

Futurewatch

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An information service of current, international perspectives on our futures, prepared by futures scanner, **Jennifer Coote**.

Communications/Transport

"Our machines shape us."

The Shallows: What the Internet is Doing to Our Brains, N. Carr, Norton, 2010, popularises some significant research into brain functioning. The mental habits we are learning as we use the Internet are altering our capabilities to read, and for thinking. New habits create new brain connections, while older established ones wither or fail to form. This brain plasticity is a great quality, but it also favours "primitive" mental functions, such as quick decision making, over intellectual ones associated with reading, such as language, memory and visual processing. Psychologists have found that people who read old-fashioned text understand it better and more profoundly than those who read the same material enhanced with links.

Several academics, psychiatrists, writers and cognitive neuroscientists comment briefly in response to issues above, **Headlines, (Newsletter of NZ Neurological Foundation), Summer, 2010**. While the access to raw information via the Internet is unparalleled, how we utilise it is up to us. We could simply endeavour to make more time to read, in order to keep those brain connections intact. The impact of the Internet has helped us to learn more ways of measuring its organisation as a network, since, like the brain, it is a non-random network. The revolutionary advances in human ability to read and write, and to develop science have arisen over the millennia because of the plasticity of the brain. The Internet is another liberating extension even though it may be put to bad usages. Understanding the design principles of the plastic reading brain highlights the dilemma we face with our children. We humans were never born to read. We have no reading template, and the reading brain can be short-circuited with little time or attention to the deep reading processes that contribute to the reader's cognitive development.

Reading in the Brain: the Science and Evolution of Human Invention, S. Dehene, Viking, 2009. A cognitive neuroscientist explains how our brain empowers us to read. A particular factor involves the balance between evoking the sound of word in spoken language and rapidly translating print to meaning, which create two major interactive brain pathways. There are marked differences between the world's languages for such a development. There is much for teachers, educational policy developers and the interested layperson to learn from this well-presented study.

Book publisher **R Nash**, interviewed by **J Rivera**, www.mediabistro.com downloaded 7 Jan 2010, considers that the supply chain and retail model for books is ending. The retail chains will disappear, the backlist will be spun off to private equity companies and a couple of front-list publishers will remain for blockbusters. Long-form, text narrative will continue to thrive, along with multimodal entertainments. The burgeoning middle classes of China, India, Brazil, etc will be producing novels faster than we can imagine. Traditional publishing will die if it holds to outmoded business and production models.

J Fallows, *The Atlantic*, June 2010, reports that while everyone knows that Google (and similar Internet based pressure) is killing the news business, it is also trying to revive it. At stake is the need for high-quality journalism for the functioning of modern democracy. A reinvented business model is envisaged to sustain professional news gathering, one which accepts quite pragmatically that of course readers will pay for their news online: the question is how? Newspapers are suffering because of loss of classified advertising, loss of circulation and loss of display advertising. Online advertising is growing but lags behind. Traditionally newspapers bundled their various sections, making it hard to know what specifics attracted customers. This business model, in Google's view, is loaded with costs yet short-changes the most valuable newspaper assets, the reporters. Google is convinced that there are readers for online news editions who will attract paid online advertisers, but the transition will be difficult.

The new online business model rests on three pillars: distribution, engagement and monetization: getting more news to more people, making news presentation more interesting, varied and involving, while converting these larger and more strongly committed audiences into revenue. Google teams are working with numerous news organisations across USA, trying everything in the expectation that something might work, but emphasising serious, sustained reporting. A decade from now, robust and better-funded news businesses will be thriving.

What Would Google Do? **J Jarvis**, Collins Business Books, 2009, is early warning of a business avalanche ready to cascade down the slopes. This is the first post media company.

The Economist, 1 May 2010, *Survey on TV*, affirms that nothing can beat TV for mobilising a mass audience. For this reason, it is here to stay, especially for sports broadcasting. Mobile TV is less likely to become the norm, but 3-D TV has huge potential. Popular TV shows are spawning a huge range of by-products. Subscription TV will continue to expand, but companies need to be mindful of their target audiences, and look for new ones by offering quality programmes.

On the social side

Pew Research Center Publications, 2 July 10, reports on a large survey of expert technology stakeholders and critics which showed that some 85% were positive about the experience the Internet was having on social relationships. Problems noted:- online interactions cut time spent on person-to-person; online fosters shallow relationships, there are issues about privacy; and people can be siloed in specific networks closed off from wide relationships, which can foster intolerance. Some envisaged a

new "Art of Politics," revisions of such terms as "privacy" and "friendship;" while new categories of relationships could emerge, and new psychological syndromes could develop.

M Rogers, US media consultant and futurist, in an interview with *World Futures Review (World Future Society)*, June-July, 2010, notes that the baby-boom generation differs from earlier generations in that they have taken to new media technologies quite readily but, unlike their children, they refuse to let the technologies change the ways they run their lives. They do not want social networks all their own but seek to connect with overall society, though they will moderate that society with media concerns of their own. Examples are:-the rule of law, security, privacy, and permanent identities on the Internet. Within a decade we can expect to have permanent identities, like passports, for the Internet because technologies for this are being developed now. The boomers are not greatly enamoured of adding endless items to their menu, and software engineers are going to have to rethink products for this market. Video games are going to become more interactive over the next decade, with games for all ages to play together. Boomers are ready to have technologies implanted to facilitate their health, mobility or security, as long as privacy is assured.

N Eagle et al, *Science*, 21 May 2010, managed to combine an almost complete record of national communications networks in UK with the national census data on socioeconomic well-being of communities. They found that there is strong correlation between the structure of social networks and access to socioeconomic opportunity.

Emerging Ethical Issues of Life in Virtual Worlds, **C Wankel, S Malleck**, Information Age Publishing, 2010. Research is just beginning into this set of issues as virtual worlds become common in business and education, but the range and complexity is very large.

Science, 26 March, 2010, *Special Section*, present some expert reports on the possibilities for electronic devices when silicon transistors can no longer cope. **T N Theis**, **P M Solomon** describe different approaches for extending the possibilities of silicon, while **H Tagaki**, **H V Hwang** explore the potential of electronic phases and functionality using metal oxides. **J R Rogers et al** describe developments in making electronic devices wearable or more transportable through bendability, flexibility or stretchiness, and **J Mannhart**, **G G Schlom** describe recent developments with oxide interfaces.

Access Controlled: The Shaping of Power, Rights and Rules in Cyberspace, **Eds R Deibert et al**, MIT Press, 2010. This presents a chilling range of international evidence of the power of authoritarian regimes to control and censor Internet communication. Moreover democratic regimes allied with private companies could develop a controlled system of their own. The research comes from OpenNet Initiative www.opennet.net based in Universities of Toronto and Harvard. They have attempted to reverse engineer a record of the search terms and content forms which have been filtered or censored out of Internet communication.

Cyber War: The Next Threat to National Security and What to Do About It, **R Clarke, R Knake**, Ecco, 2010, envisages a catastrophic breakdown within a quarter hour of full scale cyber-based attack on US cyber systems. These would include not only military systems, but those of oil refineries, air-control, freight, metro and the

electrical grid. The threats have already been heeded by a number of nations who are organising for cyberwar, including Russia, Israel, N Korea, UK and China. Recently US established its own Cyber Command Center to conduct "full spectrum operations", though the details are secret.

The Economist, 3 July, 2010, pp. 20-22, examines aspects of international cyber security systems which suggest that Clark 's fears may be overstated, and yet that there are other threats to the system:-the traffic of much data through undersea cables, especially in areas where national controls are weak, the high levels of cyber based crime and espionage, or the vulnerabilities of industrial or civilian infrastructure to disruptions which could create damaging economic upheaval.

More fuel efficient transport

Reinventing the Automobile: Personal Urban Mobility for the 21st Century, W J Mitchell et al, MIT Press, 10. This provocative look at redesign of the automobile has the growing car markets of India and China in mind, and comes from a leader of MIT's Media Lab and key designers and executives of General Motors. While stimulating, their proposals omit some major challenges, for which more ideas will be needed.

Economics/Business

New economics for the 21st century

In a talk to the *World Future Society*, July 10, see *World Future Review*, June-July, 10, academic N **Goodwin** outlines two recent textbooks for which she was lead author, **Macroeconomics in Context**, and **Microeconomic in Context**, M E Sharpe, 2009. The basic approach, Contextual Economics, realises that an economic system is embedded in a social system which include norms, culture, politics and institutions as well as the physical and built environments. There are three spheres:-that of business, a core of families and communities, and the public sphere. There needs to be a balance between the three.

During the 20th century, prevailing economic doctrines led to an imbalance of the three, and failed to provide for the fundamental challenges of the new century. They featured a bias to monetary values, inappropriate goals, limited future focus, a de-contextualised view of the economy, status quo bias, market bias, and analytical methods which excluded non-economists. Alternative economic ideas and analysis developed from these excluded areas. Goodwin et al reappraised all the economic thinking, retained what is valuable from the mainstream and incorporated what is valuable from the new insights.

Final economic goals need to be emphasised with intermediate goals serving the final ones. There are two overarching final goals:-wellbeing and equity in the present, and maintaining productive capacity for the future. This capacity includes resources which sustain us all, including the physical ones, the institutions, and human health a capability. Production and consumption are important only in as much as they serve the final goals.

N Roubini with **Stephen Mihm**, **Crisis Economics: A Crash Course in the Future of Finance**, Penguin, 2010, draws on the long experience of one of the few economists who predicted the coming great financial blowout. Such once-in-a-lifetime events are quite predictable, Roubini argues. They have recurred repeatedly through economic history because of the inherent instability of the global financial system. Lessons can be learnt and further crisis anticipated if the pressure points in the system are fully understood.

A decade-long study of financial systems and more of complexity theory, lie behind systems analyst **J L Castri**, **Mood Matters: From Rising Skirt Lengths to the Collapse of World Power**, Springer, 2010. Using a wealth of examples and data, Castri argues that the financial market is a barometer of the social market, not vice versa. The social market is driven by fundamental waves of optimism and pessimism which can be almost impervious to world events. This insight, developed by an earlier thinker, is socionomics, and it can be used to help understand long term developments.

The neoliberal economic paradigm was entrenched forcibly in S America, and as its influence is waning in the Andes, especially in Ecuador, an indigenous development paradigm is emerging. **C. Walsh**, *Development (Society for International Development)*, Vol 53/1, 2010, explores this 'Buen Vivir' (Living well, or collective wellbeing). The new institutional arrangements, or human-centred development, are part of the dismantling of the neoliberal experiment but they are not without flaws and contradictions. Like the previous European efforts to humanise capitalism there is till scope for the old colonialist entanglements to retain their hold.

B Mckibben, Fellow of the Post-Carbon Institute, co founder of the climate action group 350.org, argues that humankind, because of its own actions, now lives on a different kind of planet, Eearth. In **Eaarth: Making a Life on a Tough New Planet**, Henry Holt, 2010, he advocates for a shift to more durable, localised economies. In many places these have existed, while in more, new ones are developing. It is possible that just as we are moving into the post Peak Oil era, we are also into the Beyond Growth Era.

From several regions

W Greider, *The Nation*, Nov 22 2010, argues that free-trade globalisation is fraying as conflicting international policies and perspectives reckon with the massive hole in global demand. For USA this really means that if it is to function effectively in the global trade system it must reform its industrial structure. The administration could start with legislation to put a ceiling on the national trade deficit. Multi-nationals have hitherto been free riders, able to harvest public subsidies and capital investments. Government pressure is needed to ensure that good jobs remain at home and that there are limits for corporate strategy. The restoration of home-based manufacturing is a modest part of official policy but should be strengthened. All but the smallest economies run perennial trade surpluses with the US, but unless the US economy recovers its strength, it cannot act as the import sponge and the global system crashes.

M Wolf notes, *Financial Times*, 28 April 2010, p. 9, that achieving a strong sustained global recovery requires economic rebalancing acts which includes monetary policy. The current aggressive policies from some countries, especially USA, are met

with cries of pain from others. There is no discussion about how to develop the needed changes in national exchange rates and domestic policies worldwide. Falling exchange rates raise such fears of deflation that countries such as USA will take any aversive measures possible, regardless of the global consequences. Those countries facing the resulting inflow of capital have uncomfortable choices:- to let exchange rate appreciate, thus impairing external competitiveness, to intervene in the currency markets, thus accumulating unwanted dollars, or to curb the capital inflow with taxes and controls.

J Garnaut, *Sydney Morning Herald*, reprinted in *Dominion Post*, 27 Oct 2010, p. C8, considers that there are signs in China's latest Five Year Plan to 2015 that it expects to reduce its trade surplus through "restructuring". The Deputy Governor of the People's Bank of China is targeting a trade surplus of 4% within three years. This will involve a massive shift in the organisation of China's economy. Part of this will happen as the national labour market tightens. The flood of new migrants from the poor inland regions is dwindling while those in the developed coastal areas demand and achieve higher wages. Most of all, it will require reform of the services sector, which until now China has avoided. This sector includes state owned enterprises in telecommunications, health, education, logistics and railways.

Independent NZ think tank, **NZ Institute**, Dec 2010, outlined the ten top issues which, if resolved could make major difference to the country's future. www.nzinstitute.org.nz

They include:- building a resilient, cohesive populace; boosting skills and prospects for the 10% of young people not in school, training or jobs; the need for better management of our environment; the need to create a business culture fostering innovation; development of ultrafast broadband to reduce geographic isolation; encouraging New Zealanders overseas to return or to contribute to national development; and the need to attract migrants.

To maintain international standing in the food industry, one of NZ's prime export sectors, substantial government financial support is being given to a new initiative, The Food Innovation Network, *The Independent*, 8 April 2010, pp 6-7. This has four regional hubs, each with its own special focus:- Manukau on processed foods, Waikato on meat-and dairy-based products; Canterbury on plant-based ingredients and consumer food development; while Palmerston North is developing a centre of excellence for food research and training to strengthen research ties to industry. Three hubs in Manukau, Waikato and Canterbury will form limited liability companies to own and run pilot facilities.

Business tools

An **International Integrated Reporting Committee (IRC)** was established in 2010 to create a global framework for integrated reporting of financial, environmental, social and governance information to aid accounting for sustainability, *Ethical Investor*, Aug/Sep, 2010. This would meet the growing need for investors to have clear, consistent, and comparable integrated reporting about an organisation.

An Australian think tank, the **Australian Risk Policy Institute**, has developed a new model for managing risk, **L d'A Fisher**, *Business Review Weekly*, 5-11 Aug 2010. The Institute argues that recent catastrophic events internationally have revealed fail-

ures in risk management systems which have undermined senior managers and Directors at critical times. They are not getting the full picture because risk is being assessed at unit level rather than for its total implication for the organisation. The model requires organisations to broaden the sources of information, using their stakeholder networks and factoring in systemic risks in society, business and government.

W J Henisz, B A Zelner, *Harvard Business Review*, April 2010, present a range of new tools based on modern communications technology, social networking and game theory to help those companies investing in emerging markets. Hitherto the biggest risks in these countries were their volatile political systems, but newer issues such as taxation of executive compensation, the proper scope of financial regulation and international merger and acquisition policies are now scope for conflict.

Environment

All around climate change

The Flooded Earth: Our Future in A World Without Ice Caps. P D Ward, Basic Books, 2010. An Earth scientist projects pictures of how our world could look and how this would impact on people over the next 1000 years, focused on key three key periods in that span, as the snow melts that once refreshed lowland and farms dwindle and as aquifers become inundated with salt water in a continuing warming world.

S Battersby, *New Scientist*, 22 May 2010, reports on the combination of research which builds up the picture of why the Ice Ages began, behaved as they have done, and what this indicates in the future. The research is based on the Milankovitch cycles of the wobbles in the Earth's orbit, studies of stalagmites in Chinese caves over three hundred thousand years old, and studies of the great ice sheets in Antarctic and the Arctic. The great ice sheets become ever more unstable as they increase in size and build ups of carbon dioxide in the atmosphere accelerate the potential to tip into melt-down. The Eons of the Ice Ages appear to be over. Puzzles remain, but Earth's climate is likely to be like that in the Miocene, 10-15 millions years ago.

Turned Out Nice: How the British Isles Will Change As the World Heats Up, M Kahn, Faber & Faber, 2010, looks at the adaptability of human societies, especially urban ones, to change. He examines in detail the effects and adaptations in the British Isles generally, noting the moderating effects of the Gulf Stream, and also looks at specific locations, rural as well as urban. By doing so he positions these sites in a centuries-long process of change.

New Scientist, 15 June 10, p 2010, reports that although local sea levels have risen by 2 millimetres annually, on average most Pacific Island atolls have remained unchanged. Their composition is often affected by the debris and sand thrown up by hurricanes. Living coral reefs respond to rising sea levels by growing.

Studies of Swiss alpine glaciers suggest that not all changes are due to increased greenhouse gases, *Nature*, 10 June, 2010, p 677. A subtle mix of human activity and natural changes result in glacial change, though honest admission of this still needs balancing by the fact that the human induced changes are far from negligible.

Science, 4 June 2010, **P Kitcher**, discusses a number of recent publications on climate change, particularly focused on the debate within the scientific community and its impacts on public understanding of the role of science and what conclusions can be drawn from the research. This has helped interest groups distort the issues to their own ends. **The Merchants of Doubt: How a Handful of Scientists Obscured the Truth on Issues from Tobacco Smoke to Global Warming**, N Oreskes, E M Conway, Bloomsbury, 2010, explores this detail. Democratic societies can have real problems with the conflicts within the scientific debate, while decision makers seek more explicit guidance than scientists are often able to deliver. **S H Schneider et al** provide contributions with specifics in relatively non-technical language for citizens, in **Climate Change Science and Policy**, Island Press, 2010. Eminent social theorist **A Giddens**, **The Politics of Climate Change**, Polity, 2009, offers a lucid overview, with a global perspective, linking the energy needs of the human populations with the responses to climate change and potential courses for action.

Nature, 22 July, 2010, p. 245, reports on the **US National Research Council's, Climate Stabilization: Targets, Emissions, Contradictions and Impacts Over Decades and Millennia**, July 2010, which combines material from the IPCC Fourth Impact Report with much new material which gives more certainty. The Report is focused on the USA, and clearly spells out for decision makers just how long term and serious the impacts are going to be. It is expected to be irreversible for 1000 years. To avoid this impact, deep cuts of up to 80% in carbon dioxide emissions will be needed throughout this century. But Washington politics is expected to muffle the impact of the report.

A Vast Machine, Computer Models, Climate Data and the Politics of Global Warming, **P N Edwards**, MIT Press, 2010, is a thorough, dispassionate and timely study of the disciplines which have evolved into the modelling used in computerised climate simulations. All observations rest upon some theoretical models of the measurement system. Climate forecasting may not become as reliable as weather forecasting, but over the coming decade systems to treat the uncertainties will be incorporated.

New Scientist, 14 August, 2010, pp. 14-15, reports on observations of changes in the Jet Stream which flows at over seven kilometres above Northern Europe and Asia and N. America. Unusual holding patterns, blocking this flow, are the cause of much of the unusual extreme weather patterns in regions below. It is not clear whether the blockages are connected to rising greenhouse gasses or to changes in solar activity.

Life on earth

M LePage, *New Scientist*, 24 April 2010, reports that studies indicate that Earth warming 1.5-2.5 degrees Centigrade will lead to extinction of 37% of species by 2050. Extinction will cause more extinctions and the collapse of eco systems, with major economic and human consequences. Species most likely to survive will be small, easily spread by humans and good at colonising new territory. Humans are already preserving samples of endangered species, either in seed banks or as frozen animal tissues. Another method is management of habitats in ways which can allow evolution to continue, as is being done in the Cape region of South Africa. Genetic modification could also be utilised, for instance to boost the efficiency of photosynthesis.

Science, Editorial, H Schlesinger, 6 Aug 2010, comments on the development and value of Translational Ecology. Scientists, public groups and policy makers are working together to conduct the basic research and advocate for, or develop policies to benefit the ecosystems. This requires a constant interchange of information, alerting scientists to areas needing study, advocating from the results, developing policy from such studies and promoting the necessary funding for action.

An important, long-running experiment in Minnesota examined the combined effects of increased levels of atmospheric carbon dioxide and nitrogen on ecosystem structure and biodiversity of prairie grasses, **P B Reich**, *Science, 4 Dec 2009, summary pp. 1353-1354*. The surprising results showed that the two chemicals impact on the ecosystem independently and also synergistically. Nitrogen reduced biodiversity by 16%, carbon dioxide by 2%, but together they reduced diversity by 8%. More experiments of similar long-run character are needed.

V Gewin, *Nature, 29 July 2010, pp.552-553*, reports on promising developments in research which can enable a second green revolution, underground, by boosting the potential of plant roots to promote better yields. Some grasses have roots reaching deeply into the ground in search of water. Utilising genetic markers associated with deeper roots can speed up identification of promising varieties. Other research focuses on ways to enhance roots' ability to liberate nutrients from the soil, or to neutralise toxins. Microbes growing on and around roots can be manipulated to promote crop yields. More speculative research is exploring ways by which plants could mimic those which can fix nitrogen.

From sources to ocean deeps

Nature, 30 Sept 2010, C J Vorosmarty et al, present the first joint synthesis of the global threats to human water security and river biodiversity. They use a special framework that quantifies multiple stressors and accounts for downstream impacts. Nearly 80% of the world's population is exposed to huge levels of water security threats. Rich nations offset these by huge investment to deal with immediate threats and remediation but fail to deal with the underlying causes and sources. By using this threat framework, priorities can be determined for policy and action in response to threats, with special focus on sources.

A decade of sea research has produced many startling new discoveries in **Census of Marine Life**, www.coml.org/highlights-2010. *Nature, 30 Sept 2010, pp.514-515*, reports that this involved 80 countries and produced studies not only of fish but of sea birds, marine mammals, invertebrates and plankton. Much more needs to be done to resolve even some of the many gaps and issues remaining. The Census included projects to understand both the history of marine animals and some insights into how this could be affected by climate change. Over two thousand publications have resulted and a database of Ocean Biogeographic Information Systems has been established.

ECOLink, (NZ Environ. and Conservation Orgs), December 2009, reported on an important agreement, **S. Pacific Regional Fisheries Management Organisation**, which covers management of non-tuna fisheries over a huge area of the S. Pacific, and involves over 25 countries. Northern fishing countries and the European Commission are refusing to participate in such a development, as they are racing to boost their

catch history for future negotiations. Chile and Peru are likewise holding up agreements for the threatened jack mackerel fishery.

Ecologists are raising deep concerns about the rapid growth of the Southern Ocean krill fishery, an abundant source of protein and the food chain base for ocean fish, *Nature*, 2 Sept 2010, p.15. Besides the fish farming industry, krill are in demand for dietary and medical products. Precautionary management is needed in the quotas set by the Convention for Conservation of Antarctic Marine Living Resources (CCAMLR), along with better monitoring of krill fishing vessels.

Futures Thinking

What's next and next

Scientific American, June 2010, presented 12 events that will change everything, and their likelihood of happening before 2050. Strongest possibilities were:-cloning a human being, creation of life by synthetic biology, machine self-awareness, polar meltdown, and major Pacific earthquake breaking up California. Medium likely were:-extra dimensions discovered by the Large Hadron Collider, a deadly pandemic, and room-temperature superconductors, while lower probability attached to:- extra-terrestrial intelligence, a major nuclear exchange, and asteroid collision with Earth.

In Sept 2010, *Scientific American* presented views from selected visionary scientists about new trends over the next half century. The nine were:-an age of digital entanglement, in a jungle we allowed to evolve and cannot control; life designed to order with bioengineering; an era of infinite storage with all our information, personal or otherwise, visible; an answer to the riddle of consciousness and the resulting questions for which there were no answers; the obsolescence of oil; with adequate policies for the transition; energy that doesn't harm your health; a new window on human origins though research into ancient genomes; medicine I can call my own through a complex ecosystem of healthcare and software; and a new revolution in farming, based on sustainable methods.

More speculative and far reaching is **R Penrose, Cycles of Time: An Extraordinary New View of the Universe**, Bodley Head, 2010. Penrose has proven ability to think far ahead of his time. He builds on the puzzle that the apparent initial state of the Universe is highly improbable. It is special, because it was simultaneously very hot and very cold. The newborn universe was essentially a hot gas of photons, but since space time is cold, the direction of the universe unfolds towards more probable events. Eventually dark energy dilutes matter and the universe becomes very like its earliest state. Thus it could be that our early universe is the late model of previous ones.

Tools for futures thinking

V Wheelright, an experienced trainer for individuals wanting to use futures methods, has free download of his fully revised text, **It's YOUR Future...Make it a Good One!** at www.personalfutures.net, and for more about the author and his works see www.vernewheeright.com

R Samet, Long-Range Futures Research: An Application of Complexity Science, Booksurge Publishing, 2009, is a much broader synthesis of some of the best futures thinking with major emphasis on the evolution of spacial systems to mid 22nd century. Drawing on his extensive high level experience, Samet explains how complexity science can be applied to civil systems for real world application, covering population growth, ecological impacts, geopolitical perspectives, technological shifts, and societal transformations.

Tellus Institute is high quality think tank focused on sustainability research, and members **P Raskin et al**, *Sustainability, Vol. 2(8), 2010*, explore pathways to sustainability by considering in quantitative detail four contrasting scenarios for this century. Despite the challenges, they find that a great transition scenario is still possible.

Tackling Wicked Problems: Through the Transdisciplinary Imagination, Eds **V A Brown et al**, Earthscan, 2010. Wicked problems defy the intellectual skills of technical, scientific and managerial experts. Adding more of the same range of thinkers does not help identify the range of possible solutions to certain problems. Widening the definition to include writers, holy men, social revolutionaries (futures thinkers?) is necessary and open mindedness a crucial requirement.

The Decisive Moment: How the Brain Makes Up Its Mind, **J Lehrer**, Canongate, 2009.

We are learning from neurological studies that the emotions play a vital part in decision-making, but when do we override these feelings and when are they significant? Behavioural neurologists, social psychologists and other specialists are drawn upon in this lively presentation. For those who have had a lot of experience in such decision making situations, the "gut feeling" is crucial.

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