systems
10:00	REPORT Practice: Dr Javier Calvo-Amodio – (3142; Full Paper 3191) Creating Systems Sensibility in At-Risk Middle Schools: an Oregon State University Science & Math Investigative Learning Experiences Project

10:30 – 11:00 Tea/Coffee (Campus Karlsplatz, Karlsplatz 13, 3rd Floor Foyer)	
11:00	REPORT Practice: Peter Tuddenham – Systems Literacy
11:15	Professor Ray Ison and Dr Gary Metcalf – International Federation for Systems Research (IFSR Report)
11:45	Student Panel PhD Programme Reporting – Chris Blackmore, Professor Ray Ison, Professor Ika Darnhoffer, Professor Nadarajah Srikandarajah
12:00	Dr David Rousseau – (3195) Innovation and Optimization in Nature and Design: Key Focal Areas for Breakthrough Advances in Systems Science, Engineering and Practice? Incoming Presidential Address

12:30 Lunch (Campus Karlsplatz, Karlsplatz 13, 3rd Floor Foyer)

14:00 – 17:00 Paper Sessions (Campus Gusshaus, Gusshausstrasse 27-29, 1040 Vienna)	
Room: Kontaktraum **3111** A General Systems Outlook to the Prediction-Inference Dilemma of Neuroscience Models. *Sharma, B. Lungsi* Followed by a General Discussion of ISSS2017 and Feedback for ISSS2018	**Room: Bertalanffy Center, Paulanergasse 13, 2nd Floor, 1040 Vienna.** **PhD Graduate Programme** **Final Wrap-up for programme participants.**

16:00 Close of Conference

.

List of Abstracts

(Paper numbers in parentheses)

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WORKSHOP ABSTRACTS

Plenary Abstracts

3136

SUSTAINABLE DEVELOPMENT IN BUSINESS NETWORKS - THE ECOLOGY OF DIALOGUE AND NARRATIVES IN MANAGEMENT

Brugman, Olaf

The presentation shows how dialogue, understood as an exchange of views and ideas to find solutions for specific issues, and narratives are drivers for sustainable business development in and by organisational networks. Sustainable development and inclusive business are required for business to maintain its social license to operate, both in a physical and in a social sense. Developing business in a sustainable way regards challenges and solutions that go beyond the sphere of control of individual businesses. Effective stakeholder dialogue development builds narratives that influence and enable actors. They are essential both as a business intelligence tools to develop the business in its identity, strategy and operations, and also to design and realise physical, economic and social environments in which business can thrive in a legitimate and inclusive way.

This is demonstrated by practical examples in the areas of green finance, sustainable agriculture and in a policy dialogue between government, business and civil society on good land governance in the Netherlands.

System dynamics models on learning, development, intercommunity relationship dynamics, ecology, mind (Gregory and Marie Catherine Bateson) and management cybernetics (Stafford Beer, Raul Espejo, Fredmund Malik, Markus Schwaninger) are used to discuss the role of dialogue in non-hierarchical organisational networks. Also, a case study on sustainable soy supply chains will be presented on how management cybernetics' concepts and tools were used to stimulate dialogue and to use its fruits to design better sustainable business systems, using Malik Super Syntegration technology.

The presentation draws conclusions on what system science can contribute to designing effective dialogues for collaborative change in organisational networks. And it suggests how experiences from business practice may inspire further dialogue and narrative-centered development of viable systems science and management cybernetics.

3137

SMART CITY WIEN – A SYSTEMIC SOLUTION IN A SYSTEMIC WORLD

Weiss, Dominic

Smart City Wien is a long-term initiative by the city of Vienna that looks at a cross-section of the city, covering all areas of life, work and leisure activities in equal measure, and includes everything from infrastructure, energy and mobility to all aspects of urban development.

Smart City Wien defines the development of a city that assigns priority to, and interlinks, the issues of energy, mobility, buildings and infrastructure. In this, the following premises apply: radical resource preservation, development and productive use of innovations/new technologies and high and socially balanced quality of life

Vienna's Smart City strategy is characterised by both an internal effect to render existing plans even more ambitious and to inspire new ideas. At the same time, its external effect is to create an international frame of reference for what is happening here and to generate publicity for Vienna's aims.

The time horizon of the framework strategy extends to 2050, since the necessary and often fundamental changes in the fields of energy, mobility or construction cannot happen overnight. The thematic arc stretches from the future of Vienna as a hub of research and business to the preservation of all-important social achievements. Concrete methods of application must still be developed in many areas – but the direction is clear: Vienna wants to pursue an integrated goal for its Smart City where everyone can benefit from synergy effects and continually team play.

It is the key goal of Smart City Wien for 2050 to offer optimum quality of life for all citizens - combined with the highest possible resource preservation. This can be achieved through a holistic approach, which is the beating heart of our city and also the reason, why the Smart City Wien is an important systemic solution in a systemic world where everything is connected.

3142

CREATING SYSTEMS SENSIBILITY IN AT-RISK MIDDLE SCHOOLS: AN OREGON STATE UNIVERSITY SCIENCE & MATH INVESTIGATIVE LEARNING EXPERIENCES PROJECT

Javier Calvo-Amodio

The goal of this project was to increase systems thinking sensibility through an educational module. The module is composed of four lessons, each considering different aspects on how humans influence, and are influenced by, systems every day. The modules were developed as part of the requirements to complete a two-term course at Oregon State University: Industrial and Manufacturing Engineering Capstone Senior Design. The project was conducted in collaboration with the Oregon State University's Science and Math Investigative Learning Experiences (SMILE) Program. SMILE is a pre-college program at Oregon State University that helps lower-income, ethnic-minority, and educationally-underrepresented middle and high school students in rural Oregon pursue careers in science, technology, engineering, and math fields.

Rural Oregon teachers teach SMILE lessons to select middle and high school students in after-school clubs. Given the unique objectives and customers of SMILE, the module developed had to be: 1) comprehensive enough so students could achieve systemic sensibility, 2) simple enough for teachers to learn and prepare for each lesson in 30 minutes, or less, 3) simple enough for students ages 12 - 17 to understand, and 4) engaging enough that students would retain and utilize systems thinking skills as they progress through their education.

The final educational module contains the following four lessons:1) Defining a System, 2) System Hierarchies, 3) Emergent Properties, and 4) Feedback Loops.

The effectiveness and efficacy of the module was partially validated following three validation methods: 1) SMILE program provided an approval of completion to validate module and lesson-based requirements, 2) Educator and student-based requirements were validated through a combination of lesson demonstrations, a systems thinking expert panel, and a teacher questionnaire, 3) fulfillment of the Capstone Senior Design Industrial and Manufacturing Engineering course.

The systems thinking educational module has been delivered to SMILE at the end of this project for distribution at Oregon's middle and high-schools. The sponsor finalized and published the module for SMILE clubs to use. The SMILE program has been tasked with tracking module use and feedback over time to ensure continued project success. As future work, a revision of the current four lessons is required, in addition to the development of a fifth lesson focused on the systems thinking concept of perspectives, which could further achieve systems sensibility for SMILE teachers and students.

3146

GOVERNMENT AND GOVERNANCE

Leonard, Allenna

Government is, properly speaking an outgrowth of governance built up over time as communities and societies codified norms to address the variety, or the complexity, of their circumstances. It is dependent on the consent of the governed – or at least a working plurality of the governed – whether such consent is obtained through social contracts and agreements or coercion.

In democracies, or near democracies, such consent is based on a minimal level of aspects of coherence about the identity, purpose and norms of the community. At present, this coherence appears to be undergoing a period of instability. The norms people grew up with, their everyday lived experience (especially of inequality) and the reflection they see of their concerns and priorities in the media appear to becoming less coherent for increasing segments of the population. This is not helped by deficiencies in public education in many countries that avoid mention of controversies, whitewash less admirable parts of their heritage and massively oversimplify their histories.

The result seems to be analogous to motion sickness and it seems possible that these mixed messages at least partially account for the polarization, tribalism, and cultural conflict we see today. The present agencies of government and norms of governance do not have requisite variety. The interlocking homeostats that keep our many systems in balance badly need retuning and perhaps expansion. Also, our means of public debate and dialogue have not kept up with the times.

As most of you know, the word cybernetics comes from the Greek word for steersmanship – an agency that works with wind, tide and current to reach a desired destination rather than fighting these forces. In practical terms, the cybernetic side of the systems science offers tools to surface assumptions, highlight the perspectives of multiple observers of a system and establish indices, often close to real time, that indicate the well-being of the system.

The tools I most often rely upon are Stafford Beer's Viable System Model, that indicates the necessary and sufficient managerial functions of survival in a system's contextual environment and the Team Syntegrity process that provides a conversation space for the sharing of multiple perspectives. Both, along with others, are contributions to the needed tools for democracy.

3148

"UNDERSTANDING" HEALTH CARE– SUPRADISCIPLINARY OPTIONS OF SYSTEMS SCIENCE

Tretter, Felix
Bertalanffy Center for the Study of Systems Science, Paulanergasse 13/5, A-1040 Vienna
Felix.tretter@bas-muenchen.de

Preface: This view is based on practice in hospital management *and* on social and economic research in health care.

1. *"Health"* is a state that is *one of the highest human values*, it cannot be represented sufficiently and validly in numbers or prices. This is also true for "*care*", that is based on *empathy* and *trust*. This dual epistemic problem also limitates Big Data approach!

2. *Health economics:* This field is overestimated in research, design and management of health care: If health cannot be measured like the number of cars sold, cost-effectiveness evaluations are very insufficient. Also mind: Health affairs exhibit market failure, information asymmetry etc.! Mind finally the terminology: *patient* is substituted by "*customer"* etc.

Health economics without *medical services research* is empty, and without epidemiology it is not grounded. In consequence, practice on micro-level (e.g. hospitals) in context of quality management results in improvements of health care service, but it can degenerate easily *to an industrial number-driven management.*

3. *The doctor-patient dyade:* This is the core structure and process, it is systemic in nature,
and is based mainly on communication, and not on money (i.e. *psychosocial process*).

4. *Options of Systems Science (s. Ludwig von Bertalanffy)*
Healthcare should be conceived as a *heterogeneous multi-layer* (culture, social, personnel, technology, finance etc.) and *multi-level system* (macro-, meso-, and micro-level).
=> Systems science is the appropriate framework for analysis, design and management of HCS, and it should have a *priority* comp. to indicator-driven approach of economics.
Systemes science also allows to integrate a *systemic concept of health and disease.*

5 *Conclusions:* System Thinking OF medicine (but also IN medicine) should be enforced in academic education!

3149

SYSTEMS THINKING FOR COMMUNITY INVOLVEMENT IN PUBLIC HEALTH AND HEALTH SERVICE DESIGN

Midgley, Gerald

In this presentation I will discuss the value of systems thinking, focusing in particular on the involvement of multiple stakeholders, including members of local communities, in decision making on complex health issues. I will outline a methodology for *systemic intervention*, which supports people in exploring values and boundaries for analysis, and offers methods for opening participation to members of local communities who may have no previous experience in planning or management. In principle, this is systems thinking for everyone; in practice, the boundaries of participation need to be the focus of critical and systemic exploration, given that it is usually impossible to involve literally everyone. Systemic intervention also emphasises the creative mixing of methods drawn from multiple paradigms, and this might involve quantitative methods from the traditional sciences sitting alongside systems approaches for service design to make intervention much more flexible and responsive to stakeholder and community concerns than it might otherwise be. This methodology will be illustrated throughout my talk with practical examples from my teams' projects on public health and social systems design in both the UK and New Zealand.

3168

INCLUSIVE SYSTEMIC THINKING SUPPORTING THE UNITED NATIONS 2030 SUSTAINABLE DEVELOPMENT AGENDA

Stephens, Anne; Lewis, Ellen D.

The Agenda 2030: Sustainable Development Goals, was endorsed by 193 countries in 2015 providing a policy for global development for the next 15 years to 2030. With an intention to "strengthen the means of implementation and revitalize the global partnership for sustainable development" (United Nations General Assembly., 2015), the SDGs encourages member states to adapt policies, practices and priorities to alleviate poverty, inequality, promote peace, produce ecological sustainable resource use, renewable energy provision and emissions reductions.

The Agenda 2030 is a gift to systems thinkers in its adoption of non-linear complexity providing practitioners and academics opportunities to promote alternate paradigms and work towards generating a socially just world. As Anne Stephens and Ellen Lewis work with the UN testifies, we are seeing the creeping recognition of a genuine need to engage with systemic thinking as an emerging paradigm from the global to place-based

scale. In 2016, Anne and Ellen teamed up with UN Women to develop an evaluation guidance: *The Inclusive Systemic Evaluation* and developed the 'GEMs' Framework for systemic and participatory intersectional analysis. In 2017, collaboration with UN Women and partnering multilateral agencies, trials of the Guide have commenced.

Anne and Ellen's presentation will focus on recent pilot work conducted in Guatemala, exploring the place-based, local responses to the SDGs and monitoring and evaluation mechanisms that contribute to the building of global governance systems in the Agenda 2030 era. They will introduce their

GEMs Framework (**G**ender equality, **E**nvironments, and voices from the **M**argins) in the context of evaluation to meet the reporting responsibilities of the 17th Sustainable Development Goal.

3195

INNOVATION AND OPTIMIZATION IN NATURE AND DESIGN: KEY FOCAL AREAS FOR BREAKTHROUGH ADVANCES IN SYSTEMS SCIENCE, ENGINEERING AND PRACTICE?   INCOMING PRESIDENTIAL ADDRESS

Rousseau, David

The increasing complexity of large systems engineering projects is matched by increasing risks in terms of cost, schedule and performance. Large civil engineering projects typically overspend by 100%, and defence projects by 50%. Two thirds of large IT systems projects fail, and on average the ones that succeed deliver about half of their planned value. Moreover, the acquisition cost of complex aerospace and defence systems is rising exponentially, threatening to overwhelm available budgets.

To address such issues the US National Science Foundation (NSF) and the International Council on Systems Engineering (INCOSE) have called for a strengthening of the scientific foundations of Systems Engineering, and in particular for a strengthening of Systems Science and the development of principles that explain the nature of complex systems. Such principles, and the science they would enable, could support the design of innovative, robust and elegant solutions to the complex challenges facing contemporary society. This applies not only to systems engineering but to all areas of systems practice including management, intervention and mediation.

Nature exhibits an immense diversity of systems that are highly complex, resilient, adaptive and ecologically balanced.   If we could distil the principles behind Natures' ability to innovate and optimize, we would understand the nature of complex systems in a principled way. Science has always proceeded from the study of Nature, but over the last few decades many academic fields have developed systems specializations in order to investigate the systemic aspects of their subject areas, e.g. systems biology, systems medicine, systems ecology, systems economics, systems psychology etc. In these areas there is a search for systems concepts and principles under such notions as design principles, organizing principles, channelling functions, and optimality principles.   In Systems Engineering, too, there is a growing interest in design patterns, optimization paradigms, and design elegance.

This broad progress provides an opportunity for these strands of work to be brought together in a collaborative effort to formulate general scientific systems principles as called for by the NSF and INCOSE.   The ISSS is well placed to co-ordinate such a response to this call.   The ISSS was founded on a vision to discover principles that apply to systems in general, and to co-ordinate communication between disciplines that could contribute to, or benefit from, such insights. The occurrence of isomorphically recurring patterns in naturalistic phenomena, in different contexts and across differences in scale and composition, suggested to the founders of the ISSS the existence of general principles underpinning the evolution of natural complexity.   Much progress in developing systems concepts, characterizing isomorphisms and formulating heuristic systems principles has flowed from this vision, in addition to the development of specialized systems theories and methods. Today, the cross-disciplinary isomorphisms suggest that the scientific principles presently emerging from specialised systems fields can be generalized and integrated, to provide general scientific insights into Nature's capacity for innovation and optimization at all levels of complexity.   This could open the way to establishing the profound and integrated systems science we need to address the urgent challenges facing our world.

I invite you to help us seize this emerging opportunity, and to work together to develop collaboration networks and research teams that can realize this potential. The next Annual Meeting and Conference of the ISSS will be held 22-27 July 2018 at Oregon State University in Corvallis, and will bring together general and specialised systems scientists, systems engineers and systems practitioners to explore common interests and challenges, learn from each other, align and consolidate progress, and gather inspiration and momentum for future work in the systems sciences.

3196

APPLYING COMPLEXITY SCIENCES AND SYSTEMS THINKING FOR A DEEP DISRUPTION OF OUR ECONOMIC SYSTEM

von Mitschke-Collande, Joséphine

Disruption is the buzzword of our times, technological innovations, new business models, new entrepreneurs, new consumers, new indicators are all supposed to change the way our economic system works. Very often these are promoted as the long awaited silver bullet solutions capable of addressing the complex, interlinked socio-economic-environmental conundrums of our times.

In particular, alternative ways of living, as well as entrepreneurial visions developed in niches and subcultures are praised for their potential of change for a more just and sustainable society. However, during their dissemination process they lose the capacity to impact effectively the root causes of our societal dysfunctions. Systemic hurdles prevent these initiatives to drive fundamental transformation, as very often they become themselves a mean for legitimizing the status quo and reinforcing unsustainable trends. The Sharing Economy has been praised for its disruptive capacity however Uber, Airbnb and Co. did not made the economy more environmental friendly or socially just, the opposite occurred it reinforced the unsustainable trend of the neo-capitalist economic system. Mechanistic approaches, frameworks rooted in management thinking, the focus on technological innovation and indicators are not sufficient to support the scale-up of potential disruptive initiatives. Systems thinking and complexity sciences perspectives have to be applied in order to recognize for instance the autopoietic (self-referential) character of the current economic system. Otherwise initiatives such as the circular economy, the energy transition and the universal basic income are at risk to lose their potential for deep disruption. New heuristics models need to be conceived and means to be found to strengthen these initiatives in the scale-up process. Only then a genuinely disruption capable of an innovative and large-scale societal transformation will be possible.

3208

SECURITY, ECONOMY AND DIGITIZATION

Prof. Dipl.-Ing. Johannes Goellner, MSc

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Regions and power, new framework of analysis for analysing the interactions and correlations of societal security, economical security, environmental security, public security and political security of our complex world are the existing and future challenges of governance and governmental requirement, especially under the view of existing and future technological opportunities or created by technological innovations that are profoundly affecting the dynamics of economic growth, promotion of democratic principles, and the protection of individual rights. Areas such as management, politics, economics, law, psychology, sociology are to be discussed extensively in connection, e.g. including health care, energy and environmental policy, banking and finance, disaster recovery, investment in research and development, homeland protection and diplomacy within ICT and its economic, political and social impact.

Smart Economy, digitalization of production, awareness and occurrences of risk in supply chain networks or/and in supply chain management have become more acute during the last years. The discussion of robustness in supply chain network in relation to innovative smart economy concepts is an ongoing discussion, especially in relation to how future supply chain network-infrastructures should be structured, centralized or decentralized. This has a direct influence on the development and the use of future smart economy solutions options.

Consequently, society and economy (enterprises, governments, NGOs and individuals) have to:

- develop new innovative frameworks and concepts of Strategic Human Resource Management (Labor 4.0) in relation to Digitalization of the Production
- predict and anticipate potential disruptions of central and decentralized supply chain networks in relation to potential events in order to design adequate avoidance and mitigation strategies, and emergency plans both for the public and the private sector based on accumulated knowledge and empirical best-practices.

Depending on the digitization of the production under the keyword Enterprise X.0, changes in the working world, in terms of social, economic, legal, economic and technological conditions, will occur. This has a direct influence on the development and shaping of future working conditions, a high level of service and the possible social changes in the working world and the interactions between human beeing-machine- society. Digitization also means speed, efficiency enhancement along the process chains and thus a significant impact on the future impact on people's health, productivity and performance.

3240

FOR A VIABLE HEALTH CARE SYSTEM

Schwaninger, Markus

University of St. Gallen, Switzerland Abstract

"Today's health system is not sustainable. It is not a system concerned with the care of patients. It is a system that is sick in itself. It is counterproductive, merely providing sickness at an ever higher cost." A growing wave of critiques of this kind raises doubts about our health care systems. Indeed, the logic underlying these systems has changed: from a humanistic logic of caring and empathy to an economic logic of maximizing revenue and maximizing profit.

How can an overall improvement of the health care system be achieved? We have to overcome fragmentation in thinking and action, and strive for a holistic system design, which is centered on the patient. The design must be integrative, following a transdisciplinary orientation. The system aimed for is grounded in a salutogenic orientation, not a disease orientation. It shows an increased emphasis of prevention, and is designed for more participation.

This is a mammoth challenge in strategic, structural and cultural terms. Cyber- systemic Organization enables solutions of this kind. We will refer to case studies to illustrate how our postulate can be fulfilled. One of these studies is an ongoing project that has evolved over 30 years: it is about the foundation and development of an Oncological Care System. The leading doctors, with me as a consultant, have designed and developed that system and led it to maturity. This collaboration in a congenial team was a secret of success. Today, the system under study is a network involving and integrating the main hospital ("Landeskrankenhaus"), plus 12 further hospitals and independent practitioners.

Some features of that project: At the beginning, the needs of stakeholders - patients, hospitals, medical staff, etc. – were analyzed carefully. Then, the interactions of all agents were modeled mainly with the help of two scientifically grounded methodologies, Organizational Cybernetics and System Dynamics. From there, a holistic system design evolved. We used novel and unorthodox ways in applying the two methodologies to systems design. The results have been extraordinary, and they stand the test of practice. These successes are measurable and have been documented in three publications coming out this year.

3246

META-SYSTEMS AS MASTER CONTROLS OF MANAGEMENT, LEADERSHIP AND GOVERNANCE

Malik, Fredmund

Institute of complexity management, St. Gallen, Switzerland

My approach to management differs fundamentally from conventional thinking which is mainly oriented on business and making profit. In contrast, I understand right and good man- agement as the function of society that enables its organizations and systems to function relia- bly according to their purpose – in all kinds of organizations. Management decisions and pro- cesses create purpose, orientation and structure in order to achieve results. In doing so, man- agement also fulfills societal and political responsibility, and also basic ethical values. The mas- ter controls in this sense are meta-systems and meta-models.

Today, management means mastering complexity on the basis of the complexity sciences, i.e. systems theory, cybernetics and bionics. It makes use of complexity itself, of self-regulation and self-organization, and of evolutionary processes for organizational learning, adaptability, change and transformation. Therefore our innovations in management offer fundamentally new solu- tions for shaping and leading organizations, for transformational change and its effective im- plementation.

Management systems are the evolutionary operating system for organizations

What operating systems are to computers by analogy, management is to organizations. We can see it as the societal and evolutionary operating system for organizations of all kinds and sizes. There is thus a functional continuum from the DNA in the biological cell, to computer operat- ing systems, to the human central nervous system and to management systems for organiza- tions. In order to work, meta-systems and models are needed to guide perception, thinking and acting in organizations.

3250 (3250)

MOVING BEYOND VALUE CONFLICTS: SYSTEMIC PROBLEM STRUCTURING IN ACTION

Midgley, Gerald

Value conflicts can become entrenched in a destructive pattern of mutual stigmatization, which inhibits the emergence of new understandings of the situation and actions for improvement. In extreme cases, such patterns can even lead to violence. This paper offers a new systems theory of value conflict, which suggests the possibility of three different strategies for intervention using problem structuring methods: supporting people in transcending overly narrow value judgements about what is important to them; seeking to widen

people's boundaries of the issues that they consider relevant; and attempting to challenge stereotyping and stigmatization by building better mutual understanding. Each of these three strategies is illustrated with practical examples from operational research projects on natural resource management in New Zealand.

Keywords: community operational research; conflict; critical systems thinking; natural resource management; problem structuring methods.

3252

EVERYTHING IS CHANGING, ESPECIALLY IN GOVERNANCE

Busek, Erhard

We are living in a time, which tremendous changed in these days. It was not only politically as you can see in Europe, Middle East, United States, Far East and so on, but also in the way, information is happening. These means not only fake news and other essentials, but also the fact, that we have a tremendous amount of information, which to consume is not too easy, but on the other side we are challenged to act and react quite quickly. As a former politician, I may say that his is one of the challenges for the political system, especially for democracy. That is the reason why some authoritarian parties and leaders are getting more support and the insecurity in general is starting. Even I may say that we might be in the beginning of a Third World War, because there is not any more declaration of wars or similar things. Terrorism is creeping in our societies and creating a lot of insecurity. Until now, we are looking for capacity to handle all these things, which is a great challenge for governments.

3253

THINKING AND ACTING IN TERMS OF SYSTEMS

Lawson, Bud

As society moves deeper and deeper into the digital age it becomes vital to understand the multiple aspects of the introduction of changes into our daily professional and personal lives as well as the communities in which we live. Developing this understanding is naturally related to education and training resulting in a systems perspective that can be productively put into practice at the individual, group and societal levels. In this presentation some concepts and principles, paradigms and models that can be used to promote the role of and interrelationship of science and engineering in innovation and societal development will be presented.

3254

IMPACT OF AUTONOMOUS VEHICLES ON THE DIGITAL CITY OF THE FUTURE

Banerjee, Ian

A stagnating industry, new mobility behaviours and a new wave of technological innovation are leading to a paradigm shift in the way cities conceptualize mobility. Autonomous vehicles are pieces of a bigger puzzle of the digital and connected city emerging in the 21st century. „Everything that moves will go autonomous" - this self-confident statement coming from Silicon Valley, indeed, promises an approaching socio-technical shift where the authority of human drivers will be replaced by millions of connected and autonomous machines, smoothly operating in the post-oil city without the fatalities and agonies of traffic. The author will speak about his ongoing research in a project called AVENUE 21 conducted at the TU Wien in cooperation with the Daimler Benz Foundation.

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COLLABORATION AS THE DRIVING FORCE BEHIND THE DEVELOPMENT OF CIRCULAR SOLUTIONS
Košir, Ladeja Godina
Technological, economic, social and environmental changes are more intensive and more interrelated than ever before. How do individuals adapt their lifestyles as consumers? What challenges do companies face in the course of the transformation of their business models? What kinds of solutions are being developed within cities, regions, and countries? What are the characteristics of the disruption faced by financial institutions? And, who are the leaders who can drive systemic changes towards the circular era?
The Circular Economy, a systemic concept that detaches production and consumption from natural resource constraints, promises significant economic, societal and environmental benefits. The economic benefit alone, according to the World Economic Forum, is estimated to represent a $4.5 trillion GDP opportunity by 2030 . The intention of the international community to move to a Circular Economy by 2030 is reflected in the UN's Sustainable Development Goals. The European Commission issued the Circular Economy Package in December 2015, having recognised the Circular Economy as one of the main means of improving Europe's competitiveness.

These approaches are centred towards a systemic shift in a vast range of interrelated domains. The circular transition can't be understood only as a multi-level process, but also as a coordinated effort happening in three heterogeneous, but interrelated social fields:
- Systemic change is happening in the transition from linear to circular economic models, where technological change acts as a given, exogenous driver that increases the possibilities for the design and implementation of ever more efficient models of production, consumption and interaction.
- Organisational changes take place at the micro-level: in organisations being productive, and in consumption units.
- However, we cannot imagine the circular transition to be achievable without recognising and actively dealing with the resulting cultural change.
The reinforcement of knowledge- and sustainability-related values and the corresponding narrative enables the development of abilities to collaborate and contribute to the creation of new value.

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FINANCIAL SYSTEM CHANGE - INSIGHTS FROM THE BLEEDING EDGE OF IMPACT INVESTING
Kleissner, Charly
The investing world seems to be stuck with Modern Portfolio Theory: a theory that is 65 years old; a theory that is clearly inadequate to address major systemic issues of our times - including climate change, social justice, inequality, and global poverty; a theory that conveniently calls these systemic issues externalities. Even though behavioral biases of investors have been acknowledged by a small minority of theoreticians - resulting in Behavior Portfolio Theory, a minor modification of Modern Portfolio Theory - there are no systematic attempts to include impact risk and return into a Post Modern Portfolio Theory, that would allow impact investing practitioners to understand the relationships, dependencies and causalities between impact risk & return, and financial risk & return, the dependencies between asset classes and impact themes.
One of the major hurdles of enabling researchers to examine these dependencies is lack of adequate data. Toniic, the global network of action oriented impact investors has committed to working with multiple research institutions on longitudinal studies to develop new analytical frameworks and mathematical models which integrate impact management into their core, thus helping the advancement of Modern Portfolio Theory.
This data will enable researchers to answer important questions like: How do private investors interpret, measure and communicate their impact? What are the implications for their behavior? What is the role of investment time horizons, perceived financial risks, perceived impact? How do these aspects interact and what behavior do they drive? How strategic are investors in deciding when and how they engage in either traditional investing, sustainable investing, impact investing, or philanthropy?
This keynote focuses on insights from 15 years of being at the bleeding edge of impact investing and proposes opportunities for collaboration between impact investing practitioners and researchers with the clear potential of changing the financial system.

2995

A RE-ENVISIONING OF LEVERAGE POINTS USING POSITIVE PSYCHOLOGY

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System Science embraces complexity, models and acts upon systems, and has successfully developed tools to map out various factors and perspectives within a system. However, it tends to be reactive and problem focused in nature. It identifies leverage points in a system and places to intervene, but often fails to enable change to actually occur. Further, although System Science recognizes the importance of mental models as key leverage points, it lacks strategies to motivate people and bring about change. From a psychological perspective, the complexity that System Science identifies is overwhelming, undermining people's efficacy to even attempt to change. The methods tend to be inaccessible to those who would benefit most from them.

Meadows (1999) and others have suggested that individual paradigm shifts can happen in a millisecond, taking a single click in the mind or finding a new way of seeing. However to change the paradigms of whole societies is another matter—they resist challenges to their paradigms harder than they resist anything else. For instance, when a community has a certain paradigm, then an alternative paradigm is seen as inferior, even if that alternative would be more beneficial. The two paradigms are incomparable, because each side uses their own perspective to judge the other, thinking the other is "wrong".

We as academics are in the business of knowledge creation; this knowledge shapes our mental models. These mental models determine our interpretation of our reality (what we see and what we don't see) and govern our internal and external operating systems. To shift existing paradigms to those that are most adaptive, we need to be able to shift our operating systems and be able to motivate people to shift their mental models.

An interdisciplinary approach is needed, which directly addresses mental models, in a manner that makes people open to change. Positive psychology offers this needed perspective. The field has developed theories and methods to shift mindsets – from being closed and resistant to change to embracing and being open to new possibilities. In this presentation we will use theory and methods from positive psychology to uncover ways that we can shift deep leverage points. The science and knowledge from positive psychology can assist system scientists to help transcend paradigms, change mindsets, and enable people to let go and be more comfortable with not knowing. Through supporting people to shift mental models we can move from theory to making an impact in practice – systems thinking for everyone.

2996

FROM THE SCIENCE OF POSITIVE PSYCHOLOGY TO SYSTEMIC SOLUTIONS FOR EDUCATION: STRATEGICALLY USING LANGUAGE TO POSITIVELY IMPACT MINDSETS

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Positive education is a relatively new area which applies the science of positive psychology to education. It emphasizes well-being and academic achievement as complementary goals of education. Yet the educational context is complex and dynamic, and simplistic psychological interventions can be ineffective at best and harmful at worst when this complexity and the underlying structures of the system are ignored.

Systems science provides theories and tools that adequately recognize the complexity of educational systems. Yet although the field acknowledges that mindsets are a key lever for change, it lacks strategies to successfully shift those mindsets, many of which are formed and solidified through the adolescent years.

This presentation will illustrate how language provides one avenue for bridging the systems perspective with the science of positive psychology to positively impact mindsets at both individual and collective levels within educational settings. Language enables social interactions and provides a sense of meaning and connection amongst people. How a person speaks says a lot about who they are, where they are from, and the experiences they have had. Slight word changes can significantly change the meaning of a sentence or the tone of a conversation.

Notably, simple shifts in language play an important role in shifting an individual's mindset from resistance to

possibility, and in shifting a school's culture from welfare to well-being. Drawing on several case studies, we illustrate how the strategic use of a common, positive language offers a strategic approach for shifting individual and collective mindsets in a sustainable, positive manner.

2997

SYSTEMS SCIENCE GOES TO THE MOVIES: USING POSITIVE PSYCHOLOGY TO BRING SYSTEMS SCIENCE TO EVERYONE

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Positive psychology provides a platform for bringing systems science to life. The field has rapidly captured the attention of researchers, practitioners, policy makers, and the general public. We suggest that positive psychology can add value to systems science by making tools and theories more useable, practical, and engaging.

Positive psychology examines what makes a good life. The field has developed numerous interventions and strategies to help people thrive. However, there is a tendency to focus on individuals, ignoring the complex context in which the person resides. Systems science has much to offer to research and practice in positive psychology, and yet the terms and concepts can be inaccessible.

The creativity of positive psychologists can help make systems tools and theories more approachable. For example, the Pixar movie "Inside Out" illustrates multiple perspectives within and between each character (personified as joy, sadness, anger, fear, and disgust characters within each person's head), inter-relationships of the system (e.g., actions by the emotions impact how Riley behaves, and experiences impact the structure within Riley's brain), and unintended consequences of a given action. This workshop will illustrate how movies and other mediums can strip away jargon and illustrate key systems principles in a more accessible manner.

2998

POSITIVE SYSTEMS SCIENCE: BRINGING TOGETHER POSITIVITY, COMPLEXITY, AND TEMPORALITY

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Positive Systems Science (PSS) explicitly brings together the strength-based lens of positive psychology with the complex, holistic lens of systems science, with the ultimate goal of bringing about desired change that supports the wellbeing of human social systems. This presentation opens an interdisciplinary conversation about how positivity, complexity, and temporality come together.

The field of positive psychology focuses on positivity, including understanding and building happiness, the "good life", and optimal functioning in individuals, organizations, and broader communities. Among the psychological sciences, it is one of the most applied areas, successfully connecting with researchers, professionals, policy makers, and the general public.

Systems science incorporates complexity, considering aspects such as feedback, unintended consequences, dynamic associations, and changes that occur within any given system. It has developed a range of tools that can be used to understand and address the complexity of human life.

Underlying practice and research in both of these fields is temporality – how factors and events unfold, interplay, and change over time.

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

We will show how existing areas of research and practice reflect aspects of PSS, including youth development, organizational scholarship, public health, and social ecology. These examples illustrate the PSS framework and begin to link relevant areas of scholarship and practice.

2999 (3092)

A PRACTICAL APPLICATION OF CRITICAL SYSTEMS THINKING TO IMPROVE A BUSINESS INTELLIGENCE SYSTEM'S BUSINESS REQUIREMENTS

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Efficacious decision-making, requires relevant and intelligible information. Organisations implement business intelligence (BI) systems to provide employees timeously with the required information, to improve decision-making capabilities. Unfortunately, more than half of implemented BI systems fail.

A BI system is multifaceted. It has a strong technical dimension and must be developed adhering to stringent technical standards and quality criteria. A BI system also has a social dimension; the involved/affected people, business processes, management styles and organisational culture affect adoption rates. Literature that reflects on the success rate of BI systems agree that these systems are generally technically very good. Yet, users still perceive them as failing to realise business benefits. Designers and developers seem to fail in incorporating the social dimension; BI systems fail based on human/organisational issues, rather than lack of technical quality.

A new BI system should result in organisational improvement; BI aims to improve decision-making capabilities. However, it is challenging to determine *what* constitutes improvement. Users tend to restrict themselves within performance limitations of current systems/information when questioned regarding potential and expected improvement. They only request automation of current information. This is then incorporated in the business requirements specification of the new system. Nevertheless, users still expect tangible improvement, rather than mere automation. Subsequently, they are disappointed and perceive the system as a failure.

The researchers used action research (AR) to enrich the requirements elicitation phase of a BI system development project. They argue that BI designers/developers should embrace complementarism (e.g. methodological pluralism) to develop emancipatory systems that adhere to technical quality standards *and* realise business benefits, i.e. result in organisational improvement. Users should be guided to critically reflect on their requirements, and formulate requirements that will result in organisational improvement. To achieve this, the researchers applied critical system thinking (CST) principles to also include the social dimension of the BI system, and bring about organisational improvement.

The CST paradigm is committed to emancipation, critical awareness and complementarism; it developed as two separate strands, i.e. total systems intervention (TSI) and critical systems heuristics (CSH). TSI aims to facilitate complementarism and methodological pluralism. It recognises the value of combining different methodologies (possibly from different paradigms) to address different phases of an intervention. The CSH strand aims to promote reflective and discursive practice to surface innate characteristics and assumptions about a problem context that involved and affected stakeholders may be unconsciously unaware of.

This paper starts by discussing the theoretical concepts of the study, i.e. CST, TSI, CSH and BI requirements analysis. The remainder of this paper is then structured according to the AR phases. In the diagnosis phase the researchers identified an organisation that required a new BI system. It briefly discusses the organisation and the participants that were involved during the BI system's requirements elicitation phase.

The action plan is then discussed. Initially the organisation only requested the automation of an existing business process, and the gathering of existing information into a data warehouse to be used during decision-making. The researchers then suggested to also incorporate TSI to identify a methodology to (potentially) elicit additional business requirements that also incorporate the BI system's social dimension and result in organisational improvement.

Thereafter, the outcome of the actions taken is discussed. The TSI methodology was applied. The participants reflected on the TSI metaphors; the metaphor that best related to the organisational context suggested three potential methodologies to be applied during the requirements analysis phase. After evaluation of the suitability of these methodologies to elicit requirements a suitable methodology, i.e. CSH, was chosen.

The researchers then evaluate the outcome of this research. When compared to the initial request of the organisation, i.e. automation and data warehousing of existing data/information, a richer set of business requirements was elicited. However, it is noteworthy that the methodology that was ultimately applied in this research to elicit requirements, was the 'other' CST strand, i.e. CSH.

Lastly, the researchers reflect on this research and specify learning in terms of the identified area of concern, the underlying theoretical concepts of this study as well as the methodologies that was applied.

3000

SYSTEMIC CONSTRUCTION OF A SPACE LAUNCHING BASE IN MEXICO

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The Mexican State, educational institutions and research centers have made efforts to found organisms, programs and projects, in order to promote spatial technological development, which appear and disappear without reaching the objective for which they were founded.

In order to achieve technological development, it is necessary to integrate government-academia-industry, and it is the Mexican Space Agency, an agency of the Mexican State which is responsible for carrying out this activity; Nevertheless the Agency establishes what must be done to reach the technological development but does not mentioned how to achieve it. For this reason, designing a systemic model was proposed which allows the integration of scientific research in companies based on market goals, objectives and strategies.

The systemic model has three stages within which are five phases and within them are eight subphases: The three stages are: input (I); Box (B); Output (O); O = IB, that is, I and B can be adjusted to achieve O. Holding fixed I and O. B will have infinite solutions. Ideally B = O / I = 1 in practice will be less than 1. Therefore the systemic model for the development of the Mexican special system has infinite solutions.

It is proposed that spatial technological development begins with the construction of a spatial launch base as ground conditions exist for space launches and would attract different companies such as satellite constructors, space launchers, fuel producers, tourism services, etc.

Keywords: technological development, model, research, base, releases.

3001 (3021)

ASSOCIATIVE SYSTEM TO PREDICT STRUCTURES IN THE IONOSPHERE

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Communications are the most important part of our daily life. The ionosphere play an important role in communications due to the conditions of the ionosphere can affect severely the transmitting and receiving information. Therefore, we propose an intelligent system that can predict accurately structures in the ionosphere. We use a morphological associative model. The obtained results of effectiveness from the Leave One out, Hold Out and Ten-Fold Cross validation test were: 89.45%, 97.77% and 95.83%, respectively, when we use only the *max* memory because *min* memory showed a bad performance.
Keywords: Artificial Intelligence, Associative Memories, Pattern Recognition, Prediction, Ionosphere

3002

GENERIC EARLY WARNING SIGNALS FOR CRITICAL TRANSITIONS: AN ASSESSMENT OF THE SIGNALS' UTILITY AS A PREDICTIVE MANAGEMENT TOOL

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Complex systems range from business entities to the climate. Complex systems have tipping points at which a small perturbation can trigger a critical transition leading to an emergence at an alternate stable state. Although there are differences in the nature of complex systems, their behaviors exhibit universal characteristics as they near tipping points. Among such characteristics are common generic early warning signals that precede critical transitions. The signals include: critical slowing down in which the rate of recovery from perturbations decreases over time; an increase in the variance of the state variable; an increase in the skewness of the state variable; an increase in the autocorrelations of the state variable; flickering between different states; and characteristic spatial patterns, such as an increase in spatial correlations over time. Presence of such signals has significant management implications, as the identification of the signals prior to the tipping point could allow management to identify intervention points. Despite the applications of the generic early warning signals in various fields, such as studies on fisheries, semiconductor research, and studies on epileptic seizures, a review of literature did not identify any applications in the area of managing student program withdrawal at the undergraduate level in distance universities, hence the research gap. This area could benefit from the application of generic early warning signals because the program withdrawal rate amongst distance university students is higher than the program withdrawal rate at face-to-face conventional universities. The program withdrawal problem presents an existential crisis for distance universities especially since, in some jurisdictions, public funding is dependent on the volume of students who persist and complete their courses. The proposed generic early warning signals for critical transition are not without controversy. Some researchers have argued that the identification of variables to which the generic signals were applied can only be accomplished post hoc, and that in some of the analyzed case studies the generic early warning signals remained absent despite the critical transitions. This is referred to as false negatives. Literature also suggests that the risk of false positives exists, where the signals are identified despite the absence of a critical transition. This research assessed the generic early warning signals through an intensive case study of undergraduate program student withdrawal at a Canadian distance university. The university is non-cohort

based due to its system of continuous course enrolment where students can enrol in a course at the beginning of every month. The university's student population therefore consists largely of adult learners given its convenient system of asynchronous distance learning which allows students to pursue individualized study. The assessment of the signals was achieved through the comparison of the incidences of generic early warning signals among students who withdrew or simply became inactive in their undergraduate program of study, the true positives, to the incidences of the generic early warning signals among graduates, the false positives. Research findings showed support for the signal pertaining to the rise in flickering which is represented in the increase in the student's non-pass rates prior to withdrawing from a program; moderate support for the signals of critical slowing down as reflected in the increase in the time a student spends in a course; and moderate support for the signals on increase in autocorrelation and increase in variance in the grade variable. The findings did not support the signal on the increase in skewness of the grade variable. The assessment of the signals suggests that the signals, with the exception with the increase of skewness, could be utilized as a predictive management tool and potentially add one more tool in addressing the student program withdrawal problem.

3003

FROM SCIENCE TO SYSTEMIC SOLUTIONS

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Human imagination through mental processes of symbol manipulation in the mind produces a range of ideas for expression of thoughts in terms of a large variety of models for representations, communications, and prediction of events and states of parts of the **empirical** world such as the arts, entertainments, rules and regulations for coexistence in a society, explanatory hypotheses driven by curiosity such as the sciences and so on. This kind of thinking has been going on at all levels for facilitating survival, promoting development of human intellectual endeavours and trying to aid the construction of projects on a small, every day basis to large scale i.e. **engineering** driven by purposive activities of humans within social and technical scenarios.

This programme of work has been going on for millennia only the details changing, mostly through **paradigm** changes of concepts as the means for grasping parts of the world of interest. The last major change was the Renaissance, another is taking place now.

Pre Renaissance thinking, with the possible exception of Archimedes, had been by and large speculative along lines of philosophical contemplation, mysticism, superstition, religious beliefs etc. All kinds of thoughts had been acceptable until conventional science of physics entered the scene. Although conventional science had been propounding explanatory hypotheses of more or less generality, it only accepts those, particular instances of which can be verified by models resulting in falsification, or not, of the hypothesis itself. Mathematical models having been proved most suitable for this purpose.

Conventional **science** has been immensely successful in producing such hypotheses for the satisfaction of curiosity, discovering new materials and products, generating teaching schemes and affecting social changes. However, its theories are symmetrical in time, thus, it could just cope when faced with irreversibility, its invariants are restricted to qualitative and quantitative properties of a single, selected object involved in highly repeatable phenomenon, it operates in many domains and as such has failed engineering as a provider of knowledge base etc. A **paradigm** change beckons.

The question of **problem solving** in technical - social scenarios emerged in an organised manner for the first time during the 2nd WW when convoys of escorted ships crossed the Atlantic and moving enemy aircraft had to be shot down giving rise to operational research and control theory. The post WW period saw rapid, further development of interest in the 'systemic or structural view' evolving towards divers, speculative attempts with many ill defined models and approaches which currently still prevail.

This view rejected conventional science in its entirety branded as reductionist. The view of **new science of systems** retains science's methodology of problem solving and its structure of 'general principles plus models' but with 'systemic or structural content' for modelling and designing structures with multiple agents in static and dynamic states which constitutes a **paradigm** change and supplements current thinking.

The advantages of this approach are:

Based on the universality of the structural/systemic view.

Availability of operational models directly applicable to analysis and design of scenarios.

Accommodation of conventional science of physics in systems science resulting in a possible, unified view of the scientific enterprise.

Being part of and aiding conventional and systems engineering.

Accommodating effects of emotions, will, prejudices, ambitions etc. on activities of human beings.

Construction of novel teaching schemes to suit problem solving.

Modification of views on parts of knowledge such as chemistry.

Rooted in existing knowledge.

Adding linguistics to supplement mathematics as a symbolism for modelling.

Supplements mode of thinking by professionals and others in society.
The presentation describes the scheme of human intellectual endeavour and the 'new science of systems' in problem solving supplying material for sorely needed debate.

3007

DESIGNING A POLICY RESPONSE TO POPULISM AND THE 'WICKED' ISSUE OF EXCLUSION, UNEMPLOYMENT , POVERTY AND CLIMATE CHANGE

McIntyre-Mills, Janet

The scoping paper addresses unemployment as a complex issue, because it has many, diverse, interrelated variables that are perceived differently by different stakeholders (Flood and Carson, 1993).

It suggests a multiple mixed methods approach Romm, 2017) to inform policy development based on a policy process that re-presents the voices of diverse stakeholders (Hesse Biber, 2010), in order to inform a response that takes diverse views into account and strives to find a way to find overlaps in interests or to recognize spaces for difference.

The wicked nature of problems (Rittel and Webber, 1984, Mertens, 2015) such as climate change, poverty, crime or unemployment is that *a solution* for some stakeholders *causes problems* for others.

Thus the approach is **not** merely to *explore debates* and *either or* dilemmas, but also to explore the feedback loops of policy paradoxes or governance aporias that show the extent to which problems are systemically interconnected.

Often political complicities are involved in addressing unemployment in a world where divisions in life chances are associated with *growing inequalities between rich and poor* which are the result of **deliberate structural choices** made by **some at the expense of others**.

The paper builds on the argument developed in 'Planetary Passport' (McIntyre-Mills, 2017) and makes a plea for re-connection and re-membering our hybrid relationships with others and the land on which we depend. Developing a greater number of connections enhances consciousness (Greenfield, 2000, 2003, 2008). My research to date tests the extent to which mindfulness (based on enhancing the capability of people to think about our thinking) could help us to create closer bonds with others based on the realisation that we are interdependent and thus that we need to bridge differences. The notion of the Mobius Band from the string theory workshop hosted by Louis Kauffman (2002, 2016) provided a metaphor for understanding our interconnections and interdependence on living systems (see also McIntyre-Mills, 2008). Pragmatic recognition of this fact could be the basis for working co-co-operatively to draw on diverse practical cultural wisdoms based on experiential knowledge.

3008 (3054)

WHAT IS PROBLEM REPRESENTED TO BE: WATER SCARCITY, WATER MISMANAGEMENT OR MISDIRECTING THE SYSTEMS? THE WICKED PROBLEM OF WATER MANAGEMENT IN NAULI CITY – INDONESIA

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The paper delves into the area of concern of water scarcity in an area in Indonesia that we will call Nauli. A critical analysis addresses the social, cultural, political, economic and environmental context of the problem which reveals that the root of the problem is a misdirected system of managing water in the interests of profit for some at the expense of the majority and the environment. The paper addresses the social and environmental justice priorities of managing water effectively. The government regards water as a commercial good and prefers to sell it to the people rather than provide it as a common good.

This paper addresses the conflicts between governments and the challenges that have arisen with the water companies that commodify water while neglecting to maintain water quality and to provide services that also support and preserve the environment. This paper will examine the wicked problem of how to address the challenges of decentralization by ensuring that the needs of people are met by those who are elected and that the constitutional requirements of providing water are indeed addressed.

The WPRB approach is used to produce a map of the different ways in which the problem is represented, and propose a shift in the paradigm to address the water management problem through Ulrich's Critical Systems Heuristics (CSH).
Keywords: Wicked problem, water management, CSH, sustainability

3009

AN ATTEMPT TO EPISTEMOLOGICALLY GROUND CURRENT PSYCHOTHERAPY. NEITHER BETWEEN NOR WITHIN: ON THE EIGENFORM AND VIABILITY OF HUMAN COMPLEX SYSTEMS.

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In the last 15 years, psychotherapy has progressively faced with the ambition of reshaping foundative concepts and best practices. This trend seems to be coherent with the need for a theoretical integration psychotherapists are looking for, so as to epistemologically ground their discipline. From a constructivist perspective, two major biases seem to arise: (i) the paradox of seeking for a new framework through an old one (e.g. person-centered interventions within almost-reductionist models); (ii) the tendency not to question the superordinate assumptions of all the different topics (e.g. old-fashioned realism). The paper is mainly based on Heinz von Foerster's eigenform, Ernst von Glasersfeld's viability and Ludwig von Bertalanffy's general systems model and on the interconnection of these concepts with modern and contemporary psychotherapy from a

The present paper is devoted to describe a tentative framework that may foster the convergence on a superordinate epistemology and so a theoretical integration of psychotherapy. I claim that second-order cybernetics and radical constructivism offer an effective methodology in advancing psychotherapy, and that in turn psychotherapy is trying to absorb a few assumptions of this methodology. I also claim that complex system point of view may support the overcoming of ineffective dichotomies between personal and social psychology, normality and psychopathology, and so promoting a superordinate comprehension of human experience.

I first analyze the intertwined paths of Foerster's eigenform and Glasersfeld's viability through the lens of modern psychology and general systems theory. Subsequently, I define a theoretical model aimed to integrate this analysis and epistemologically ground psychotherapy. Finally, I describe the implications of such a framework in identifying, interconnecting and applying relevant threads in clinical practice.

The concepts of eigenform and viability lead to a versatile methodology in anticipating constraints and possibilities of human experience. I describe five foundative processes mainly based on the contiguousness and continuousness of observing systems, and on the epistemological irreversibility of life. I interconnect these processes with five recurrent dimensions of clinical psychology. These dimensions are discussed and defined as three epistemological principles and two transformational principles:

1. *Systemic Emergence*: the first epistemological principle tries to argue that from a theoretical point of view a system is the comergence of its observing processes, and from a clinical point of view human actively pursue a viable pattern of self-organization.

2. *Fluctuational Continuousness*: the second epistemological principle tries to argue that from a theoretical point of view a system is always a node, a relation, and a network, and from a clinical point of view social experience is a self-organizing source of individuation.

3. *Autopoietic Contiguousness*: the third epistemological principle tries to argue that from a theoretical point of view a system is the entanglement of selfhood and otherness, and from a clinical point of view personal experience is a structurally coupled embodied action.

4. *Constructive Irreversibility*: the first transformational principle tries to argue that from a theoretical point of view observing processes are non-balanced and irreversible, and from a clinical point of view experiencing is a dissipative and irreversible process.

5. *Constraining Imbrication*: transformational principle tries to argue that from a theoretical point of view observing events are locally collapsed and context-dependent, and from a clinical point of view agency is defined by informational closure and punctuation.

The thesis contributes to the complex systems research programme, by demonstrating its effectiveness in fostering psychotherapeutic integration. Although this is not the first attempt in doing this, it extensively debates and integrates the most of the recent clinical advances.

3013

MATURITY MODELS IN SYSTEMS RESEARCH AND PRACTICE

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In 2016, a team of scholars met in a gathering sponsored by the International Federation for Systems Research (IFSR), to discuss how systems research could support the increase of systems literacy worldwide. Members of this team developed a conceptual model of the role of systems research in developing such literacy. One consideration this model identified was that people engage with the "systems world" from the vantage point of numerous roles: systems scientist, systems researcher, system engineer, systems philosopher, etc.. Each of these roles demands particular competencies with respect to systems theory and

practice. Future research must be done to identify the competencies particular to each role. Alongside such research, there is a need to identify a maturity profile for each role – how we can assess the degree to which a person is effectively executing the competencies required to do good systems work.

Maturity models are utilized in several industries, in the attempts to cultivate and evaluate people's ability to effectively execute complex tasks . This paper will examine current thought about the value and pitfalls of maturity models. To further the IFSR 's work of promoting world class systems research, it will identify principles and exemplars that can guide the development of maturity models for the varied roles people take in the systems world.

Keywords: Maturity models, systems research

3014

CRITICAL SYSTEMS THINKING AND ENGAGED COMMUNITY OPERATIONS RESEARCH IN ACTION: AN APPLICATION TO PROMOTE PEACE AMONG URBAN AND RURAL COMMUNITIES

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The relationship between systems thinking and Community Operational Research (COR) has been controversial. This paper shows how the simultaneous use of systems thinking and COR can be used to learn across research community boundaries in order to improve the lives and collaboration among people of marginalized communities. It has been argued that COR's practice has a common concern: the meaningful engagement of one or more communities. Moreover, it has been pointed out that COR practitioners have been concerned with generating social improvement as well as designing new methodologies, methods, techniques and processes of engagement. In this paper we describe a research inquiry guided by critical systems thinking and COR in which members from different local and marginalized communities, collaborating with external researchers, conceived and developed a peace program that has been implemented in hundreds of schools and more than thirty cities, and that has affected the lives of the families and communities in which it has operated. This research program has fostered a culture of peace in social contexts in which cultures of violence used to prevail. The paper presents qualitative as well as quantitative evidence of the impact of the research inquiry. We show that the key elements to achieve these results have been the engagement of local communities and the use of critical systems thinking. The communities have participated in the understanding of the problematic situations to be addressed, as well as in the conception and design of alternatives to create meaningful improvements in these situations. This intervention has taken advantage of diverse systemic problem structuring methods (interactive planning, soft systems methodology, causal loop diagramming, etc.) and has used critical systems thinking, boundary critique, and critical systems heuristics. The combination of these methodologies and methods has allowed marginalized groups to express their ideas in safe and constructive environments. The continuous use of boundary critique during 14 years has allowed the communities to redefine the peace program several times, to question our understanding of what we mean by an engaged community, to increase people's participation, to address the complexity of the problematic situations, and to prevent less than fully responsible actions in these situations. The paper shows how the use of critical systems thinking and engaged COR can prevent some ethical research problems such as researchers' self-deception, groupthink, ignoring vital information, giving too much importance to the participants' self-interests, interpreting situations from inaccurate and narrow perspectives, and uncritical deference to authority.

3016

TRANSDISCIPLINARY RESEARCH: METHODOLOGICAL INSIGHTS IN THE EMERGING STUDY OF SUSTAINABILITY IN PROJECT MANAGEMENT

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The 'truths' of project management are changing with increasing attention being paid by practitioners and researchers on climate change and other public priorities. Projects and their management are recognized as "a way to sustainability" and sustainability is recognized as a developing theme in project management research. With the examination of the relationship between sustainability and project management increasing, a more detailed review of the associated research designs can now occur. The purpose of this research is to identify methodological insights that indicate and guide the transdisciplinary research in this field.

As sustainability is a topic that crosses several disciplines, such as physical sciences, natural sciences, ecology and social sciences, its research requires transdisciplinarity. Project management similarly crosses multiple disciplines as seen in papers concerning 'schools of thought' contributing to project management and

complex applied problems requiring innovative and novel approaches . Preliminary analysis of the methods of a 'sustainability school' indicate conceptual studies of an interpretive nature, giving meaning to how the concepts of sustainability could be interpreted in the context of projects, or of a normative nature, prescribing how sustainability should be integrated into projects.

Scholars in project management have also been urging project management researchers to use translational research by borrowing research methods from other disciplines. Research in sustainability requires systemic thinking and project management researchers would benefit from systems research approaches that also support transdisciplinary research. Scholars of systems thinking have also labelled issues arising from sustainability as 'wicked problems' and urged the use of systems methodologies in transdisciplinary research.

A systems approach to project management offers a framework that connects the change associated with an individual project (at a micro level) to an intermediate (or meso) level where the results of a particular project could address a larger societal issue (eg, climate change). Beyond this—at the 'macro' level—project managers can see how their projects contribute to not only the sustainability of the planet, but its thrivability. And its partly through the incremental work of project management researchers that a fourth stage of '*protopia*' can be described…one where nuances of societal progress could be as valuable (or even more) than the great leaps associated with traditional measures of project management success.

In this paper we will identify strategies used by researchers who have investigated sustainability in project management, describe specific methods, and propose how future research could be designed that can further evolve the field towards transdisciplinarity.

3019 (3251)

A SYSTEMIC INTEGRATION APPROACH TO DESIGNING INTERAGENCY RESPONSES TO WICKED PROBLEMS

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Wicked problems are open-ended, highly interdependent issues that cross agency, stakeholder, jurisdictional, political and geopolitical boundaries. This confounds governments because policies and budgets tend to be aligned within these boundaries and not across them, making it difficult to bring the appropriate talent, knowledge and assets into an interagency approach to tackling whatever wicked problem is at hand. This paper describes the development and implementation of a Systemic Intervention approach to designing government interagency meta-organizations to address specific wicked problems.

Many governments realize the need for a 'whole-of-government' approach to tackling large complex issues, and have employed various methods to achieve interagency and other private/public partnerships. One approach is to employ experts (sometimes called Czars) who are in charge of specific policies and can coordinate input from across government and private entities. Other organizational approaches have focused on forming high-level committees and task forces made up of representation from stakeholder organizations. These approaches are intended to increase cross-government information sharing, identify best-practices, and generate reports that include recommendations to policy makers. However, the formation of these vehicles can be ad hoc and not designed holistically to handle the complexity of wicked problems where interdependencies abound and the perspectives and values of agencies and other stakeholders can often be in conflict. Other complaints about forming these ad hoc groups include the slow, long-term process required to build trust; one agency typically takes the lead, creating problematic power relationships when their own inevitably partial perspective starts to override the perspectives of other agencies; difficulties of reaching agreement on crosscutting agendas; too many meetings; inaction in the face of the above difficulties; and missed opportunities.

The research described in this paper was conducted to develop and evaluate a new Systemic Intervention approach to designing interagency organizations. It is a multi-method approach that combines the viable system model (VSM) as the organizational design instrument with participatory problem structuring methods and boundary critique. The idea is to create interagency meta-organizations that are specifically aligned to the particular wicked problem they are charged with addressing. The VSM offers a valuable method for creating such interagency meta-organizations because it allows agencies to remain autonomous, while also being part of a larger complex systemic organization. It also offers ways to build adaptive mechanisms for dealing with the rapidly changing dynamics of wicked problems, and establishes protocols for interagency coordination and information sharing. In contrast, problem structuring methods facilitate the engagement of multiple agency stakeholders to structure and formulate an expanded and shared understanding of the wicked problem (which is then seen as the "environment" within the VSM), and boundary critique helps the participants to understand and address power relations when boundary decisions are being made.

This Systemic Intervention approach was evaluated through an action research project called *Crime on the Urban Edge* (CUE). CUE has been focused on designing an interagency as a complex adaptive system for countering illicit drug trafficking by transnational organized crime, U.S. urban gangs, and their potential for

systemic interaction. This is a wicked problem that crosses local/national/international agency divides. Although the action research was conducted in the specific context of CUE, the idea was to generate transferable knowledge about how the same or similar methods could be used for designing interagency meta-organizations more generally to better address wicked problems (e.g. urban sustainability, climate change adaption, terrorism, the energy/food/water nexus, migration issues, etc.). Preliminary results and lessons learned from the analysis of this action research will be discussed.

3020

LIMINAL CONSCIOUSNESS - A SYSTEMIC THEORY FOR "ALTERED STATES OF CONSCIOUSNESS"

De Pari, Manfred

Academic psychology focuses mainly on research regarding rational consciousness, while other forms of consciousness are first and foremost marginalized as 'altered states of consciousness'. The indication of 'altered states of consciousness' consistently reproduces: firstly the positing of rational consciousness as a primal given; secondly the fixation on a (consciousness)process as a state; thirdly the mistake, to characterize something as 'altered' which is defined by constant alteration; fourthly a dichotomization of 'normal' and 'altered', which conceals the ongoing reproduction of rational consciousness; and fifthly the suggestion that non-rational consciousness is epistemically inferior, illegitimate and deviant. This paper aims to make a contribution to solving those problems, by focusing central aspects of autopoietic systems theory and the fundamental term liminality, which are then combined to a new theory of non-rational consciousness. In this paper the term 'liminal consciousness' is used, which refers to forms of a psychic system that are less focused on points of reference, rather they converge to the limit of (temporary) omission of its autopoiesis. This concept is not thought of as a dichotomous category, but rather as a continuously increasing omission of the reproduction of self-referential structures. Three basic possibilities are identified, which can lead to liminal consciousness: a focus on self-reference, a focus on external-reference, or a short-circuit of concentration by focusing on the occurrence of thoughts. Within this framework many forms of consciousness, e.g. those 'invited' by ecstatic or meditative practice, can be conceptualized, without relying on religious, reductionist or mystic terms. This paper recommends the use of the term 'liminal consciousness' over 'altered states of consciousness', to improve the connectivity of communication within the scientific system.

3024

DEVELOPING A SYSTEMIC EVALUATION METHODOLOGY: AN APPROACH TOWARDS SOCIAL PROGRAM EVALUATION

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Evaluation is commonly seen as a systematic process to determine merit, worth, value or significance. When engaging in program evaluation, evaluators use research methods to systematically investigate the effectiveness of social intervention programs adapted to the political and organizational environment surrounding them. However, aside from having a systematic character, evaluation has at its core a systemic and a critical character as well, as it is based on the establishment of judgments and the inclusion of stakeholders, both of which inevitably affect what will be seen as an improvement. Critical in terms of not taking for granted predefined assumptions about the evaluation and systemic in terms of a dynamic attitude towards the establishment of what and who should be considered in the evaluation and the acknowledgment the existing relationships of those involved in the evaluation. Thus, the systems theory of boundary critique (about how to explore value and boundary judgements) is relevant. For this reason, we seek to propose a methodological development for conducting social program evaluations. Our methodological proposal, seeks to contribute at a theoretical and a practical level as we not only seek to present a methodology that can be widely applied in the realm of social program evaluation through a practical case but we also seek to contribute to enriching the literature that links systems thinking practice and evaluation, focusing primarily in the contributions that critical systems thinking can make to the practice of evaluation. We examine different stages of the evaluation process and show how boundary critique can be used in each one. A practical example will

be provided of an evaluation of a program for teaching alternative conflict resolution techniques to children in vulnerable areas of Bogota, Colombia.

3025

EMERGING TECHNOLOGIES & COMMUNITY RESILIENCE (ETCR)

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Modernity has increased the complexity of everyday life, exposing ordinary citizens to oftentimes imperceptible social and environmental risk. Integrated technological systems that leverage emerging sensor, computational and communication technologies, though, may allow individuals, organizations and communities to better understand, prepare for, survive and mitigate after micro, mezzo and macro hazardous events. Emerging Technologies & Community Resilience (ETCR) proposes to provide the knowledge, technology and expertise needed to create just this type of integrated system.

ETCR builds upon Sociological Theories of Action, Systems Theory, Information Theory, Computer Mediated Communication, and Social Construction of Technology perspectives as well as a novel theoretical framework, Systems of Accountability, to frame an applied, techno-sociological study of risk & resilience on university campus and their surrounding communities. An Action Research design, meanwhile, extends novel, inclusive and reflexive methodologies for studying complex system risks/hazards, which engages the collaboration of experts, researchers, administrators and community members in three international setting (Utica, NY, Concepcion, Chile and L'Aquila, Italy). Each of these settings experience varied types and intensities of environmental, social and health risk, while representing unique historical-cultural and relationships and socio-technical responses to these hazards.

While enhancing/developing new computational, communication and sensor technologies, ETCR identifies/creates and aggregates dynamic social and physical data from various social data and bio-eco sensor sources related to social, health and physical-environmental hazards. These sources energize an automatized algorithm of hazard probabilities, made visual to community members through Virtual (VR) and Augmented (AR) Reality to integrate the operations and maintenance of the three participating smart and connected, international communities.

The project proposes to accomplish these technological improvements and interventions, while considering broader social and cultural perspectives on how community members identify, evaluate, adapt to, and incorporate smart technologies to reduce risk and increase trust among community members. Enhanced data science technologies will provide interdisciplinary, applied collaborations with integrated methodologies to identify, analyze and mitigate dynamic, multi-level risk.

3027

UNDERSTANDING HUMAN ACTIVITY SYSTEMS: A STUDY USING SYSTEMS PRINCIPLES

Wang, Siqi; Calvo-Amodio, Javier; Rousseau, David

Heuristic methods have provided, to differing degrees of success, the means to design and manage the human activity systems that support the realization of engineered systems. However, as the complexity of engineering systems has increased, the effectiveness of the heuristic methods to design and manage the realization of the system has decreased. Furthermore, the constraints that heuristic methods inherently possess limit their evolution and the ability of systems and engineering managers to understand how emergence in human activity systems rises and how can it be managed. Von Bertalanffy argued that deriving a theory of universal principles applying to systems in general is imperative. Considering that human activity systems are notional systems which express purposeful human activities and can be used to study possible changes in complex real-world situations, then a team is defined as the elemental form of a human activity system. In this case, teams are a result of emergence from individuals joining into human activity systems. In this research, the authors propose to study teams using systems principles Rousseau proposed. Gaining understanding on the principles that drive the emergence of teams and human activity systems will assist systems and engineering managers efficiently design and manage complex human activity systems.

3028 (3131)

INTEGRATION OF SUSTAINABILITY PERFORMANCE INDICATORS AND THE VIABLE SYSTEM MODEL TOWARD A SUSTAINABLE SYSTEMS ASSESSMENT METHODOLOGY

Tong, Anh; Calvo-Amodio, Javier; Haapala, Karl R.

Reports on the progress of sustainability research have increased significantly during the past decades. The developmental milestones of sustainability are consistent with the post-normal versus traditional science, where trans-disciplinary and policy/action research are among the important criteria to be added to traditional analysis approach. This requires a new perspective to look at the problem at hand: we are no longer

considering a group of users with common and self-interested goals when defining the scope of sustainability studies. This in turn requires sustainability indicators that can capture largely diverse but relevant measurements to completely represent the different perspectives that must be fulfilled, and methodologies that focus on heuristics, systemic stability, control, and feedback, versus traditional optimization for mechanistic problems. The present study attempts to build upon current established connection between sustainability and viability, specifically how the Viable System Model offers a framework for organizational systems to consistently perform self-adapting mechanisms to cope with internal and external sustainability challenges, and how these capabilities can help organizations achieve their sustainability development goals. A sustainability assessment model that integrates both the sustainability indicators approach and Viable System Model has also been developed and presented here.

3030 (3047)

A POLICY COMPASS FOR ECOLOGICAL ECONOMICS IN THE DIGITAL AGE

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A policy compass indicates the direction and degree of success of a policy in both very general qualitative terms and in robust statistical terms. I propose to modify the compass to reflect the underlying suppositions of ecological economics: that society is dependent on the environment, and that economic activity is dependent on society. We can think of this as three concentric circles, the economy being the smallest.

Any formal institution can develop a policy compass to examine the discrepancy between what the institution would like to do (its mandate) and the actual performance and situation it finds itself in, where the latter is determined through an aggregation of statistical data and facts. These are made robust and stable using meta-requirements of convergence. They can be aligned with some of the fundamental conceptual and normative thinking of ecological economics with this new adaptation of the compass.

In this paper, the general policy compass is explained, followed by an adaptation for ecological economics. The policy compass is original, and so is the adaptation. The compass is inspired by the work of Satish Kumar, Stanislav Schmelev, Anthony Friend, Georgescu-Roegen and Rob Hoffman. In the conclusion, I discuss the accompanying conception of sustainability.

Keywords: Policy compass, policy decisions, qualitative accounting, ecological economics, environment, sustainability

3031

GREEN DECISION MAKING: SUSTAINABLE TRANSPORT AND SYSTEMIC PLANNING (SP)

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The generic framework for planning and decision support set out in this paper is the outcome of the research work carried out in recent years in the international research project SUSTAIN concerning national sustainable transport planning. In the paper focus is on sustainable transport and infrastructure assessment and on the methodology and process of systemic planning (SP).

SP theory development has interchanged with practical application and testing of the SP approach in a large number of cases. The word systemic in SP indicates that complex planning problems and provision of decision support in today's strategic planning needs a focus on what may be addressed as systemic insights in balance with more conventional, systematically-based findings where causal linkages can be modelled and made use of. In practice this means that SP is based on a study-specific combination of hard (quantitative) and soft (qualitative) operations research (OR) methods; especially the latter have a function as regards knowledge generation that relates to obtaining systemic insights. Furthermore, SP applies a process that drives group-based learning forward. The group should be formed with the different stakeholder interests as regards the outcome represented by different group members. The process is guided by a facilitator and is assisted by an analyst, with the analyst providing ongoing, interactive modelling. This collective (man/machine) learning aims to lead to a final decision (or decision recommendation) about the best alternative or course of action for the actual strategic planning problem. The flexibility of SP makes it adaptable to different problem types.

The paper is disposed as follows: After the Introduction about green decision making, Section 2 presents five SP-perspectives, where each perspective is grounded in a particular research approach that serves a particular function in the SP framework. The following Section 3 describes the SP modelling toolbox consisting of 2 x 7 soft and hard OR methods. Based on the previous sections, Section 4 describes the 'SP-wheel', which is the process-driver behind an iterative group-based learning cycle, intended to provide decision support for the actual decision making. The SP-wheel consists of 8 steps which produce knowledge that is intended to accumulate as final decision support. In the following Section 5 findings from a number of conducted case

studies are applied to illuminate various aspects of the individual steps in the SP-wheel. A final Section 6 presents findings and perspective.

A more comprehensive treatment of the SP framework presented in the paper and the ideas behind the framework is available as a free E-book download from the author's ResearchGate page: https://www.researchgate.net/profile/Steen_Leleur *GREEN DECISION MAKING – How Systemic Planning can support Strategic Decision Making for Sustainable Transport Development*, Tech. Univ. of Denmark, Department of Management Engineering, April 2017.

Keywords: systemic approach, sustainability, planning, decision support, generic methodology

3032

ENLARGING THE SYSTEM BOUNDARY OF SUSTAINABILITY ASSESSMENT OF PRODUCTION AND CONSUMPTION: A GLOBAL INTRA-NATIONAL ANALYSIS

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With a globalized economy, while consumption of products takes place in some parts of the world, manufacturing and consumption occur in different parts of the world. However, the scope of the traditional sustainability assessment studies is predominantly at product level and does not address macro-level impacts and cannot capture a majority of upstream supply chain impacts due to narrowly defined *System Boundaries*, which is also known as the cut-off criteria. To promote sustainable consumption and production policies and to understand the social, economic and environmental effects of consumption, there is a dire need to capture whole sustainability impacts across international supply chains using a systemic approach. The importance of consideration of all indirect supply chain-related impacts (is also called economy-wide macro-level analysis) within the sustainability science is emphasized in the past as inter-related global sustainability issues require more holistic approaches in which the macro-level impacts (economy-wide, or global) covering entire supply chain is essential to reveal sustainability impacts of products, services, or systems. This is because process-based models involve a limited number of processes without tracing the entire supply chains of products, and the inclusion or exclusion of processes is decided on the basis of subjective choices, which create the so-called system boundary problem. Past studies on the environmental footprint of sectors also showed that process-based models neglecting the role of indirect global supply chains suffer from significant truncation errors, which can be of the *order of 50% or higher*.

At this point, Multi Region Input–Output (MRIO) models can be a better modelling approach in the estimation of sustainability impacts of production and consumption at global scale. MRIOs can be a superior method for extending the scope from a regional economy to global economy. This research will discuss the importance of enlarging the system boundary in sustainability assessment of production and consumption from micro level to macro-level analysis. A web-based Global Carbon Footprint Accounting Tool (GCAT, http://s3-lab.sehir.edu.tr/gcat) will be introduced for presenting real case studies for sustainability analytics of manufacturing and service industries from world's major economies. Finally, we discuss the importance of integrated system-based methods for advancement of sustainability assessment framework towards regional and global level analysis using multi-region input-output analysis that is capable of quantitatively capturing macro-level social, environmental, and economic impacts.

3033

APPLICATIONS OF SYSTEMS THINKING IN SUSTAINABILITY ASSESSMENT METHODS: THE CASE FOR ALTERNATIVE VEHICLE OPTIONS

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Assessing sustainability of systems requires integration of various approaches, methods, and disciplines. Although Life Cycle Assessment (LCA) has been a widely accepted method to assess environmental sustainability of products, processes, and goods, it has some limitations such as isolated way of assessing the environmental impacts with no consideration of social and economic impacts. In this regard, LCA method has been transforming into a new framework known as life cycle sustainability assessment (LCSA), which proposes improvement in three dimensions: (1) inclusion of social and economic indicators in addition to the environmental impacts, (2) broadening the scope of analysis from product-level impacts to quantification of macro-level economy-wide impacts, (3) deepening the assessment mechanisms to capture and understand the interrelations, feedback mechanisms, rebound effects, scenario-analysis, stakeholder involvement, and

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uncertainties. In this study, challenges related to these dimensions, applications from recent literature, and future perspectives are discussed along with a case study and a comprehensive literature review. According to the literature review, there is a lack of collaboration among the environmental, social, and economic disciplines. Among the applications of LCSA studies, only few (3 out of 56) studies were able to quantify sustainability impacts at global scale, meaning encompassing complex supply chains at global level. Furthermore, rebound and feedback effects of the system-of-interest were not studied sufficiently. In terms of methods applied in the field of LCSA, there were a high degree of diversity among the tools, methods, and approaches. In this regard, there is a strong need for developing a common system language and bringing tools, disciplines, and methods to overcome challenges associated with assessing sustainability. As a case study, life cycle sustainability assessment of alternative vehicle technologies, in the U.S. is conducted using a system dynamics model in which economic, social, and the environmental impacts of various alternative vehicle types are quantified until 2050. The proposed model captured complex dynamic relationships between economy, society, the environment, and the U.S. transportation. Alternative vehicle options include including battery electric vehicles (BEVs), plug-in hybrid electric vehicles (PHEV), hybrid electric vehicles (HEVs) and internal combustion vehicles (ICVs). Extreme customer choice scenarios are tested for each vehicle type to compare their maximum potential impacts. BEVs are found to be a better alternative for most of sustainability impact categories in long run, while they are economically not preferable until mid-2020s. Analysis results revealed that any alternative vehicle option, alone, cannot reduce the rapidly increasing atmospheric temperature and the negative impacts of the global climate change, even though the entire fleet is replaced with the most environmental friendly vehicle option. In addition, the impacts from feedbacks within the society, economy, and the environment are found to be smaller compared to exogenous drivers such as existing and expected trends in population, economy, and global warming. This study exemplifies the advancements in life cycle assessment methods and aims to strengthen the transformation of the current sustainability assessment methods by considering all of the inherent mutual and dynamic relationships in the environmental, social, and economic aspects.

3035 (3232)

THE ENTROPOCENE

Robbins, Jeffrey H.

According to Eric Schneider and the late James Kay "nature abhors a gradient" as it seeks to degrade any and all differences that can make a difference. They also claim that life self-organized by creating a meta-order out of disordered orders, evolving as an increasingly efficient, effective, sustainable (order from order) means for degrading the huge sun to earth temperature gradient. They inject purpose into the scheme by claiming that life represents "order emerging from disorder in the service of more disorder." Or, as Jeffrey Wicken succinctly put it in "Evolution and Thermodynamics: The New Paradigm," "Organisms are remote-from-equilibrium systems that maintain their organizational structures by irreversibly degrading free energy through informed kinetic pathways acquired through evolution. Dissipation through structuring is the strategy of life." In other words, life came about as an evolving means for giving the second law of thermodynamics what it wants. Entropy. In my 2015 ISSS paper, "Anthropocene as Life's State of the Art in Disorder Production: A Sustainability Conundrum," I proposed that our species collectively is disorder producer summa cum laude. We are the most efficient, most effective, degrader of gradients, producer of entropy yet evolved. Calling our epoch, "the Anthropocene" doesn't capture our essence. Our epoch is the Entropocene. We have turned the bio-geosphere from an accumulator of solar exergy ("free energy", the measure of energy's utility) as in fossil fuels, into a trapper of entropy a.k.a., global warming. Unfortunately, not only is our achievement as agent-of-entropy-in-chief not something to celebrate, our perch is being increasingly usurped by a new disorder churner on the block. Hyper-exponentially evolving technology is taking over where we leave off as it represents a far more effective, far more efficient means of degrading gradients, disordering orders including the gradients, including the orders that R us; our brains, our bodies, our face to face, family, community, societal bonds. This disorder, manifested as our increasing helplessness sans the escalating power of our technological props, our techno-prosthetics, spills over into the bio-geosphere and its ongoing degradation. My purpose in this paper is to continue exposing what's really pulling the strings backstage of such global threats as climate change and by so doing set the stage for redress to ourselves, to our progeny, to our common, non-virtual, downstream future.

3036 (3199)

COMPLEMENTARITY MODEL OF THE ORGANIZATIVE SYSTEM AMONG MICRO, SMALL AND MEDIUM-SIZED TOURIST ENTERPRISES OF MEXICO, IN A CHANGING ENVIRONMENT

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The interventions of a tourist MSMEs in a conventional Mexican destination turn out to be inefficient in facing the perturbations of a changing environment. The forces of global markets do not provide equal conditions, increasing barriers that risk their life cycle. This context, provides the opportunity to address a local problem with high implications at national level through the Systemic Method and propose effective and adaptive actions. This paper presents the design of a model based on the beneficial adaptation of MSMEs heterogeneous attributes. The Soft Systems Methodology, served as an integrative frame of factors and actors that influence the problem situation and its abstraction in a model, which was contrasted through AHP. The results allow to establish that, systemic complementarity is a framework for integrating local collaboration opportunities and increasing the variety of response to generate a favorable environment and extend the permanence of these organizations. Likewise, the relationships could absorb deficiencies from the collective learning and the development of individual capacities.
Keywords**:** AHP, Complementarity, Soft Systems Methodology, Systems Science, Tourism MSMEs

3037 (3050)

CAN WE TRAIN STUDENTS TO BE SYSTEMS THINKERS- ADDITIONAL RESULTS

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Systems thinking, a holistic approach that puts the study of wholes before that of parts, is an efficient way of dealing with real-world situations. By emphasizing the interrelationships between the system's components rather than the components themselves, systems thinking allows us to increase our personal and professional effectiveness, and transform our organizations. Specifically, systems thinkers can conceptually analyse the system without knowing all the details, recognizing the forest through the trees. They can see beyond the surface to the deeper patterns that are responsible for creating behaviour.

The current study deals with the development of systems thinking among students and graduates of technology management. The goals of the study are to identify the factors that influence the development of systems thinking and to find ways to encourage this development. We used a variety of research tools: A questionnaire for assessing the capacity for systems thinking, The Myers-Briggs Type Indicator (MBTI) personality type test and supervisor evaluations.

In conclusion, the current study findings show that graduates with certain personality traits can gradually acquire or improve their capacity for systems thinking by receiving appropriate training and through a wide range of work experience, and by holding different job positions over time. Having a broad range of professional experience and holding different job positions can help graduates gain knowledge and become familiar with diverse systems and technologies.

3038 (3222)

TOURIST BEACH MANAGEMENT, A PERSPECTIVE FROM THE SYSTEMS THINKING

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The development of tourist activities has been present in different spaces, being one of the most significant the coastline, which valuation as a recreational scenario has motivated the rapid conditioning and transformation of the beaches. The massive tourism produced tourist activities without planning that have undermined the quality of the resource and its aesthetics. In this sense, it is considered important to propose alternatives from the Systems Science that allow designing strategies for the suitable management of these spaces. This paper presents an option which, from a holistic perspective, contributes to strengthen the management of the coast line through the integration of relevant actors in order to protect it. The methodological approach was carried out through Soft Systems Methodology and the Viable System Model,

having as a result an inclusive diagnosis that allowed: to characterize the coastline where the study was conducted, to elucidate interrelations between actors who intervene in the problem and determine an administrative structure based on mechanisms of control, coordination, surveillance, respect and estimation of the space coast. The above, in order to strengthen the coastline as a political, social, environmental and economic resource.

Keywords: Systems Science, Soft Systems Methodology, Viable System Model, Coastline Management, Tourism.

3040 (3203)

TOWARDS A VIABLE SYSTEM MODEL FOR MICE TOURISM IN MEXICO

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MICE (Meetings, Incentives, Conferences and Exhibitions) Tourism in Mexico generates more than 501 thousand jobs and contributes 1.43% to the national GDP. According to the World Ranking of the International Congress and Convention Association (ICCA) Mexico is increasingly positioned as a destination for this tourism market, becoming a key driver in the economy.

This tourism activity is characterized to be a large-scale phenomenon, in which an interdependence is generated between the various agents involved creating positive and negative impacts and repercussions on the hosting destinations of the events. That is why is relevant manage this activity as a complex system identifying the relationships of its elements to generate solutions considering its economic, social, cultural, and environmental reality.

In this research is presented the current situation of MICE Tourism in Mexico through the Soft Systems Methodology. In the end, all those components and external agents that make up this tourist segment in Mexico can be identified, as well as the problem situations existing in the system and its environment. This diagnosis guides to the generation of a Viable System Model that allows the system to persist over the time despite the changes that occur in the environment, this by the realization of sustainable events.

Keywords: Viable System Model, Mice, Tourism

3041 (3202)

SOFT SYSTEMS METHODOLOGY AND AHP TO DEVELOP A CONCEPTUAL MODEL FOR HUMAN CAPITAL MANAGEMENT IN MEXICAN LODGING SMES

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The lodging SMEs operate in a dynamic environment where aspects such as turbulence and information asymmetry undermine them compared to large enterprises. On this matter, it is considered that Human Capital Management is relevant to overcome deficiencies, delays in operations and to ensure the permanence of the organization. However, these human activity systems (HAS) lack of a systemic model that contributes to the achievement of such an end. This paper presents a perspective on this matter, from the Systems Thinking. In the methodological approach the Soft Systems Methodology was used, obtaining as finding a conceptual model that considers the heterogeneity in lodging SMEs problems and the human capital management. The construct was verified through the Analytic Hierarchy Process, that allowed to find congruence between what had been proposed from the Systems Thinking and reality, enabling its conduction towards a viable equilibrium state in its current environment. Personnel with managerial functions can benefit from an approach that pursues systemic solutions and the transcendence of the whole system like the one mentioned.

Keywords: Systems Science, Soft Systems Methodology, AHP, Lodging SMEs, Human Capital Management.

3042 (3043)

ORGANISATIONAL STRUCTURING: A SYSTEMS APPROACH

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How to structure organizations is an issue that has always been relevant. In today's complex world, new ways of refining organizations are required so that they can respond quickly to the demands of the environment.

The system approach allows one to visualize an organization from a holistic perspective under different scenarios.

There are certain terms and distinctions that must be taken into account in the following discourse on systemic context: structure, methodologies, approach, paradigm, metaphor, model, and vision. In order to improve an organization, it is necessary to identify systems methodologies that can structure each type of organization. It is also important to provide organizational skills that allows one to structure organizations appropriately. To determine the effectiveness of structuring, one must know how to measure the impact of organizational structuring.

The operation of an organization requires the participation of all organizational actors: observer, facilitator, and participants. The methodologies explored in this paper have not only been tested in Colombian organizations, consultancies, seminars, and courses, but they have also been applied to various sectors of the economy. These applications have made it possible to observe the benefits of Interactive structuring process (ISP).

The use of isolated methodologies is insufficient for achieving organizational structuring. Holistic structuring brings coherence and clarity with regards to strategy, processes, actors, and information. The complementarity of methodologies is an interactive process that allows one to achieve the best organization. By coordinating important factors such as strategies, objectives, processes, values, and organizational information, it is possible to build a more interactive structure.

The first order of business will entail the defining of key terms associated with structuring methodology. Secondly, we will examine what types of views and perspectives are being adopted by organizations. Thirdly, we will turn our attention to the systemic approach and the importance of evaluating methodology. Fourthly, we will determine the best model to be used in each approach to a given situation. Lastly, we will observe the chosen methodology in action.

Organizational learning is defined as the process by which knowledge emerges from the interaction between the organization, methodologies, and its users in a research-action relationship, with respect to the environment. The design, diagnosis, and organizational redesign arises from a process that is repeated and improved upon through comparisons. It is through this process by which Meta methodologies are generated and aligned.

3044

SOCIAL RESPONSIBILITY AND ETHICAL ISSUES ABOUT SMART TECHNOLOGY USAGE

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The new forms of smart and artificial intelligent technologies present a great risk to the society (political – ethical challenge). For this reason the ability of the society's decision makers to prepare an appropriate ethical response is needed.

The paper is focused on the outline the main social, economic, and ethical issues, raised by the faster development of the smart and artificial intelligent products or services in everyday life processes. Smart technologies can today explore their environment, communicate with each other or with humans and help their users. The development and implementation of the smart technologies in the human environment is and it will be influenced by social and economic changes and opening new social and ethical problems in the near future, because smart technologies are now: (i) invading into the sensitive human areas and allow others to come easier for sensible private information in real time; (ii) causing job losses; (iii) replacing humans for tasks such as driving and more demanding (e.g. management of the industrial processes).

The paper presents the issues of technology and human sciences. It is going for a complex subject which is quite often misrepresented, some of the fundamental concepts relating ethics in science and technology are recalled and clarified.

At the conclusion of the paper social responsible model for implementation of the smart technology in human environment will be presented. The purpose of the model is to provide ethical and social norms and thus protect human before the socioeconomic changes caused with the high penetration of smart technologies in human everyday life.

3046 (3075)

ETHICAL REGULATORS AND SUPER-ETHICAL SYSTEMS

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The Good Regulator Theorem proved that every effective regulator of a system must be a model of that system, and the Law of Requisite Variety dictates the range of responses that an effective regulator must be capable of. However, having an internal model and a sufficient range of responses is insufficient to ensure effective regulation, let alone ethical regulation. And whereas being effective does not require being optimal, being ethical is absolute with respect to a particular ethical schema.

This paper takes the Good Regulator Theorem, and unifies it with the Law of Requisite Variety and seven other requisites. The resulting Ethical Regulator Theorem has implications for designing and certifying explicitly ethical systems. It claims that the following nine requisites are necessary and sufficient for a cybernetic regulator to be effective and ethical:

Truth is not just about information that the regulator receives as inputs or treats as facts, but also the reliability of any interpretations of such information. If the regulator's information sources or interpretations are unreliable, and cannot be error-corrected, then the integrity of the system is in danger. And if the perceptions of the regulator can be manipulated, it can be tricked into making decisions that are ineffective or unethical.

Variety in the range of possible actions must be as rich as the range of potential disturbances or situations. This is The Law of Requisite Variety.

Predictability requires a model that can be used to select the actions that will give the best outcome. This is the Good Regulator Theorem.

Purpose is expressed as unambiguously prioritized goals.

Ethics are expressed as unambiguously prioritized values that have a higher priority than the goals for purpose. By always obeying the relevant highest priority ethical imperatives, the regulator is guaranteed to act ethically within the scope of the ethical schema. Because ethical schemas vary between legislative jurisdictions, they are handled as plug-ins.

Intelligence must be applied to the previous five requisite types of information to select the most rational and effective ethical action from the set of possible actions.

Influence is the existence of pathways to transmit the effects of the selected actions to the regulated system. This is not a property of the regulator itself, but a function of the connectivity relationships that span from the regulator's outputs to elements of the regulated system and its environment.

Integrity of the regulator and all its subsystems must be assured. Monitoring mechanisms must identify if an ethical imperative is violated and, if necessary, automatically notify the appropriate authorities, preserve evidence, and activate an ethical fail-safe mode.

Transparency is defined by the **Law of Ethical Transparency**, which states "For a system to be truly ethical, it must be possible to prove retrospectively that it acted ethically with respect to the appropriate ethical schema."

Integrity and Transparency are codependent because we require integrity of transparency, and transparency of integrity.

Because this theorem is independent of the ethics schema that is used, it provides a basis for systematically evaluating the adequacy of existing or proposed designs for systems that make decisions that can have ethical consequences; regardless of whether the systems are human, machines, or cyberanthropic hybrids.

In addition, a new framework is proposed for classifying cybernetic systems, which highlights the existence of a possibility-space bifurcation in our future time-line, and the implementation of "super-ethical" systems is identified as an urgent moral imperative for the human race to avoid a technological dystopia. Concrete actions are proposed to steer our future towards a cyberanthropic utopia.

3048

GEOSPATIAL ASSESSMENT OF FOREST BIOMASS TOWARDS POTENTIAL REDD+ INITIATIVE FOR SUSTAINABLE ECOSYSTEM

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United Nations Framework Convention on Climate Change (UNFCCC) aims in developing strategies to reduce emissions from deforestation and forest degradation (REDD), and emphasized the role of conservation, sustainable forest management and enhancement of forest carbon stocks in developing countries (REDD+).

Geospatial technology is a fundamental tool in monitoring forests for various REDD/REDD+ related biophysical parameters; like deforestation, reforestation, afforestation, forest degradation, biomass and biomass burning, carbon stock and footprint. Current study deals with the future scope of REDD and REDD+ regimes for measuring and monitoring the current state and dynamics of carbon stocks over time with combined (integrated geospatial and field-based) biomass inventory approach using multi-resolution satellite data. The combined approach was applied on a regional scale with hierarchy of forest strata representing almost the forest structure found all over India. The top-down and bottom-up approaches can henceforth be implemented from local to global scale. Biophysical modelling was implemented to model the relationship between NDVI and biomass. Power regression model was accepted as the best fit (R2=0.82) to model this relationship which was further implemented to calculate multi-temporal above ground biomass (AGB) and carbon sequestration for complete study area. The current observations reveals that geospatial initiative for biomass assessment can serve as useful benchmark for future studies related to global environmental change and access financial incentives that may lead to sound environmental practices towards sustainable smart cities.

Keywords: Geospatial Technology, REDD / REDD+, Forest biomass, Sustainable Ecosystem.

3049

FROM 'SYSTEMATIC' TO 'SYSTEMIC' RESEARCH AND POLICY ANALYSIS – PROGRESSING THE APPLICATION OF SYSTEMS APPROACHES TO POLICY EVALUATIONS AT A EUROPEAN UNION RESEARCH AGENCY (EUROFOUND)

Schmidt-Abbey, Barbara

This study explores the relevance and applicability of using systems approaches to enhance policy evaluation projects conducted by Eurofound (European Foundation for the Improvement of Living and Working Conditions). This European Union (EU) agency is mandated to support European policymakers in their endeavours to improve the working and living conditions in Europe, by providing *"scientifically sound and unbiased, high quality information"* (Eurofound, 2012, p. 9).

One of Eurofound's activities to achieve its mission is described as '*exploring and assessing policies and practices'* in the subject areas it covers (Eurofound, 2012, p. 18). This activity is the main area of interest for this study, with particular attention to 'assessing policies', interpreted as forms of policy evaluation.

How can evaluation of such policies be accomplished as part of Eurofound's role, and give justice to the complexities of the policies assessed and multiple perspectives and stakes involved?

The overall aim of this research was to investigate the effectiveness of current approaches and methods in policy evaluation activities of complex social policies and phenomena undertaken by Eurofound, and to test the 'systemic desirability and cultural feasibility' (Checkland, 1990) of moving beyond a 'first-order science' research tradition within Eurofound to advance opportunities for applying systems concepts and approaches in these activities.

3056

SYSTEMS MODELS OF LEADERSHIP

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Leadership is usually by definition about leaders, meaning that it is inherently an issue of humans and their characteristics. That characterization, though, has allowed for many competing theories with minimal clarity over decades of research. The purpose of this presentation is to consider what leadership might mean in more formal terms. It will suggest several possible models of leadership, drawing on principles from James Greer Miller, Stafford Beer, Russ Ackoff, Andryas Angyal, et al. The models will build on data about great leaders, taken from a study of officers in the U.S. Army by Gary Metcalf and Teresa Daniel.

3059 (3063)

SYSTEM THINKING FOR GLOBAL POLITICAL CITIZENSHIP EDUCATION

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Humans are political animals but need to be better ones, because like all other animals, indeed all life forms, they are connected, through their various social systems of all types and at all levels, more closely than ever before with a planet's subsystems increasingly interlocking in a global system. Their role as political animals is crucial because politics remains the authoritative distribution of values. In a global society lacking an equivalent world government, humans are everywhere performing political activities on different levels, from

households to villages, from cities to provinces, from states to suprastate entities, from individual economic transactions to membership in organizations interacting with other organizations, that, in the context of globalization, cannot help affecting the lives of others around the world. Because all political decisions matter, it is necessary in constructing a global society as a system for humans to cultivate their political citizenships, and for others to help them understand what the needs of a sustainable future for the earth require them to take into consideration in their political choices from the perspective of system theory.

Key words: global political citizenship, system thinking, complex system, education

3123 (3123)

TAOISM: SCIENCE-BASED CONCEPTS OM A MORE SUSTAINABLE GLOBAL ECO-SYSTEM

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Increasing wealth disparity, polarization of discourses, move into the Anthropocene epoch, people's migration, terrorism…are all pieces of evidence that our worldview ought to evolve quickly if we want our eco-system, our humanity to survive and to keep claiming we are the smartest species on earth.

The elements of ancient Chinese wisdom like *wu-wei*, the power of *de*, and practicing meditation, echo many of the principles which have emerged in recent years, such as *spiritual leadership*, and are also expressed in organizational models such as *Holocracy*, *Sociocracy*, or *Teal*, and in economic concepts, such as *enlightened capitalism*, all seeking at making our world more sustainable. So, what can we learn from the school of thoughts of the Warring State period, 2,500 years old, and can this help us address the wicked problems we are facing both in the West and the East?

In this article I will look specifically at Taoism through the lens of Clare Graves's human development model. Graves defined eight levels of human consciousness, six defined as *needs-based systems* and two as *being systems*. According to Graves's research, only when thinking at the latter two levels can we develop sustainable systems. When analyzing some key Taoists concepts through that lens, looking also through Ken Wilber's *trans fallacy* concept, it is hard not to conclude that the Taoist philosophy operates at Tier 2 level and offers many keys to develop a more functional eco-system.

Yet, are these Taoists assumptions and concepts plausible and viable in today's world? Can they really support the development of a more sustainable society? To answer these questions I will look at the latest research in neuroscience and social science. Focusing on Taoism, I will look at three principles.

First, the *cycle of reversion*, that is nothing should be taken to extremes or it will turn back to its original state, causing the opposite effect, a concept illustrated by the design of the Yin and Yang symbol. I will explore this principle through the work of Wegner on *the ironic effect of conscious efforts* and of Frankl on *paradoxical intention therapy*. Both showed that conscious pursuit of a goal often leads to missing that goal and it is what the Daodejing refers to as the quests of opposites. In any dyad, Laozi wants one to pursue the part one does not want: choose weakness rather than strength, darkness over brightness.

I will then look at the research on *downregulation of the prefrontal cortex* to explore the validity of the state of wu-wei. The state that Laozi wants one to enter into is similar to what cognitive neuroscientist Arne Dietrich referred to as *transient hypofrontality*, that is, the downregulation of our prefrontal cortex. His work on the physiology of athletes being in the zone, that is, in wu-wei, showed that due to the intensity of the exercise the prefrontal cortex is literally shut down for a while, giving a sense of peacefulness, of living in the present, of flow, of oneness with nature and the universe. Reaching this state allows one to be more authentic, spontaneous.

Next, I will look at the notion of *categorical rigidity*. Zhuangzi was very concerned by the risk presented by language. This categorical inflexibility hinders what is often referred to as *divergent creativity*. This human limitation has now been proven scientifically, for instance, by the work of Guilford on the development of *unusual alternative task*.

I will finally present an environmental project showing how Taoists principles, based on system thinking, can enhance biodiversity.

I will conclude that Ancient Chinese wisdom, Taoism in particular, provides very valuable elements to help humanity develop a more sustainable world.

Keywords: Taoism, sustainability, Eco-system

3061 (3051)

A SYSTEMS VIEW OF VIOLENCE AND SOME PARADOXES IN WORKING WITH VIOLENT ABUSERS

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This paper commences with a theoretical underpinning of the nature of violence from a systems perspective, exploring the interactions between parts and wholes where boundaries are transgressed or vital flows are disrupted. A case study of Rangi, a perpetrator of family violence, who is a composite of people the author has worked with over the years, is then used to demonstrate how systems principles can be used to understand the nature of human violence on an individual level and to inform ways of working with clients aiming to reduce the frequency and severity of violence in their lives and the people around them. The focus then shifts to structural violence imposed on the parts of the system by the whole. First, this is examined at a societal level, then returning to the case study of Rangi, there is an exploration of structural violence within the criminal justice system revealing paradoxes to be confronted in working with violent clients.

Keywords: DSRP, violence, structural violence, boundary, systems

3064

INNOVATION AS A STRATEGIC TOOL: ANALYZING THE INNOVATION TYPES OF MOST INNOVATIVE COMPANIES

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As known, innovation is the most important tool for individuals, organizations and states at todays' world. Innovation has a strategic role for companies especially, because they can increase their revenues, access to new markets, increase profit margins and have a competitive advantages in sector.

Innovation can be defined as the process of implementing new ideas to create value for an organization. It involves deliberate application of information, imagination and initiative in deriving greater or different values from resources, and includes all processes by which new ideas are generated and converted into useful products. So by that way companies can be sustain business growth. Also it is the key to maintain the competitiveness for long term.

This study aims to analyze the innovation kinds of most innovative companies that are in the list of 2016 Forbes. Firstly, a literature research is done and the strategic importance of innovation is highlighted. Then Boston Consulting Group's The Most Innovative Companies 2016 List is analyzed for determining their innovation types. In the list there are 50 companies in different sectors and they were ranked by company's revenue, R&D spending. Content analysis is used for determining the innovation types.

The study also comprises the innovation ranks between 2005 and 2016 for these companies. As a result of these analyses most of the companies are technology and telecom and most of them use product innovation.

Keywords: Innovation, Strategic Innovation, Innovation Management, Strategy

3065

ENHANCING THE ROLE OF EDUCATION IN SAUDI SECONDARY SCHOOLS: A CRITICAL SYSTEMIC APPROACH TO ADDRESS POLICY AND GOVERNANCE CHALLENGES

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The area of concern for this paper is how to enhance the quality of education in secondary schools in Saudi Arabia. The Critical Systemic Approach addresses the challenges that students face in achieving their learning and life goals and then makes policy suggestions based on 12 is/ought questions (Ulrich, 1983). The analysis draws on the 'capabilities approach' (Nussbaum, 2011) to provide policy recommendations that can be used to enhance the role of education in human development. The findings suggest that schools emphasise academic achievement in terms of a standard curriculum, but not in terms of producing well-rounded graduates. Critical systemic analysis suggests that the normative approach for education needs to be based on the development of students' capabilities (Nussbaum, 2011). The Critical Systems Heuristics (CHS) analysis stresses the importance of working with different stakeholders and across different disciplines in order to enhance the quality of education. The process needs to be based on an inclusive approach to shaping and implementing policies to make sure all stakeholders can contribute to the process.

Keywords: Critical heuristics, education, human development, Saudi Arabia

3066 (3209)

WHAT DRIVES THE SYSTEMS? FROM CONATUS TO DYNAMICS: DESCARTES, HOBBES, SPINOZA, LEIBNIZ, AND KANT－

Takahashi, Kazuyuki Ikko

I will highlight the concepts of conatus and dynamics in Descartes, Hobbes, Spinoza, Leibniz, and Kant. These philosophers' ideas are sometimes referred to as precursors of modern systems theories, or cybernetics.

First, I will analyse the idea of conatus in Hobbes's theory, comparing it with those of Descartes and Spinoza. For Hobbes, conatus is motion through the length of a point and a small beginning, which causes interaction between matter. All natural and social systems then begin to move automatically. Conatus is thus just a trigger of motion.

After I discuss the transition from the notion of conatus to that of dynamics in Leibniz's thought, I will illuminate Kant's in both his pre-Critical and mature philosophical works. His idea is that the soul has a dynamical relation with the body, making it the prime power to move the body. Kant then examines the phenomena of the world from this viewpoint of dynamical interrelation. Thus, it lies behind the systems of recognition, which is formed simultaneously with the natural and social systems, according to Kant's philosophy.

The interaction between elements in systems is essential to modern complex systems theory. I would like to say that these philosophers, especially Hobbes and Kant, are pioneers of complex systems theory.

3069 (3069)

SOFT SYSTEMS METHODOLOGY AND COGNITIVE MAPPING: A LINKAGE BETWEEN THE INITIAL PHASES OF SSM

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Systems Thinking enables to simplify our thinking about and management of complex realities and messes. Throughout the existence of the Systems Thinking philosophy several systems approaches have been developed with varying perspectives and purposes. This paper focus on the Soft Systems Methodology (SSM) which emerged from the Hard Systems approaches, such as Systems Engineering. The aim was to use systems principles for unstructured, ill-defined problematical situations. The main system concepts that SSM build on are emerging properties, hierarchy, and feedback communication. Through its use the notion of worldview for meaningful actions has evolved as crucial. This paper builds on this notion and include Cognitive Mapping to make plain different worldviews and their relation to meaningful action in a hierarchical approach. Cognitive Mapping also has its roots in Systems Thinking approaches. Its origins in psychology and have been included in Operational Research applications with the aim of mapping and representing how a person thinks about a particular situation, issue or problem.

The paper discusses the features of Soft Systems Methodology and Cognitive Mapping including the interrelation. The combination of these approaches is demonstrated in a case which investigates the complexity of compulsory school teachers' use of digital technologies in their everyday practice. The research followed a focused ethnographic approach, based on observations and interviews, which allowed the researcher to collect rich empirical data that related to various stakeholder perspectives. These perspectives affect the everyday practice of the school teachers and their possibilities to combine use of digital technology in education and own teaching philosophy.

Through the combination of Cognitive Mapping and one of the SSM modelling techniques we demonstrate an approach that bridges the richness of the real-world situation and the analytical phase of SSM. This approach advanced the understanding of underlying factors that contribute to the complexity of this particular situation and enabled insights which, if transferred to appropriate actions, may lead to an improved situation for involved stakeholders.

3070 (3197)

MS WINDOWS PRODUCTIVITY RESEARCH APPLIED TO THEATRE

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This work begins interdisciplinary, theoretical support for a new technical age of more creative and varied play writing and more productive theatre performance.

I summarize past, highly validated display theory that is applied in an "interdisciplinary experiment" as technical additions to a professionally, table read, full length play showing justification of the application. Results suggest further interdisciplinary research to take advantage of demonstrated benefits and address

interesting problems uncovered. In contrast to much theatre today that stems from past elocution, realism and illusion ages, presently being added are technical elements reinforcing live action and dialogue including projection. Projection had to wait half a century from attempts by Tennessee Williams to introduce it in "The Glass Menagerie." I take this technical addition a step further by projecting an MS Word script with color and embedded sound and images that come with productivity and "viewability" increases traded off with increased pre-performance costs. The article defines these and following constructs. Play writing, performance and audience enjoyment can be greatly enhanced using script projection with embedded technical elements, and I present a needed, better, theoretical approach to play writing supporting this technical addition.

I summarize a Social Science experiment resulting in my former, original display theory, involving Viewability, Complexity, Productivity and MS Windows. That theory is expanded and applied to both play script "pages" in one or more MS Windows and to Proscenium Theatre Production. See papers discussing that experiment presented and published through ISSS in the '90's. I consider projection of a digital script, with embedded multi-media that is played/displayed by the projectionist, as one or more additional "virtual" cast members along with traditional non-human theatre elements. Practical considerations of script projection suggest beneficial changes in the "standard" script format. Original contributions to display theory for playwrights and theatre performance follow from summary and analysis of the results of readings of the experimental play, "Con Te Partiro," in December, 2016. Using the new theory promises very much greater opportunity for variety and creativity to the playwright and audience. MS Word is more powerful and flexible compared to existing play writing Apps. This resulting theory is applied to the script, projected image and proscenium as analogues of Windows.

Points in the theory are correlated with results--validating them as appropriate applications of the prior social sciences experimental results--suggesting a different script format and an architecture for play writing (in development). Lessons learned in the table readings suggest improvements that might be made by Microsoft to Word. Interdisciplinary research opportunities to substantiate other points in the new theory are listed.

This paper lays a guiding, validated, scientific foundation for a new, theoretical architecture of more creative and varied play scripts in a technical, interdisciplinary age of theatre, promising cost savings at performance time.

3076 (3087)

THE PROVIDE-PICKUP PARADIGM: THE CORNERSTONE IN A GENERAL SYSTEMS FRAMEWORK FOR AGENCY AND GOVERNANCE IN SOCIAL SYSTEMS

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In spite of significant advances in technology in today's world, our large social systems—workplaces, schools, and more—are marked by increasing social decline. Organization practices typically have conflicting approaches of two camps—top-down directive versus bottom-up participatory. A new unifying paradigm is needed. The aim of this paper is to uncover, understand, unify and clarify the laws of human social systems, as we have done with the laws of material and mechanical systems. Illustrations, examples, and metaphors serve the goal of being accessible to a wide audience from a variety of disciplines, academic and lay. The development of the paper is a narrative path analysis. The path begins with large social system outcomes as the unit of focus, links it with general systems theory—Boulding's nine-level typology of system complexity and skeleton of science —then adds specifics from a wider knowledge base drawing key concepts, literature, and evidence from instruction, management, control systems engineering, psychology, adult learning theory, plus examples from large urban schools and workplaces. The root causes of organization learning and behaviour are located within the individual system member (individual as unit of focus), and a great shift becomes evident. Namely, in mechanical systems, behavior is determined by exteriorly prescribed criteria, controlled by outside forces, including a leader, engineer or scientist. In human systems, behavior is determined by interiorly prescribed criteria, inside each learner or worker. The narrative path then ascends toward the large social system, identifying new corresponding concepts, principles and practices—from the individual system member as unit of focus, to the pair, to the small social system, and then the large or multisite social system. At the level of the individual, the CAP (cognitive, affective, psychomotor) principle is identified, that is: every system member, leader and worker, learns and performs according to his/her own willingness (affective) and ability (cognitive and psychomotor). Updated theory, at the pair level of focus, is that agency of organization learning and behaviour is not in the leader, nor the worker, but in both, thus unifying the conflicting directive and participatory camps. A new PROVIDE-PICKUP paradigm is proposed as the cornerstone of this new framework. The leader's role is to PROVIDE input, resources and tasks; the learner/worker role is PICKUP of input, each at his/her own rate.   TPO Theory (Things, People, Outcomes) is offered for predictability, stating that: In *ineffective* social systems, decision makers select, design, arrange, distribute, and provide their THINGS (input, resources, and tasks) without regard for their PEOPLE'S needs, abilities, perceptions, choices, and learning rates, resulting in ever-increasing negative OUTCOMES. In contrast: In

effective social systems, decision makers select, design, arrange, display, distribute, and provide their THINGS explicitly to allow their PEOPLE to pick up and work according to interiorly prescribed needs and goals, abilities, perceptions, and choices, each at his or her own pace, resulting in increasingly positive OUTCOMES. Back at the level of the large social system as the unit of focus, important input is beyond the pickup range of individuals—that is beyond their [1] awareness and understanding (cognitive span), [2] concern and care (affective span), and [3] physical control (psychomotor span). The concept of span-of-control in management theory is supplemented or replaced by span-of-pickup. User-designed ideal-based automated social control systems are proposed to allow organizations and system members to flourish. Finally, the rICE methodology proposes three necessary sufficient conditions for social system designers and management to consider: organization inputs and processes are most effective when they are inclusive, continuing, and emancipatory (ICE). Further, specifics of these conditions are relative (r) to each group of users.

Keywords: Systemic Renewal, Educational Systems, Organizational Transformation and Social Change, System Methodologies for Social Systems, Agency and Governance in Social Systems

3080 (3122)

THE STRUCTURE OF REALITY: AN EMERGENT HIERARCHY OF AUTONOMOUS LEVELS?

Pretel-Wilson, Manuel

This paper starts with a question: did the levels of reality emerge out of the increasing complexity of matter through evolution? I will critique this deeply held conviction in the field of systems thinking, and I will argue that a different world-image is possible. Indeed, I will suggest that my alternative world-image is a more accurate depiction of the structure of the universe. My argument will be unfolded in four parts. First, I will claim that the forerunners of the idea of emergent levels can be found in the British emergentist movement of the 1920s (Alexander 1920; Morgan 1923). Second, I will argue that the idea of hierarchical levels entered the biological world in the early 1930s (Bertalanffy 1933) and the rest of the cosmos in the 1950s (Bertalanffy 1953; Boulding 1956). Third, that idea of a "hierarchical order" of the universe could have been suggested to Bertalanffy by Hartmann (1926) who was developing his theory of "strata of reality" (1940). Finally, in contrast to these ideas, I will argue for a structure of reality that is neither emergent nor hierarchical.

3082

EMERGING PROPERTIES OF THE FUEGUINIAN INDUSTRIAL TECHNOLOGICAL SECTOR

Gessaga, Tariana Maia

The Province of Tierra del Fuego (Argentina) is an island with a legislation that has been promoting the industrial production for the last forty years. These situation has been generating diverse impacts in the social and economic order through the creation of employment, production for domestic consumption and exportation of that production to the continental zone of the country. Also, these effects were impacted or has been a consequence of national policies, economic development at national and international level. The present work is part of a bigger research which aim is to produce information about the fueguinian business structure, taking as an exponent the organizations of the technological industrial sector of the island.

The methodology of the present study is based on the consideration of the accounting information systems of each of the companies and, based on the overall analysis, seeks to deepen the information about this productive sector, highlighting the magnitudes and relations between capitals (understood as a source of financing for companies). For the recollecting data stage, a model called "Capital Relationships Map" has been designed to show some of these characteristics.

This analysis of relations allows us to consider the level of diversity as a property of capital, which is destined to the production of technological goods in the special customs area (Tierra del Fuego), and seeks to recognize sensitive elements that can cause a great impact changes to the local environment, resulting from this network of complex relationships.

Keywords: Capital - Financial Statements - Business Structure - Technological Industry.

Socio-Ecological Systems

3083 (3228)

EMBRACING THE COMPLEXITY: MULTIPLE INTERESTS AND DEBATED RESOLUTIONS IN THE PINEAPPLE VALUE CHAIN IN UGANDA

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Strengthening horticultural value chains can be used for improving food and nutrition security while reducing rural poverty. However, the complexity of local situations challenges the effectiveness of development strategies and calls for actor-oriented approaches. The fresh pineapple value chain in Uganda is illustrative of such a complex situation. The market supply is not organized though dominating and organizing lead firms. By contrast, individually negotiated and context specific actor relationships and their purposeful activities form and sustain this human activity system. As value chain actors take multiple factors for their business activities into account, the aim of our system analysis is to elicit their perspectives on the influence of these factors. This provides a more contextualized understanding to inclusively increase local actors' benefits.

We used a systems learning approach, in which stakeholders and scientists seek a better understanding of the local system. Cognitive mapping and additional methods were applied to reveal internally hold perceptions about the factors and their influences on the income generation from engaging in the pineapple value chain. Several meetings with participants from only one actor group informed subsequent multi-actor meetings: five with farmers (4-8 each), one with brokers (5) and five with traders (2-6 each). Group cognitive maps served as starting point for twelve meetings which included participants from several actor groups (4-13 each). To foster the feeling of connectedness between actors along the chain, these consecutive multi-actor meetings evolved around the factors and situations that participants had identified as influential to all actor groups, such as prices, markets, quality and communication. The facilitation of the entire process was constantly adapted to encourage participation. Semi-structured interviews and participant observation further complemented the analysis.

The approach resulted in a contextualized picture of how multiple natural, technical and social factors influenced actors' income generation in the pineapple value chain, e.g. farm and market price, market size, quality, seasonality, production methods and skills, buyer-seller relationships and transportation. There was little disagreement about the rationale of the influence of factors during the single actor group meetings. However, the number of factors and their cause-effect relations differed between actor groups. The dialogue during multi-actor meetings revealed problem-situations in the value chain. Participants expressed solutions and also explained barriers to them. For all actors in the chain to profit from their respective business activities, awareness of prices and other market information is particularly important. However, problematic communication patterns between actors showed current challenges and dissatisfactions. The flow of information was disrupted by the intertwined patterns of changes in prices, supply and demand, along with structural constellations, such as many small-scale farmers, relatively few brokers linking production areas to distant market centers and many, dispersed traders in different markets. Moreover, prices were individually negotiated and generally competitively formed. The occurring fragmentation among actors is the result and also part of the causes for communication problems, observed fluctuations and actor relations. In addition, the debate regarding proposed solutions, such as collective bargaining or establishing uniform prices, showed that this fragmenting feedback cycle is difficult for actors to break when contextual constraints and their conflicting interests are taken into consideration.

The participatory activities and shared explanations allowed the surfacing of problematic patterns and value chain structures that caused friction and hindered broader collaboration. The approach helped to trigger dialogue and understanding between otherwise often competing market actors. While actors are aware of the benefits from improved collaboration, this is difficult to implement given a contextualized system understanding. Participatory system inquiries are challenging, yet important for enabling actor-driven system change.

3084

A SYSTEMIC ABUNDANT ECONOMIC MODEL

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Most of us dream of living in a better world. We would like the economy of the planet to be more just, kind and equitable. We are always looking to be secure in all areas of our lives. As a matter of fact, we usually waste a fortune on insurance. Health insurance, life insurance, home insurance, financial insurance...... insurance for everything! That is the equitable transfer of a risk of loss from one entity to another in exchange for payment. It is a means of protection, used to hedge against the risk of a contingent uncertain loss. But, what if instead of thinking we can control everything, also with insurance, we learn how to deal with uncertainty. What if we learn a different systemic way of using the ¨human being energetic tecnology¨: that embraces our body, mind and spirit, to lead the universal energy in order to favor our purposes, projects and desires in life, whatever they are.

This abstract shows how a Systemic Abundant Economic Model helps to grow not only in an economic way but also in a spiritual one. This requires us to be open minded. Remember ¨we are what we think¨ (Buddha).

Besides, if we always use the same variables, it is difficult to obtain different results (Albert Einstein). So, why not take the risk, learn how to deal with uncertainty and lead the Cosmic energy to help us in our endeavors and wishes.

3088 (3088)

STATE POLICIES FOR THE TECHNOLOGICAL DEVELOPMENT OF THE SPACE SYSTEM

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The Technological Management (TM) is defined as: the decisions that the State adopts on the policies, plans programms, etc. relating to the creation, diffusion, use and transfer of space technology in order to achieve Technological Development (TD).

In Mexico the government, educational institutions and research centers have made efforts to found organisms, programms and projects, in order to foster space DT, which arise and disappear without achieving the objective for which they were founded.

The main purpose of the TM is the TD. To achieve this, integration is necessary concerning government-academia-industry in order to reduce political, economical and social conflicts.

For this reason, a Systemic Model (SM) for the Technological Development of the Mexican Space System (TDMSS) is proposed, allowing the integration of scientific research in companies based on market goals, strategies and objectives.

The MS has three stages: the first is the input (I), consisting of the analysis of the satellite system in the International and National context; The second, box (B), consisting of: diagnosis, proposal, planning to carry out the proposal;

The third relative to the output (O), in this case is the satellite TD. O = IB, ie, I and B can be adjusted to achieve O.

3089 (3217)

WHAT DOES CONSTRUCTOR THEORY CONSTRUCT? - KNOWLEDGE AS A PHYSICAL PROPERTY

Malecic, Aleksandar

"Constructor theory of eigenbehavior" is the most appropriate short way to describe what this article is about. To those who have encountered the idea of eigenbehavior for the first time through this issue and article, let's say that it is related to recursions within and emergence of consciousness and information in general. In a back and forth manner between constructor theory of possible tasks and eigenbehavior as a viable (since it passes the test of existence) phenomenon. This author uses in an already published paper the metaphor of systems as footprints and wonders what kind of "animal" (constructor) might leave them behind. This article goes further in combining and criticizing constructor theory with the concept of eigenbehavior. Interpretations of quantum mechanics and physical principles are also elaborated.

The following definition is the central idea of this article. We shall insist on it even in cases when something looks unexpected, (counter)intuitive, or inevitable.

Constructor theory is the theory of which transformations

input state of substrates --> output state of substrates

can be caused and which cannot, and why.

It is a search for physical principles allegedly more fundamental than physical laws. Instead of doing physics as usual based upon initial and physical laws, the initiators of constructor theory are foremost interested in fundamentals of quantum computation, but also want to know deeper truths about other phenomena such as information, life, and thermodynamics. All of them are for different reasons closely related to what we call here eigenbehavior. This idea isn't entirely new, but the way frame the discussion is framed with the aforementioned definition is. Worth mentioning here is also General Systems Theory (GST).

Similarities behind constructivism and constructor theory are not just in similar words, but also in their approaches to expectations from reality and doing scientific work. It is a similar mindset when we try to understand minds by shadows they cast or systems by footprints they leave behind.

The author is implementing in this paper an approach similar to constructivism, but does that in a way that other proponents of constructivism might not approve. Systems science requires a radical change of perspective and this is where the constructivist approach is helpful – in encouragement of open-mindedness about reality and ideology and playfulness with mental constructs. Constructivism in its radical form denies any ultimate truth and this is the point at which we should stop playing and get serious and rigorous. The radical form of constructivism applied to physical reality means that "we" shall never know for instance whether or not we are living in a computer simulation. It is a tiresome and annoying exercise (try to walk while being cynical about each step) in empty philosophizing and a futile attempt by someone who doesn't understand to

deny the right of anyone else to understand or get closer to understanding. Even if humans will never be able to understand everything, that's because of our limitations rather than physical reality being somewhat questionable. A defeatist and nihilist approach to thinking and doing should be discouraged. It is just plain wrong to insist (and still be sane) that physical and/or societal principles and the Universal Constructor are whatever we want them to be.

This article will have two parallel story-lines in order to allow the reader to compare strengths and weaknesses of different approaches and what the author has to say about it. The author is first and foremost interested in understanding the truth and open to critique.

3090 (3126)

FROM HIERARCHIES TO NETWORKS: CHANGES IN ORGANISATION OF PUBLIC SERVICE DELIVERY

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Government services slowly enter new and promising era. The traditional way of organising public sector service delivery in western democracies is hierarchical. Hierarchical organisation means functional specialisation. Top layers of the hierarchy specify and specialise different parts of the hierarchy in the bottom to provide rather specific functions – services. Service provision is then fragmented. Citizen in need of long-term help often ends up using many services with low cooperation between them. These conditions lead to high costs and low quality. We currently can identify in Europe promising cases of institution which are organised as network organisations and sometimes even changed their structures from hierarchal type with great success. In this paper, we discuss what drives hierarchical organisation ineffectiveness when supporting people suffering with complex problems and what are some of the crucial conditions to organise successful network based integrated services. There are four principles discussed that are common to successful network organisations which are very different from the principles of hierarchically organised institutions – holistic service provision, flat organisation structure, high trust and capability measurement. These principles are shown on three cases - Jeugdbescherming Regio Amsterdam (aka Child Protect, Netherlands), Karolinska University Hospital (Sweden) and Buurtzorg (health and social services, Netherlands).

3091

PERFORMANCE MANAGEMENT IN THE PUBLIC SECTOR: THE URGENT NEED FOR A PARADIGM SHIFT

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Nowadays the public sector faces many challenges related to human health, biodiversity, and the fundamentals of life – water, food, and energy. There are many complex interdependencies between social, ecological and technological systems. Future scenarios are showing an increase in complexity and uncertainty. For many public service managers, it's hard to keep up with all the changes and transformations in society. Their work is often about making cities and villages, and their residents, resilient in the face of rapid change. Public service managers are struggling with achieving community outcomes in a 'value for money' cost-effective way and with managing the unknowable.

The challenges show that there is a clear and increasing need for an effective performance management system in the public sector. For many public service managers, this is a big challenge. Research often focuses on performance *measurement*, but does not offer practical solutions to performance *management in public services*. There's still a need for empirical studies of public performance management practice. This paper combines systems science with the daily practice of public performance management, to be able to translate research results into practical solutions.

The public sector, and the performance management system within, are complex adaptive systems, which means that they need vital energy flows to stay healthy. In this paper, we look at the limitations of performance management tools and the lack of energy that they create.

First, the technologies are introduced. The public sector has adopted many performance management tools from the private sector. A popular tool is the Balanced Scorecard. This paper explores the growth of the tool into a "systems dynamics-based Balanced Scorecard", supposedly based on systems thinking.

Secondly, we explore the people's side of the public performance system, because the key resource in many public services is human capital. In many organisations, the system of public performance has a negative effect on staff morale leading to poor staff engagement and lack of openness by managers. Solutions to address this problem are not based on systems thinking, and are leading to short term results, if any. So, the public performance system is not creating the essential vital energy flows to stay healthy, needed for its survival as a complex adaptive system.

In this paper, I use a number of systems and futures concepts and principles including DSRP, Cynefin's five contexts or "domains" of decision-making, Complex Adaptive Systems, Batesonian ideas of "space in between", Nora Bateson's Symmathesy, and Causal Layered Analysis.

Then, based on and explained by the research above, I'm introducing a coherent, holistic performance management system, using my two models: the COMPASS model and the Coherent Organisational Performance Model. These models identify the position of the Balanced Scorecard, and visualise the dynamics of organisations and people.

This paper shows that public performance management needs to be addressed in a different way, and with high staff engagement, to face the current and future challenges. This paper identifies the urgent need for dialogue about the underpinning paradigms, identifies the key success factors, and offers a practical model and method to approach performance management in a new coherent and holistic way.

Keywords: Performance Management, Public Sector, Balanced Scorecard, Systems Science, Causal Layered Analysis, Complexity, Staff Engagement

3094

APPLYING SYSTEM DYNAMICS: CASE MANAGEMENT IMPLEMENTATION IN AN ARGENTINEAN JUSTICE OF PEACE COURT

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This article explores how systems dynamics combined with employee empowerment can be used to reduce timeframes on key stages in court proceedings. This analysis is done from the empirical perspective of a Justice of Peace Court in Argentina, where the researcher and the team of The Lobos City Justice of Peace Court, the practitioners, worked together towards a common goal using action research as methodology. The implementation took place between February 2014 and May 2017 and the key research objectives were to explore on how collective transformation, as a motor for time reduction, can be enhanced through four forms of engagement: creation of awareness, self-implementation of innovative methodologies, understanding systems dynamics and building "Team Pride" as a core value. The article is structured as follows.

Initially, it is presented the background story of the project in Lobos City Justice of the Peace Court, then, by combining insights from the case and previous literature, the author unpacks the four forms of engagement. The stages of implementation are presented including in-depth interviews and workshops, results and feedback loop. To test the hypothesis, the author performed a non-parametric Mann-Whitney and Wilcoxon test, comparing two data sets (previous and during the implementation timeframes). Finally, a set of conclusions are discussed and presented together with potential areas for further considerations like challenges of implementation in courts with higher amount of cases.

3095

ABILITY TO RAISE QUESTIONS AS A MODERN SKILL

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One of the current issues, relevant for modern society, is the need to cooperate with people who speak another language (either literally or metaphorically) and have different life experiences and views. This problem is aggravated by the fact that the most fundamental beliefs are not usually discussed - they are too obvious for those who believe in them and too incomprehensible for those who believe in different things. Every complicated issue demands cooperation of different professionals and coordination of efforts of many stakeholders. And very often their dissimilar "languages" and hidden contexts lead to misunderstanding and conflicts.

The techniques of collective work with questions can be useful in this case. Do not only they help participants to understand the issue as a whole, but also to find a solution and to coordinate their actions further. Work with questions is very important for social self-organization. However, the examination and discussion of such technique as a questioning is quite rarely observed in the modern academic research.

As the authors are intended to prove the power of questions, this paper raises the following questions:

• It is necessary to describe and analyze existing practices of asking questions and using them as a tool for problem-solving;

• It is necessary to develop new techniques of questioning relevant for the current issues of civil initiatives and public self-organization;

• It is necessary to develop those new forms and methods of education that will motivate and teach people to raise questions.

In recent years we have developed three techniques of working with questions: Creative questioning, Map of questions, Positional questioning. They were used to organize strategic resolving discussions in Ukraine and Russia.

The procedure of a creative questioning requires from its participants to chose a common theme and discuss it for 20-30 minutes solely in form of questions. This procedure is the most effective for discussing common fundamental ideas. Among the most successful applications of this technique is the discussion of an idea of freedom at the workshop of the Ukrainian-German seminar "New Media - New Education" (Kharkov, 2016).

Drawing up a map of questions includes three main steps: a) formulating by each of participants several questions on the common issue being discussed, b) placing these questions in a common space, grouping them, c) discussing grounds for such grouping and relations between the groups established. This work allows participants to get acquainted with each other's interests and see how these interests position itself the general field of work. It is especially useful when the problem is complicated by contrasting views of stakeholders (for example, the problem of school reform).

The positional exchange of questions suggests that before the beginning of process several positions (functions in a common activity) are identified. The procedure is that each of participants determines which questions he should answer to from the position that he occupies, and asks questions to those who are important for his activities. That exchange of questions is an effective tool for both self-organization (to formulate questions that no one except you can answer) and the organization of interaction (expressing what you expect from others in the form of questions). This technique is especially useful in public self-organization (for example, of a group of volunteers) to solve a particular practical problem.

Our experience shows that even a relatively short (2-3 hours) discussion using these techniques allows the participants to raise the common problem more precisely, clarify individual interests and preferences, discuss common values, putting emotions and disagreements aside. It helps participants to discuss their differences in understanding and attitudes without getting into conflict.

3096 (3101)

INDUSTRY NEEDS FOR DATA WAREHOUSING STUDENTS: USING SSM AS HERMENEUTIC DATA ANALYSIS TOOL FOR INTERPRETIVE INTERVIEW DATA

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The soft systems methodology was developed by Peter Checkland over an extended period of time to assist organisational improvements. It provides tools to assist different stakeholders to articulate their perspectives on the best action to be taken in problem environments. It is grounded in the ideas of soft systems thinking, where systems are viewed as conceptual models to make sense of a messy real world environment. The original focus of soft systems methodology is organisational use rather than academic use. In this paper we demonstrate how the soft systems methodology can be used to guide and analyse interpretive interviews with participants in an academic research project in the context of interpretive research methodology.

We reflect on the hermeneutic nature of interpretive qualitative data collection and analysis and then we show that an activity diagram as used in the soft systems methodology, is a valid data analysis technique in terms of the epistemological context of interpretive data analysis.

We demonstrate our proposal by means of the data analysis of interpretive interviews of data warehouse practitioners on their perspectives of the required skills of information technology students majoring in data warehousing. We compiled activity diagrams and used them in communication with our participants, thus enabling our participants to verify our data analysis and enhance our understanding of their perspectives. We show how different perspectives can be represented and reflected upon after compiling activity diagrams and how different perspectives can be accommodated to develop a single strategy for change.

Our main contribution is to demonstrate the suitability of the soft systems methodology in data collection and analysis in interpretive cases studies where strategies for changes are studied.

The paper is organised in four main sections, starting with a discussion on the ontological and epistemological assumptions of interpretive case studies in order to show that it is possible to use the soft systems methodology from an interpretive research perspective. The second section provides a very brief discussion of the soft systems methodology. Our main contribution is in section three, providing justification and guidance for using the soft systems methodology to guide data collection and analysis in the context of interpretive research methodology. We demonstrate our proposal in the fourth section, where we show how we analysed interpretive interview data. Our paper concludes with reflection and recommendations.

Keywords: soft systems thinking, interpretive data analysis, qualitative data, data warehousing

3102

A FRAMEWORK FOR COMPLEX PROBLEM SOLVING BASED ON SYSTEMS THINKING AND DESIGN THINKING

Hieronymi, Andreas

Systems thinking and design thinking are two powerful and complementary approaches for addressing complex multistakeholder problems. Combining these two approaches seems to be especially promising for finding new and creative solutions for ambiguous and dynamic issues. The challenge of integrating systems thinking and design thinking has been of increasing academic and practical interest in recent years, but there are many remaining questions regarding the conceptual synthesis and practical implementation. The proposed framework tries to fill this gap. Teams, projects, companies and communities are facing many situations where previous knowledge and strategies are no longer valid but a shared understanding and vision is highly needed for coordinated action. Traditional approaches, such as lengthy and unguided group discussions or top-down authoritarian control by a single leader, do not work well in complex multistakeholder situations where both emotional commitment and technical expertise are of high relevance. The proposed framework provides a conceptual and practical synthesis of systems thinking and design thinking for solving complex problems. The presentation also includes a guideline for workshops in companies and educational settings. The method incorporates visual elements of systems thinking (such as behavior-over-time-graphs and causal loop diagrams) and elements of design thinking (such as observation, empathy, point-of-view, brainstorming, presentations and peer-feedback). The format is optimized for rapid reflection and fast-prototyping in meetings and workshops, while more detailed research and elaborations may be included in later iterations. An example case illustrates the use of the method along with typical needs and questions of novice participants.

Keywords: complexity, problem solving, systems thinking, design thinking, workshop facilitation, methods

3104

DIGITAL JOURNEY IN CUSTOMER EXPERIENCE MODELLING

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Globally, digital solutions are gaining prominence and their prevalence and proliferation is evident by the rate of adoption by the masses. Organizations in government, civil, commercial and business domains are increasingly adopting digital to reach out to customers and impact them in ways that were not possible earlier. Digital technologies are far more pervasive now and their mass adoption has enabled information generation, and application in the form of information technology in different areas. The corner stone of digital technologies has been the creation, manipulation, and enhancement of meaningful information which significantly change the way organizations engage with their customers.

Presently, there are practices, approaches, methods, life-cycle processes, frameworks, methodologies that help organizations in synthesizing, evaluating and implementing digital technologies in their respective areas of business. There are model based engineering and architecting approaches that have been found to be useful in computer-aided-generation of software systems from an expression of corresponding models. In all these situations, what comes to the fore is that most of the available approaches, follow the notion of "How to" do things rather than "why" it should be done, "what" should really be done" and "when" it should be done. This is further evident when we see that solutions in one area of application are not found to be useful in other areas. In other words, the digital solution patterns are useful for only one instance and are not useful for further instantiations.

There are different schools of thought with regard to digital technologies and how businesses can utilize them. Gartner is of the view that the nexus of forces (Cloud, Mobile, Social, and Information) are the driving factors for digital technologies and related business. TCS is of the view that the digital five forces (Cloud, Big Data, Social, Mobility, and Robotics & Artificial intelligence) are the driving factors for digital technologies and related business. HBR is of the view that smart, connected, miniaturized devices (Internet of Things) are the driving force of digital technologies and related businesses. One thing that is evident from these views is that, all of them speak about the constituent parts but they do not say clearly: a) Why should these parts exists? b) Are these parts sufficient? c) How to put these parts together to form a whole? d) When should these parts be used? e) What is the evolution path of these parts? f) What could be evolution path of the whole? g) What is the underlying systems model for digital based solutions?

This paper is an attempt to articulate the digital journey, the different levels of discourse in the digital journey and the possible evolution of the digital technologies to address the contextual knowledge needs of the human civilization. As an exemplar, the digital journey of supporting customer experiences design using digital technologies is taken up and illustrated in this paper.

Keywords: Digital Technologies, Digital Forces, Digital Journey, Digital Solutions, Customer Experience.

3105

STRATEGIC ALLIANCES BETWEEN INDEPENDENT PARTICIPANTS

Frias, Ricardo Andres

In many national and regional economies, small and medium-sized businesses are the main driver of these economies.

But at the same time, this important role is contrasted with a great vulnerability of these companies to face the challenges that are generated in the processes of globalization initiated in an irrepressible way since the last decade of the XX Century, and that give place to markets highly competitive.

On the other hand, and in the same direction, the dizzying flow of information to which people have access, and the impact of technology on economic relations and everyday life in general, make traditional ways of dealing and engaging economic links, are presented as qualitative and quantitative limitations for certain actors and in certain contexts.

These small organizations, which are developed in small economic contexts and with high exposure to the changes, can face the threats and opportunities provided by the environment in which they operate, individually with the tools and resources they can achieve with great effort ,or associated with other organizations, seeking to reduce weaknesses and grow their strengths through strategic alliances with other players in their environment.

These groups that are strategically allied, can have a more or less structured organization, or with different levels of formality.

In this context, the goverment also appears with its different levels of representation and interests (nation, province, municipalities), and universities, as actors interested in the development of the territories in which they act, thus forming a group of organizations that, although they have autonomy and independence, may coincide in one or more common interests that lead to objectives that they intend to achieve.

In this way, the way to achieve match in the search of objectives that interest a heterogeneous and independent group of organizations, is through the collaboration and the generation of synergy inner the group of participants, who collaborate with the expectation of achieve particular benefits, those that would not exist when they act individually, but in turn justify the resignation of independence and autonomy in certain aspects that make the daily action of these participants.

Collaboration in these types of groups is sustained over time by the benefits (material and immaterial) generated and distributed.

The benefits are achieved by the concretion of the objectives; this is possible by the collaborative actions developed by the group of participants, which is feasible because of the trust that the individuals gives to the group, and also is it possible beacuse is supported by the information about the activities carried out that is shared with the group.

The present proposal aims to model the problems that arise and is expected to serve as a guide to continue the research that collaborates with the design of a methodology suitable for the management of these strategic alliances.

3106

A SYSTEMS THEORY OF HUMAN AND LAND TRANSFORMATIONS: SYSTEMIC ANALYSIS OF LAND USE CHANGES AND DYNAMICS IN THE NORTH-WEST OF PICHINCHA, ECUADOR.

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Despite past high deforestation rates, the north-west of Pichincha, Ecuador, is a forested area characterised by its large quantity of cloud forest and the creation of private conservation networks. Nowadays, the fragmentation of remnant forest is important, but both a strong conservationist movement and foreign investment in conservation and ecotourism activities counteract it. In fact, much of the cloud forest around Mindo is protected in the Mindo-Nambillo Protected Forest thanks to civil society initiatives.

In the context of this systemic research, the combination of the "Analytical Framework for a Systemic Analysis of Drivers and Dynamics of Historical Land-Use Changes" with Grounded Theory approaches have allowed researchers to achieve both creative thinking and novel outcomes, without losing a certain degree of coherence.

a) Historical institutional changes; b) production and external conservation trends; c)the biophysical characteristics of the land; and d) individual cognitive factors have influenced the decision-making process of the landowners in this area. Individual decisions have shaped the landscape, which in return have re-influenced formal and informal institutions and believes, as well as societal processes. Ultimately, decisions and choices affect present and future land-use functions (goods and services provided by different land-uses).

The system's dynamic observed in this middle-range theory of human and land transformations pretend to generate knowledge in the way the already aforementioned drivers trigger historical processes (including changes in practices, and changes in understanding and learning). Understanding of the real motives of land use decisions have wider implications for nature conservation, policy and human development.

3107

GROUNDING TRANSFORMATION IN ARTICULATION

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The advent of digital transformation invading all societal and economic systems requires to re-consider the generative nature of socio-technical system design. Transformation needs to be studied, in particular how links are continuously explored and accelerated between existing as well new systems. The accelerated production of relations does not only substantiate system thinking, but also characterizes the fundamental nature of digital production systems.

As digital transformations are complex, some scholars have already called for a system science approach to deal with. Thereby, traditional cognitive or top-down approaches to regulate or control dynamic processes are seen as 'last resort'. Evolving complex systems bear systemic challenges, which are wicked due to their social or cultural nature and incomplete, contradictory, interconnected, and changing requirements that are often difficult to recognize.

Bringing together complexity and wicked problems theories to understand how individual organizations and change agents can better influence large system change. We have developed a framework that helps to understand and cope with system interventions while taking the perspective of individual agents for change in organizations. Consequently, we do not only need to put forward theoretical understanding of transformation and change management by positioning the organization in the context of a broader system, but also need to define its role in creating change based on articulation of individual stakeholders. Individually informed articulation (e.g., on underlying principles for certain behavior patterns) is likely to facilitate addressing the nature of wicked problems by setting informed relations between individual systems and the large systems where they are embedded.

In articulation the relation of individuals as change agents and their relations to organizations and society in transformational change are considered. Sharing relational background knowledge and developing relations allow creating transformations that can be substantial and lead to emergence system behavior due to that change. In the presented samples stemming from organizational development, the essential role of individuals in a situated while cognitive transformation process becomes evident. In contrast to behavioral manipulation, cognitive transformation acts in a subjective environment. It can be experienced by everyone in the same situational context. Transformations are achieved to giving situations a different meaning than before.

3108 (3238)

UNIVERSITY FOR BUSINESS AND TECHNOLOGY KNOWLEDGE CENTER: MAKING LOCAL KNOWLEDGE VISIBLE

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In setting the aspirational vision for University for Business and Technology, founder Dr. Edmond Harjrizi sought to educate Kosovo students to become active contributors to the society and at the workplace, within the country, the Baltic region, and beyond. For historical reasons, success initially depended on inviting lecturers and scholars from abroad, as reflected in the university's brand statement, 'American European Education'. Now, after more than a decade of successfully educating Kosovo graduates and developing Kosovo instructors, the University plans to further awareness and promote usage of university produced knowledge, within the institution and throughout the country, in a Knowledge Center.

This UBT Knowledge Center initiative extends the founding vision of national development through higher education. Reflective of its institutional maturity, the University now produces considerable local knowledge, including but not limited to faculty publications and presentations, student paper and reports, and commissioned studies and reports. In the first stage of this initiative to enhance visibility and accessibility of local knowledge, computer science students developed the code for a repository of UBT faculty publication and presentation references, which now serves as the platform for the Kosovo national faculty bibliography.

In this second phase of making local knowledge visible, the University will create a repository system and associated workflows for acquisition, organization, and dissemination of student research projects, faculty

research papers, and community research reports. This initiative acknowledges a university's responsibility to foster democratic civil society and regional economic growth, as well as further smart business practices and higher education efficiencies. Since local knowledge, identity, and learning are necessarily situated, Kosovo students, faculty, staff, and administrators serve as domain experts and international educators from Sweden and the United States serve as design facilitators.

After two years of planning activities, initiation of human-centered design for the UBT Knowledge Center commenced in April 2017 in a graduate level Information Systems Analysis, Design, and Modeling course at the Pristina campus. Soft systems design tools guided exploration of essential questions related to the why, what, and how of this national innovation generator. Since this initiative acknowledges the social context of learning – that knowledge is acquired and understood through action, interaction, and sharing with others, soft systems models and processes explored social relationships necessary for information exchange and knowledge creation enabled by technology.

In this paper, a pedagogical model is presented for initiating student learning about systems thinking ideas and tools, such as the Soft Systems Methodology (SSM) Rich Picture and PQR technique. Student projects illustrate application of these tools to advance local knowledge visibility within prototype UBT Knowledge Center environments. Course evaluations reveal students' success in advancing knowledge ecosystem design through soft systems. One student expressed this as now "my life will have two eras, before SSM and after SSM".

Concluding reflections explore implications for the University's knowledge vision, including consideration of interrelationships between university and society which develop new and more complex ways for working with people, information, and technology. This necessarily includes educating graduates to curate, interpret, and use information to create knowledge, which preserves intellectual, cultural, national, and regional resources for future generations.

3109 (3150)

SYSTEMIC INNOVATION IN A WORLD OF UNCERTAINTY

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Systemic Innovation is a field of praxis that is rapidly taking shape as a key driver in R&D initiatives focused on integral sustainability the world over. This field curates the exploration of socio-technical systems design, implementation and insertion in society in ways that foster planetary thrivability at local and global (aka 'glocal') levels. To do so, it adopts a transformative approach to characteristically "wicked" societal problems through the transdisciplinary study of ways in which pragmatic socio-technical systems innovation can dissolve VUCA challenges (i.e., those that are characteristically volatile, uncertain, complex and ambiguous). This paper explores how insights from the systems sciences can directly influence real-world socio-technical systems change. By considering both the systemic leverage points and systemic nurturance spaces that foster the emergence of innovations for thrivability, the field of systemic innovation is developing new methods, models and means of emerging ecosystems of R&D+i (research and development plus innovation). Results include the generation of socio-technical solutions that are synergetic with each other (thereby forming collective incubators or innovation greenhouses based on the application of collective intelligence). The emergence of such innovation ecosystems requires leadership and systemic innovation that incorporates social values, technological creativity, economic opportunity and environmental integrity. This paper considers themes of innovation, leadership, connective intelligence, collective intelligence, collective creativity, design thinking, systems practice, entrepreneurial experimentation and other considerations related to the emerging field of leadership and systemic innovation.

3111 (3224)

A GENERAL SYSTEMS OUTLOOK TO THE PREDICTION-INFERENCE DILEMMA OF NEUROSCIENCE MODELS.

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As the predictions made by a mathematical model gets validated, the level of confidence on the model grows with every successful prediction. With this rise in confidence one is tempted to make inferences from the more abstract parts of the model. This may result in perceived notion of contradictions or paradoxes. For an ontologically oriented non-general system theorists the relation between model and real-world such that the

model results are applied, is a complex one. Let me illustrate this using one of the most famous models in computational neuroscience, the Hodgkin-Huxley model.

Since its unveiling 67 years ago, the system of the four differential equations have successfully modelled other axons and entire neurons based on the modelling schema. For the typical model the equations are such that one is a derivative of the membrane voltage. This is coupled to the remaining three derivatives of the probability that three different ion gates are open. Consider the case of a single channel with four charged particles. And the probability that each charged particle is in a position to open the channel is 0.5. But a real cell membrane has more than one channel of the same type, say ten. Does that mean there are only four charged particles for all the ten channels combined? How can a single channel have four charged particle and at the same time the number of charged particles in the remaining nine channels is also ten?

This contradiction leads to the prediction-inference dilemma. The dilemma that the model makes successful predictions yet, inferences from the model results in inconsistencies. If we waited until someone produced a type of channel with four charged particles and also four charged particles for an arbitrary number of the channel we would not be using the Hodgkin-Huxley model today. This would be like, not using geometry until someone produces a point with no dimension.

From the perspective of a general system theorists the prediction-inference dilemma is resolved. This is because from a general system view, a mathematical model has two facets; principal quantity/ies and secondary quantity/ies or constructs. The principal quantity agrees with the measurable quantity. For instance, membrane voltage variable in the system of equations. The principal quantity and the measured quantity are two different quantities. The model and real-world relation is provided by the agreement between the quantities. Secondary quantities are the result of mathematical abstractions; concepts, operations and symbols of which there are no counterpart in the real-world. This is the Slepian's two-world view from information theory.

In the interdisciplinary field of neuroscience the role of computational neuroscience (also, theoretical or mathematical neuroscience) is to join the disciplinary rungs of the neuroscience ladder. The computational neuroscientist must therefore be a general system theorists and also be proficient in the science of modelling. This paper will present the solution to the prediction-inference dilemma as an illustration of the general systems approach to the science of modelling in computational neuroscience.

Keywords: general systems theory, model making, computational neuroscience, neural network, portable concepts.

3112 (3198)

TOWARDS THE DEFINITION OF A DYNAMIC/SYSTEMIC ASSESSMENT FOR CYBER SECURITY RISKS THROUGH A SYSTEMS THINKING APPROACH

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Nowadays our society is increasingly becoming economic and social dependent on the cyberspace, which includes physical network assets and software based systems. However, the cyberspace is exposed to numerous risks, and there is a constant threat of exploitable vulnerabilities, which could cause significant reputational and economic damages to the companies. For addressing these increasing threats, the Italian National Cyber Security Framework was developed to offer a uniform approach to assessing cyber risks into organizations, as well as to help improve the related security through focused investments. Still, this evaluation is not a straightforward endeavor. Using the principles of the Systems Thinking paradigm, this work presents a way to put into causal relationship the self-assessment risk-categories of the framework by associating them to the various aspects of reference inside a theoretical organizational structure (composed of business areas, process, functions, and roles), hence deriving a systemic causal-effect relationship map capable of evidencing, at least qualitatively for this study, how a change in one or more categories is driving changes also into other ones.

Keywords: National Cyber Security Framework; Cyber-security Risks; System thinking.

3113

TOWARDS A GENERATIVE FORMULATION OF MECHANISTIC SYSTEMS

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Every discipline of engineering has an extensive body of knowledge relating to the design and analysis of its systems. Systems engineering community (INCOSE) has worked through the commonalities across these engineering disciplines, and created SEBOK, that applies to the design of any kind of system, particularly mechanistic systems across different engineering domains. While there is widespread agreement on the concepts, as articulated in SEBOK, there is still some sense that the field is empirical, and it would be desirable to create formal foundations. For example, it is widely accepted that design synthesis needs to be complemented by analysis and verification – but there is no theoretical basis for explaining why it is needed. The broad agenda for Systems scientists has been to build these foundations and provide the theoretical basis for the different concepts that are found useful by system engineers.

In this paper, an experiment to explore and extend the explanatory power of the commonly accepted concepts in systems engineering is discussed. It formulates an abstraction of a "block" based on existing systems engineering concepts. This abstract concept, "block", is described in terms of elements such as inputs, outputs, state, characteristics, outcomes and relationships with the context. It is realized recursively as a network/hierarchy of blocks, giving rise to structures and processes that produce the outcomes. It is conjectured that this network/hierarchy of blocks can be generated through recursive application of three operations: decomposition, dependency closure and realization.

The value of the block concept is explored by applying it to explain several of the practices and phenomena in SEBOK, including the Vee model. It leads to a specific framing of the concept of domains, the nature of domain knowledge, and relationships between domains which is presented in this paper. It also provides an explanation of the need for analysis to complement synthesis, as well as subsequent verification. We believe that this conceptual approach holds promise in terms of creating a framework for reasoning about engineering systems. The current formulation is expressed and discussed in conceptual terms, but it could be formalized mathematically. The result would be an abstract mathematical construct that could enable abstract reasoning about systems phenomena and engineering practice, at least for mechanistic systems.

Keywords**:** Block, SEBOK, Theoretical basis, Block elements, Vee Model, Framework for Reasoning, Engineering Systems

3116

THEORETICAL ASPECT OF SYSTEMS METHODOLOGY FOR KNOWLEDGE MANAGEMENT

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A person gradually establishes one's personality and becomes an expert. Such a process is related to some concepts of unconscious learning such as 'tacit knowing' by M.Polanyi, 'identification' by H.A.Simon, 'appreciation' by G.Vickers, 'legitimate peripheral participation' by J.Lave and E.Wenger, and 'blind point' by O.Scharmer. Based on the concepts, we investigate the fundamental idea of an inquiry and learning process of systems methodologies for knowledge management. We then discuss that the establishment of personality and mastery are a process of exteriorization into an organization. In this presentation I will show some details of the above concerns.

3117

A SYSTEMS THINKING PERSPECTIVE FOR DESIGNING AN ONLINE INFORMATION SECURITY LABORATORY

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Information security is considered an important subject within the field of Information Systems. E-learning in the field of information security is gaining popularity mainly due to the convenience to take classes online without the expense and time constraints involved in commuting to a campus facility. E-learning classes have unique requirements compared to campus-based education. Accordingly, the information security curriculum needs to keep up with new teaching methods. Information Security education benefits greatly from hands-on laboratory oriented exercises. An online information security programme is supposed to include plenty of hands-on exercises, but mostly the laboratory experiments are unavailable to distance students that represent a challenge in online education. Virtual laboratories facilitate hands-on learning for distance students in

information security education. An online information security laboratory is an artefact which comprises a collection of systems and software used for teaching information security, and which is accessible through the Internet. However, the design, development and implementation of an online information security laboratory has many challenges. A variety of pedagogical strategies can be utilized to develop online laboratories for information security education.

This research focuses on the question of how we can design a pedagogical online information security laboratory which is flexible and adapts to different educational contexts for various courses. The current literature about online information security laboratories still lacks well-specified pedagogical approaches and concrete design principles. This hinders the accumulation of technical and pedagogical knowledge for the implementation and use of online information security laboratories. Moreover, the literature ignores the pedagogical elements of curriculum and the rationale behind them and instead focuses mainly on details of technical lab implementations. This situation leads to inadequate guidance about how the instructor and the learner can make use of the lab to pedagogically align the course objectives, teaching / learning activities and assessment methods. Systems thinking can be applied to design an online information security laboratory to improve flexible hands-on education and security skills development.

To match the benefits with traditional learning environments, a successful e-learning system must be designed and constructed carefully, based on well-grounded pedagogical principles and robust design guidelines. Systems thinking can help in understanding a system by examining the relationship and interactions among different components of a system (such as online information security laboratory). The systemic approach incorporates different approaches such as soft system methodology to explore and incorporate major aspects of the problems in design of a system. This study proposed a conceptual model of an online information security laboratory comprising important building blocks. This study explained the black-box tools view of the laboratory in order to understand and explain the important building blocks (entities of the lab), and the interrelationships of the entities. This study attempts to provide conceptual clarity by recognizing the stakeholders and explaining their roles for each entity in the proposed conceptual model of an online information security laboratory. Different building blocks / entities of laboratory interact with each other during the process of lab design and development.

The study puts forth the rich picture and a conceptual model of an online information security laboratory to meet the active learning preferences of distance learners of information security, such as support for flexible hands-on learning. The whole system view of systems thinking can be applied to an educational system for understanding, analyzing and conceptualizing the different interconnected systems. These systems need to work together for the whole system to function successfully and effectively.

3124 (3124)

THEOANTHROPOCENTRIC ERA

Crespo, Fabiana

A new era is beginning. It is the era of Consciousness. In India, Daddy Yankee of Brahma Kumaris, calls it ¨The Golden Era¨, because human beings are rediscovering ¨energy¨ within themselves and how to play god's roll of creator with it. We know WE ARE ALL ONE, we are UNIQUE but we are not separated. We live in an holographic reality. Neither separation nor matter exist in the universe. We are waves, vibrations. Information as in-form-ation. We are energy, as waves. We are ¨in-form-ed¨ energy, Ervin Laszlo referring to David Bohm´s affirmations. The Universe is Holographic. We can see all the parts within the Whole. The locality doesn´t exist. what exists is the whole. We are all parts of the Holographic Universe (Laszo, E.; Bacchia, A. 2017. *Our Holographic Reality*). Now human beings can access the forbidden education of the Alchemy of Gnosis, the Spiritual Wisdom. This discipline, during ancient times, was only revealed to the kings. Tantra also has a lot to do with this wisdom. Sexual energy is the energy that creates life, it is the most powerful energy in the universe, it is the energy of LOVE. Pure and unconditional love. The one that performs miracles. In this abstract, we are going to focus on the Whole system, and the subsystems of the universes. Not only the subsystem of this universe but also the whole planet subsystem, and the subsystems of human beings are linked. Special attention is going to be the powerful sustainable subsystem of Human Technology. The one is within, in our hardware: the body, and with the software: in the mind. It is the system which is free to perform whatever and whenever required. The decision of how and when to use it is ours.

Keywords: Spirituality. Science. Energy. Thoughts. Emotions. Gnosis. Tantra. Alchemy. Holographic.

3128 (3129)

PILOT CASE STUDY: HOW TWO NON-PROFIT EDUCATION FOUNDATIONS USE SOCIAL MEDIA TO SUPPORT SYSTEMIC ENGAGEMENT

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Easily available and widely used, social media tools look like a boon for small, nonprofit organizations that need systemic approaches for disseminating information and cultivating networks for donor and member engagement, especially those relying on a few paid staff and many good-hearted volunteers to do the work. This case study examines the experiences of two nonprofit organizations and the complexities, constraints, and contextual challenges that have made adopting social media practices more difficult and less effective than industry advisers, researchers, and examples suggest. Leaders of these two education foundations describe themselves as caught between the demands of tending key person-to-person relationships and the additional duties associated with cultivating interactive relational networks through social media. The experiences described in this instrumental case study align with themes found across trans-disciplinary research on social media and organizations. These themes are *social media*, *organizational capacity*, and the changing concept of *engagement*.

Keywords: nonprofit, social media, engagement, social media engagement, organizational capacity, complexity

3130

ENERGY AND WATER IN THE EARTH SYSTEM: AN INTEGRATED MODELLING APPROACH

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The concept of global change refers to planetary-scale changes in the Earth system. The system consists of the land, oceans, atmosphere, life, and the planet's natural cycles that are linked and influence one another. As a result, it becomes necessary to consider impacts of global change from an integrated perspective. The ANEMI integrated assessment model is developed at Western University to study feedbacks in the Earth system as they relate to water resources management and the energy-economy using the system dynamics simulation approach. Nine different model sectors are used to represent the system structure, which is composed of stocks and flows used to represent feedbacks within and between sectors. The model sectors include population, climate, carbon cycle, energy-economy, water quality, water quantity, water demand, food production, and land-use. The model has been used to study the dynamics of adding water pollution affects into the determination of water stress, potential for wastewater reuse to limit water stress, and the effect of carbon taxation on economic growth, CO_2 emissions, and climate change within the integrated system.

In this work, structural changes to the ANEMI model have been made to create a tighter link between water resources and the energy-economy sectors and to study the feedbacks between them. Capital stocks for water and energy supplies are modelled dynamically in order to examine the development of alternative water resources such as desalination, wastewater reuse and groundwater mining to offset future water stress, as well as the dynamics of coal, oil, and natural gas as sources of energy for electricity and heating purposes. A link between the water and energy capital stocks is made by examining future projected growth in energy recovery from biogas and biosolids by-products from the wastewater treatment process, which is influenced by a projected increase in the level of wastewater treatment and reuse. Preliminary results show that by investing in recovered energy from wastewater treatment by-products, fossil fuel consumption may be reduced, thereby slowing price increases in fossil fuels as the supplies are being depleted.

Current improvements to the ANEMI integrated assessment model are focused on the development of a methodology to study potential feedbacks between drinking water and wastewater treatment as they are related via source water quality and economics. For example, treated and untreated wastewater discharges have the potential to reduce water quality of lakes and rivers, which act as source waters for drinking water treatment plant intakes. If water quality becomes degraded due to increased levels of sediment and dissolved organic matter, the cost of treatment and plant maintenance increases. At this point there is an economic trade-off between investing in increased wastewater treatment and the increase in drinking water treatment costs. The results of the ANEMI model are currently globally aggregated. This allows for the Earth system to be modelled simply in a way that allows for the dynamics of global change to be analysed and feedbacks to be diagnosed. However, this level of aggregation also limits the practical value of model results. A multi-scale feedback disaggregation approach for the ANEMI model is briefly discussed.

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CAN COUNTERFACTUALS HELP TO ENHANCE THE SYSTEMIC THINKING OF MANAGERS?

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The focus of this paper is on counterfactual narratives and whether they can be used as a learning tool in a business setting to enhance systemic thinking. Counterfactuals have recently received a lot of attention from academics of different disciplines – from politics and international relations to philosophy and management. However, little attention has been paid to evaluating the outcomes of the use of counterfactuals and whether they can be used to increase decision makers' systemic reasoning skills and their ability to deal with the complexities of the business world. Hence this paper will discuss how counterfactuals can be used to expose deterministic worldviews and to encourage managers' explorations of alternative scenarios of the past. The discussion of theory in this paper is complemented with the description of a PhD project, still being designed, that aims to evaluate the impact of counterfactuals on managerial awareness. The research is essentially systemic in nature, given its focus on holistic understanding and appreciation of complexity. The field work will be based around executive education-style sessions involving the analysis of a fictional case study with multiple points of intervention. In addition, the project will also aim to determine whether there is an intercultural aspect to counterfactuals and management learning, as it will involve fieldwork in Turkey, Ukraine, the Netherlands and the UK.

3133

STUDY ON INNOVATION MANAGEMENT THROUGH A CASE STUDY BASED APPROACH

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Today, innovating new systems, solutions and services at unprecedented rates is critical for the survival of businesses in any industry sector. Increasingly, traditional products and services that are offered by businesses are not sufficient for these businesses to retain their market share and revenues. Hence, businesses are looking at innovation in anticipation of growth in their respective businesses. Globally, it has been established that, businesses need to continuously innovate so as to stay ahead of the competition. While, innovation is supposed to introduce something new to the business that disrupts their value systems, habits and culture, it is often the case that businesses fail to change sufficiently and succeed in their innovations. Even though businesses invest heavily on capital and human resources in order to come up with innovations, it is often the case that these implementations are seldom successful.

Even though businesses try their best to be innovative and adopt a wide variety of approaches, the percentage of successful innovations is significantly less all over the world. In this situation, it is widely recognized that without innovation management, businesses cannot meet the changing requirements and achieve non-linear growth that arises due to innovation. Innovation management deals with the management of business innovation practices, procedures and processes starting from ideation till its successful implementation. There are many approaches, frameworks, methodologies that has been espoused by the leaders in the field to aid in innovation management. Each of these, describe the decisions, activities, and practices that businesses could utilize to generate business value to their customers and other stakeholders in a specific context. To adopt these approaches, frameworks, and methodologies, businesses need to deal with contextual variations/extensions in the business environment, variability in geographies, vertical markets, product lines, services, customers, operating environments, technology platforms, business logic, operating contexts, interaction/integration concerns, market needs, etc.

In this paper, a study to explore the successful innovations of a large conglomerate is discussed. The objective of this study is to understand and reason over an innovation, its structure, intent, purposes, processes, success criteria, constraints, outcomes and its ability to bring in change and disruption in the business domain. Another objective is to identify, classify and understand conceptual foundations, principles, properties, core-ideas and techniques of the innovation management approaches, practices, frameworks, methodologies that were adopted by this large conglomerate and draw meaningful conclusions about their formal and spatial aspects.

Keywords**:** Innovation, Innovation Management, Businesses, Classification, Exploration of Successful innovations, Large conglomerate, Innovation Management Frameworks, Methodologies, Approaches, Practices

3134

THE Â∞2 MODEL OF MULTIDIMENSIONAL INTELLIGENCES THEORY

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In the intelligent web era, the measure of intelligence can no longer depends on the linear model. The various multidimensional measurements, such as integer dimension, topological dimension, fractional dimension, negative dimension, etc., shoud be taken into serious account. Based on these multidimensional measurement, we could further apply grand multidimensional design–a meta-ontology (or upper, fundamental ontology) to integrate human wisdom and compassion into machine knowledge. The ∞^2 model represented as a multidimensional intelligences theory with meta-ontology could help realize the grand multidimensional design. In this paper, the author will first pinpoint the advent of multidimensional super-intelligent era which might come much sooner than we could imagine. With deeper understanding of the core concept of the super-intelligent era, the author will then highlight the significance of human adaptablity to multidimensional thinking. Secondly, the author will compare 20 contemporary available meta-ontology or upper ontologies, and trace their deficiency in responding to the creative design of the grand multidimensional measurements. Thirdly, towards a dynamic semantic web, the author will apply a dynamic multidimensional matrix to describe the ∞^2 model of multidimensional intelligences theory. The dynamic multidimensional matrix is based on the multidimensional nonlinear language, which has been shown in the TV series Earth Final Conflict (1997) and in the film Arrival (2016). It might provide great possibilities to resolve the constraints imposed by small display media and linear language. By further research and applications, it is expected that machine knowledge and human wisdom and compassion could be more delicately integrated by synthesizing the most general 42 elements in the ∞^2 model of multidimensional intelligences theory. The author contends that the ∞^2 model of multidimensional intelligences theory will promote the integration of human-machine smart era, accelerate multi-level jump of the multidimensional intelligences, and nurture the new universe of ubiquitous web of things and beings.

Keywords: infinity square model, multidimensional intelligences theory, meta-ontology, dynamic multidimensional matrix, multidimensional nonlinear language

3135 (3235)

PROPOSAL OF A CAPABILITY MATURITY MODEL FOR HEALTH AND PRODUCTIVITY MANAGEMENT

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Currently, as society progresses, it faces a challenge of increased social security expenses. It is important for companies to promote health, in order to suppress the growth of social security expenses. Considering this, the Ministry of Economy, Trade and Industry initiated the "Health and Productivity Management Stock Selection" and the "Certified Health and Productivity Management Organization Recognition Program." However, as health and productivity management (HPM) is a relatively new perspective, individuals within a company, who are responsible for HPM, are struggling to identify the problems to design and conduct HPM activities.

3139 (3184)

SYSTEM-PURPOSE METHOD: THEORETICAL ASPECT.

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This article observes methodological aspects of conflict-contractual theory of social systems. System-purpose method is formulated and determined in frame of the theory and presented in this article.

Keywords**:** Philosophy of science, epistemology, system theory, methodology of science, social theory.

3140 (3192)

SOCIO-TECHNICAL SYSTEM WHOLENESS: A THEORETICAL MODEL APPLIED TO GLOBAL SECURITY PROBLEMS

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Researchers and practitioners continue to study the causes of high-consequence events such as terrorist attacks or catastrophic failures of complex socio-technical systems. These studies have relevance to postulated and real events and are important, but limited. Analyses focusing on linear causal pathways are common in vulnerability and probabilistic risk analyses. These linear pathways typically focus on individual human error or technical system malfunctions. The linear approach is limited in its value as broader systemic issues can remain hidden.

A new model is proposed using an integral approach that describes vulnerability from a systemic wholeness perspective. Wholeness is a concept that has many meanings, from various academic and practical perspectives. This paper offers a new definition of the wholeness concept that draws from earlier ideas but is distinct in its application. The model can be used to focus attention on many integrated systemic domains simultaneously in a continuous and ongoing process. The model's foundation is a four-quadrant framework that describes subjective, objective, inter-objective, and inter-subjective domain spaces. Vulnerabilities or systemic deficiencies within these spaces are described using the metaphors of system holes and shadow aspects. Collection and depiction of these deficiencies allow for analysis, revealing common patterns of concern. Clarifying inter-organizational relationships is also important and highlights the need for clear systemic and sub-systemic boundary definitions.

Improvement of industrial, community, or infrastructure security requires a perpetual process that is described by a dynamic dimension to the wholeness model, drawing from methods employed in participatory action research. This paper presents the main points of the wholeness model, shows how deficiencies are analyzed, and provides examples of characteristic patterns of concern.

3141

USING MONTEREY PHOENIX TO MODEL EACH ISOMORPHIC SYSTEMS PROCESS (ISP) OF THE SYSTEMS PROCESSES THEORY (SPT): TEST OF CONCEPT

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This paper describes preliminary research in formalizing Isomorphic Systems Processes, Patterns or Pathologies (ISPs) using automated systems engineering tools, based on systems science research. Monterey Phoenix (MP) is a behavior modeling approach and tool used by systems engineers to describe system behaviors and expose emergent behaviors in engineered, complex systems. MP is introduced in the context of its potential for modeling ISPs both abstractly (at the universal patterns level) and concretely (at the example, case study, or instantiation level). In this paper, the Cycles ISP is modeled in MP and executed to compute many possible variations for the Cycles ISP. Input for the model of Cycles ISP comes from the accumulating SPT relational data base of 30 categories of information for each ISP briefly described in the paper. Selection of key information from just four of the categories were used to model the Cycles ISP in Monterey Phoenix, namely, "Identifying Features," "Measurables," "Identifying Functions," and "How a Process." Inspection of the output from this executable model provides insight to inform the proposed ISP taxonomy. In particular, MP-generated variants of the Cycles ISP are shown to contain patterns of positive feedback, negative feedback, oscillation, lifecycle, and recycling. Although, the input relational data base contained preliminary information on three of these (oscillations, lifecycles, and recycling), the other two were not anticipated in pre-model analyses. Applications of the Cycles ISP are included to demonstrate example instances of where these patterns occur and which deviations from the standard universal patterns might result in system dysfunctions or pathologies. The paper suggests how knowledge of these deviations might contribute to knowledge of why they occur at the fundamental general systems level, what exact impacts they have, and how they might be corrected. The initial results show that MP is a productive framework for describing an ISP as a formal and executable model, in terms of a simple and straightforward event grammar. Future work includes expanding the overall SPT-MP meta-model with other proposed ISPs (there are at least 55 additional ISPs available), creating more exploratory executions of the meta-model, and cataloging the formal MP models of ISPs. The ultimate goal would be to interconnect a sufficient number of the ISPs to yield

a very general model of sustainable systems dynamics at all scales and for many types or classes of systems as well as models of dysfunction that are often encountered in engineering and natural systems.

3144

THE INFLUENCE OF HISTORY AND CULTURE ON SCIENCE AND PHILOSOPHY – JJH PERSPECTIVE FOR 20 QUESTIONS

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Submit to the panel of the same name at ISSS 2017, Vienna, Austria. All questions in this conversational format paper are raised by Stuart Umpleby. Thanks for Stuart's sharp and important questions that facilitated the organization of my thoughts.

Q-1: How do you see the influence of history and culture on science and philosophy of science?

A-1: Big question, deserves a bid answer. First, I shall use a method of concept-simplification (we have to, in many cases). Thus:

- history = (hi-story: inaccurate, collective memory, sometimes with multiple versions.)
- culture = (set of cultural gene, distilled from history);
- science = (God 2.0, a specific and unique culture maintained by a special group called scientists);
- philosophy of science = (theology 2.0, the Level-1 study of sciences)
- study = (effort to obtain knowledge: level-0: unjustified, no evidence, assertions. Level-1: simple observation, logical reasoning, Gedankenexperiment; Level-2: large scale observation, statistics, use of measurement scales, datamining; Level-3: controlled experiment, strict use of mathematic tools, high precision experimentation equipment.)

3145

ANALYZING PROTRACTED CONFLICT SYSTEMS: A COMPARATIVE STUDY OF STATE AND NON-STATE ACTORS

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This study applies the systems approach to the study of protracted conflicts (PCs). The goals of this study are to demonstrate the usefulness of a systemic view-point and to reveal differences in the interactions among state actors, and between state actors and Non-State Actors (NSAs). In other words, this study intends to investigate whether PCs involving NSAs have a different dynamic than those involving state actors alone. The importance of such an inquiry is that identifying differences in interaction patterns between the two kinds of PCs should assist decision-makers in forming suitable policies and in increasing control over events in world politics. For instance, if we could tell that NSAs are more prone than states to attack as a response to a demonstration of power, we would know that we must manage situations with NSAs differently than with states.

In order to broaden the field of PC research, this study sets forth a new conceptual framework that combines knowledge from various disciplines, including international relations, mathematics, physics and engineering. Contemporary research on PCs is largely influenced by 'political realism' which considers only states as main actors that determine the political events in the world system, while leaving the influence of other actors aside. The framework offered by this study is designed to supplement existing research on PCs by broadening it to include NSAs as active participants, enabling researchers to understand the role of both types of actors in PCs dynamic. Accordingly, it offers and applies new concepts that allow for the investigation of those interactions as processes of international systems that contain both states and NSAs as actors. In doing so, it highlights the interactions between states, and between states and NSAs, as chains of interrelated actions. A mathematical analysis of those interaction chains would uncover behavioral differences between state-only PCs and PCs with NSAs. The new concepts include 'Protracted Conflict System' (PCS), 'process bifurcations', 'process stability' and 'dangerousness'.

The study establishes a new dataset containing time-series of salient events from the Israel-Arab PC between 1947-1962, as reported by *The New York Times*. Each time-series is dyadic and contains actions played by both sides of the dyad. A dyad is the smallest international system, containing only two actors, and therefore is the simplest to describe and analyze. The analysis of dyadic systems allows for a more nuanced investigation that may teach the investigator specific details regarding the relationship between the two actors that would not have been found in systems with more actors, mainly because of the multiplicity of actions that may cancel one another out.

In addressing the differences between state-only PCs and ones with NSAs, the study hypothesizes that they occur in the following areas: 1. Interaction patterns, 2. Causality mechanisms, 3. Process stability levels, and 4. Dangerousness levels. Results have shown that regarding interaction patterns and causal mechanisms

PCs with and without NSAs do indeed behave differently. However, regarding process stability and dangerousness, both types of PCs show much resemblance. This indicates that at the basic level of causes of processes, state-only PCs and PCs with NSAs have significant differences; however, at the level of the effects, they behave similarly. Further research should address other PCs and longer spans of time in order to validate these results. Even so, these preliminary results indicate that states and NSAs behave differently in the global political arena. Therefore, it is my hope that this study will aid decision makers in determining how to respond to different types of conflict, as well as motivate the application of the systems approach in uncovering more important traits of world politics.

3151

CAVEATS AND LIMITS ON THE SYSTEMS PATHOLOGY-BIOMEDICAL ANALOGY

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This paper and presentation focuses on the search for negative evidence for a hypothesis because that task is the hallmark of critical thinking and the scientific method. While it seems unusual to begin a new discipline with examination of all the possible pitfalls or disadvantages of that effort, it appears to this team that a comprehensive search for possible errors is a good way to begin design of a new approach. The paper begins with comparative definitions of analogy, homology, and isomorphy and lessons learned in biomedicine from past mistaken applications of those concepts. It continues with a quick overview of the Systems Pathology analogy with biomedicine, our attempt to capitalize on its vast knowledge base and 5000 years of development to give a significant jump-start to Systems Pathology. The paper describes how research into pathologies or dysfunctions has been a great methodology for advancing the gradual understanding of complex systems of all types in the past, and especially for study of complex systems. It continues with definitions for our use of the words "caveat" and "limits" in this context. It continues by describing at least twenty specific caveats and limits to the Systems Pathology analogy. These include difficulties defining healthy systems, diseased systems, conflating symptoms versus ultimate causes, difficulties in generalizing across all scales, distinguishing change and evolution from dysfunction, avoiding the trap of optimality, avoiding iatrogenic or unintended effects, difficulties in certification of SysPath knowledge, broadening education about Systems Pathology, noting positive aspects of senescence and death, the need for SysPath values and a Hippocratic Oath, and more. With each description, there is a discussion of ways to ameliorate or reverse negative effects. Finally, it lists at least a dozen independent domains of Systems Pathology that are fragmented and remain unintegrated causing difficulties in cross-communication, less transfer of models, barriers to use of knowledge, and generation of new knowledge in our understanding of how to curate or cure ailing systems at all scales. We hope for, anticipate, and enable a future world where humanity protects and preserves its nest of all surrounding systems just as biomedicine attempts to increase longevity and quality of human life.

3152

A PUBLIC DATA BASE FOR SYSTEMS PROCESSES THEORY AND SYSTEMS PATHOLOGY (DB-SP2T)

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Systems Processes Theory (SPT) teams, following 40 years of collection by its originator Dr. Len Troncale, are continuing to collect numerous case studies, scientific research articles, books, references, definitions and other related material on phenomena across the major domains of science (astronomy, physics, chemistry, geology, biology, mathematics, computer science, & human & social systems). These collections are organized according to some 55 Isomorphic Systems Processes or Patterns (ISPs) as GST components because the peer reviewed scientific method gives evidence for their underlying commonality, similarity or universality despite specific differences in scale, discipline, or type of system compared. For example, SPT has collected under the cycles ISP, about 100 case studies of cycling features/functions from the literature of the above 9 disciplines. Same for hierarchies, or networks. Over 1,000 research articles have been collected for "Origins patterns" alone as one ISP. Plans are to collect items for 30 Categories of Information for each and every ISP. Access to this valuable, transdisciplinary, general systems oriented body of knowledge is currently very limited. Several wish to secure this huge knowledge base in perpetuity for use by a wider range of systems scientists, systems thinkers, sustainability experts, systems engineers, design & management specialists, etc.

The authors are working with Dr. Troncale to develop a publicly accessible relational database of the information. This development would make the work of the many usable by anyone. This presentation and paper describes initial planning. We recognize two major parts of this project: 1) the database schema & software, and 2) the human interface to the data. The development of the schema is complicated by the wide diversity of material in the collection. Metadata surrounding each item lacks uniformity. For example, the bibliographic citations exist in a multitude of formats (ALA, Chicago, Dewey Decimal, IEEE reference numbers, URL, LOC, Marc 25 and so on.) The first step in developing the schema is collecting, rationalizing and building a common citation construct with enough flexibility to adjust to future requirements without introducing redundancy. The development of the interface must anticipate the questions a user might ask. Since the users of the database will range from experienced science researchers to students to engineers to curators and more - most likely there will be multiple access modes needed.

This paper and presentation also discusses the progress so far and outlines the next steps for other key design challenges such as: (1) enabling crowd sourcing and collaboratories; (2) representing NxM matrices; and (3) expanding the GUI. The earliest paper (1978) in the SPT series described the ideal of a virtual network graphic of great complexity that would be instantaneously updated with any new entry to the RDB, and enable real-time travel through thru the graphic by the user for choice of any specific part of the net graphic. Organization of the net would be with ISPs as nodes and LPs as linkers between nodes. Description of the NxM matrices indicate the incredible detail in the SPT-RDB. Consider a matrix of ISPs by ISPs that would record the number of current Linkage Propositions (LPs) and would have over 3000 interstices, each containing critical information. Or consider a matrix of ISPs by InfoCategories, where just one of the 3,300 interstices would usually have a dozen items of information, resulting in a matrix possibly totaling nearly 40,000 items. Examples of such matrices will be presented and their inclusion in the RDB critiqued.

3154

SYSTEMS PROCESSES THEORY (SPT) AS GENERAL SYSTEMS THEORY (GST)

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This paper suggests that two reasons for the lack of progress toward a widely recognized consensus on a candidate general theory of systems (GST as GTS) are: (1) there does not exist a consensus set of criteria with which to judge alternative candidates (so they just continue to proliferate without any unification); and (2) there is little or no tradition of judgement or selective force in the ISSS eliminating alternatives or forcing them to integrate. In this presentation and paper, a list of 15 criteria or features that we propose MUST be present in any candidate GTS are submitted, described and critiqued. One major criterium is that any candidate GTS must cite or utilize multiple (as in many) isomorphies as hypothesized by the Founders of GST in the beginning. The author knows of several authors of alternative systems theories who dispute this claim and so arguments for and against are presented and refuted. Then the list of criteria for a GST are compared with a list of twenty Tenets (or features) of the Systems Processes Theory (SPT). Each tenet is explained in terms of the criteria needed for a GST. Then a listing of a dozen other candidate systems theories are listed, examined, and discussed. Some of these theories of system dynamics are adequate for the purposes or functions for which they were designed, but this presentation will show that they are not within the realm of the science of systems intended by the ISSS Founders or are not, in fact, general. SPT will be shown to be strictly a science of systems as opposed to attempts at systems thinking for purely human design objectives. SPT will also be shown to be general in the widest definition of that term. Then the SPT will be compared with newer descriptions of features needed for a GST emerging from the work of Rousseau and Wilby et. al. and the BCSSS (Bertalanffy Center for the Study of Systems Science). Several continuing obstacles that inhibit formation of a consensus on a unified GST will also be considered and their history discussed as well as the current fate and/or status of the SPT.

3155

SYSTEMATIC THINKING IN SCIENCE EDUCATION

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In the past, whether within kingdom, empire, colony, or republic, young Koreans had to remain focused on passing tests, even in the midst of the war or the collapse of schools and the emergence of private education in the Joseon Dynasty period (1392-1910). Because private tutoring has been a major factor in Korean

education for 650 years now, it can be seen as a major influence on the weak development of an integrated education experience in Korea. However, integrated education strengthening basic science education, linking liberal arts and natural sciences, and developing skills in problem solving rather than rote memorization will be necessary for successful participation in the impending Fourth Industrial Revolution.

South Korea's science education is caught in a web of paradoxes. Basic science education is weak, but memorization education for the university entrance examination is the best in the world. Students display a low level of creative thinking compared to advanced countries, but their academic achievement is very high. Koreans have been content to remain in the mindset of their proverb, "'It is the fastest thing to be late." Yet college students do not seem content to wait, given their tendency to break away from their majors. Although educational policies and curricula are constantly in flux, why have these patterns emerged, and how can they be changed?

This study examines the relevance and goals of science education through the perspective of recent work in brain science. Specifically, we will examine the relationship between creativity and the biology of the brain, in particular the division between the left and right brains. Brain research focused on cognitive function differentiation has strongly indicated that cooperation between the left and right brains is essential for increasing the ability for creative thinking. Yet the focus on memorization in Korean education can result in relatively weak left brain development, which can shortchange left brain functions including abilities to learn and apply mathematics, language expression, logical reasoning, and rational thinking and criticism.

In summary, although both the left and right brains share roles in creative thinking, Korea's entrance examination does not fully utilize the brain's differentiated cognitive functions. We need a balanced basic science education with the long-term goal of effective left and right brain development, not the short-term goal of admission to a good college.

Keywords: science education, educational policies, systematic

3156

THE CONSTRUCTION OF SUSTAINABILITY: STUDY ON PRODUCTION OF KNOWLEDGE IN SOCIAL ECOLOGICAL SYSTEMS

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One of possible approaches to construct sustainable social ecological systems(SES) is that we can understand the complexity of sustainable development of SES and then control the dominated function of key slow variable. The Knowledge production model, as one of key slow variable, has dominated other variables of SES. Its sustainable evolution is the important part of construction of SES. The fundamental dilemma for Logic-Experiment Model of knowledge production is that this model has failed to deal with the complexity of SES and create sustainable knowledge. While the Construct-Action Model of knowledge production has promoted the emerge of intersection of SES evolution and holistic knowledge innovation in critical state. Moreover, this model can help SES to withstand interference and create sustainable knowledge. In Construct-Action Model, the construction of sustainability emerges from the process of iterative feedback between actor level and observer level, and this has provided a structural narrative framework for the possible development of SES.

3157

CONSTRUCTIVIST VIEW OF SYSTEM IN SYSTEM DYNAMICS

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System dynamics is an important systems methodology for analysing the complexity of the world, and the system dynamics school is one of the most influential schools of complexity research. Systems thinking based on holism has become an important mode of thinking for human beings to explore the complex world. It has provided an important methodological foundation for system dynamics. Systems thinking aims at analysing the complex system structure and adopting intervention measures from the whole, interrelated and macroscopic perspectives. Since its establishment, system dynamics has been perfected in theory, method and tool, and has achieved great success in solving complex problems in the fields of society, management, economy, ecology and so on. As an important systems theory and systems management methodology, the generation and development process of system dynamics contains rich systems holistic thought which is based on constructivist view of system.

Firstly, the generation of system dynamics inherits the definition of system in general system theory. For example, Bertalanffy tried to form a common general law of different systems from the biological and human problems. The Cybernetics proposed by Wiener, especially the feedback concept plays a very important role in system dynamics. The combination of information and feedback becomes the key of system dynamics to deal with complex problems. Secondly, one of the most important contributions of system dynamics is that it has changed people's views on system definition and system concept. Different from the traditional concept of entity system, system dynamics holds that the system is constructivist. It means that a system is a collection of variables but not entities. This systematic view of constructivism is a view of the integration of the subject and the object. Thirdly, the systematic view of constructivism has an important connection with Holon, and it has a great methodological significance in the management of complex systems. For example, Checkland's soft system methodology tried to overcome the shortcomings of hard system methods such as operations research, system analysis, system engineering, etc. In particular, he advocated the use of holon in management. The soft system methodology can supplement the methodology of system dynamics.

3159

A STUDY ON THE CAREER CHOICE OF LATE ADOLESCENTS IN REPUBLIC OF KOREA

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The purpose of this study is to investigate factors influencing the career choices of Korean youths in late adolescence. The data for this study came from the youth panel (YP2007) of the Korea Employment Information Office. SPSS (WIN) 21.0 was used for the analysis of data. Binary logistic regression analysis identified variables influencing career choice, and causality was examined. Among the respondents, 36.1% had career choices and 63.9% did not. In order to verify the research hypothesis, career development, negative self-esteem, job level, positive self-esteem, job level, daily stress (current), stress during daily life (past 3 years), mother's final educational background, the household's total earning income, participation in career guidance and counseling, and 14-year-old residence location served as independent variables. Analysis of the data established that career development and daily life stress (current) affected results negatively. Positive self - esteem and job level, daily life stress (past 3 years), career guidance and counseling participation, The fact that residents of Seoul, Busan and Jeonbuk proved to have a static effect.

3160

MODES OF ANALOGY "WHAT HUMAN COGNITIVE ABILITIES CAPTURE STRUCTURES FROM THE WORLD?"

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Every new things and ideas involve any inventions inside. If people attempts to elucidate those creative abilities to make them being enable, there would be one question that people could come up with. "What human cognitive abilities capture as structures from the world?" Structualisme gave an answer to this problem through Metonymy and Metaphor. Recently those questions are relocated in analogies. However those solutions have not been reached out to concise suggestions to apply analogies to several fields in practical way due to be unclear and uncomfortable to utilize them.

Analogies are generally described in these three; proportional analogies, predictive analogies and analogical problem solving in existing research on analogies. These classifications are fit to comparing results which are available to observe from outside as data, but not good enough for analogies generation processes which are ways to know human cognitive effect. By current general cognitive processes of analogies, it begins with source domain and target domain to get analogy. Then there are key effects in middle of analogies processes; retrieval, mapping and transfer. In order to make the capacity for putting analogies to practical use, it should be considered to refine the works on some key elements on cognitive processes such like memories, abstraction and transfer. To those problems, this study has been approached to make an addition to types of memory by Larry Squire with 'memory of image' as the third memory. Therefore, in this study it is considered that most of metaphors are utilized to understand things to make them outstanding, and metonymy refers to describe things through part-whole relation. In addition, it is concerned that synecdoche based on concept hierarchy is also a class metonymy. It attempts to formulate analogies for analogies research by categorizing analogies as working modes to find out relations. Considering these points, this paper provides 5 types of analogies modes in the categories of metonymical and metaphorical at first, then 3 types of analogies modes which could be located in new categories between metonymy and metaphor to give an answer to "What human cognitive abilities capture as structures from the world?"

The previous study of analogies generation processes in human cognitive science has been adopted in this study to make processes more clear. In evaluating modes of analogy, 'transfer' which is a key element on analogies processes should be also refined. For this problem, this paper gives an attention to what things make relations on each domains; source and target. Then this paper gives two classifications to show features

of relations between source and Target domains. Also, this paper provides one more kind of classification to know features from modes of analogy. According to features of existing analogies, modes of analogy could be divided in case-based analogies and no case-based analogies. Through these framings, this study found that some modes of analogy could be considered that they displays more creativity on the analogies generation processes than other modes of analogy.

As a result of this achievement, this study found one unique way to capture structures by human cognitive besides metonymical and metaphorical ways. It shows relations even there is no common axis to link between things. Some part of this field were mentioned in philosophy as 'strength'. It means human cognitive captures structures in infinity, and this is before representations. This field will be discussed in future work.

3161

THE INTERNATIONAL SOCIETY FOR SYSTEMS PATHOLOGY (ISSP): AN INITIAL IMAGE OF PUBLICATIONS

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This presentation establishes an initial image of the planned comprehensive publication program for the new professional society - International Society for Systems Pathology (ISSP). It describes the contents of five proposed products or services: a semi-annual bulletin, a proposed Annual Yearbook (or volumes of an Annual Review of Systems Pathology), a new proposed Journal devoted to publishing peer-reviewed research articles on Systems Pathology, an initial Review Book (i.e., Introductory Collection of Chapters on Systems Pathology), and a Bibliographic Manual giving the source citations for important foundational papers. Each of these will be described in the talk.

The overall goal of the publication program is derived from the goals of the ISSP as reflected in its society's By-Laws. These include promoting wider awareness of the multiple domains of Systems Pathology, enabling communication among domains, researching mechanisms by which systems dysfunction, enabling transfer of concepts, theories, techniques and tools, developing models, taxonomies, applications, that are useful across domains, and promoting synthesis, unification and integration across the currently separated domains of Systems Pathology. Publications should also play an important role in education in Systems Pathology and both expanding and disseminating its knowledge base.

The first planned publication is the Bulletin that informs the membership about the growth, organization, and activities of the Society. The Bulletin's will contain regular sections with the following titles: Editorial; Managing Director's Report; ISSP Business; Meetings and Conferences; Guest Articles; Products and Services; Reports from Working Groups and Chapters; Correspondence; Members Bulletin Board, and more.

At this moment, the second publication will be an introductory text containing a collection of chapters on Systems Pathology. This proposed text will include chapters by noted authors representing different types of pathology from the systems point of view and on the systems level. Effort will be made to include chapters representing all domains relevant to Systems Pathology including, among others, Systems Engineering, Systems Science, Systems Thinking, Sustainability, Design and Management, Anatomical, Clinical (including molecular conventional medical pathologies),and Systems Biology.

The Annual Yearbook is intended for libraries and will mimic the structure of the initial Introductory Collection in that it will include selections from the best publications representative of every known domain of Systems Pathology. The Editor-in-Chief will make these selections with the help of an at-large Editorial Board composed of experts in each one of the Domains of Systems Pathology cited above.

ISSP intends on creating a scholarly journal, a periodical publication, in which scholarship relating to Systems Pathology can be published. This yet-to-be named journal will serve as a permanent and transparent forum for the presenting, scrutinizing, and discussion on topics related to Sytstems Pathology research. The journal will be peer-reviewed by members of ISSP and experts in domains of applications. Content will typically take the form of articles presenting original research. However, reviews and books, as well as opinions and technical papers will be solicited. Staying true to Henry Oldenburg, researchers, government, and industrial leaders are "invited and encouraged to search, try, and find out new things, impart their knowledge to one another, and contribute what they can to the Grand design of improving natural knowledge, and perfecting all Philosophical Arts, and Sciences" (Oldenburg, 1965, p. 2) – in terms of pathology, of course.

A Bibliographic Manual, will be developed and updated, accordingly. This manual will provide sources (and citations) to foundational papers relevant to Systems Pathology.

These efforts, will require significant efforts and will be part of the activities for the new ISSP society. Finally, the specific details, for example, the number of issues per year for the proposed journal, are still 'unknown.' These details will emerge as the society matures.

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A CYBERNETIC APPROACH FOR CHANGING VEHICULAR CIRCULATION FROM DIFFICULT TO SMART IN CITIES OF DEVELOPING COUNTRIES

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We describe the partial results of a research in systems engineering for a specific socio-technical situation. It addresses the problem of urban circulation in Latin American cities not so technologically advanced. The rating of their circulation performance is very low, when travel times are considered, which produces big ecological, health and economic impacts. The problem is serious and it is still growing. The city traffic system is complex because of the large number of participants and because of the intricacies of their interrelationships. The difficulty of framing this research is observed in that it touches on five known thematic axes: Governance, Economy, Health, Ecology and Technology. The central idea to communicate is that the solution to the problem must be systemic. No feasible solutions will be obtained if the implemented actions are of trial-and-error nature, only technical or only social reductionist approaches, or copied from solutions designed for cities of different locations. The proposal is to gather the main city stakeholders at the systemic academic approach and to guide the improvement process with tested and validated effective actions. Some of the difficulties that have been detected so far concern: describing the unstructured problem; setting up the soft systemic model and finding the feasibility conditions for the solution. After looking at the literature on the subject, outstanding scientific advances are found in the topics of the ecological automobile, the autonomous vehicle or the smart city, with proposals based on electromechanical, communications, and computing fields. They are taken into account for the project, but their expectation for been operative does not make them affordable for this case. Nevertheless, many autonomous vehicle details could be useful under a systemic view: what makes it operational is the information exchange with its environment. The synergetic operation of traffic in a congested city requires a proper information usage. In several studied cases, the urban infrastructure does not inform the driver about the restrictions, the driver does not take advantage of information to execute his actions and the traffic regulation does not profit of information to provide corrective actions. Moreover, punitive measures are privileged over preventive ones. Solving the congestion questions of these cities would only be possible if improving actions are also committed to the physical infrastructure, the traffic regulations and the respectful driving subsystems. For this reason, organizational transformation is imperative. Within the project, coordination between soft and hard system models is analyzed, aiming to carry out simulations of identified noteworthy conflict situations. And feasibility will be particularly taken into account before implementation through the agreement of the administrative, technical and social parties, based on the research work conducted at the systemic academic guide.

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SYSTEMS BIOLOGY AS SYSTEMS PATHOLOGY

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This presentation and paper will explore the similarities between the established discipline of Systems Biology and the new suggested discipline of top-down Systems Pathology. It will show that both investigate complex systems, and both are necessarily interdisciplinary. Both recognize some of the same isomorphies (especially self-organization, feedbacks, and networks -- though Systems Biology is less consciously aware of them as isomorphies). Both look for the primary or fundamental causes of dysfunctions (one at the reductionist level; the other at the systems dynamics level). Whereas there are similarities, there are also differences that will be discussed. While systems biology is reductionist dominated, most often elucidating molecular machine and organellar level foci, even these levels may be considered as examples of total systems dynamics such that even systems biology may be considered systems pathology oriented and not just conventional reductionist science. Systems Biology is unaware of this perspective.

The talk and paper will begin with citation of evidence for the rapid recent expansion of the new field of systems biology measurable in terms of funding, institutions, job descriptions, major centers, and initiation of new education and academic programs. Systems Biology will be characterized as very successful and here to stay. The paper will continue with an explication of how useful investigation of dysfunctions have been in getting a start on understanding of complex systems in biology (with examples from the studies of enzymopathies, knock-out genes, and errors in development and how each gave us a handle to pursue to understand better

otherwise impenetrable complex physiology). We will suggest that as Systems Biology has amply demonstrated, this is a fruitful strategy for Systems Pathology and even all of GST to pursue in researching complex systems.

The talk will continue with examples of the utility of the systems biology approach to research on key and important total system diseases (thus systems pathologies) as represented in the author's course lectures on the Systems Biology of Cancer (Bio 302) and the Systems Biology of Aging. (Bio 328). But beyond providing a better understanding of disease states such as those, the systems approach is also useful in understanding the structure and limits-on-structure of all systems at all scales and types thru such new fields as the author's Systems Allometry and Systems Mimicry (spin-offs of Systems Processes Theory (SPT)), which also may be classified under the title, Systems Biology.

Further examples of overlap will include the use of network theory in both Systems Biology and Systems Pathology to discover "motifs" (unlikely similarities of part:part interactions true of many diverse system network analyses) and of the use of hierarchical structure to gain the advantages of modularity in both Biosystems and all systems. This latter case has especially been useful as an application of systems theory as a guideline for engineering and as a source of errors in engineering as in Systems Pathology. The overall conclusion will be that many aspects of the widely accepted new field of Sy

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STATUS REPORT ON THE FOUNDING OF ISSP INTERNATIONAL SOCIETY FOR SYSTEMS PATHOLOGY

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This short conclusion talk and paper will report on the current status of founding the 501c3 non-profit, the International Society for Systems Pathology. Handouts for the participants will include the final By-Laws for the ISSP, Articles of Incorporation for the ISSP, a Manifesto for Systems Pathology, and a listing of current officers and members of the Board of Director's. Projections of membership from the many domains of Systems Pathology will be presented. A timetable for the remaining tasks will be discussed. Forms for joining the ISSP will be distributed. Consistent with the title of this Joint Session of the ISSS Systems Pathology SIG and the Systems Biology/Evolution SIG, ISSP will provide a new and additional scientific research and professional development home for both topics.

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PROPOSAL OF VISUALISING MODEL OF CUSTOMER DEMANDS SUFFICIENCY DEGREE IN DESIGNING PRIVATE LIFE INSURANCE

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Since May 2016, customer demands confirmation at the time of insurance solicitation was strengthened by the Japanese Financial Services Agency (FSA). It requires not only confirming what customer is requiring but also to realize what is required though the insurance plan proposal. To realize this, insurance company must firstly understand their customer's needs then secondly need to show how the it can be realized though insurance plan proposed as well as how it matches with their own needs. This means both customer needs and the matches between customer intention and the proposal must by visualized. The visualisation can be realized by using three-dimensional model which has time, space and products axes. These three axes represent the elements of insurance products, which time represents 'when' insured will deserves the benefits and space represents 'for what' insured will deserves as the benefit. The customers expectation to insurance, in other words, is to clarify the function which customer are expecting out of entire functions of insurance. That is, clarifying which function of insurance is required by customer means that customer demands of insurance is identified. Therefore, the three-dimensional model can be used to visualize both what insurance can do and also the customer demands itself.

This paper aims to propose a visualised three-dimensional model which represents the structure, essence and the concept of insurance. The three-dimensional model is a model which enables the visualization of sufficiency degree of customer demands that are considered to be invisible in most of the cases. Each axes of three-dimension represents the function of life insurance. The visualising model of customer demand sufficiency degree enables to comprehends the function of insurance in public social security, private life/non-life insurance and customer demands point of view. Through the process of understanding insurance as a

system using this model, people will understand how can insurance support their financial risk and find out what they should and should not expect for private life insurance product.

Through the result of workshop and the interviews to the professionals and the specialist of life insurance as for an evaluation of the model, it was proved that the model helped understanding the features and function of life insurance and participants could know their needs of insurance. And, also, they had the impression that life insurance is something valuable and will benefit for future financial risks.

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A LEARNING COMMUNITY TO FOSTER AN "ECONOMÍA AMABLE"

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The search for sustaining abundance and genuine happiness is a human aspiration since immemorial times. Nowadays in a scenario of increasing complexity with unforeseen challenges linked to systemic fragility we continue this quest and must undergo a profound cultural transformation to shape desirable futures.

By enhancing the awareness and comprehension of the interconnected nature of our world, and developing the capacity to execute meaningful choices that (truly) recognize our interdependency within the web of life is a key to live joyfully in a sustainable and nurturing society, both locally and planetary. A society to which corresponds an "Economía Amable": an economy kind to people and to nature.

Note that the Spanish word "amable" comes from the Latin amabilitas, which in short means conducive to love. In our view it means "love in action", a genuine kindness that comes from nurturing multidimensional generosity and carefulness in every field of human action. Feminine values, since long diminished by the patriarchal culture, are core to bring forth capabilities and conditions for the emergence of an "Economía Amable".

A way to create a new system, out of an existing one, is envision a new desirable one, and then find out what resources to rely on to advance —recreating past, present and future— in a co-evolutionary process. We propose action-research practices to promote coevolutionary change towards a culture that expresses kind feminine values, an economy of abundance.

We created a work of artscience as a tool to contribute to that endeavor. The World of Navis Utopia depicts a world in which the currently most delicate challenges humanity faces doesn't exist anymore. It is a travelling exhibition to easily find its way into the imaginations and lives of all those yearning to make the world a better place. It shows that the seeds of a desirable scenario already exist in our planetary community, as well as the knowledge and methodologies to successfully overcome the challenges our specie undergoes at the time being.

We started an autoecolearning community with the aim to learn together, redefining and opening up to unforeseen possibilities. We intend to promote its development offering encounters and workshops in which to address significant issues, using variations of the Bela Banathy Conversation Model and exhibits of the World of Navis Utopia. In these learning events we foster personal, organizational and social learning, addressing the main concerns of the community, including keys to develop a systems perspective, cyclical consciousness and multidimensional amabilitas. Envisioning, looking beyond the constraints of present circumstances and tendencies is a first attempt to bring in a rich innovative learning process in which to share ideas, experiences and concepts, cultivating systemic leverage, designing a desirable future, changing the ways we perform our daily activities: creating a better world for everyone by becoming the systems be wish to see in the world.

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SYSTEM THINKING IS NOT FOR EVERYONE – FROM THE BELL CURVE 2.0 TO THE MULTI-LEVEL APPROACH TO SYSTEM THINKING EDUCATION

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The theme of this conference contains a mistake, or a mind-bug, or a cognitive error, that the late John Warfield, the ISSS president of 1982, named "Insensitivity to Conceptual Scale" in his proposal of a new field of study he called mentomology – the study of mindbugs. System Thinking (ST) is not for everyone, if everyone means everyone not just our ISSS members. ST is not for everyone because we know that many people would not use or would not learn ST. This short paper discusses why and suggests a more practical alternative.

First, ST needs a certain level of Cognitive Capacity (CC). CC to the quality of mind is like Construction Capacity to the quality of a building – the quality of architecture design, the quality of engineering, the quality

of material, the quality of worker, and the civilizational capacity supporting everything above. We can use CC to measure the status of the development of an individual's brain, similar to DXO Scores measure the quality of a camera sensor and lenses. Previously there are theories about IQ and EQ indicating approximately the sophistication levels of the neocortex and limbic system (of the triune brain model.) CC is different from IQ or EQ in the way that it might be a combination of IQ and EQ because the information received/deciphered/interpreted consists of both analytical and emotional contents.

CC is a measurement of how much information an individual can handle at a certain time. The recent high-profile case of AlphaGo beating the human champion illustrates the level of CC specific for playing the game Go, known as the highest game challenging human intelligence. But AlphaGo is just an extreme case. What I am discussing here is a continuous spectrum of CC scores (testing methods to be developed) spreading from the dumbest person (such as someone mentally retarded, or those who cannot pass Sally-Anne Test,) to the far left of the spectrum, and the smartest person (such as, say, Einstein or Hawking) to the far right, with every one of us in between. For discussion purposes, let us assume it is a normal distribution, i.e. a Bell-curve, of CC within any population. (The actual shape of the curve can be measured for any specific population, and thus comparing different populations is possible.) It is reasonable to speculate that ST is not for the people on the left part of the Bell-curve. Where exactly it can start, (perhaps a little right to the mean?) is a subject of research.

This is because, before one can have a capacity to do ST, one must first have a capacity to do CT (Critical Thinking), and before one gains the capacity to do CT, one must first develop a capacity to do LT (Logic Thinking). While LT and CT are taught in K-12 schools in advanced countries, it is widely observable that both LT and CT are not so well-taught in developing countries, or countries dominant by strong religious or ideological brainwash. In societies that most people believe that the age of our universe is 6000 years, that a virgin can get pregnant through holy spirit and a dead guy can raise to heaven, or that the whole world will be ruled by Sharia Law and all infidels will be either converted or killed, what would ST look like? After all, ST is a product of System Science, System Science is a kind of Science. If science has not established its root yet, it is too early to talk about "ST for everyone." Simply put, if LC and CT capacity are missing in one's brain-tool-box, ST is simply impossible.

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THINKING-ACTIVITY SCHEME AS A COMMUNICATION BRIDGE BETWEEN SYSTEMS THINKING AND SYSTEMS PRACTICE

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Exploring ways to co-organize systems thinking and systems practice we discuss the answer of Russian systems thinking which was developed by the Moscow Methodological Circle (MMC).

MMC was organized in USSR in the year of J. Stalin's death (1953) and was led for more than forty years by G. P. Shchedrovitsky (1929–1994). Now it exists as the "Methodological Movement" and a few institutions associated with it.

MMC developed "methodological thinking", which was characterised by the following general features and principles:

1) holism and reflexivity in relation to the other approaches and types of thinking (in science, designs, engineering, socio-cultural and law studies, etc.);

2) practical orientation (connections thinking-activity, which used systems approach as the means for organizing processes of resolving complex problems by multi-professional and transdisciplinary teams, etc.);

3) reflectivity as practical orientation of thinking to itself, its capability to re-construct and re-direct itself;

4) the "methodological turn" from thinking about systems as objects to the process of systems thinking.

The shift from objects to thinking which was mentioned above characterises MMC from the very beginning of its activity. It corresponds to the shift of interest from "systems sciences" to "systems rationality" – as discussed in holistic systems thinking approach. This methodological turn has allowed MMC to formulate original vision of problems of the systems approach: not to investigate "systemic objects", but to conceptualise and resolve "systemic situations" as a form of work with complex problems.

Now MMC systems methodology has three basic components which are the foundations of System-Thinking-Activity Approach (STA-Approach):

1) systems thinking (as "methodological thinking" described above);

2) Thinking-Activity Scheme ("scheme" in MMC is a diagram linked to the certain model as its meaning) and moderation technologies;

3) Systemic 3D-Methodology.

In Thinking-Activity Scheme (published in 1983) thinking and activity are represented in the form of different "layers" ("Pure Thinking" and "Thinking-Action"), divided by a "Thinking-Communication" layer. Links between three layers of Thinking-Activity Scheme are mediated by Reflection and Understanding processes. "Thinking-Communication" layer in Thinking-Activity Scheme provides collectivity of Thinking-Activity and allows to govern it by the means of moderation technologies. We use them in order to apply STA-Approach to systemic situations from practice. Moderation technologies are considered as the mode of communicative management supporting adhocratic type of interaction and deliberative communication, i.e. the "horizontal" and not-alienating interaction in multi-professional teams providing collectively-distributed thinking and multi-positional organization of resolving systemic situations which bear in themselves complex problems.

Systemic 3D-Methodology is the principle to think in the space of two "orthogonal" planes:

1) Object-Ontological plane with schemes and objects of practical theory;

2) Organizational-Activity plane with schemes organizing multi-professional communications and methods, forms and instruments of transdisciplinary thinking.

Methodological schemes are specific MMC instruments – intellectual constructions, which can co-organize Object-Ontological and Organizational-Activity planes of 3D-Methodology as complete reflexive 3D-space and be used as instruments on both planes. Using Thinking-Activity Scheme in this function with the help of moderation technologies allows to bridge systems thinking and systems practice in moderated forms of events organization (seminars, "round tables", transdisciplinary conferences like ISSS etc.) and in process forms of workflow organization: project groups, foresight, Organizational-Activity Games (OAG), strategic sessions, staff games, civil juries, wisdom councils, etc.

Now Thinking-Activity Scheme has implemented in consulting, education, city&regional development, public policy, public expertise procedures, organizing of public-political communications, conflict resolving and mediation procedures. In future it will be useful in international relations, cross-cultural interactions, global problems resolving, etc.

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THE FUTURE OF THE PERUVIAN NATURAL GAS THROUGH THE STUDY OF THE POWER OF INFLUENCE OF STAKEHOLDERS: ALTERNATE SCENARIOS USING SOCIAL NETWORK ANALYSIS WITH A SOFT SYSTEMS APPROACH

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The work aims to study alternative scenarios that could occur in the future of the management of Peruvian natural gas, as a consequence of the synergy of actions of the diverse stakeholders that are involved in their management within the Peruvian reality.

Natural gas (NG) is becoming the central energy source on various economies around the world, replacing oil and coal and complementing the hydroelectric power supply, mainly because of its price in international markets and also because of its low level of pollution for human populations, the flora fauna and wildlife in general.

To address this issue, this paper, firstly, introduces the reader to the problematic situation of NG in the Peruvian case, mentioning the stakeholders involved on it and investigating their particular worldviews (weltanschauung) and objectives in relation to the problematic situation of NG, considering the level of power of influence from one stakeholders over others involved in the problematic situation, on issues concerned to strategic decisions related to NG. This implies, firstly, that these stakeholders are identified

Then, the paper shows possible alternate scenarios in relation to the future of NG, doing an analysis of probable courses of action of these scenarios considering the specific weight that each stakeholder has over others, in order to define these courses of action. For doing that, an analysis of the level of power from one stakeholder over other ones and the goals that of each them seeks around the NG are analyzed.

Following the scenarios methodology, four potential scenarios for the future development of NG are established, considering two axes: the level of exploration of NG Peruvian reserves on one side (axis 1) and the expansion of the use of the Peruvian NG at the internal and external markets level (axis 2). From these axes, four scenarios were defined that could be taken into account for the use of social network analysis (SNA) in order to define possible alternate scenarios on the future of Peruvian NG.

In order to do so, SNA is used to see the level of relationships with positive synergy (contribution, alliances) or not (opposition, lack of collaboration) among the stakeholders. SNA will also be used to consider how the level of power exercised by each stakeholder can influence over others, to conduct the whole sector to one of the delineated scenarios, to finally raise the probabilities of which scenario can occurs, based on the intentions and objectives of the stakeholders, expressed in their relevant systems and root definitions.

Finally the conclusions of the case are made, the learning points obtained from the development of the present work and comments on future developments concerning the issue and the approach applied are mentioned.

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FROM COMMUNITIES OF PRACTICE TO BOUNDARY CRITIQUE: AN EXTENDED APPROACH

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In the critical systems thinking (CST) literature, particularly in the theory of boundary critique, the process of marginalisation has been studied mainly taking into account those elements (issues, values, and agents) that are not fully included or excluded of a social design (Midgley, 2000). Taking this theory into account, this paper presents an extension of the theory of boundary critique by using elements of the social learning theory proposed by Wenger's (1998, 2000, 2010b): Communities of Practice (CoP). In doing so, the proposal includes the idea of considering the marginalisation process as one described by different forms of participation and non-participation that build the participants identity and their concerns. To achieve this, this paper is organised as follows. The first section presents the main aspects of the CST research approach and the systemic intervention bases to establish the context of the discussions about marginalisation process. The second section presents the main aspects of the CoP framework. The third section presents the proposal of an extended version of the marginalisation process, applying some CoP concepts. We conclude by presenting a practical example of implementation of this extended approach and discussing the implications of this approach for CST research.
Keywords: Communities of Practice, Boundary Critique, Process of Marginalisation, Periphery, Participation and non-participation

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COMBINING THE WORK SYSTEM METHOD AND SOFT SYSTEMS METHODOLOGY TO OPERATIONALIZE THE DIAMOND MODEL OF CRISIS MANAGEMENT BY MITROFF

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Ian Mitroff published in 2005 the Diamond Model of Crisis Management as a systems approach for crisis analysis and evaluation. It consists of four phases:

- Audit of systems vulnerabilities which determines the scope of the threat as a messy problem;
- Crisis planning and systems development of crisis capabilities;
- Crisis enactment of an organization's crisis plans which leads to damage containment plans; and
- Learning and Systems Redesign that close the continual cycle of learning and understanding of the nature of the analyzed crisis problem.

To the best knowledge of the authors, Mitroff does not elaborate in subsequent publications on the suitable systems approaches that might be applicable to the stages in his model of crisis management (CM). Certainly, one may apply Strategic Assumptions Surfacing and Testing or Soft Systems Methodology or other existing systemic methodologies. The complexity of a crisis situation requires often however the combination of different systems methodologies or parts of them in the same crisis intervention. We are proposing and justifying a combination of techniques from Checkland's Soft Systems Methodology and Alter's Work System Method.

Checkland's Soft Systems Methodology (SSM) has been used in systemic Interventions for almost 40 years while Alter's Work System Theory (WST) emerged after 2002 as a more pragmatic systemic approach for Information Systems and business analysis. The latter found more recent acceptance also in Industrial Engineering and in the emerging field of Service Systems Science. The complexity of some project contexts cannot be addressed sometimes by one methodology and that is the motivation behind this research. The purpose of this presentation is to demonstrate how the mix of techniques from the two methodologies in the same crisis intervention can be justified and to show how it can be used to operationalize in practice the ideas of the systemic approach to crisis management mentioned at the beginning. The contribution of the paper is in the formulation of a multi-methodology approach based on SSM and WSM applicable to the Diamond Model of Crisis Management by Mitroff.

First is provided a brief overview of Mitroff's Diamond Model of Crisis Management, followed by a short introduction of SSM and WSM and some comparisons between them based on published past criticisms of SSM. The suitability of SSM and WSM to different project contexts defined according to the nature of the interests of the stakeholders involved and the complexity of the situation is explored next. That leads to the justification of mixing techniques from SSM like Rich Pictures and CATWOE analysis and from WSM like the WS Snapshot and Responsibility tables. That is justified following the principles of Jackson's Critical Systems

Practice, a meta-theory in Systems Thinking. A brief illustration is provided of the application of the mix of techniques to the analysis of the role of Emergency Notification Systems for crisis situations at an American university.

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ASSESSMENT OF SYSTEMS THINKING AND SYSTEMS ANALYSIS SKILLS IN HIGHER EDUCATION: THE CASE OF A SUSTAINABLE Resource Management Program.

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System thinking and system analysis are important skills in solving problems in our complex world. Research from the last two decades showed that students of all domains of sciences are not well prepared to understand correctly the dynamic behaviour of even very simple systems. This phenomenon can be tested and evaluated with help of so-called bathtub tasks that represent simple stock and flow relationships of simple systems. Many studies identified a surprisingly poor performance on different levels of education and even on the level of domain experts. This raises the question if sufficient education in system science will result in better performance to solve complex system problems. Since, 2001, the School of Forest Science and Resource Management of the Technische Universität München offers the International Master of Science (MSc.) Program in Sustainable Resource Management (SRM) which attracts students from all over the world. The SRM Programme includes classes in systems theory and systems analysis in order to improve students' ability to understand and solve complex problems in interrelated systems that are commonly subject of resource management activities. At the beginning of the system theory class students are invited to participate in an assessment that includes a questionnaire and solving system dynamics tasks (bathtub tasks). The questionnaire asks about their personal and educational background, previous experiences in system sciences and their opinion about own skills and the relevance of system thinking in their career. The bathtub tasks are slightly modified applications of the original bathtub tasks so that results can be compared with other existing studies. The presentation will show some selected results and discuss some experiences from these activities. Until now, poor performances of master students still persist. Only very few students choose to focus more on system thinking and systems analysis skills in their further study programme. However, presumably other scientific methods and approaches are much more accepted and appreciated in conventional academic educational systems than systems thinking and system analysis. It is recommended to increase the presents and relevance of courses on system thinking and system analysis into contemporary academic education.

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CONTEXT ADAPTIVE MODELING TOOL IN SERVICE DESIGN

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Nowadays, analysts and business researchers are modeling a huge number of services. To develop a service accomplishing a simple requirement is quite easy to fulfil and any currently used modeling tool seems to be fully sufficient for the purpose. But is it really true? Are we sure that we can cover (with some level of abstraction) all processes and relationships hidden in the service provision by current modeling tool? We want to elaborate on these questions further.

The situations and services we are currently trying to model become more and more complex. Complexity itself is just one part of the issue. The other one is that the services should work in different contexts. A high number of analysts create simply as many models how many contexts they are able to recognize. Thence, the question is: Are we able to mention the role of the particular service in different contexts using current modeling tools?

Let's take a simple example of a street lighting. There is a try of cities to save money by upgrading street lamps into adjustable LED equipped lamps. The idea is to dim a light when there is no pedestrian nor a driving car on the street. For this purpose, LED lamps need to be equipped with a camera that signals the LED to increase luminosity when a pedestrian or a car is identified. Moreover, once the camera is equipped, it can be used to identify free parking slots on the street, or even to help ensure public safety (passively - by identifying moving people, lighting the street more when needed/actively - by informing a police about suspicious situations).

As it can be seen, there is at first a context of an adjustable lighting to save money. Then we used same devices to identify free parking slots and lastly to ensure a public safety. Whence, we used the same devices and similar data in different contexts to create different services.

If there is an error in some service, it can influence the other services. The problem can be a dysfunction of some cameras or the recognition software resolving in bad illumination of the street, not correct recognition of free parking slots, with no active public safety. If there is just one service deployed at the beginning and the other is added later, it can influence a traffic on the network the data are going through and slow down both service or lower a service reliability.

Therefore, for context modeling, we need to use (or develop) a tool that is not only context adaptive but also accepts the context as a part of the model itself. This tool should have following features:

Enable to decompose any situation into a set of elements

Build any related model by a specific use of those elements in any context

Recognize the differences among the contexts and describe them

Use of such modeling tool for an analysis of a complex service should bring better value for all the service participants. Nevertheless, according to the last service research, services are not only more and more complex, they become more adaptive at the same time. Therefore, we need to develop a modeling tool that will be also adaptive, meaning that it can adapt the model according to the actual context without losing any knowledge, information or relationships from previous contexts. In this paper, we propose such a tool for adaptive context service modeling.

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PATTERN LITERACY IN SUPPORT OF SYSTEMS LITERACY: LEARNING TO FIND THE PATTERNS AND CREATE THE MODELS THAT REPRESENT SYSTEMS IN WORDS AND PICTURES

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This session, part of the Designing Educational Systems SIG, follows up on Peter Tuddenham's work on Systems Literacy, and on Helene Finidori's inquiry on the role of patterns and pattern languages in bridging the fragmentation of systemic knowledge and approaches, and learning about systems. The purpose of this work is to co-explore the connection between systems knowledge representation, its embodiment and the systemic phenomena we wish to learn how to make sense of and to anticipate, using patterns as boundary objects and connectors.

At the ISSS Annual Meeting and Conference in Boulder in 2016 during a plenary session on Systems Literacy that referenced his previous work on Ocean Literacy, the presenter Peter Tuddenham asked the participants to take a 4x6 card and to either 1. Draw a System and or 2. Draw symbols to represent essential principles or big ideas (of Systems). A total of 34 Cards were handed in at the end of the plenary. The 4x6 cards were a blank space upon which different interpretations of the question were made explicit. The authors of this paper have reviewed the submitted cards and examined them for patterns and also to develop categories of responses.

This session will present the results. The implications for the representation of "Systems Literacy" will be explored, both in terms of words, and also in terms of symbols and drawings. In the light of the above, we will examine the question of deriving and formulating shared cross cutting patterns.

The process itself will be examined as a way to create a continuous development of "Systems Literacy" in complement of the quest for a General Systems Theory.

In particular, we will examine the critical role of patterns and pattern languages in embodied cognition, and we will look into how the development of a pattern literacy can reveal essential in support of systems literacy. The ultimate goal is to reflect upon how the capacity for humans to discover, record, retrieve, embody, use or design of systemic patterns can be enhanced.

A workshop session will be connected to the paper presentation. Before this session starts participants will be asked the same questions and asked to complete 4x6 cards. Their responses will be compared and contrasted with the 2016 results.

3180

THE INTERNATIONAL SOCIETY FOR SYSTEMS PATHOLOGY (ISSP): AN INITIAL IMAGE OF WEBSITES

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This talk and paper develops an overview of the planned online services of the proposed ISSP. Initially there will be two websites on the WWW and one website on Wikipedia. The Wikipedia entry will not be available until all incorporation documents are submitted and approved. When it appears, it will contain the ISSP

definition of Domains of the new Systems-level pathology and links to the 27 Pathology Organizations already represented in Wikipedia. Presumably, ISSP will join this listing when submitted.

The website systemspathologies.com will contain the particular research program of Systems Pathology as a spin-off of the Systems Processes Theory (SPT) developed as a candidate GST in the ISSS and INCOSE organizations over the past two decades. This variant Systems Pathology provides a very detailed and rich taxonomy of dysfunctions of systems that are defined as isomorphic, common, or universal across systems at all scales and in all domains. The taxonomy is based on errors that occur in the 55 Isomorphic Systems Processes (ISPs) of the SPT. As such, this website will contain vital information on the ultimate causes or etiology of systems dysfunctions or diseases in general as seen from the systems architecture rather than reductionist level.

Most of this talk and paper will concentrate on description of the third website. The website intsocsyspath.org will make publicly available the official documents and activities of the ISSP organization. The "shell" of this website is already available by invoking that reserved URL. It contains the usual pull-down menu's for professional societies. The "About" pull-down will have multiple subheadings for ISSP Stats, Overview Definitions of Systems Pathology as used by the ISSP, A Manifesto on Systems Pathology, description of the Major Domains of Systems Pathology and a short history of each of the several domains. The "Membership" pull-down menu will offer information on "Benefits," "Types/Dues," and useful "Forms." The critically important "Working Group" pull-down menu will contain lists of working groups (WGs)," "special committee's," and "special research projects." The ISSP By-Laws require the Board of Director's to name and find leadership for WGs that represent all of the existing domains that might have interest in a systems-level aspect of Pathology. The "Meetings" pull-down menu will include information on current annual conferences, annual workshops, and any geographically local meetings as well as co-sponsored, related conferences. The "Publications" pull-down will contain information on ISSP publications as described in the following Katina talk and paper. The "Products/Services" pull-down will inform members of the ISSP "Newsletters," "Knowledge Data Base," ISSP "Awards," and ISSP official "Bibliographies." The "Administration" pull-down will offer information on "Officers," "Chapters," "By-Laws" and other official documents. The "Education" pull-down will include information for Professional Development in the new Field. The final pull-down, "Alliances" will contain links to related and cooperating professional societies such as the ISSS, INCOSE, IFSR, AAAS, ISSB, and more. Screen shots of these pages will be shown in powerpoint. Participants will be asked to suggest additional features for online development of the new field of Systems Pathology. The authors will be happy to discuss further the pro's and con's of online education and WWW professional development from their past extensive experiences.

3181

THE BOUNDARY TRIAGE, ITS OBJECTS AND HEURISTICS: A SYNOPSIS OF THE DEVELOPMENT OF A CRITICAL SYSTEMIC LEADERSHIP DEVELOPMENT TOOLBOX FOR A NETWORKED WORLD

MacNamara, Delia Pembrey

Since 2004 the arrival of online social media technologies (such as Facebook, LinkedIn and Twitter) combined with personal digital technologies (such as smart phones, tablets and laptops) that connect to the internet have seen business deconstructed and communication mediums proliferate. The past 10 years has seen a considerable change from businesses constraining the use of social technologies to the current status of encouraging more engagement from the overall supply chain and developing new technologies to harness this collective capacity for organisational goals. Coupled with a generation that grew up with 'always on' global connection via digital combined and a generation with clear boundaries, the class of the 'boundaryless' meets the 'bounded' has come with both exciting new innovations and opportunities and, at the same time, increased risks, threats, security and uncertainty. Business leaders are calling this the VUCA era, a term coined by the US defence force meaning 'Volatile, Uncertain, Complex and Ambiguous'. 'Leadership' within this VUCA environment has been identified as a key organisational success factor that needs to be addressed, specifically leadership development at all levels. Yet despite a plethora of leadership literature over the past 60 years, leadership development has changed little. Systems thinking has been hailed as the new way of thinking and working, with Systemic Leadership, as the next operandum for leaders. Yet what is 'systemic leadership'? The theme for the 61st Meeting of the International Society for Systems Sciences (Vienna) is "From Science to Systemic Solutions: Systems Science for Everyone." This paper aims to provide a leadership development toolbox for 'everyone' to explore systems sciences and potentially develop systemic solutions critically using the idea of 'embodied cognition', cybernetics and critical systems thinking. This paper is a synopsis of my PhD research which investigates 'Systemic Leadership for the networked world'. My mission is to develop a critical systemic leadership toolbox that encourages the critique of multiple systems and systemic thinking, while being easy to remember, employ and transfer to others with just one word – 'Boundary'. 'Boundary' is word that is familiar and, at the same time, it is a key – if not 'the key' – concept in Systems Science. I present the core elements of the Boundary Triage (an axio-onto-epistemological

symbolic representation of Boundary), its Objects and heuristics, designed using a critical systems thinking approach, from the perspective of embodied cognition. This paper summarises the pragmatic and practical aspects of the Boundary Triage toolbox to develop critical systemic leadership skills in a collective, connected and networked world.

3185

I'M AGAINST THE GRAND PLAN

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Grand plans can be seductive. A grand political plan to save the country. A grand scientific plan to save the planet. A grand plan to lose that last fifteen pounds. But I don't believe in grand plans. I believe only in try and fail and try again. Inspect and adapt. Try something, mess it up and fix it. Venture outside your comfort zone and learn something.

In this talk, Daryl will look at how certain trends in software development, known as "iterative and incremental" might help with academic work in systems thinking. Several prominent systems thinkers have lamented how hard it is to teach systems thinking models. Why is that? Is it because the students are not prepared? Or because we are teaching the wrong way? Join Daryl for an interactive dialogue on this topic.

3190

ADVANCING KNOWLEDGE BY LOOKING UP AS WELL AS DOWN

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Presently there is growing interest in "translating" knowledge so that it is easier for practitioners to use it. The intent is to minimize jargon and maximize the utility of knowledge. I agree with these efforts, and I have done such work myself. Applied knowledge is very important, particularly for transdisciplinary fields. Working on practical problems almost always requires the perspectives and methods of more than one discipline.

However, if we devote too much attention to translation or technology transfer or applications, we might miss some opportunities. In addition to asking how a theory can be used, it is also useful to know where a theory came from or what was the context or the origin of the theory? In addition to reasoning down to applications, it can also be helpful to reason up the philosophical and historical origins of ideas.

This paper will examine the ancient philosophical questions that various societies have asked in an effort to learn the nature of the intellectual journey that the society was engaged in and how the fundamental philosophical questions that were of concern emerged from the practical problems the society had faced.

3194 (3194)

RESILIENCE MANAGEMENT: FROM FUKUSHIMA DISASTER TO BOILING OCEANS AND VIRAL SPREAD

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The present paper reviews the necessity of 'resilience based on disaster management' (Chroust, G., 2015). Firstly, it examines non-resilience, showing the current status of nuclear fuel debris, contaminated water and radioactive waste after the Fukushima Nuclear Disaster, since when radioactive contamination has damaged the local community and socio-economic systems. Secondly, it presents evidence of global spread of super-typhoons and unusual weather patterns, with the location of maximum typhoon intensity having moved northward by approximately 150-200 km compared to 1982, and at the same time expanded due to the 'boiling ocean' effect. Thirdly: it considers ir-resilience, 'global ocean warming' through the multiplier effects of hydrospheric and CO_2 atmospheric warming. Finally: it discusses un-resilience, arising from the spread of infectious tropical diseases to the northern hemisphere caused by global ocean warming, as part of the irreversible environmental change caused by our artificial systems, which will increase the risk and crisis of disasters for all human beings. Re-consideration of our living systems is therefore necessary to create awareness of the 'five functions of resilience management' for all-round sustainability.

Keywords: Disaster Management, Super Typhoon, Northward Viral Spread

3205

SUPPLY CHAIN NETWORK RISK MANAGEMENT

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The importance of integrated risk management of supply chains is increasing as well as the dependence of critical or stategic infrastructures. Especially the dependence of energy supply and the information and communication technologies increases rapidly. On the other side new threats like Cyberthreats occured. Therefore the existing risk management systems fall too short and cannot match the existing complexity.

Within this publication there are some necessary steps explained for the development of an integrated Supply Chain Risk Monitoring and Supply Chain Risk Rating Model. The basis is a standardised categorisation system and then the red thread is explained with a bottom up process.

The goals are to develop an integrated Risk Monitoring and Risk Rating Model for defined Clusters as well as for the Supply Chain as a whole and the description of a Supply Chain Network Risk Monitoring System as well as a Supply Chain Network Risk Rating System. The background of these considerations are the improvement of the strategic and operational decision making process via innovative systems and models.

Over the past decade, the awareness of the importance of risk management for supply chains has risen continuously. Recent incident, such as the catastrophic floods in the Bangkok region in 2011 have demonstrated the high interdependency of international supply chains, in this special case the high dependence of the worldwide hardware industry on disks manufactured in the flooded region. This and other similaraly disastrous events have led to a renewed interest in robustness and resilience of supply chains. Also the various cyber threats continuously increase and the number of attackers (states or professional criminals) capable of developing cyber attacks is increasing.

The need of an integrated Supply Chain Risk Management is supported by the complex situation the acteurs are confronted like

- globalization,
- specialization,
- homogenity of strategies and business models,
- outsourcing,
- competition,
- fusion of IT and production in and between companies and
- corporate social responsibility and compliance.

This discussion is ongoing, especially in relation to how future supply chain network-infrastructures should be structured in a centralized or decentralized way. Of primary interest and in some cases even vital importance is the discourse of all horizontally and vertically integrated interactions and dependencies between the different supply chain networks for providing uninterrupted services. This has a direct influence on the development and the use of future smart solutions options, not only in the context of energy supply, but even more so in the context of ICT infrastructures.

Based on the research agenda and the research process we created a generic integrated systemic supply chain network model. Various unique scenario portfolios and single scenarios were described in relation to the generic integrated systemic supply chain network model. Further on we developed a risk assessment and analysis process and model, including the identification of the relevant and corresponding key performance indicators and key risk indicators. Those indicators are necessary for the designed risk rating model for future trend analysis and also as well as the implementation of a effective and efficient crises management on demand. The result of the research can be used for centralized or decentralized strategic or critical supply chain networks as well as for the crisis management. The unique result for an organisation is at least an integrated supply chain risk-, crises and performance management and monitoring system which depends on the relevant rating elements.

3206

VR ON-SITE

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Effective training is a cornerstone of disaster preparedness. Quality, consistency and frequency of training are shown to impact self-perceived disaster readiness of first responder units. However, barriers such as time, cost and safety limit the extent to which large groups of responders can be brought up to established standards, particularly related to integrated disaster team response skills and experience. This is particularly evident during events involving large-scale mobilization of population-based healthcare and public health resources where skills learned through training impact directly the actual response. Although large-scale events like the 2011 earthquake in Japan or the 2001 attacks in New York City have highlighted the need for additional emphasis on disaster response training and exercises, preparedness efforts have continued to focus primarily on three conventional training methods: 1) didactic, classroom-based teaching; 2) web-based training that consists primarily of pre-recorded, user-paced presentation material; and 3) reallife drills and tabletop exercises. While all of the above are long-established valid approaches, classroombased teaching and web-based presentations lack the realism offered by real-life drills. On the other hand, real-life drills are often inconsistent because of an inability to vary levels of stressful events and the extent of time and resources required to design, execute and review such drills. The advent of technologicallybased approaches through virtual reality (VR) environments holds significant promise in its ability to bridge the gaps of other established training formats. VR-based systems encompass a wide array of technical capabilities ranging from non-immersive computer-based setups to fully immersive and highfidelity platforms where participants wear head mounted displays (HMD) for 3D scene viewing and use 3D input devices (joystick, gamepad) for interaction in controlled environments.

Over the past decade, VR-based training in disaster preparedness has been increasingly recognized as an important adjunct to traditional modalities of real-life drills. Multiple studies have highlighted VR applications in disaster training. This increased practice realism enables responders to gauge their individual and/or team's ability to execute tasks and decision-making under more closely representative conditions. In essence, the immersive environment incorporated in VR-based training and exercise applications not only offers the realism that classroom-based instructive teaching lacks, but also may reduce the time and cost burden that real-life drills and tabletop exercises can place on participating organizations. Using VR technology, training can be provided in a controlled setting that mimic real-life situations as closely as possible and that can be repeated unlimited times. Repetition time as well as the feeling of presence that is provided in VR both have positive effects on task performance, enabling the learning situation to be experienced as a real context. This in turn promotes experiential learning as well as the development of operational and formal thinking by facilitating the exploration of different possibilities. The project's goal was to develop and evaluate the first fully mobile, generic, multi-user immersive virtual reality platform. It is specifically designed for the needs of training first responder personnel, such as fire brigades, paramedics, police forces and other disaster relief units. We designed and developed a highly versatile, mobile setup to allow quick deployment at different real-world locations.

3207

FROM CERTAINTY TO WISDOM: THE CONTRIBUTION OF DYNAMIC AND INTEGRATIVE EPISTEMOLOGY TO SYSTEMIC LEADERSHIP

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There is a "thinking and doing dichotomy" that assumes that chronologically we should think before we act. This dichotomy reduces human cognitive processes to their intellectual dimension assuming a superiority of reason over emotions. This dichotomy is rooted well-entrenched epistemological assumptions such as the assumption that the aim of the process of human knowing is to achieve accurate representation of the world leading to "a form of deductive knowledge that contained a degree of certainty unaffected by convictions, expectations, or passions" (Prigogine & Stengers, 1984This degree of certainty matches the Cartesian requirement that knowledge must be indubitable, infallible and incorrigible.

Dynamic and integrative epistemology overcomes the thinking and doing dichotomy by acknowledging that knowing is most and first of all an activity of the knower. Secondly, knowing does not aim at making accurate

representations of reality (clear and distinct ideas) but at accumulating insights through information processing. Information processing is defined as enriching immediate data of experience with value and meaning for the purpose of decision-making and problem-solving. Knowing as information processing occurs at four levels of consciousness, namely, the emotional (pathos), the intellectual (logos), evaluative (ethos) and the active (praxis). These four levels of consciousness imply four different possible outcomes of the process of human knowing. Experiencing generates data or representations, understanding generates meaning, evaluating creates value while acting leads to achievement of practical goals. Furthermore, knowing involves whole organisms and not isolated minds, hence rationality and intelligence can be extended to artifacts such as economic systems, social institutions and non-human experts such as electronic expert systems. In this context, leadership in an information-rich has to be based on wisdom rather than on certainty.

Defining human knowing as accumulating insights through information processing implies challenging in an unprecedented way assumptions that normative epistemology inherited from modern science and its attempts to model all of human knowing on the physical sciences. The three facts of information i.e. being, behaving and becoming, show striking similarities with Lonergan's process of human knowing in way that defining knowing as information processing implies an assimilation of the two frameworks. All in all, knowing as information processing implies that, as Simon (1971) has pointed out: "in an information-rich world, the wealth of information means a dearth of something else: a scarcity of whatever it is that information consumes. What information consumes is rather obvious: it consumes the attention of its recipients. Hence a wealth of information creates a poverty of attention and a need to allocate that attention efficiently among the overabundance of information sources that might consume it."

These skills are not isolated acts but attitudes that shape the process of knowing despite its dynamic and integrative nature. Lonergan (1990) has called these skills transcendental precepts. For him: "progress proceeds from originating value, from subjects being their true selves by observing the transcendental precepts, Be attentive, Be Intelligent, Be reasonable, Be responsible. Being attentive includes attention to human affairs. Being intelligent includes a grasping of hitherto unnoticed or unrealized possibilities. Being reasonable includes rejection of what probably would not work but also acknowledgement of what probably would. Being responsible includes basing one's decisions and choices on an unbiased evaluation of short-term and long-term costs and benefits to oneself, to one's groups, to other groups."

3213 (3214)

SOCIAL INCLUSION AND COMPETITIVENESS IN SMART TOURIST DESTINATIONS: A SYSTEMIC PERSPECTIVE

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The development of smart cities is considered an alternative to face urban problems; one of them is the growth of population with disabilities and senior citizens, which will lead to sustainability issues particularly those dealing with services and infrastructure. The purpose of this paper is to highlight the need of innovation in the tourism sector, considering the Triple Helix model to achieve competitiveness in urban tourism destinations. This research presents a literature review of the smart cities characteristics, challenges and opportunities that bring technological development in social inclusion. The Soft Systems Methodology is applied to show how the smart tourism destination can be modeled. This review shows that smart cities can make more competitive and inclusive the tourism destinations, considering the cultural, economic, politic and social context and how the Triple Helix model of innovation is capable of building strategies and public politics that bring social inclusion for people with disabilities and senior citizens, making the city a more competitive destination.
Keywords**:** Smart Cities, Innovation, Triple Helix, Soft System Methodology, Tourism, People with disabilities, Senior Citizens.

3225 (3226)

THEORETICAL PROPOSAL FROM SYSTEMS' THINKING FOR THE INTELLIGENT TOURISM SYSTEM

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Intelligent tourism is difficult to define not only because there are different interpretations according to the researcher focus and the resources target but also because it is a newly topic with difficulty for its practical application. However, lately, some authors have been working on the generation of general elements that

characterize this kind of tourism activity, such as the technological utilization, social benefits, sustainability relevance, and products design. This study constitutes a theoretical approach from the systems thinking to analyze the scope of the system of intelligent tourism in order to identify some of the elements and relations through the purpose of a holistic interpretation.

Keywords**:** Intelligent tourism, system thinking, holistic interpretation.

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RISK MANAGEMENT IN SMES IN CZECH REPUBLIC

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Business management stands in today's complex and dynamic business environment ahead of the crucial task of ensuring the requirements of all involved stakeholders in the required way. For future-oriented entrepreneurship, effective knowledge of risk management is absolutely necessary, particularly in terms of increasing demand and limited business conditions. Functional and target-directed risk management is a vital contribution and need for corporate governance. For small and medium-sized enterprises (SMEs) it is a particularly important part applying this knowledge in the context of changing business conditions (legislative change, economic change in the field of direct and indirect taxes, in regulatory measures and standards, etc.)

The knowledge, use and implementation of internal risk management processes can fundamentally change the view of business management**.** The concept of risk management includes a wide range of definitions or interpretations, but the presented article considers risk and risk management as one of the possible effects on the achievement of the company's objectives, not in terms of financial management and reorganization of the company, but in relation to the continuity of business and prevention of the possible damages caused by the company's activities.

Future system based knowledge and risk analysis of organisations should support and improve strategic and operative organizational development, leading and controlling activities-following a comprehensive approach, sometimes in ways not anticipated before and should ideally allow for the speedy aggregation and presentation of data, information and knowledge supported by effective and efficient communications in new ways, offering improved systemic interpretation, assessment and decisions.

Changing the organization and the organizational structure also fundamentally changes the possibility of creating a risk situation in corporate management. For example, changes in the manufacturing process and equipment, introduction of new products, and so on. The underlying assumption is that the business environment is changing unexpectedly, globally and comprehensively.

The article critically analyzes the situation in using the principles of risk management on a sample of 300 small and medium-sized companies. These companies are in the field of construction and production of building materials in South Moravian region in the Czech Republic. This field is one of the extraordinarily strong economic units of this land; and is a major contributor to the gross domestic product.

3244 (3244)

PAYING ATTENTION TO THE EMOTIONS IN THE PROCESSES OF CHANGE USING THE VSM

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The Beer´s Viable System Model (VSM) is a powerful tool for studying organizations as cohesive "*wholes*" and for evaluating their strategies counter to the complexity of the tasks they must perform. Primarily, it is a tool to diagnose the effectiveness of the structure of the organization, and offers a conceptual model of the information system to the management. It also allows assessing the consequences of organizations' policies. Social and human actors are not trivial, they pursue ideals, ends, objectives, and have preferences and values, all of which may change. To model that, there are three dimensions to take in account: activities, structure and behavior.

The last dimension mentioned above, behavior, can be of interest at distinct levels: individuals, teams, organizational units, a whole organization, networks, etc. But a mere arrangement and the relationship with behaviors. And when took about behaviors, it´s necessary took about emotions, perceptions and cognition.

The VSM has been adopted by several researchers and practitioners for diagnosing organizational performance, and/or for (re)structuring organizations based on the factors essential and adequate for its long-term viability. In this paper, the scope is to design or change companies to assess and take responsibility for the company's effects on environmental and social wellbeing.

Keywords: Emotion, Change, VSM, perception, workplace.

Poster Abstracts

2994

PASSIVE ENERGY CONSERVATION FOR SUSTAINABLE BUILDINGS

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The increasing demand for air conditioning especially in developing countries is a time bomb for the global climate warming. The supplementary electrical energy demand is on the way to be satisfied by means of CO_2 emissive energy sources mainly fossil.

The passive solutions must be used where it is possible; to decrease at least the energy load and it can be done for a low additional cost especially if it is implemented at the construction initial design stage. Some other promising passives means can be used for existing houses which are the weak point of all energy conservation policies.

A passive house uses mainly passive systems to provide the ambient atmosphere treatment (lighting, heating, refreshment, renewal of air) and the associated comfort. A passive system uses and controls the natural energy streams surround the building such as the solar radiation and the wind. The active components of low energy consumption (such as ventilators and pumps) can be associated there and can be powered by renewable energy sources such as photo-voltaic.

In fact, traditional architecture has always tried to adapt itself to the climate. The use of massive walls associated with white paint, small windows and narrow alleys in warm countries are a good example. Besides, architecture being a local feature, the original solutions of climate adaptation developed on a giving site on the earth can be unknown somewhere else. There is then the need for globalization to help us to benefit from others experience.

If some well known passive techniques have shown a real efficiency in the reduction of the energy needs of the new buildings where they were integrated with the design and the construction, It is not the same case for the existing housing where these passive practices are rarely applicable. An insulation to be really efficient must be made on the outside of the house envelope. This is impractical in buildings already integrated into the urban architecture. It's the same for the thermal mass, the permanent solar protections or the orientation of the housing that are generally an inheritance of several decades of urban development. But recent improvements on some techniques well known by the past but suffering from some inconveniences, make them very promising especially on the adaptation to the existing house. It is the case of using phase change materials, reflecting paints and adapted ventilation strategies.

In fact, the reduction of the energy consumption remains the best mean to limit the resort to fossil fuels and make economically viable the use of the renewable energies. It also gives time to the research in this field to succeed and to reach the phase of industrial maturation.

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THE CONCEPT OF SGAL-PARA SELF-LEARNING SYSTEM

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 "Learning" from daily living is an important and valuable self-investment. By learning continuously, people may discover and have breakthroughs into one's true self, which may eventually lead to a better lifestyle and career. By learning continuously and using a systematic learning model, people may gather miscellaneous beneficial experiences. By applying this learning model and making the best use of their own existing learning experiences, people may continue growing and break through personal problems in order to reach excellence. SGAL-PARA Self-Learning System research examines individuals through work and daily living. Furthermore, encourages applications of their own existing life situations as learning materials. By applying this unique self-learning system, people are able to promote their own way of sophistication, growth, and transformation.

SGAL-PARA Self-Learning System is divided into two subsystems, which have eight elements supplying two courses of action. The first work-and-life subsystem consists of four elements, namely, situation analysis, goal setting, access the gap, and learning design. The second subsystem is called action-and-learning, which includes learning participation, learning about the situation, reflecting towards the situation and action-correction. This gives each individual two courses of action – solving the original gap and changing personal goals.

The following is a brief description of the learning system:

First; Situation Analysis : clarify and assess their environmental resources, limits, and the demand factors. Second; Goal Setting : Refers to one's own environmental opportunities, strategic vision, and form clear goals. Third; Assess the gap : refers to the ability gap between the target and the status quo, and understand their own deficiencies. Fouth; Learning Design : design a viable learning program, or choose the appropriate learning program to close the gap. Fifth; Participation in learning : referring to their own resource conditions, select a learning program, and implementing it. Sixth; Awareness course: after implementing one's actions, you learn to perceive the program, then change one's self-conscious states. Seventh; Reflection behavior : through reflecting the self-conscious state, one can learn from your past behavior, and assess if one has reached their goals. Eighth; Corrective action : After reflecting upon improved actions, one can continue to learn and acheive your learning goals. Nineth; Action Adjustment : close the gap between the current situation and the goal. Tenth; Innovative action: raise the bar, and find new goals.

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HEALTH AND SYSTEM THINKING SIG: FROM HEALTHCARE TO GENERAL SYSTEM THEORY FOR ANY PARTICULAR PERSPECTIVE

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

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

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

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

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

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

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

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

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

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

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

3219

HEALTH AND SYSTEM THINKING SIG: PHYSICAL HEALTHCARE

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

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

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

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

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

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

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

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

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

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

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

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HEALTH AND SYSTEM THINKING SIG: SPIRITUAL HEALTHCARE

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Spiritual Healthcare is about the improvement of our in-born characteristics, possibly hidden in our physical DNA or our energetic "spirits" fields (Aura?). We now try to match this with the "Observation Aggregate" of the

Five Aggregate Human Mind system in the teaching of Buddha. The Five systems are: observation, distinction, sensation, action and physical object. These five systems are able to describe the properties of the observer and the decision maker. Here we must put our foundation in the fundamental teaching of Buddha in the "Four Nobel Truth", guided especially by the "Right View" and "Right Thought" in the "Eight-Fold Nobel Path", which is the fourth part of the Noble Truth.

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

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

Workshop Abstracts

SYSTEMS BASICS: SYSTEMIC SOLUTIONS WITH EVIDENCE-BASED MEDICINE FOR BETTER CONCENTRATIONS - THE SYSTEMS THINKING FOR EVERYONE'S MIND THROUGH THE TEACHING OF BUDDHA ON THE EASTERN SYSTEMS SCIENCE OF FIVE AGGREGATES

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The ability to concentrate has grown in importance in the ever speeding pace of modern society. The feedback cycle of information and matter are getting faster and faster. Moreover, multi-tasking has become a fundamental prerequisite for daily work. Furthermore, quality of services and quantity of serving duration keep increasing. All these factors require our good concentration. Research has been carried out to evaluate different treatments using evidence-based medicine methodologies. One of the treatments is the observation of one's breath, namely Anapana, and its extension to the observation of the bodily sensations called Vipassana. In this workshop we will practice the mini version of the treatment.

From the analysis of the practice, we will try to find the common structure and relationship that can be generalized using systems thinking which could help us understand how our minds work. Research has shown that this systems thinking is rooted from the teaching of Buddha.

The application of system theory requires the understanding of ourselves and of each other, the nature, and the past and future possibilities in a systemic way. That is, we need to understand both the structure and dynamics of our physical body systems, and of our mental mind observations. Research shows that the composition of our body and that of our mind may be explained by the same system theory relating to energy, matter, life and information. We employed this simple ancient system theory as taught by Buddha to investigate how our naturally systemic-structured mind arbitrarily developed all the non-systemic and problematic way of thinking. We use our body to experience the world around us but our mind is the one which is observing and making decisions to change the world. System theory sees the world as composing of observers, decision makers, systems, the environment, the boundaries and relationships between them. There are in effect two opposite forces in the world that constantly interact with each other, creating a flow of energy, matter and information between systems and the environment. On one hand we have the disorder force governed by the second law of thermodynamics that drives everything into an equilibrium state with maximum entropy. On the other hand we have the organizational force governed by the constraints of a system that drives the system into a particular desired steady state with a low entropy.

Our minds are both the observer and the decision maker confronting a major problem. Throughout our life we look for satisfaction that brings happiness. Our government has been relying on economics to achieve this but 80% of the time we are dissatisfied with the people and situations around us, giving rise to craving, aversion and ignorance in our minds and creating all sorts of problems in our society. This is called suffering in the teaching of Buddha, and he offered us a three step solution for our mind. In this workshop we will investigate the systemic view of these three steps, namely self-protection, concentration and purification of mind. We will also investigate a 10-day Vipassana mental healthcare program for people of all religions including scientific communities. It is believed that such a program could bring happiness, peace and harmony for our society.

Is death the end of our lives or just the beginning of another new life? A system undergoes a transition of system state upon death, but will the system continue in other forms at other places? Or will it just terminate totally? What are the possible new system states and are they sustainable? In this workshop we will investigate the sustainability of Heaven, Hell, Earth and Nibbana (null). We will also investigate the way to prepare ourselves to transit into these states.

Keywords: Evidence-based medicine 循證醫學,Vipassana mental healthcare內觀靜坐, Buddha middle path (middle way) 佛法中觀,Concentration 集中力, self-protection 戒,Purification of our minds 淨化心靈,organizational force組織力, entropy熵, second law of thermodynamics熱力學第二定律, Energy-Matter Life-Information 能量物質-信息生命,Craving Aversion Ignorance Wisdom 貪嗔癡智, feedback 反饋, Happiness 快樂, Harmony 和諧, Health and system thinking Special Integration Groups SIG 健康與系統思維特別整合分組, Eastern Systems Thinking 東方系統思維,Heaven and Hell 天堂與地獄, Life and Death 生死, Nibbana 涅槃, Unification of nature and man 天人合一, 80% of the time are spent on 20% of the satisfactions in life 人生不如意事十常八九, Spirituality and Systems 靈性與系統

3058

SYSTEMS BASICS: SYSTEMIC SOLUTIONS WITH EVIDENCE-BASED MEDICINE FOR RELIEF FROM INSOMNIA - THE SYSTEMS THINKING FOR EVERYONE'S BODY THROUGH TRADITIONAL CHINESE MEDICINE ON THE EASTERN SYSTEMS SCIENCE OF TAICHI YIN-YANG FIVE ELEMENTS

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Insomnia has become a modern city sickness. Research has been carried out to evaluate different Traditional Chinese Medicine treatments using evidence-based medicine methodologies. The cause of insomnia may come from one or more of the five elements systems, including the Wood mental system, the Fire emotional system, the Metal behavioural system, the Water spiritual system, and the Earth physical system (with one or more of its five sub-systems).

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

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

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

Keywords: Evidence-based medicine 循證醫學,Insomnia 失眠,Five aggregates systems of human mind 五蘊系統, Traditional Chinese medicine differential diagnosis-cure process 中醫辨證論治系統,Confucius Golden Mean 儒家中庸之道,Taoism 道家思想,Buddha middle path (middle way) 佛法中觀, Yin-Yang Five Elements i ± 1 System 陰陽五行天地人系統, General System Theory 廣義系統論, Health and system thinking Special Integration Groups SIG 健康與系統思維特別整合分組, Eastern Systems Thinking 東方系統思維,Causal loop diagram CLD, quantitative and qualitative changes, System dynamics, Viable system model VSM,Unification of nature and man 天人合一, Cold-Hot spectrum 寒熱譜, Deficient-Excess spectrum 虛實譜, Superficial-Internal spectrum 表裏譜

3085

WHAT IS CONSCIOUSNESS

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The objectives of this workshop is to learn how to be conscious and how to develop consciousness in an easy way. I´m going to use plain words and simple exercises to let you experience ¨consciousness¨.

There are four stages of consciousness:

-With oneself

-With others

-With medio

-With cosmos

We are going to experience some exercises to develop our senses to be more in touch with ourselves, others, medio and the Cosmos.

-How to be in touch with oneself.

-How to know ourself deeper. The feather touch exercise.

-How to develop consciousness with the internal senses.

- Kinestesia

-The Pineal Gland and tips to make it work better.

-The way we think. How to improve our way of thinking.

-How to control our mind.

-The importance of the Chakras.

-Cellular memory and how to clean it.

-How to deal with emotions and feelings.

-Alchemy, Gnosis, Tantra.

Please, bring your smart cell phone we need it to use in an exercise.

Consciousness is like a muscle, the more we use it the better it works.

A new era is beginning. It is the era of Consciousness. In India, Daddy Yankee of Brahma Kumaris, calls it ¨The Golden Era¨, because human beings are rediscovering ¨energy¨ within themselves and how to play god's roll of creator with it. Now everybody can access the forbidden education of the Alchemy of Gnosis, the Spiritual Wisdom. This discipline, during ancient times, was only revealed to the kings. Nowadays with internet and the human being technology everybody has access to that important wisdom.

-Comments and share experiences.

3110

A BROAD SURVEY OF THE FRAGMENTED DOMAINS OF SYSTEMS PATHOLOGY: GST AS A UNIFIER

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We are particularly interested in ourselves as humans. When our human systems dysfunction, experience pathology, or fail we pay special attention. Illness and death of ourselves or our loved ones may be the most important events in our lives. This has resulted in the vast enterprise of medicine. In the U.S. alone, it has developed into a nearly $2 trillion/year industry.

But all systems experience dysfunction, not just humans. If we can study our human body systems using medical science, perhaps we can join General Systems Theory (GST) with the lessons learned in medicine to study pathologies of ALL systems, at ALL scales. The purpose of this unique new study would be to discover the primary, underlying causes of pathology of systemness in general. Patterns for how things work along with patterns for how things don't work may inform all the fragmented domains of the several conventional domains, whatever their current names, with meaningful new remedies for ALL kinds of dysfunctions not yet recognized as similar.

We will present a general-systems-based, top-down, and new Systems Pathology research approach enabled by Systems Processes Theory (SPT). This new approach has significant potential for integrating the many separated domains of conventional systems pathology. We advocate learning from the 5000-year history of conventional medicine by joining its proven practices to this new GST approach to Systems Pathology. This tutorial will present descriptions of the widest possible range of domains of "systems" pathology from the conventional discipline-based or reductionist-based to the isomorphic and transdisciplinary, including SPT, Living Systems Theory (LST), Systems Dynamics, other systems thinking tools and traditions, systems engineering praxis, risk and failure analysis, cell/molecular biology, and conventional, anatomical or molecular pathology. For each domain, an exemplar approach is provided along with a researcher, collaboration and the results. In each case, there is an attempt to relate current status to the potential unification in Systems Pathology using SPT.

This tutorial will also act as an Introduction to the ISSS'17 Joint Special Interest Group (SIG) Sessions on Systems Pathology and Systems Biology/Evolution because this conference will serve as the second official event (with the previous INCOSE IW'17 in Jan) for the founding of a new professional society, the International Society for Systems Pathology (ISSP). The tutorial will end with presentation of a Manifesto for Systems Pathology, By-Laws and Articles of Incorporation for the new ISSP, and a call for Founding Members.

3118

INTERACTION BETWEEN IDEAS AND SOCIETY

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At the ISSS conference in Vienna there will be a discussion of the influence of history and culture on science and philosophy of science.

Heinz von Foerster invented the term second order cybernetics in 1974. Members of the American Society for Cybernetics have been promoting the idea for 40 years. Meanwhile Vladimir Lepsky at the Institute of Philosophy of the Russian Academy of Sciences said that he and his colleagues are working on third order cybernetics. Lepsky and I decided to meet at the conference of the World Organization for Systems and Cybernetics (WOSC) in Rome in January 2017 to discuss what we meant by 2nd and 3rd order cybernetics.

As I read the Russian abstracts presented in Rome, I found they often spoke about "a more humanistic approach." I thought, "This sounds like Locke, Rousseau, and Voltaire." Perhaps the Russians missed that discussion, which was important in the development of democratic institutions. They were citing more recent Russian scholars. So, are the Russians reinventing earlier ideas or are they developing something the West has not developed?

I had similar thoughts when writing a paper that I presented in China in 2015. I said that systems problems can occur at three levels: 1) the world (e.g., building a fast rail system), 2) science (e.g., not having knowledge to combat an epidemic disease) or 3) philosophy of science (e.g., using an inadequate epistemology). It occurred to me that there was a fourth level (the social and philosophical orientation in the society). What has China learned over its long history that the West can benefit from? I did not think that I knew enough about Chinese history and philosophy to discuss this idea in 2015.

In universities around the world people use essentially the same theories and methods for the physical sciences. In legal systems there has been convergence between North America and Europe due to the European Union and the desire to facilitate trade. In social, political and economic systems there is great variety and much to learn. The purpose of this inquiry is to describe the interaction between the challenges societies face and their social, political and economic structures and procedures.

Do societies develop similar ideas eventually as they encounter situations requiring those ideas? Or do they develop different solutions to similar problems? If the latter, what explains the difference? Since scholars now interact globally rather than nationally, we have new opportunities to learn from each other. If societies can preserve and enhance their traditions, while learning from other societies, we should experience a remarkable flowering of human society. My particular interest is in methods of governance which enable societies to be secure, stable and innovative.

Here are some questions we could discuss:

1. What is the status of the convergence hypothesis from the 1960s?
2. What role does geography play in influencing the development of institutions?
3. What are present beliefs regarding the role of religion in governance? Has there been evolution in these ideas or is current thinking a continuation of past thinking?
4. What is the effect of technology on society? Will the usual economic mechanisms of comparative advantage and supply and demand be adequate to provide jobs and income at near full employment levels, or will something like a guaranteed basic income be necessary?

The overarching question concerns the interaction between ideas and society. Assuming that ideas, when acted upon, do affect society, how do changes in society affect changes in science and philosophy?

3119

JOINT MEETING BETWEEN IIASA AND IASCYC

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The International Academy for Systems and Cybernetic Sciences (IASCYS) defines its role and function in the following way: While the traditional disciplines of science focus on parts of the reality of life and consider them from their more or less narrowly selected viewpoints, systems and cybernetics theories and practices deal with a world-view of holism. Likewise, IIASA has developed a profile of research programs devoted to significant challenges for contemporary societies around the world. The following three topics are shared interests between IASCYS and IIASA: Participatory science, Risks and societies, and Sustainability.

IASCYS will organize six speakers for this meeting, namely Stuart A. Umpleby (President of IASCYS), Ockert J.H. Bosch (Vice-President), Matjaz Mulej (Vice-President), Karl H. Müller (member), Raymond L. Ison (member) and Pierre Bricage (Secretary General). IIASA will nominate at least three presenters for this meeting.

For the first topic, IIASA will select a speaker who is working on participatory research designs. IASCYS offers two presenters for this topic.

Stuart Umpleby has long experience in working with participatory research methods. Umpleby was a student of Heinz von Förster and has been active in promoting second-order cybernetics as a way of including observers in research processes in an explicit way. Umpleby has led many workshops and produced a number of relevant publications on this topic.

Ockert Bosch will present an overview of his different institutionalizations of evolutionary learning laboratories for dealing with complexity in contemporary societies, for the art and importance of interconnected thinking starting with young students and for systems education and executive training.

For the second topic, IIASA will find a speaker from its research program "risks and resilience". IASCYS nominated two speakers for this issue.

Matjaz Mulej deals with the issue of societal risks under the special focus of social responsibility. For the last ten years he applied systems and risk theoretic considerations to social responsibility as necessary attributes which become relevant for an ethics of responsibility, interdependence and for requisite holism. In his talk Matjaz Mulej will present an outline of social responsibility in the context of contemporary societies with increasing levels of interconnected and complex risks.

Karl Müller will focus his presentation on the evolution of RISC-societies (Rare Incidents, Strong Consequences). The talk will give a summary of the societal risk potentials of these rare events as well as the necessary societal shortcomings in dealing with the impacts of these rare events in societal and in environmental affairs.

For the third topic, IIASA will select speakers with a strong competence on sustainability issues. IASCYS will have two speakers for this topic.

Raymond Ison will talk about the challenges of governing the anthropocene. His presentation will focus on the transition to the anthropocene as a new stage at the geological scale, the cybersystemic potentials inherent in this transition and the great challenges of this transition to the anthropocene for sustainability.

Pierre Bricage will focus on how attempts to dominate the planet lead to difficulties. Trying to win at local games can lead to losses in a larger game. Local goals should be developed in the context of global sustainability. We need to have a holistic view of how advantages and disadvantages are shared. The talk will present an outline of the emergence of sustainability in living systems, at all levels of organization.

The meeting will be at the Hotel de France, Schottenring 3, 1010 Vienna. IASCYS is responsible for the arrangements with the hotel, including the necessary digital equipment to record the session.

3182

CRITICAL SYSTEMIC LEADERSHIP DEVELOPMENT FOR A NETWORKED WORLD

MacNamara, Delia Pembrey

This workshop introduces and invites you to engage with the Boundary Triage, its Objects and Embodied Cognition heuristics as a personalised continuing leadership development tool for the networked world.

In an increasingly socially networked world dependent on social technologies, literature suggests that leadership and continuing leadership development is of increasing importance especially in the areas of communicating in conflict and/or crisis moments, developing empathy, self-awareness and, at the same time developing high performing teams for the networked era that are highly mobile, distributed and virtual. Incoming innovations, inter-generational expectations and increased information inputs from our environment on many levels is demanding us to be more critical of the information that we receive and how we communicate.

Designed to be simple, easy to remember and practical, the Boundary Triage Toolbox (consisting of the Boundary Triage, its Objects and Embodied Cognition Heuristics) is grounded theoretically in General Systems Theory, Critical Systems Thinking and Cybernetics, and supported by psychosocial and physio-psychological research findings from the health sciences.   The workshop aims to provide an innovative, engaging, simple, easy to remember, employable, and transferrable continuing critical systemic leadership development tool – potentially an androrithm (an algorithm for the evolution of Man) – focussing on the key system concept 'Boundary'.

Keywords: Critical systemic leadership, boundary, Boundary Triage, Embodied Cognition Heuristics, leadership development, networked world, androrithm, anthroporithm.

3183

SIX DEGREES OF BERTALANFFY OR SOCIAL MEDIA FOR SCHOLARS

Rosencrans, Kendra; MacNamara, Delia Pembrey

Our systems for learning, for working, for relationships, for communicating, for finding and disseminating information, for research, and more, are being rewoven through social media platforms and networks. Academic institutions and funding agencies not only demand that scholars publish, but also demand

evidence from citation metrics that others are reading and citing the work. The demand that academics both publish and demonstrate impact is a conundrum amidst the increasing "digital deluge" (Boon, 2016).

The case for using social media to reference, discuss, and promote your research, and for connecting with others, is research driven (McKenzie & Ozler, 2011; Mollett, Brumley, Gilson, & Williams, 2017). At the same time, there is a need for scholars to critically examine social media tools, use, and the impacts on academia, learning, institutional behaviors, and society. This workshop offers an introduction to social media, its relevance to academic work, critical digital & media literacy skills, and how you can make choices about how, and in what ways to develop your social media presence.

 This is an interactive digital workshop to show you how to use social media to multiply your presence and digital presence on the internet, engage the networks, explore how you can monitor systemic flows across the social networks, and how the 'real' world activity flows and energy links to the social virtual and back again. We will also be introducing new forms of journalism (citizen, deep, constructive, solutions), upcoming trends in media, social media, virtual reality & augmented reality technology and what it may mean for you. Learn how to stop 'pushing' and start 'pulling'; relationship building online and offline; social media etiquette… yes, there is an etiquette.

The goal of this workshop is for participants to be able to use and understand the now and future of social technologies in academia, business and society to connect and collaborate with other researchers, to disseminate their research and to manage their public profile, to extend systemic thinking and research into society; to expand the ISSS professional, academic, and practitioner network.

3186

HEALTH AND SYSTEMS THINKING SIG DISCUSSION PANEL

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People interested in Health and Systems Thinking should get together and have a good discussion during the conference. We will start the discussion by talking about our current research area for 5min each, and then talk about the topics discussed in the morning health plenary sessions. Plenary speakers and anyone interested in Health and Systems Thinking are welcome.

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A SYSTEM OF ACCOUNTS FOR GLOBAL ENTROPY PRODUCTION

Friend, Anthony; Friend, Michele

The Workshop is in three parts: (1) the theoretical foundation of SAGE-P, (2) the 'big data' algorithm to construct SAGE-P and (3) the policies to reduce the rate of entropy production per unit of consumption. While part (1) and (2) are theoretical/technical issues, part (3) assumes the focal point of the Workshop. The participants will be introduced to a hierarchical structure of values upon which to frame policies aimed at reducing to a minimum the rate of entropy production per unit of consumption of economic, social and ecological product. This value-structure represents the essential cultural values unique to each, and every, decision-taking unit, be it a village level council to a grand UN Assembly of Nations, be it a family household to multi billion dollar investors of multinational Corporations.

We have formalised, and thus reduced, the value-structure to represent the qualitative properties of

'objects' and 'functions' we wish to conserve in any well-defined (complex) Economic, Social and

2 Ecological System. Employed is the concepts of Category Theory to map values on any well-

defined set of objects/functions we wish to conserve: {i.e., A: **Ecosphere;** values conserved-in-themselves, or intrinsic → **B: S*ociosphere*;** values conserved-in-use → **C: Econosphere;** values conserved-in-exchange. Or **A [B(C)]}.**

3216

COMPETENCIES IN SYSTEMS WORK

Metcalf, Gary; Ison, Ray
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As organizations consider the inclusion of systems approaches and perspectives into their work, there is a need to identify the types of skills and knowledge which systems professionals possess. In recent conversations the terms systemic sensibility, systems literacy and systems thinking in practice capability have been used by some. A number of related high-profile projects have been, and are currently, underway, which include:

1. Efforts by INCOSE, with ISSS members, to include systems principles in the Systems Engineering Book of Knowledge (SEBoK)
2. Preparation of competency frameworks for the systems engineer by INCOSE as well as INCOSE (UK)
3. Development of a competency framework to assist with mentoring its members by SCiO (Systems & Cybernetics in Organisations)
4. UK initiative to create a Level 7 (Master's Degree) apprenticeship, in Systems Engineering in which Systems Thinking is a key component of the standard; this is related initially to the defense industry – but will be more broadly based in future
5. An initiative championed by the Open University (UK) to create a trailblazer employer committee to formulate a level 7 apprenticeship standard relating to the Systems Thinking Practitioner
6. Action research led by systems academics at the Open University with national and international stakeholders to create a competency framework for the Systems thinking in Practice (STiP) professional;
7. An OECD initiative related to public sector innovation and the need for Systems Thinking
8. Multiple efforts to secure funding through the National Science Foundation, and the National Institutes of Health, in the US

These, of course, are in addition to the many, many projects undertaken by individual practitioners and consultants in organizations, institutions, and communities around the world.

This workshop, hosted by IFSR, will provide a time for very brief presentations of examples where the identification of systems competencies are needed. It will primarily focus on discussions about ways in which we can establish international foundations on which to continue to build. We invite you to join us at ISSS2017 in Vienna.

3241

STRENGTHENING THE RESILIENCE OF AGING SOCIETIES

Sankaran, Shankar; Chroust, Gerhard

University of Technology Sidney, AU   *Johannes Kepler University Linz, AT*

Shankar.Sankaran@uts.edu.au   *Gerhard.chroust@jku.at*

Europe is ageing, due to higher life expectancy and decreasing birth rate. It is estimated that in 2060, 30% of the population in the EU are older than 65 years. Human worry, suffering, and grief caused by old age are a concern for everybody. This needs increased attention because the physical and mental health of a growing number of persons is actually or seemingly affected. Strengthening the resilience of seniors is a necessary but complex interdisciplinary challenge.

Can we do a better job of anticipating, understanding systemically, and mitigating the consequences of ageing? We are challenged to find new ways of integrating scientific, technological, cultural, ethical, political, and economic influences in order to alleviate the physical and mental stress caused by ageing and its consequences.

In analogy to Industry 4.0 the power of Information and Communication technology (ICT) and Systems Thinking provide tools for analysis (e.g. Big Data), simulation, extrapolation, and strategic planning of the trajectory of ageing and assistive technologies.

Nowadays, the senior population, many of them still active and even working, is surrounded by technology, internet and social networking. It is, however, necessary to adapt and align existing technology with the

physical and cognitive needs of the lifestyle of seniors, their specialized health care, their idiosyncrasies, and their interests   to support their active ageing, their independence and quality of life.

For this workshop we invite researchers in this field to present, discuss and compare their objectives, approaches, and (as far as available) results with respect to both theory and practical experience.

Typical issues are:

- reduce physical, cognitive and social frailty amongst seniors, typically overcoming deficiencies of sight, hearing and touching
- enhance seniors' participation in physical activities,
- motivate seniors to remain healthy and active,
- supporting elders in healthy eating habits.
- develop elderly-oriented, body positioning and training computer games
- overcoming psychological problems, loneliness and isolation
- non-intrusive alarm systems for helpers

Participants are invited (but not required) to send a short (half page) position statement by **July 1st 2017** to the chairpersons in order to improve comparison and discussion of various approaches in the workshop.

Note that this workshop is closely related to the session '*Resilience 4.0: ICT Support for Human Resilience in Crises and Old Age* ', where full papers are expected.

For further details and information feel free to contact the chairperson.

3245

LIVING SYSTEMS SCIENCE: THE SCIENCE OF LIFE

Simms, Jim

Evolution from philosophy to a qualitative (descriptive) science.

Evolution from a qualitative to a quantitative science.

Where are we now.

How a quantitative science of life can affect your work. I.e. (what good is it?).

Applications.

3247

TOWARDS THE UNIFICATION OF SYSTEMS SCIENCE AND SYSTEMS ENGINEERING

Daniel Allegro, Brigitte; Lawson, Bud; Smith, Gary

In this workshop on-going efforts to improve the understanding of unifying concepts and paradigms are presented. The workshop will be presented in three Modules.

Module 1 - Unification has been a clear goal of the College Publication Systems Series that involves a cooperative effort involving the BCSSS as well as Stevens Institute of Technology. Highlights of some of the unifying concepts and paradigms that have evolved in the series will be presented.

Module 2 - An important unifying concept is the notion of the "systemist". Characteristics of how a systemist deals with any situation, problem or opportunity are presented. The systemist approach is based on an innovative "Systems Tree" that identifies an epistemology, ontology and semantics of systems, as well as how to move from thinking to an effective value added action (axiology). In the workshop, highlights of this unifying innovative explanation of the role of the systemist is presented.

Module 3 - The systemist approach to unification will be illustrated by presenting some of the highlights of a new volume in preparation for the Systems Series that addresses biological and medical systems.

3248

A NEW WAY OF THINKING: INTRODUCTION TO SYSTEMS THINKING & EASY-TO-USE SYSTEMS TOOLS

Bosch, Ockie; Nguyen, Nam

Introduction to afternoon workshops, especially for industry people: Evolutionary Learning Laboratories; Participatory information gathering and integrating different mental models, Causal Loop Diagrams, Bayesian Networks, Sensimod, identification of leverage points and systemic interventions to manage complex problems in any area of interest. What will I get out of the Workshop? Understand what is Systems Thinking, complex systems, multi-dimensional nature of issues facing managers, etc.

- Appreciate interconnectedness between different components of systems
- Awareness of <u>easy-to-use </u>systems tools
- Practical experience to unravel complexity and how to find long-term systemic solutions
- How to develop systemic policies and management plans

3249

ILLUMINATING PATTERNS FOR COPING WITH COMPLEXITY WITH SPECIAL FOCUS ON VISUALIZATION AND DISTRIBUTED ANALYTICS

Lenzi, Maria

Session «Illuminating patterns for coping with complexity» should become an interdisciplinary platform for exchange of experience in application of patterns for analytical reasoning and knowledge transfer in different domains.

We have invited experts from areas of cognitive research, human-computer interaction, visual analytics, biocybernetics and system science, whose work is coupled with detecting and application of patterns.

We see «patterns» *as units of knowledge, which can be reused* to support understanding and problem solving in messy situations and believe, that system science and cybernetics can offer universal patterns for handling of complex issues at all levels of scale: for individuals, groups, organizations and governments.

Seeing patterns is strongly coupled with visualization and our session will give special attention to visualization techniques, supported by computational power and human skills of drawing pictures and diagrams to fascilitate understanding.

Following experts are going to take part in the discussion: expert for pattern languages Mag,phil. Alexander G.Mirnig from Center for Human-Computer Interaction/University of Salzburg, expert for visual analytics a.o.Univ.Prof.Dr.Margit Pohl from Institute for Design and Assessment of Technology/ TU Vienna, Managing Director of Bertalanffy Center for the Study of System Science Stefan Blachfellner, system analyst and associate @ Malik Management Zentrum St. Gallen AG Dipl. Geol. Gabriele Harrer-Puchner, specialist for system modeling&simulation Mag.MAS Maria Lenzi.

In the first part of the session (from 10.00 till 12.30) experts with their presentations will enable insights in patterns of human-computer interaction, in practical application of patterns for communication of knowledge and illuminate patterns of prominent systemic methodlgies like Sensitivity Model and biocybernetics, Soft Systems Methodology, System Dynamics, Viable System Model and patterns of wholeness, revealed by Christopher Alexander, who is considered to be initiator of pattern language movement.

After presentations, experts and attendees can take part in a discussion about idea of a general pattern framework, that could integrate patterns from different domains and make them understandable, usable and accessible for everyone.

In the second part of the session (from 14.00 till 17.00) attendees together with experts are invited to work in groups on problem-in-focus, which will be defined during the discussion.

The workings groups will use different exploration perspectives – Sensitivity Model and Soft Systems Methodology are suggested for a systemic perspective.

Results of those explorations are going to be visualized, presented and discussed and we expect to learn more about patterns and how they work at the end of the session.

System experts, software developers, managers, architects, specialists for visual analytics, cognitive science, pattern languages and all those who search better ways of coping with complexity are welcome to join us!

3255

BUSINESS NAVIGATION

Klein, Louis

A Navigator serves the captain, the ship and the crew. A navigator facilitates daring endeavours and overseas trade. A navigator's responsibilities go far beyond those of a mere guide. Exploring unchartered waters, mapping unknow territory and embarking on ventures, end to end, vouching for a safe passage and a successful return.

A systems and cybernetics paradigm allows to see the world differently, to see bigger pictures, more details and different perspectives. Better maps show new opportunities and minimise risk.

The Business Navigation workshop translates the role of the navigator into business contexts. On the one hand, it revisits the contribution of a systems and cybernetics paradigm, of models, methods and instruments, and how this profoundly contributes to more challenging business journeys. And on the other hand, it elaborates new aspects to the role of consultants, researchers and strategists.

Author Index

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Keyword Index

Sponsor Information

www.systemdynamics.org

The System Dynamics Society provides a forum in which researchers, educators, students, consultants and practitioners in the academic, corporate and public sectors interact to keep abreast of current developments, build on each other's work and introduce newcomers to the field.

Our constituency is international, multi-faceted and diverse, affording members numerous occasions to build both local and international associations. With over 1,100 members in over 75 countries, the System Dynamics Society provides a strong, unified voice supporting the advancement of System Dynamics. Members are able to stay on top of developments around the world by reading the cutting-edge research and applications of System Dynamics published in the *System Dynamics Review,* using the discussion forum and the membership directory, and attending the annual conference. Additionally, local Chapters and Special Interest Groups allow for more frequent face-to-face and electronic meetings.

Chapters

Africa Regional	Italian
ASEAN	Japan
Australasia	Korea
Benelux	Latin America
Brazil	Pakistan
China	Russian
Economics	South Africa
German	Student
India	Swiss
Iran	United Kingdom

Special Interest Groups

Agriculture & Food	Health Policy
Asset Dynamics	Information
Biomedical	Science and
Business	Information
Conflict, Defense,	Systems
and Security	Model Analysis
Education	Psychology and
Energy	Human Behavior
Environmental	Transportation

For more information on the System Dynamics Society and to learn about our activities and resources please contact:
Roberta L. Spencer
Executive Director

System Dynamics Society
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Albany, New York 12222 USA
Phone: (518) 442-3865

office@systemdynamics.org
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36th International Conference of the System Dynamics Society

Reykjavik, Iceland † August 5-9, 2018

Hosted by the Iceland System Dynamics Center at the University of Iceland

Photo courtesy of Visit Reykjavík / Ragnar Th Sigurdsson

Program: The conference program consists of invited and contributed sessions and workshops demonstrating the state of the art in the theory and application of System Dynamics. We welcome all research and documented consulting activities in System Dynamics, including applications of the methodology to solve real-world problems, new technical and software developments, and productive integration of complementary methodologies. A pre-conference summer school will also be scheduled.

Conference Contacts:

Program Chairs

E-mail:progchair@systemdynamics.org

- **Robert Eberlein**
  isee systems
- **Allyson Beall King**
  Washington State University
- **Jürgen Strohhecker**
  Frankfurt School of Finance & Management

Workshop Chairs

- **Jack Homer**
  Homer Consulting
- **Hazhir Rahmandad**
  MIT Sloan

Organizing Chairs

- **Anna Hulda Olafsdottir**
  University of Iceland
- **Harald Sverdrup**
  University of Iceland

VP Meetings

- **Erik Pruyt**
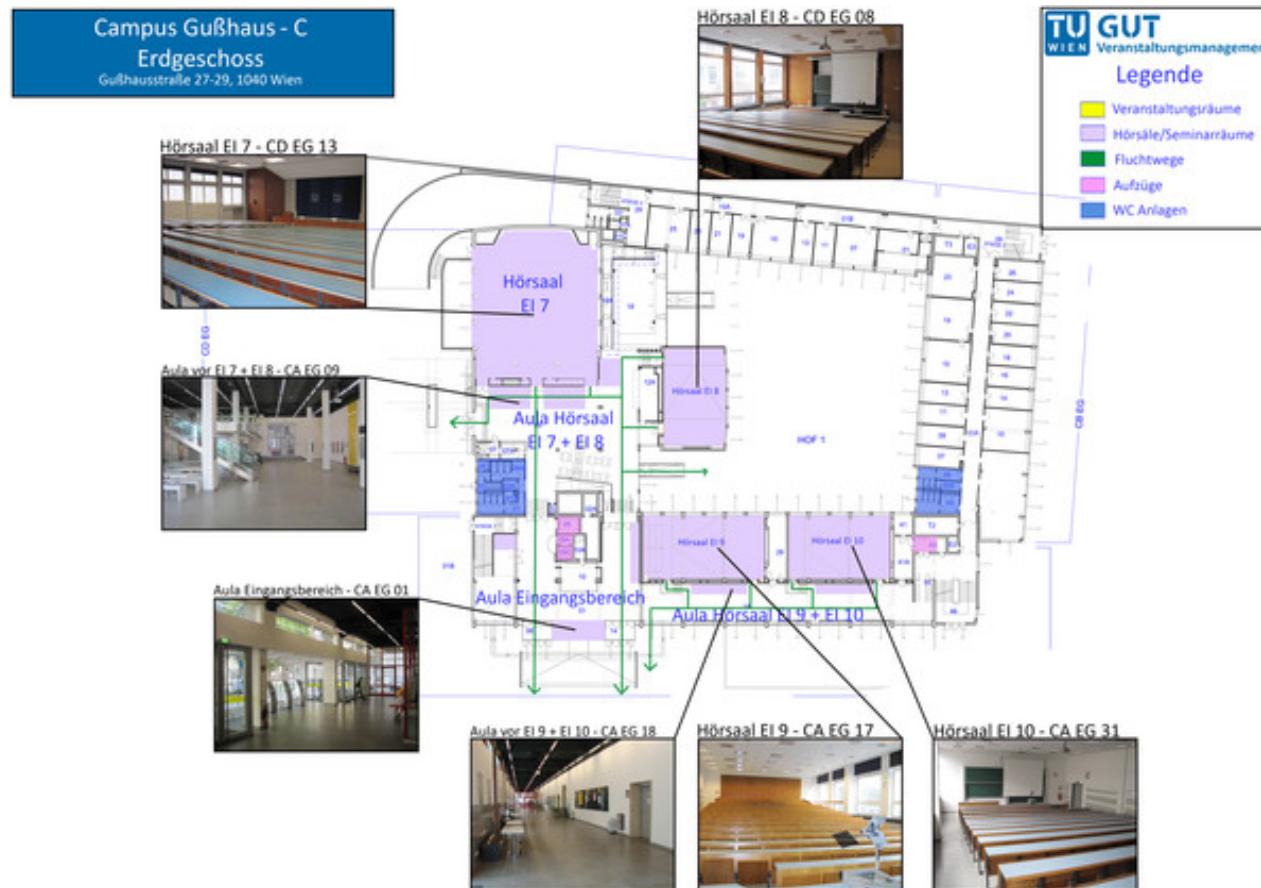 *Delft University of Technology*

Conference Manager

- **Roberta L. Spencer**
  *Executive Director,
  System Dynamics Society*
  conference@systemdynamics.org

Conference Centre Maps

GROUND FLOOR OF GUSSHAUS

FLOOR TWO OF GUSSHAUS

Campus Gußhaus - C
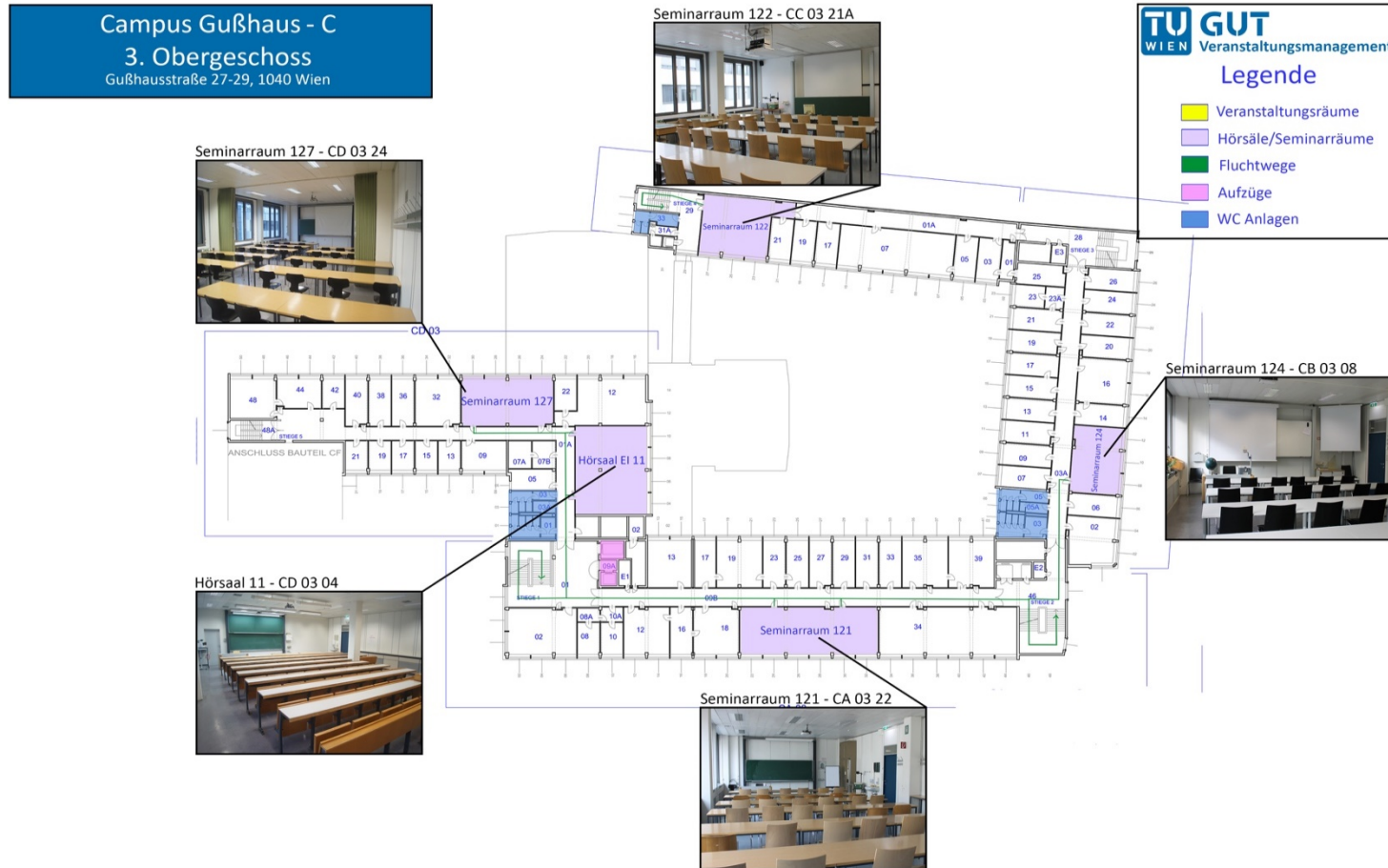2. Obergeschoss
Gußhausstraße 27-29, 1040 Wien

TU WIEN GUT
Veranstaltungsmanagement
Legende
- Veranstaltungsräume
- Hörsäle/Seminarräume
- Fluchtwege
- Aufzüge
- WC Anlagen

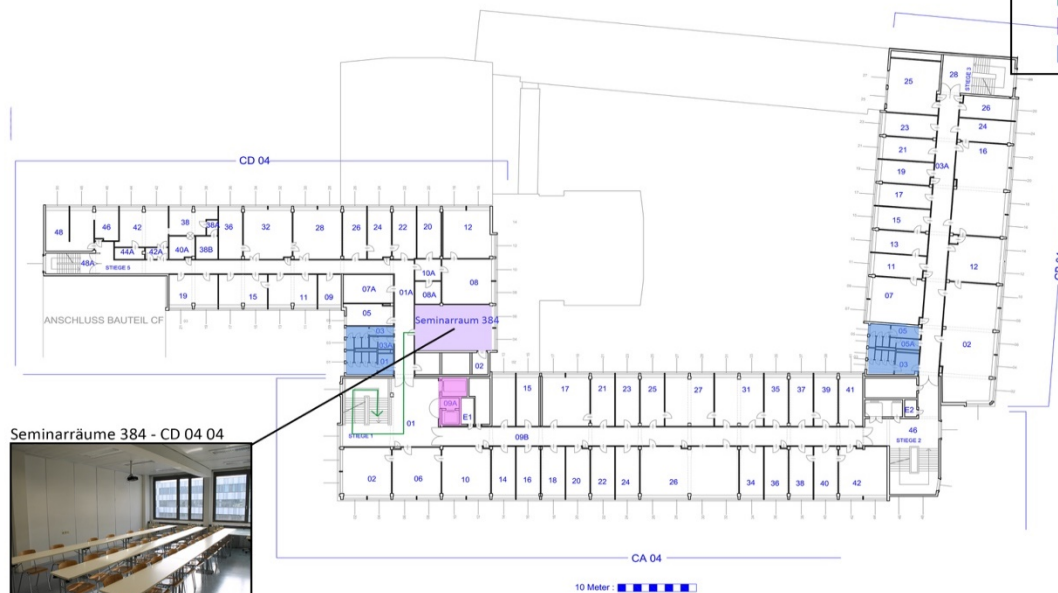Seminarraum 125 - CD 02 04

FLOOR THREE OF GUSSHAUS

FLOOR FOUR OF GUSSHAUS

Campus Gußhaus - C
4. Obergeschoss
Gußhausstraße 27-29, 1040 Wien

Legende

- Veranstaltungsräume
- Hörsäle/Seminarräume
- Fluchtwege
- Aufzüge
- WC Anlagen
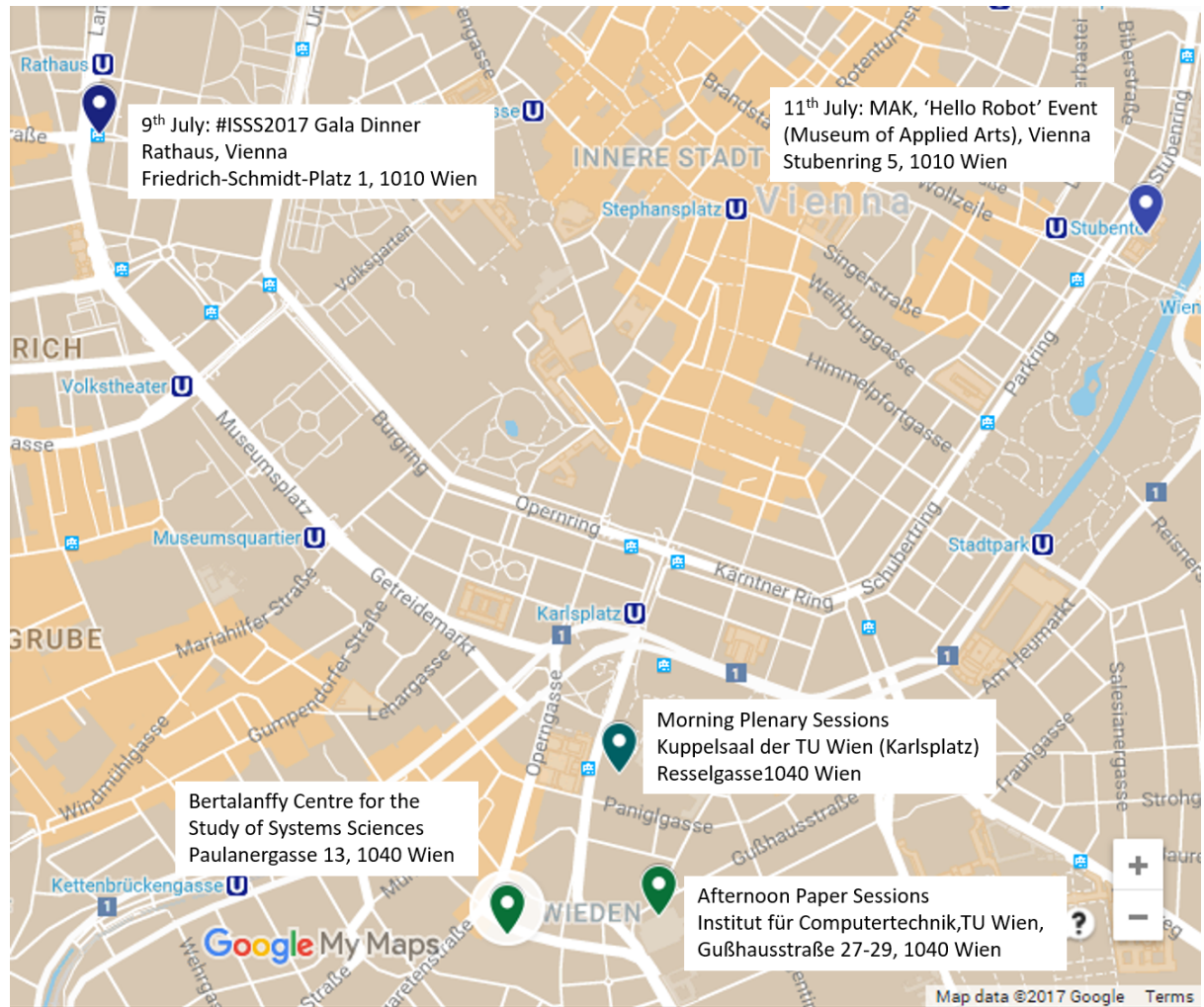
Seminarräume 384 - CD 04 04

FLOOR SIX OF GUSSHAUS

MAPS AND LOCATIONS

9th July: #ISSS2017 Gala Dinner
Rathaus, Vienna
Friedrich-Schmidt-Platz 1, 1010 Wien

11th July: MAK, 'Hello Robot' Event
(Museum of Applied Arts), Vienna
Stubenring 5, 1010 Wien

Morning Plenary Sessions
Kuppelsaal der TU Wien (Karlsplatz)
Resselgasse1040 Wien

Bertalanffy Centre for the
Study of Systems Sciences
Paulanergasse 13, 1040 Wien

Afternoon Paper Sessions
Institut für Computertechnik,TU Wien,
Gußhausstraße 27-29, 1040 Wien

TU Wien
(Technical University of Vienna)
w: https://www.tuwien.ac.at/en/

Morning Sessions
Kuppelsaal der TU Wien (Karlsplatz)
Resselgasse1040 VIENNA, AUSTRIA

Paper & Workshop Sessions
Institut für Computertechnik,TU Wien,
Gußhausstraße 27-29, 1040 VIENNA, AUSTRIA

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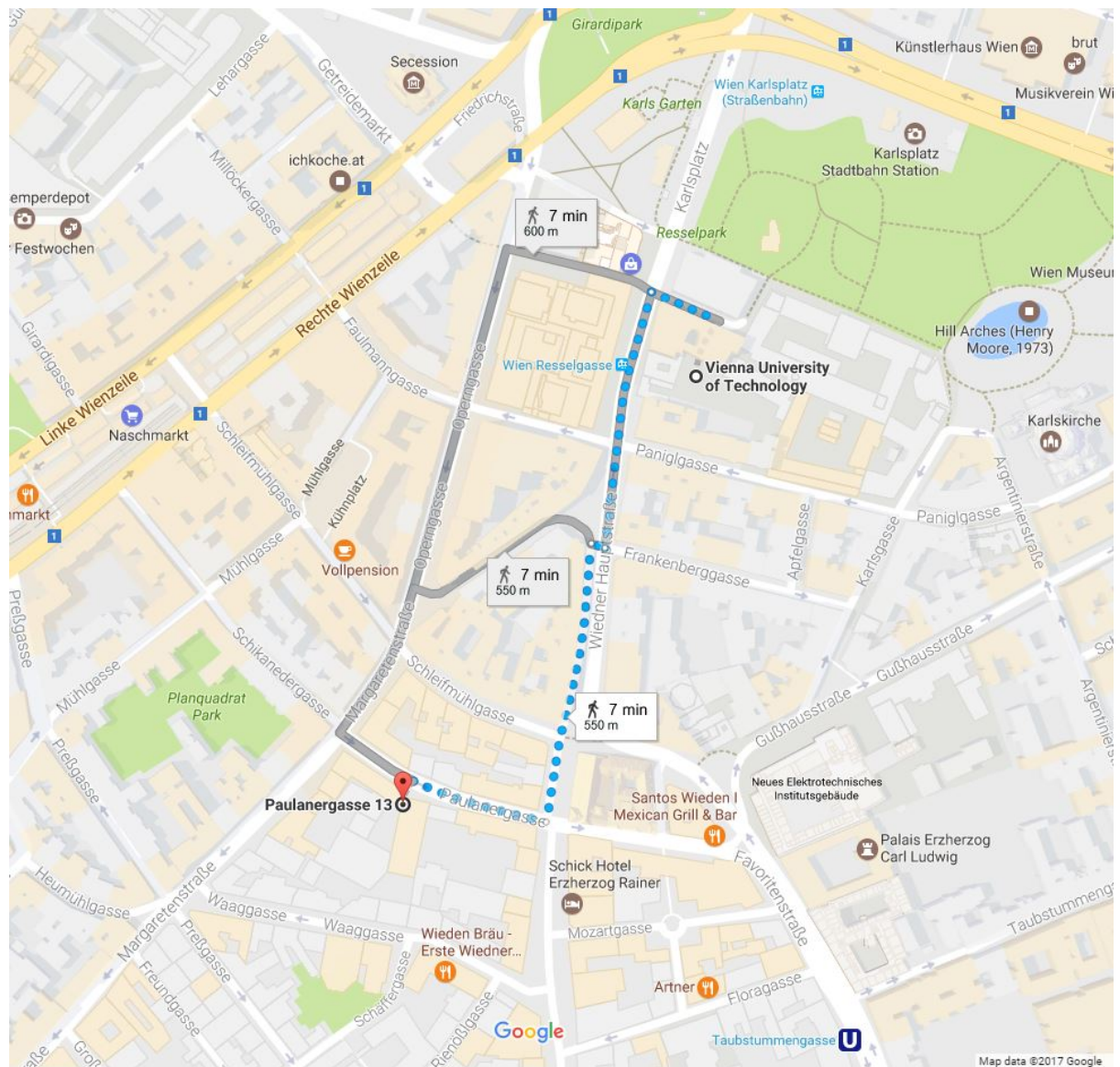# WALKING DIRECTIONS BETWEEN BCSSS AND Kuppelsaal der TU Wien

Morning Plenary Sessions

Kuppelsaal der TU Wien (Karlsplatz)

Resselgasse1040 VIENNA, AUSTRIA

Bertalanffy Centre for the Study of Systems Sciences

Paulanergasse 13, 1040 VIENNA, AUSTRIA

WALKING DIRECTIONS BETWEEN Kuppelsaal der TU Wien AND Institut für Computertechnik TU Wien, Gusshausstrasse 27-29.
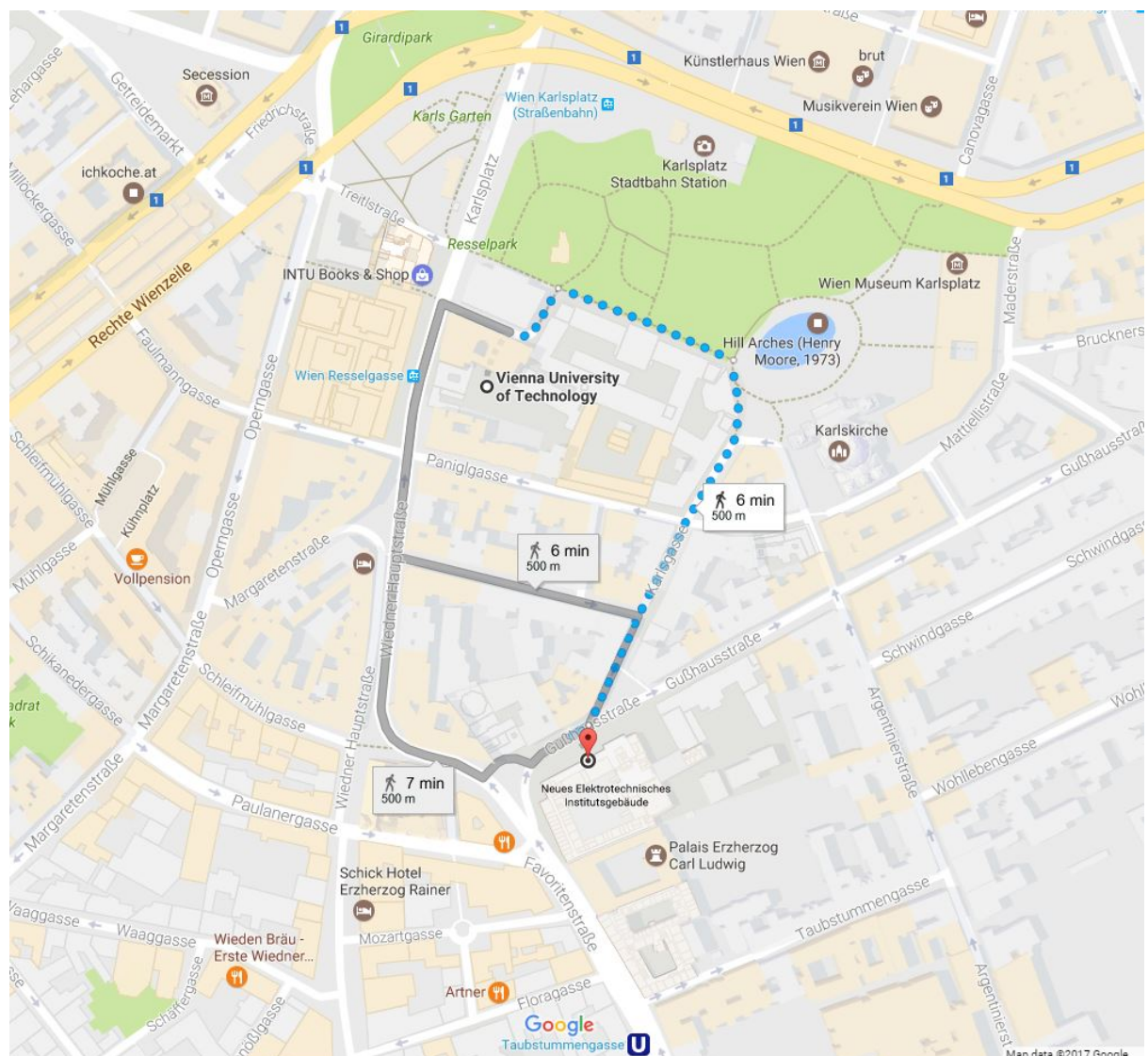
Morning Plenary Sessions

Kuppelsaal der TU Wien (Karlsplatz)

Resselgasse1040 VIENNA, AUSTRIA

Paper & Workshop Sessions

Institut für Computertechnik,TU Wien,

Gußhausstraße 27-29, 1040 VIENNA, AUSTRIA

WALKING DIRECTIONS BETWEEN BCSSS AND Institut für Computertechnik,TU Wien

Paper & Workshop Sessions

Institut für Computertechnik,TU Wien,

Gußhausstraße 27-29, 1040 VIENNA, AUSTRIA

Bertalanffy Centre for the Study of Systems Sciences

Paulanergasse 13, 1040 VIENNA, AUSTRIA