

*Transcultural Foresight:
Multiple Horizons of
Challenge & Application*

**World Future Society
Toronto Meeting
July 29 2012**

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Trans-Cultural Foresight Projects

Sponsor	Project	Cultures
European Commission	<ol style="list-style-type: none"> 1. IPTS-FTA 2008 - Big Picture Survey; 2. IKNOW 2010-2011; 	EC-CAN-TKY
		EC-UK-ISR-CAN
APEC Center for Tech Foresight	<ol style="list-style-type: none"> 1. APEC Future Fuels 2005-2006 2. Emerging Infectious Diseases 2006-2008; 3. Low Carbon Society 2009-2011 	THAI-TWN-US-CAN-AU
		THAI-JAP-AU-TWN-CAN
		THAI-CAN-JAP
Russia – Higher School for Economics	<ol style="list-style-type: none"> 1. RusNano; Horizons 2020 for Russian Nanotechnology 2010-2011 2. Foresight Methods -Strategic Assessment 2011 	RUS-UK-CAN-US-EC
		RUS-UK-TKY-CAN
Canada - USA - European Commission	<ol style="list-style-type: none"> 1. Bio-Systemics 2003-04, Towards Understanding Convergence 2004-05, Prospective Applications of Convergent Technologies – PACT 2007-2012 2. US National Nanotechnology Initiative – Nano-Bio-Info-Cogno Convergence 2003-04; 3. EC Converging Technologies for the European Knowledge Society – CTEKS 2004-05 	CAN; US; EC
		US; CAN: EC
		EC; CAN; US



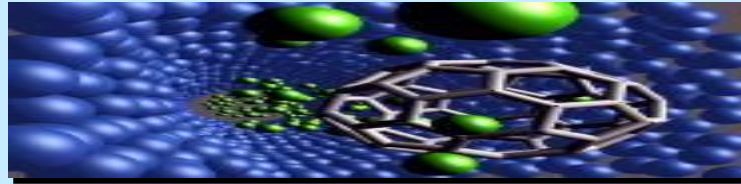
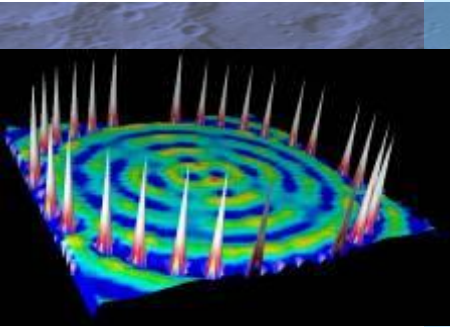
Transcultural Foresight Premises

- I. Purpose – Context
- II. Precision – Scope
- III. Probability – Prediction
- IV. Application – Adoption
- V. Valuation - Impact
- VI. Accountability – Transparency

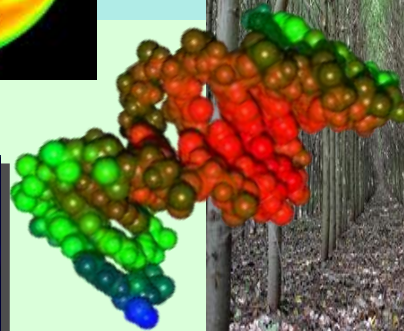
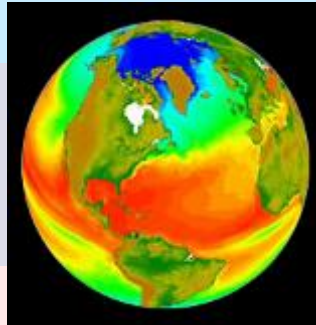
Each of the above foresight dimensions may have transcultural variations, gradients, differences.



Three Revolutions in Science



Nanotechnology



Systems Biology



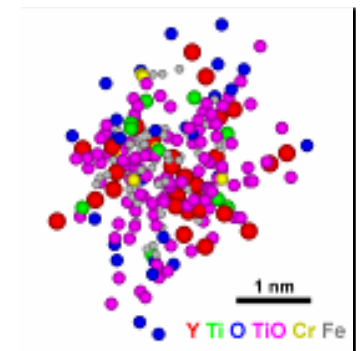
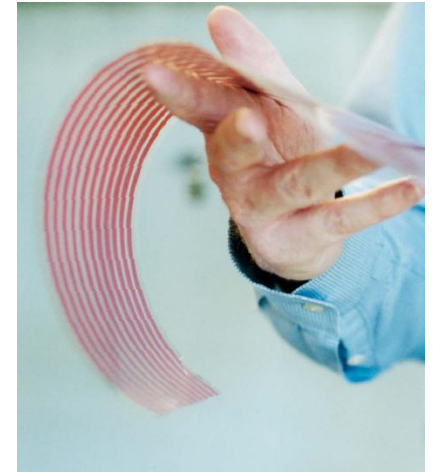
Advanced Computation





Trends in Nanotechnology

- ❖ Smart materials with nano films, structures
- ❖ Integration of functions and structure in membranes, fabrics, fibers, self powered entities, biomimetic materials
- ❖ New environmental leaps in performance: e.g water filtration and purification, biocidals, bioremediation and decontamination
- ❖ Nano sensor networks, tracking capacities – nano-electro-mechanics (eg HVAC embedded)
- ❖ Wearable personalized nano sensors with data and communications capabilities
- ❖ Energy and power efficiencies improvements, battery power management
- ❖ Smart dust capability for widespread human , environments surveillance
- ❖ Computational devices embedded in consumer, commercial goods
- ❖ Functional, programmable nanostructures for controlled drug delivery, performance of implants, protheses
- ❖ New devices, building materials and fabrics that incorporate nano film solar power and are climate responsive





Trends in Biotechnology

- **Control, improvements in living organisms**
- **Bio-sensing at the micro and nano level, micro and nano electromechanics**
- **Integration with wireless, RFID, photonics-molecular level cameras**
- **Tissue engineering, artificial organs, implants and prostheses**
- **Targeted drug delivery and use of in vitro capacities**
- **Rapid scaleable bio-assays for molecule ID, medical diagnosis and forensics**
- **Personalized medicine using large data sets of patient information, disease statistics, gene sequences and genotypes**
- **Genetically modified insects to counter pathogen carriers**
- **In silico- computer testing and comprehensive modelling for drug characteristics, side effects and receptor simulation – lab on chip**
- **Molecular recognition –targeted drug delivery to organs, tumours**





Trends in ICT & AI

- ❖ Progress toward ubiquitous access and integral capacity;
- ❖ Open source collaborative tools and deeper peer- to peer functionality = social networks maturation;
- ❖ Continued migration towards device and functional convergence;
- ❖ Info-based manufacturing, claytronics for distributed fabrication;
- ❖ Broader object based nodes and networks so everything can be smart and connected;
- ❖ Pervasive E Science and dynamic simulation and modelling;
- ❖ Gaming for personal and organizational decisions, learning;
- ❖ Emerging horizons for faster, exponentially more powerful encryption, quantum information and environmental knowledge-control-efficiency potential;
- ❖ Sustained info markets growth for surveillance, sensor networks, tracking capacities, nano-electro-mechanics
- ❖ Wearable, implantable personalized micro-nano-bio info sensors with data and communications capabilities





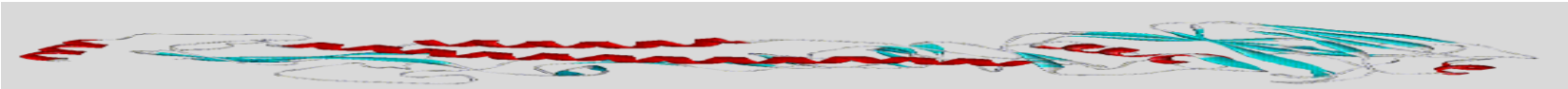
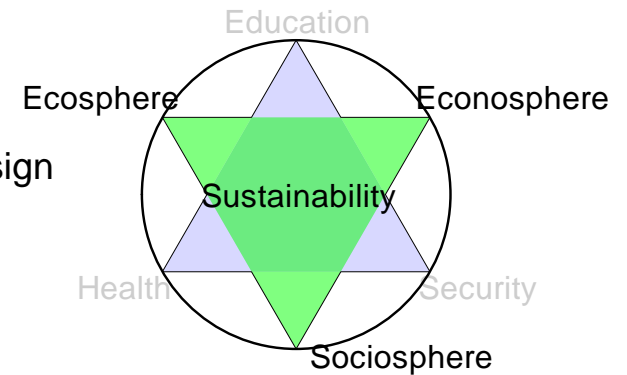
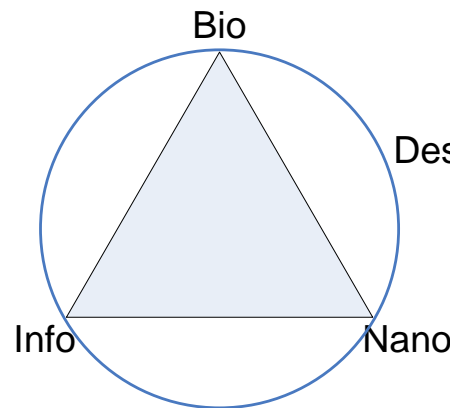
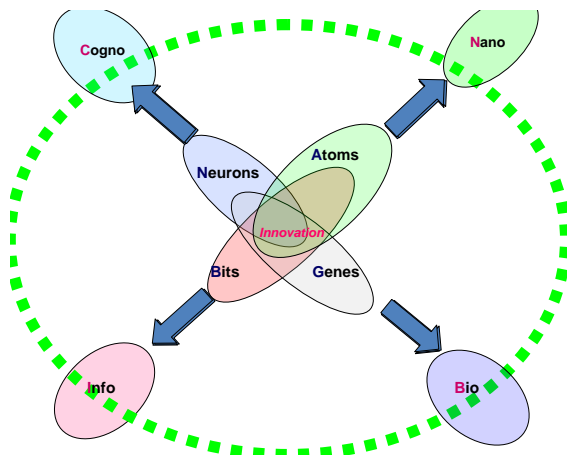
Macro Shaping Trends - Convergence is #15

1. **Demographic, wealth shifts** in West & world, BRICs-NICs – beyond boomers;
2. **Mechanization of Intelligence** – ambient networks & toward Singularity;
3. **Global Anxiety** – from Global Warming-Climate Change to Debt and Terrorism;
4. **Miniaturization, Automation (robotics) & Socialization** of Technology;
5. **Globalization of Capital, Terror, Disease, Eco-Environment, Wealth Creation**;
6. **Anti-globalization** of Biodiversity, Culture, Sustainability, Wealth Distribution;
7. **De-Carbonization, Diversification** of Energy Economy;
8. **Harmonization - Standardization** for Trade ;
9. **Proliferation of Surveillance** - Security in all domains;
10. **Urbanization Migration, Multi-Culturalism** of Populations;
11. **Acceleration of Services as Economic Driver**;
12. **Smartness Transformation** of Infrastructure Systems;
13. **Intensification, Differentiation** of Knowledge, Health & Wealth;
14. **Virtualization, Digitization & Integration** of: Business-Professions, Production, Communications, Entertainment, Education;
15. **Convergence** in technology applications: bio-info-nano-design (BIND) + eco-cogno/neuro capabilities - signalling new possibilities across multiple platforms



Converging Technologies

Converging Technologies are applications having new and combined features or functional potentials that are derived from the intersection or combination of more than one enabling technology platform.





Converging Technologies: Examples

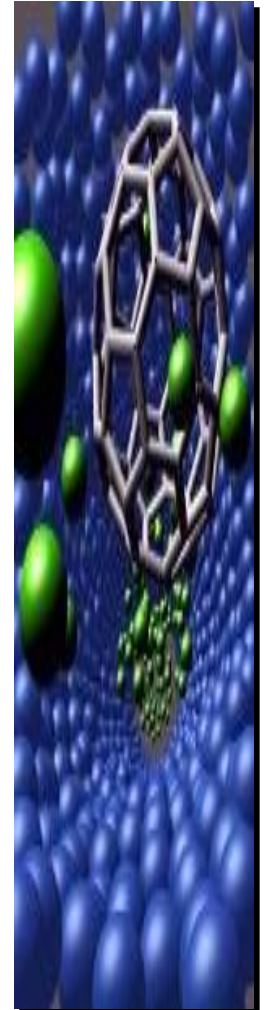
- **Autonomous vehicles – aerial, underwater, space applications**
- **FabLabs – personal fabricators / volumetric printers**
- **Synthetic biology – writing digital circuits in protozoa**
- **Open Source development – software, biology, education**
- **Evolutionary computation – evolution to silicon for AI**





Converging Technologies: e.g.

- **Integrated helmet with tuneable hearing, night vision, communications, physical and auditory protection**
- **Wireless miniaturized sensors and computers woven into the fabric of uniforms/body armour**
- **Self-sterilizing organic and inorganic hybrid materials for field situations**
- **Autonomous intelligent systems to support decision-making**
- **Nano-robots for surveillance and medical applications**





Characteristics of CT Applications

Material unity at the nanoscale

Atoms combined to form complex novel structures

Embeddedness

The better they work, the less they will be noticed

Unlimited reach

*Nano = everything can be made from atoms;
Info = understand everything as bits*

Engineering the Mind and the Body

Enhancing or controlling body -mind?

Specificity

Personalized solutions, + sector differences economic – public

Unknown potential

Early stages / general purpose



CT Tools

Example of a Domain Matrix

Contrib. Domain	Extended or Assisted Domain			
	Bio	Nano	Info	Cogno
Bio	—	<i>RNA-scaffolded nanostructures</i>	<i>DNA computing</i>	<i>cognitive enhancement</i>
Nano	<i>nano-biosensors</i>	—	<i>single molecule transistor</i>	<i>real-time brain nanosensors</i>
Info	<i>proteomics</i>	<i>nanophysics simulations</i>	—	<i>brain augmentation</i>
Cogno	<i>bio-data mining</i>	<i>nanodevice optimization</i>	<i>swarm intel. for network monitoring</i>	—



CT Tools: Example Of A Table Of +/- Impacts On Possible Domains Of Application

<i>Impact on</i>	Bio/Nano	Info/Cogno
<i>Environment</i>	<ul style="list-style-type: none"> - Nano-particle toxicity + Energy-efficiency +/- Synthetic life + CO2 scrubbers 	<ul style="list-style-type: none"> + Reality browsing + Sensor nets + Integrated landscape models
<i>Economics</i>	<ul style="list-style-type: none"> +/- Personal fabrication - High-cost interventions 	<ul style="list-style-type: none"> -/+ IP as major repository of value -/+ IP easily violated thru invisible spying
<i>Public Safety</i>	<ul style="list-style-type: none"> - GMO hazards - On-line virus building - Grey goo 	<ul style="list-style-type: none"> + Disaster response nets - Information security, privacy
<i>Health</i>	<ul style="list-style-type: none"> + Smart drug delivery - Incredible medicine for very rich only +/- Aging slowed down 	<ul style="list-style-type: none"> + Health informatics - Privacy of personal genomes - Genetic predeterminism



Convergence Ideological Polarities

