

Complexity Insights: Future Healthcare, Global Governance under Environmental Uncertainty & Identities

*Raffles City Convention Centre, Singapore
Hullet (Level 4)*

Thursday, 20 July 2017

8.30am	Registration
	Future Healthcare
9.00am	Overview <i>Cheong Siew Ann</i> <i>Associate Professor, Complexity Institute, Nanyang Technological University (NTU)</i>
9.15am	Understanding Health needs Big Science, not just Big Data <i>Peter M. A. Sloot</i> <i>Co-Director, Complexity Institute, NTU</i>
10.15am	Coffee/Tea Break *
10.45am	Next Generation Simulation for Future Healthcare <i>Peter Klimek</i> <i>Associate Professor, Medical University of Vienna</i>
11.45am	Panel Discussion (30mins)
12.15pm	Networking Buffet Lunch <i>Jointly with Foresight Conference participants</i>
	Global Governance under Environmental Uncertainties
1.30pm	Optimizing Infrastructure In The Asia-Pacific Region <i>William F. Laurance</i> <i>Distinguished Research Professor, James Cook University in Cairns</i>
2.30pm	The Complexity of Cascades and Interaction Relationships for Managing Large Scale Natural Hazards and Environmental Disasters <i>Adam Switzer</i> <i>Associate Professor, Asian School of Environment, NTU</i>
3.30pm	Coffee/Tea Break *
4.00pm	Will Climate Related Global Assistance Offer an Unique Opportunity for Development in Asia? <i>Wu Fengshi</i> <i>Associate Professor, S. Rajaratnam School of International Studies, NTU</i>
5.00pm	Panel Discussion
5.30pm	End
7.00pm	Welcome Dinner hosted by Strategy Group * <i>Venue: National Gallery L6 Aura Sky Lounge</i>

* No Pork & No Lard

Friday, 21 July 2017

8.30am	Registration
	Identities
9.00am	How Languages Affect Self-Perception of Social Identity <i>Helena Hong Gao</i> <i>Senior Lecturer, School of Humanities, NTU</i>
10.00am	Complex Narratives and Identity <i>Cheong Siew Ann</i> <i>Associate Professor, Complexity Institute, NTU</i>
11.00am	Coffee/Tea Break
11.20am	Cultural Mixing, Cultural Attachment and Architecture <i>George Georgios Christopoulos</i> <i>Assistant Professor, Nanyang Business School, NTU</i>
12.20pm	Panel Discussion
12.50pm	Closing Remarks <i>Peter M. A. Slood</i> <i>Co-Director, Complexity Institute, NTU</i>
1.00pm	Networking Buffet Lunch <i>Jointly with Foresight Conference participants</i>
2.00pm	End

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Sponsor: Para Limes, NTU



Organiser: Complexity Institute

Speakers & Abstracts



Peter M. A. Sloot
Full Professor, Complexity Systems Science
Co-Director, Complexity Institute
Nanyang Technological University, Singapore

Peter Sloot is also a full professor of Computational Science at University of Amsterdam (UvA) and Advanced Computing, ITMO University, St. Petersburg as well as the Scientific Director, Institute of Advance Study, Uva.

His research interest is to understand how nature processes information. He studies this 'natural information processing' in complex systems by computational modelling and simulation as well as through formal methods. His work is applied to a large variety of applications with a focus on - but not limited to - Biomedicine. Recent work is on modelling the virology and epidemiology of infectious diseases, notably HIV, through Complex Networks and Cellular Automata.

He led two EU projects: ViroLab and DynaNets and supervise research from various NIH, NSF and NWO projects. Recently he started the Kumbh Mela Experiment on crowd dynamics. His theoretical work focuses on out of equilibrium dynamics of Complex Adaptive Systems using Information Theory and Thermodynamics.

Additionally, he is a laureate of the Russian Leading Scientist President Programme, the editors-in-chief of two Elsevier Science journals: Future Generation Computer Systems and Journal of Computational Science. He published over 400 research papers and his works featured in international media and some made into scientific documentaries.

Abstract: Understanding Health needs Big Science, not just Big Data

Recent developments in Big Data and Data Analytics seem to indicate that these methods provide a novel way to study health and diseases. There is however a serious danger in using such methods without probing for a deeper understanding of the complexity of the diseases. In this talk I will present examples where big data failed big and where dramatic consequences could happen. I will come with novel scientific approaches, inspired by Complexity Science, to map out the intricacies of diseases in a holistic way. In addition, two case studies will be presented: Diabetes and the HIV-1 pandemic.



Peter Klimek
Associate Professor, Section for Science of Complex Systems
Medical University of Vienna, Austria

Peter Klimek is the Associate Faculty member of the Complexity Science Hub Vienna. His research focus is to explore and exploit the possibilities that big data and complexity science offer for the future of medicine. His work uses methods from network analysis, statistical mechanics, complex data analysis, and various simulation & modelling approaches to understand how we can improve, both the patient health & health care system itself. His results include novel methods to quantify and predict the future health state of multi-morbid patients, statistical models for the influence of epigenetic factors on disease risks, as well as network characterizations of health care processes. His research interests also include complexity economics and socio-economic modelling. He developed a statistical test for electoral fraud, novel methods to measure systemic risk, as well as modelling techniques for emerging risks and for socio-economic impact analyses of new technologies.

He obtained his PhD in theoretical physics in 2010 and master in 2007 in quantum information. His work attracted broad media interest and was featured on various BBC programs (Radio 5, Scotland, World Service), Austrian Radios OE1 and FM4, magazines like Nature News, Science News, Scientific American, New Scientist and other newspapers including Sunday Times, NY Times, Daily Telegraph, Berliner Morgenpost and Moscow Times.

Abstract: Next Generation Simulation for Future Healthcare

Healthcare costs are currently growing unsustainably around the world. The root cause for this unsustainable growth is a dramatic increase in the prevalence of chronic disorders, such as diabetes, cancer, or cardiovascular diseases, which represents one of the most pressing challenges in health & medicine today. However the integration of large-scale computational models & mathematical know-how allows us to better understand personalized health risks and how their quantification can be used to prevent disease. These developments lead to personalized models for the spreading of diseases and data-driven identification of risk factors for chronic illnesses. With the availability of complete data on population health, such as medical claims or electronic health records, it now becomes possible to quantify objectively costs, efficiencies and bottlenecks in our health care system in a systemic way.

We will discuss how these findings allow for the first time to build a predictive full-scale model for the health state of an entire country's population based on large-scale observational health care data. These developments will provide policy-makers with novel tools to assess the effectiveness of health interventions in order to make those systems more effective and sustainable.



William F. Laurance

Full Professor

**Director, Centre for Tropical Environmental and Sustainability Science
James Cook University, Cairns, Australia**

William Laurance is a Distinguished Research Professor and Australian Laureate at James Cook University in Cairns, Australia. He also holds the Prince Bernhard Chair in International Nature Conservation at Utrecht University, Netherlands. A tropical environmental scientist, he has written eight books and over 600 scientific and popular articles. He is a fellow of the Australian Academy of Science and has received many professional honors, including the Heineken Environment Prize, BBVA Frontiers in Conservation Biology Award, the Society for Conservation Biology's Distinguished Service Award, and the Zoological Society of London's Outstanding Conservation Achievement Award. He is the founder and director of ALERT - the Alliance of Leading Environmental Researchers & Thinkers - a science-advocacy group that reaches up to 500,000 readers weekly. He is a four-time winner of Australia's Best Science Writing Prize.

Abstract: Optimizing Infrastructure in the Asia-Pacific Region

Developing nations need better roads and transportation infrastructure to create economic opportunities and social development. However, if inadequately planned and constructed, roads can create an array of economic, social, environmental and political problems. Effectively designing and prioritizing roads is essential because at least 25 million kilometers of new roads are expected by 2050 - enough to encircle the Earth more than 600 times. About 90% of these new roads will be constructed in developing nations that sustain exceptional biodiversity and ecosystem services.

I will highlight the multidisciplinary efforts to maximize the social and economic benefits of new roads and transportation infrastructure while minimizing their environmental costs and socio-political and economic risks, focusing particularly on the Asia-Pacific region.



Adam D Switzer
Associate Professor
Associate Chair (Academic), Asian School of the Environment
Nanyang Technological University, Singapore

Adam D Switzer is an Executive Council member of the Asia Oceania Geoscience Society and a member of the editorial board of peer review journals *Geoscience Letters* and *Journal of Coastal Research*. **Principal Investigator (PI) , Earth Observatory of Singapore.** He has 15 grants in Singapore (worth >\$5M) from which he has been PI or Co-Investigator. He authored > 60 peer-review publications, including lead academic publications in *J. Geophysical Research*, *Geophysical Research Letters*, *Bulletin of American Meteorological Association*, *Scientific Reports* and *Nature Communications*. His research includes storm surges, tsunamis and sea level along with multi-hazard interactions. Research sub themes include sedimentary geology, time series analyses, mathematical models, visualization, complexity, confronting models with data, and communications of science to user groups.

Abstract: The complexity of cascades and interaction relationships for managing large scale natural hazards and environmental disasters.

What is rarely discussed in future planning and disaster risk reduction & management is: the potential of one natural hazard triggering or increasing the probability of another natural hazard occurring. For example, a volcanic eruption as a primary hazard can trigger many different secondary hazards, including earthquakes, tsunamis, landslides, floods, lightning and extreme temperatures, with each of these in turn triggering or increasing the probability of other hazards, thus resulting in multi-hazard cascades. Constraining hazard interactions is particularly relevant when considering countries which experience a high frequency and breadth of natural hazards.

Here, I will present case examples of potential interaction relationships between natural hazards and people in Southeast Asia including Singapore. I will draw on a wide-ranging synthesis of literature, to present a broad overview, characterization, and visualization of several interaction relationships between multiple natural hazards. I will summarise methodologies to identify and characterise the interaction relationships between these hazards (also termed ‘multi-hazards’), using visual formats particularly suited to end users. I will underscore the importance of providing a platform that allows those undertaking research into single hazards to place their work within the context of other hazards. Moving forward scenario based approaches also communicate important aspects of hazard interactions, thus facilitating an effective analysis by those working on reducing and managing disaster risk within the policy and practitioner communities. Knowledge of these potential interactions reinforces the need for holistic or multi-hazard approaches to natural hazard assessments regionally.



Wu Fengshi

**Associate Professor, S. Rajaratnam School of International Studies
Nanyang Technological University, Singapore**

Fengshi Wu obtained her BA from Beijing University and PhD from University of Maryland. She specializes in Chinese politics, environmental politics, non-traditional security and global governance. Her recent publications appeared in the *International Studies Quarterly*, *The China Journal*, *VOLUNTAS*, *Issues and Studies*, *Journal of Environmental Policy and Planning*, *China Perspectives*, *Journal of Contemporary China*, *Journal of Chinese Political Science* and the *Saint-Petersburg University Vestnik*. Her edited book entitled “China’s Global Quest for Resource: Energy, Food and Water” was published by Routledge (London) in 2016. Since 2013, she joined the Editorial Boards of *Global Environmental Politics*, *China Review*, *Politics*, and *Voluntaristics Review*. She was among the inaugural class of the Graduate Fellows of the American Academy of Political and Social Sciences (2004), and a Visiting Scholar at the Harvard-Yenching Institute (2008-09).

Abstract: Will Climate Related Global Assistance Offer an Unique Opportunity for Development in Asia?

The Paris Agreement is now entering a new stage of negotiation. The outcomes will shape how global climate governance will look like in the coming decades, which will affect many developing countries. Many of the ASEAN member states (esp. Philippines, Myanmar, Vietnam and Indonesia) and their neighbouring countries (esp. Bangladesh) are now on the watch-list of the international climate policy community as they are among the most vulnerable to any climate changes. Different from previous rounds of climate negotiations such as the Kyoto Protocol, the Paris Agreement is anticipated to offer more funds, reduce the binary division of developing versus developed countries, enhance technological transfer, and produce more effective international cooperation.

Given these new developments, it is time to look at the overall potential impact of global-level climate governance building. Some experts have already argued that global climate governance can offer “flagship opportunity” for developing countries to re-steer domestic structures and economic models. My talk will examine climate vulnerabilities, domestic structures and pending international climate assistance related to ASEAN member states in order to shed light on such an argument, and call for more attention to the global-local linkages in climate politics.



Helena Hong Gao
Senior Lecturer of Linguistics
Director, Bilingual Development Lab
Director, Master of Arts in Translation & Interpretation Programme
School of Humanities
Nanyang Technological University, Singapore

Dr. Gao started her career as an Assistant Professor, a Lecturer, and then an Associate Professor in English, while working as a jointly appointed Senior Translator and Coordinator for the international collaboration programmes for the Sheyang Municipal Government in China. Through teaching applied linguistics and translation courses in her early career, she developed her research interest in psycholinguistics and became a Lecturer and Research Director of the Cognitive Development Lab in Department of Psychology at University of Toronto after she received her PhD degree from Lund University, Sweden.

Since she joined Nanyang Technological University (NTU) in 2006, she has developed more than 20 courses for the programmes in Chinese linguistics & translation and taught 18 of them to both undergraduate & graduate students. She is a Faculty Fellow of NTU University Scholars Programme.

Her current research focuses on bilingual development in relation to cognitive development and social development in both children & adults in Singapore. Most of her recent publications can be found on the website of the Bilingual Development Lab (<http://web.hss.ntu.edu.sg/gaoresearchteam/>), which was established with the funding support of Tier 1 and Tier 2 grants from Ministry of Education, Singapore.

Abstract: How Languages Affect Self-Perception of Social Identity

Being a bilingual does not simply mean being able to speak two languages. The socio-cultural aspects of bilingual development often involve changes of bilingual speakers' perception of their social identities.

In this talk, I will present part of my current study on the perception of social identities of English-Chinese Singaporean bilinguals via online communication. The participants of the study were young Singaporean adults who speak English and Chinese on a daily basis and whose English was their dominant language. Thirty-six statements expressing their own opinions on different social roles in English and Chinese were collected via online communication from the participants. They were analysed within the frameworks of social identity theory and self categorization theory.

Based on the preliminary analysis of the data, I will first discuss the cognitively and culturally based thinking patterns of English-Chinese Singaporean bilinguals and then illustrate how these patterns affect young adult bilingual Singaporeans' perception of their social identities, such as self, other, and gender roles. How bilingual competence can be assessed accordingly will also be discussed. The main goal of the research is to explore the process of reformation of active bilingual speakers' social identities and to identify which aspects of the reformation are related to their bilingual competence and the particular language they habitually use in a particular social context.



Cheong Siew Ann
Associate Professor
School of Physical & Mathematical Sciences
Deputy Director, Complexity Institute
Nanyang Technological University, Singapore

He is interested in understanding complex systems from both modeling and data perspectives, using a comparative approach on markets and economies, epidemics, earthquakes and tectonics, biological macromolecules, brain, society and language to distill more universal theoretical understanding of complex systems. Ultimately, his goal is to develop a computational theory of complex systems, by treating their dynamics as information processing, and discover the underlying logic. Using this theory, he would like to shed light on how evolutionary processes shape the complex network topologies and dynamics of complex systems.

Abstract: Complex Narratives and Identity

In *Hard Truths to Keep Singapore Going* (Straits Times Press, 2011), the late Lee Kuan Yew said that in spite of years of nation-building, Singapore is “not yet a nation”. This admission stirred up controversy amongst Singaporeans who equate ‘nation’ with ‘country’. According to the Oxford English Dictionary, ‘nation’ (Latin *natio* (birth)) refers to “a large aggregate of people united by common descent, history, culture, or language, inhabiting a particular country or territory”, while ‘country’ (Latin word *cuntrata* via Old French *cuntree*) and means “a nation with its own government, occupying a particular territory”. Thus, commonly speaking, we can have nations without a country (e.g. the Kurdish people), or countries without a nation, yet.

In a multi-racial, multi-religion, and multi-cultural society like Singapore, the differences are still too big for Singaporeans to see themselves as a nation. With their increasingly global outlook, frustrated with the ‘official narrative’, and their own inability to articulate one, younger generations are asking themselves what it means to be a ‘Singaporean’. They do not know who they want to become, what they need to learn, and where to find the knowledge to achieve that goal.

How can Complexity Science help us better understand identity as a project for future citizenship at various levels? In this talk, we will use a complexity approach to investigate the highly controversial relationship between factual events and their narratives. We will begin by pointing out the fallacy of over-simplification (i.e., that one set of factual events ‘leads’ to only one narrative) on a historical method basis. In fact, the same set of factual events can support multiple coherent (non-self-contradictory) narratives constructed out of different subsets of events. In telling stories that form the bases of identities, different narratives can assign different causes to the same effect, and sometimes a cause in one narrative can be recognized as an effect in another narrative. In fact, some of the events narratives draw upon can be wholly fictional.

From the Complexity Science point of view, the different narratives arise from the needs of different human communities with different cultural backgrounds (logic) to process the *same* information. To re-engineer fictional elements to make narratives more compatible with each other, we propose to turn to agent-based modeling and simulation (ABMS).



**George Christopoulos,
Assistant Professor
Nanyang Business School
Nanyang Technological University, Singapore**

He is a Decision Neuroscientist. He obtained his PhD at University of Cambridge and did his postdoc at University of Cambridge, Baylor College of Medicine and Virginia Tech. He is a Fellow, *Asian Consumers Insights Institute*; Principal Investigator, *Future Resilient Systems, ETH Zurich*; and Affiliated Scholar, *Virginia Tech Carilion Research Institute, USA*.

He has extensive research experience in neurobehavioral accounts of human behaviour. In a series of studies, he identified the neural correlates underlying risk attitudes and explored the social aspects of human behaviour, such as cooperation, trust and social influence, employing novel neuro-computational approaches. Part of his current research examines the rather unexplored effects of culture on human decision making. A new research stream in his lab explores the effects of the development of Mega-Cities and urbanicity on human behaviour, mental health and performance.

His lab has received well over \$1.1M in external funding from both governmental and private institutions. This research has been showcased in various media, including the French TV and Channel News Asia. Finally I have been occasionally consulting major companies in Singapore and overseas.

Abstract: Cultural Mixing, Cultural Attachment and Architecture

I should be sorry to learn that Chinese culture resided in brick and mortar or in huge tomes which the moth can eat. A nation's culture resides in the hearts and in the soul of its people.

Mahatma Gandhi

The future of architecture is culture.

Philip Johnson

I will offer evidence and data examining these two quotes. Our research shows that culture does affect our stress-related body and brain responses. Thus the idea that culture resides in our hearts is not just a metaphorical poetic concept. Culture can act as a parental figure that offers security in the face of threat – mimicking the caring function that family offers to children. However, this protective mechanism carries a dark side as well. In human history, the mixing of cultures has been proven to be a beneficial but as well difficult exercise – with the major obstacle being mostly psychological and less of a pragmatic, financial nature. I will demonstrate the psychological mechanisms that underlie resistance to foreign cultures and influences. Surprisingly the major emotional reaction is neither fear nor anger.

Then I will explain how architecture and culture build each other in an infinite loop. I will show how seemingly innocuous aspects of architecture could affect human preferences, behaviour, performance, emotions, social exchanges and health. Subsequently humans rebuild their houses, workspaces and public spaces according to their preferences thus reshaping their culture's architecture. Policy makers that understand these mechanisms have the opportunity to shape identities and nudge citizen behaviour towards positive and creative choices, possibly without the need to take up the legal route that, many times has the opposite effect.