

WORRYING ABOUT US

MOMENTS IN HUMAN ECOLOGY



DOUG COCKS

The cover picture is Jean-Francois Millet's 'Man with a Hoe,' painted in oil on canvas (80 x 99 cm) in 1860-1862. It is reproduced with the permission of the J. Paul Getty Museum, Los Angeles.

CONTENTS

PREFACE	5
INTRODUCTION	8
RATIONALITY AND EFFECTIVENESS IN LOCAL GOVERNMENT AND RESOURCE AGENCY PLANNING	15
MANAGING AUSTRALIA'S NATURAL RESOURCES IN THE 21ST CENTURY	22
SCENARIOS FOR AUSTRALIAN LANDSCAPES	28
RESOLVING CONFLICTS OVER LAND AND RESOURCE USE	38
EUROPEAN SETTLEMENT IN AUSTRALIA: EXERCISE IN ADAPTATION	45
THOUGHTS ON BEING ASKED TO TALK ABOUT 'AN OVERUSED CONTINENT'	56
PROSPECTS FOR ENVIRONMENTAL QUALITY: AN EDITORIAL	62
THE LOADED RABBIT	64
THE CASE FOR STABILISING AUSTRALIA'S POPULATION	66
POPULATION, CONSUMPTION AND ENVIRONMENTAL DEGRADATION	73
TAKING THE LONG VIEW	77
FUTURE TAKERS, FUTURE MAKERS	81
POWERING UP TIMESHIP AUSTRALIA	90
THE FUTURE IS ANOTHER COUNTRY	100
LIVING WITH COMPLEXITY: CAN WE DO BETTER?	105
A LOVELY BIRTHDAY	110
THE REMARKABLE MIND OF JULIAN JAYNES---CRACKPOT OR GENIUS?	113
WRITING AND THE FORMATION OF THE MODERN MIND	118
WONDERING ABOUT HUMANITY'S DISTANT FUTURE	128
QUO VADIS HOMO SAPIENS?	133
THE ROLE OF HISTORY IN FUTURE-GAZING	139
GLOBAL OVERSHOOT: CONTEMPLATING THE WORLD'S CONVERGING PROBLEMS	150
DOES THE LONG PAST MATTER?	155
MY UNFINISHED WORLD VIEW	165

AN ACCEPTANCE SPEECH

(On being presented with a CSIRO Lifetime Achievement Medal, 2003)

Minister McGauran, Ms Livingstone, Everybody

I am going to read you a little from the Prefaces to two of my books, starting with *Future Makers, Future Takers*:

At birth I was thrice blessed. I was born Australian. I was born at the end of the great depression and have lived much of my life through prosperous and domestically peaceful times. I was born to loving parents who were always able to feed and clothe me, and who fostered my education. This triple endowment has been the foundation on which I have been able to build a long, healthy self-fulfilling life. Now, as some remuneration, I am here writing a book which I hope will contribute, in a small way, towards helping future Australians live similar lives. Australian society is my focus of interest and the well-being of its people is my concern.

Next from *Use With Care*:

All my working life, I have been paid well to enjoy myself studying the natural resources of Australia, starting as an extension officer and then as a commercial agricultural consultant in western Victoria. After some years overseas, I returned to the CSIRO Division of Land Research at the time when they were just winding down their massive program for mapping the natural resources of sparsely settled Australia. It was my job to evaluate the economic prospects for commercial cropping in the Kimberleys and the Northern Territory. From that bleeding I developed a lasting interest in land use policy and land use planning which has since taken me all over Australia.

Central to this book is my belief that it is still possible to have an Australia where the values of all but the most extreme materialists and extreme environmentalists can be satisfied. It is up to me to argue how this might believably come about. It will be inch by inch, step by step, not in one miraculous leap. Notwithstanding, I would still be sad for things that we have unnecessarily lost---great Huon pines, Tasmanian tigers, Lake Pedder, and so on.

I once asked Professor Geoff Leeper, doyen and scourge of generations of Melbourne University agricultural science students, what I could do to change the world. 'The best you can do is tell people how you see things' he said and that is just what I have been doing.

I am quietly pleased to be accepting this medal today. It remains only for me to place on record my thanks to CSIRO and to my friends, my colleagues and my extended family.

PREFACE

Like the man who found he had been speaking prose all his life, it has taken me a long time to realise that I am a *human ecologist*. Not, I explain to people, not an ecologist who is human but an ecologist who studies how humans have adapted to and, conversely, changed the world in which they have found themselves. This book is an anthology of popular articles and occasional talks that I have given over the many years since I decided that I wanted to be something more catholic than an agricultural economist.

It is my hope that, in a pleasing-enough way, the pieces I have chosen are not only windows into a story of changing and expanding interests but, more importantly, carry a fair sample of the trickling of insights I have had into how and why, in all human societies, things are never the same as they used to be.

While none of these pieces is technically difficult, some have been lightly edited to remove avoidable technical terms. Where there is an overlap between pieces, as happens when collating freestanding presentations, I have made a few cuts but, usually, have preferred to not spoil the integrity of the originals. Perhaps I can claim that if an idea is worth presenting it is worth presenting a second time!

While I believe these pieces to be interesting in themselves, they have been written over thirty years and readers will naturally view them from their contemporary perspectives. I too have been interested to re-read these pieces with a 'cold eye' and have added a postscriptal comment to many as to their contemporary implications and the context within which they were written.

The collection's pieces have a variety of provenances: Ockham's Razor talks on the ABC; pieces in magazines including *Dissent*, *Australian Quarterly*, *Mosaic*; talks to community and professional groups; several newspaper articles (Financial Review, Good Weekend); and several 'thinkpieces' from academic journals. I have also included several 'whimsical' pieces including a short story (*A Lovely Birthday*) which, yes, is relevant and which, to this literary outsider's delight, was highly commended in a major competition last year.

Looking for a pattern, the pieces are samples from five overlapping eras in my history as a human ecologist:

Land use planning

My background in agricultural science and farm economics led easily to an interest in land use planning when I joined the CSIRO's (Commonwealth Scientific and Industrial Research Organisation) Division of Land Research in 1968. For many years the meta-question behind my work was, 'How can and should large tracts of land be rationally allocated between alternative uses in a society like ours?' I continue to believe that the way in which any society uses its land base is a fundamental determinant of that society's likely well-being.

Population policy

My experience as adviser to the 1994 Jones inquiry into national population policy convinced me of the need to advocate (in *People Policy*) the stabilisation of Australia's population as soon as practicable. I was shocked by the crudeness of the population debate I found myself in.

The future of Australian society

Then there was a period where I was trying to understand the inability of the Australian governance system to guide the nation's medium-term future in any sort of comprehensive and well-informed way, to achieve something better than 'adaptive muddling.' My book, *Future Makers, Future Takers* was an attempt to demonstrate how I thought this challenge should be approached.

The long-term future of the human species

Pure curiosity lured me into a period of synthesising and collating (in *Deep Futures*) what can be reasonably said about humanity's survival prospects over coming millennia and mega-years. As is my wont, I have written about how we might go about maximising those prospects.

The overshoot crisis facing today's global society

Global society is in crisis as the human-made problems of population growth, resource depletion, global warming and runaway complexification bear down. The questions I have been interested in most recently are whether this crisis is likely to turn into a catastrophe and from what vantage points (e.g. 'wait and see,' 'stop fiddling,' 'rise like a phoenix') can one legitimately and realistically respond to that possibility.

There is one aspect of my group's past work which I would have liked to have included in the present collection but which does not seem to have spun off any suitable popular output. I refer to our pioneering work in the 1980s on the development of several computer systems (ARIS, CAMRIS) for analysing Australia-wide resource data and their use for a variety of interesting studies which, twenty years later, have become newly-fashionable. For example, we designed a national high speed ground transport network and we searched the continent for sites suitable for the establishment of new cities. Continental-scale computerised information systems are commonplace nowadays and are marvellous tools for analysts who want to think comprehensively when developing and comparing geographically-based policy alternatives.

This book's title needs to be explained. Philosophically, I am a humanist and a meliorist. A humanist is someone who wants the best for people, now and into the future. Meliorism is the doctrine, somewhere between optimism and pessimism, that purposive human action can often improve outcomes over what they would otherwise be in the absence of such action. Plaiting these strands together, I do worry about us, we humans, and what can be done to ensure that people everywhere, including those yet unborn, have the opportunity to lead high quality lives, i.e. to abundantly satisfy their needs.

My rear-view mirror tells me that I graduated from worrying about individual farmers and farming communities to worrying about Australians *en masse* and their grandchildren. More recently, I have seized the chance to worry about the species as a whole, both in relation to its present problems and into its distant future. Worry is useless as such but the underlying point of the title is that my interest in human ecology is prescriptive or normative in its intent rather than just descriptive. It is a pity that the term has become pejorative but I am a 'do-gooder.'

Over the period of my working life from which the present volume is drawn, I have worked alongside and had the friendship of some fine scientists and technicians and I would like to acknowledge them here. In particular, from the Land Use Planning Group and its successors which I led for several decades, I am grateful to John Ive, Paul Walker, Ian Baird, Chris Parvey, Jenny Clark, Nina Wood, Peter Compagnoni, Richard Davis and Neil Hamilton. I have worked under two CSIRO Divisional Chiefs, Dick Millington and Brian Walker, who each gave me the freedom to work on matters I considered important. Special thanks are due to Mike Austin and Franzi Poldy, colleagues and friends with whom I have enjoyed innumerable stimulating discussions on diverse aspects of the human situation.

INTRODUCTION

In the 1970s, despite a growing disaffection for the methods and spirit of formal economics, my world view was still essentially that of a resource economist. That is, for both societies---through the agency of government---and individuals, the primary task is to first understand the resources at their command, together with the available technologies (recipes) for using such resources; and to then identify the mixture of technologies whose use will generate more net benefits than any other. A resource is anything you would rather have more of than less of. As you get told in Economics 101, economics is the study of how to allocate scarce resources amongst competing ends.

I accepted that this task could usually be completed ‘well enough’ using the available quantitative modelling and analytical techniques. A model of a real-world situation is a simplification which retains the most important aspects of that reality and a quantitative model is one which expresses the relationships between components of the situation being modelled in the language of numbers and functions, e.g. the proportions between inputs in some technology recipe. Models simplify reality by making simplifying assumptions about what reality is; and the reason for doing so is that one never has the time or knowledge to model what-to-do in ‘unsimplified’ situations. I accepted that, being a researcher, my role was to recognise where models are unnecessarily ‘over-simplified’ and to find credible and practicable ways of correcting for various over-simplifications, i.e. learn to make more realistic assumptions.

So, the willing analyst primes his or her model with numbers which describe some real-world situation, follows the model’s instructions and, voilà, a what-to-do solution to her resource allocation problem is generated.

Decades later, I still see this procedure as, *in principle*, a satisfactory way of deciding how to best use one’s resources. Notwithstanding, back in the 1970s I was rapidly coming to appreciate just how few are the situations where one has the time and knowledge to implement this procedure and feel confident that something close to a ‘best possible’ what-to-do solution will result. In particular, my resource economist’s world view came under severe strain when I was trying to bring an analytical perspective to the *land use planning problem*.

Land use planning is a ‘social technology’ which takes many forms but, archetypically, it involves nominating, on behalf of one or more stakeholders, one of a candidate list of land uses (e.g. conservation, forestry, agriculture, recreation, residential, commercial) for each parcel in a regional-scale mosaic of land parcels, e.g. city blocks, farms in a local government area, coupes in a forest. The land use planning objective is to match parcels to uses in a way that balances the goals, needs and values (e.g. economic, environmental, social) of each group standing to be affected by the outcome (called the stakeholders).

The hope is to get a better outcome, in some collective sense, than would be achieved by, e.g. custom, fiat, coercion or pure market forces. For example, even if usage rights to every land parcel in some target area were available to the highest bidder (and such a ‘free market solution’ is almost never the case), it would still be a solution which ignored the ‘off-market’ side effects on the welfare of others---called external costs and benefits---that accompany every decision to use a parcel of land in a particular way, e.g. the air pollution it generates. Also, such a solution would be tacitly assuming that every stakeholder bidding in the property market had, in social justice terms, arrived with a ‘fair’ stock of funds.

Political advocates of 'free market' solutions to resource allocation problems (neoliberals) commonly play down the impacts of the externality problem and the 'initial funds' problem. Some 'laissez faire' economists agree but most economists recognise that these problems can be important, arguing though that they are political rather than economic and best addressed by subsidies to and taxes on landholders. Political economists are those who study how governments, using environmental regulations, taxes, subsidies etc. can ameliorate the failures of markets.

Apart from these intrinsic weaknesses in market mechanisms *per se*, land allocation in Australia takes place in a very piecemeal way. For example, much land is locked up in public ownership and privately owned land dribbles onto the market as people and circumstances change. It was in the light of such realities that the introduction of land use planning by governments and resource agencies (e.g. forestry departments), in Australia and elsewhere, in the mid-20th century came to be widely seen as offering an improved possibility of rationally and comprehensively balancing private and public interests in the land allocation process. The opening piece in this anthology charts my group's attempts to understand and respond as research scientists to this social reality.

I became increasingly convinced that land allocation within a region is more usefully viewed as an ecological process with economic aspects rather than as an economic process subject to social and environmental constraints. By 'ecological process' I mean that it is a way, and a fundamentally important way I would argue, in which the people of a region *adapt* to its problems and opportunities. Thus, regional land use planning is a social technology for improving a community's *adaptedness*, its capacity to survive and reproduce and live well.

Even as I was learning that land use planning had practical and theoretical limitations of its own, I was also appreciating that adopting an ecological perspective protects one from *economism*, a narrow view of human nature and the public policy task which is common amongst economists. Economism is the philosophical stance that, because people are primarily strivers after material gain (sic), decisive importance should be given to economic considerations when making public policy decisions, e.g. about land allocation. It is a perspective which is unable to see people as anything other than self-interested, lacking any concept of the public good, the collective interest.

At the time, I was disinclined to assume, as my starting point for thinking about the land use planning problem, that people are selfish materialists---even when, as Adam Smith first observed, this can lead to mutually beneficial outcomes. I say 'at the time' because, as will become clear, I have become increasingly concerned about the difficulty that groups united by shared interests---I call them virtual species---have in cooperating with each other in any serious way. Back then, my more generous assumption was that stakeholders in the land allocation process would recognise that compromises and trade-offs between the interests of various stakeholders are unavoidable but, in the public interest, can be accepted if seen to be based on a fair-minded, disinterested consideration of all the relevant information. It was our job to create such a process.

LAND, PEOPLE AND ENERGY

An early insight from viewing regional land use change as an ecological process is that land use change is a 'one way street' in which the community's options for choosing a mosaic of land uses inexorably decline as, parcel by parcel, a more energy-intensive land use replaces a less energy-intensive use, e.g. housing replaces farming. This is because reversion to a less energy-intensive use is almost always going to be economically and/or physically infeasible. Thinking of a community and the land base it exploits as a human ecosystem, i.e. as an *ecosocial system*, land use change is a successional process which keeps reducing the number of *niches* available to most sorts of stakeholders. In ecology, a niche is an opportunity (read land parcel) for an organism (read land user) with particular capabilities and needs to survive.

What commonly happens as regional land use intensifies (reflecting, for example, demographic changes, price changes, technology changes, cultural changes) is that conflict and competition between stakeholders also intensify. There is much to be said for pre-emptive planning, i.e. for putting restrictions on the location of certain land uses early in a region's development history. Such long-sighted planning limits the tendency, at a later date, for political pressures to produce *ad hoc* approvals for proposed land use changes. Plans can still be updated periodically as circumstances change, but 'holistically' rather than piecewise and out of context.

That's the theory. Unfortunately, while politicians and land managers in general pay lip service to the idea of rule-based planning, many (most?) are loath to give up their discretionary 'case-by-case' decision-making powers. Many are unwilling to try to understand the logic, the mechanics and the limitations of the planning process; nor are they accepting of the expense of planning and re-planning. For many, any sort of simplistic plan is sufficient for their needs. Once again, these lessons came to me only slowly.

After being involved for several decades in land use and land management projects around Australia, I wanted to paint on a bigger canvas. I wanted to test my understanding of Australia as a continent-sized *ecosocial system* which, from 1788, had been settled by an invasive virtual species called Europeans. My approach was to pursue an historical understanding of how the country's natural resource base (soils, minerals, vegetation, fauna, climate) has been used to meet the population's basic needs. The Europeans' attempts at adaptation present as an evolving kaleidoscope of land uses and social and material technologies across of the country.

Endowed as Australians are with an excellent scientific, historical etc. literature about their country, it is easy enough to find plausible explanations for past transformations in the structure, geography, technologies etc of the Australian socio-economy. Indeed many of the ideas which helped me to understand change, particularly of land use, in regional-scale *ecosocial systems*, translated easily into explaining adaptive changes in the national system. While the national system is larger and more complex in terms of the tangle of inter-relationships between society's numerous interest groups, its evolution is still the result of each separate group adapting to their own perceptions of an ever-changing suite of problems and opportunities. At both scales, adaptation is commonly based on switching technologies or introducing new or improved social-material technologies.

Some of the recurring factors which have driven change in what Australians have historically done to earn a living are:

- Change in the resource base, e.g. soil degradation
- Changes in perception of the resource base, e.g. recognising climate variability
- Changes in costs and prices, e.g. commodity prices, transport and machinery costs

- Changes in community attitudes, e.g. towards nature conservation
- Changes in process knowledge, e.g. the importance of trace elements for plant growth
- Demographic changes, e.g. labour supply
- Changes in government policy, e.g. industry protection

PROBING AUSTRALIA'S FUTURE

Having once satisfied myself that, after a fashion, I knew how the Australian ecosocial system had evolved, I turned to wondering how it might evolve in future decades and how it might have evolved other than it did in the past. It is one thing to have enough understanding to tell a (not 'the') convincing cause-and-effect story of how the Australian ecosocial system evolved as it did, but quite another to confidently predict its future or engage in plausible counter-factual (What if...?) speculation about its past. But this was what I now wanted to do. How would the Australian ecosocial system evolve over coming decades? What were the consequential choices facing the nation-state? Could I suggest government policies or social movements which, if implemented, stood to protect-improve quality of life for future generations? What if different choices had been made in the past; would Australian society now be better adapted? In what ways could past Australians have adapted more successfully to their environment? What adaptations seem to have proved particularly successful? And so on.

My starting assumption for thinking about how to better manage the future of the national ecosocial system was that (the federal) government is society's agent and has a responsibility and capacity to make disinterested policy choices which, it is hoped, will maximally improve survival and wellbeing prospects for the system and its people. Nowadays I use the shorthand term *quality survival* for the societal goal of achieving high quality of life for most people into the indefinite future.

Foremost amongst the policy areas where government decisions had the potential to impact very significantly on quality survival prospects I identified *population policy* and *energy policy*. As reflected in this anthology, I devoted several years to developing a low-immigration population policy for Australia and attempting to raise it to the status of 'an idea in good currency,' especially amongst politicians. On the latter I largely failed, two reasons being that I did not realise the ubiquity of the unqualified idea that 'bigger is better' or the political influence of those virtual species which stood to benefit from strong population growth. And while I have sometimes written and talked about energy strategies for Australia, I have never put comparable effort into 'selling' associated ideas such as, for example, the long-term benefits of capping total national energy consumption.

In an ideal world, a conscientious government would have the time and resources to construct a development strategy, i.e. a comprehensive, internally consistent and mutually-reinforcing portfolio of policies designed to be implemented over decades and to deliver benefits over similarly long periods. Policies within the portfolio would be periodically reworked in light of their success or failure or as circumstances changed. In practice, political parties tend to develop a narrow suite of policies directed at current electoral issues or, in government, they just 'muddle through' producing *ad hoc* policies in response to unfolding events.

Still, even when muddling through, a government tends to make policy choices compatible with or suggested by its political ideology. A political ideology, at its core, is a belief about the role of government in society. Thus, *social democracy* is a political ideology that emerged out of socialism in the late 19th century. Unlike socialism, which aims to replace the capitalist system entirely, social democracy aims to reform capitalism in order to remove its perceived failings. *Neo-liberalism*, on the other hand, assumes that the role of government is to support the pursuit of material wealth through economic growth and that this is best achieved through a fully marketised economy.

While never particularly identifying myself as a social democrat or a socialist, it was clear that I was no neo-liberal, no economic rationalist to use the Australian term. But neo-liberalism was a widely-supported ideology in Australia from the 1970s to the 1990s and, if I was going to contribute to discussion on how best to improve long-term quality of life in Australia, I needed to compare the (best) case for neo-liberalism as a policy umbrella with the corresponding cases for other candidate ideologies. These I sieved down to *conservative development* (meaning strong intervention in the economy) and *post-materialism* (meaning modest consumption combined with strong environmental protection). My organising ideas were to (i) develop 50-year policy manifestos for three hypothetical political parties and (ii) develop scenarios for best-case and worst-case outcomes on the assumption that those manifestos would be implemented. Several pieces in this anthology discuss my efforts to explore this comparison.

This theoretical ‘What if?’ exercise was disappointing to the extent that it did not yield a conclusive case for the greater effectiveness of any of the three contrasting ideologies. It is one thing to create a well-defined suite of policies to be implemented over time and quite another to suggest with any confidence what sort of society these might produce. The number of possible trajectories balloons out of control as one tries to imagine society’s responses to policy failures, contingencies, imponderables etc.---even when those possibilities are ideologically constrained. In fact I emerged from constructing my future-gazing scenarios for Australia 2050 with much the same doubts about these ideologies as before: Neo-liberalism may or may not produce strong economic growth but certainly stands to produce gross inequalities which have unpleasant social consequences. Strong intervention and post-materialism both stand to protect society and the environment from the economy (in different ways) but risk stalling it.

What did become clear on looking into Australia’s future in this way, was the sensitivity of future quality of life to certain ‘key indicator’ or ‘driver’ processes. These processes show up as internal or external trend variables or as shocks (sudden large disruptions). Population growth and natural disasters are good examples.

This was a perception to which I would find myself returning when, some years later, I began to worry that global society was facing an overshoot crisis in which a handful of ‘negative’ driver-processes (e.g. resource depletion) was threatening to precipitate an overshoot catastrophe in the form of a global-scale plunge in quality of life. It is a perception which suggests *resilience-building* as a pragmatic strategy for managing quality survival, i.e. a strategy which focuses on adapting to or mitigating negative driver-processes and protecting or enhancing positive driver-processes (e.g. rising education levels; better health care).

GLOBAL FUTURES, GLOBAL PASTS

Meanwhile, it was time to expand my horizons once more. I had long been curious in the extreme as to how our species will fare over coming ages. Will the human lineage survive, reasonably happily, into the distant future? Indeed, will we survive another millennium in reasonably good shape? Will the next thousand years be particularly difficult or just ordinarily difficult? Supposing we survive the next thousand years, will we eventually go extinct as most species do or will we evolve into a new species with which one might empathise? And, supposing we continue to evolve, will that new species or its descendants survive the death of the Sun as an energy and light source in five billion or so years? Beyond that, there is the ultimate question as to if, when and how the universe will end and whether, in some sense, life might best that challenge. A question which is almost as big is whether we ourselves can take steps to significantly improve our chances of being part of a long-lasting lineage.

Several pieces in this book recount my efforts to collect, synthesise and assimilate some plausible well-informed stories---optimistic, pessimistic and realistic---about what might happen to the Earth and its inhabitants in their deep, deeper and deepest futures. Despite all its uncertainties, what I found was that acquiring an informed appreciation of the long-term future is very comforting, indeed spiritual if that word is taken to mean 'feeling at home in the universe.'

This success with future-gazing encouraged me to turn from 'Where are we going?' to the complementary question, 'Where have we come from?' My commonplace hypothesis was that a better understanding of the long past (meaning 'big bang' till now) as an evolutionary and ecological process would yield valuable insights and lessons for understanding the present and guiding its evolution into the future. Once again, there is a large respectable literature to be drawn on and, from there, I set out to extract, not some 'true' story, but a 'plausible enough' story of the long past---one free from 'unexplained gaps' as far as possible and connected throughout by causal rather than just chronological links. I defend the value of knowing this story in the piece, 'Does the Long Past Matter?'

With respect to causation, I already had a tentative world view that everything that had ever happened could be explained, at least in principle, as being part of an ever-changing hierarchy (like Chinese boxes) of energy-degrading, matter-cycling systems (called dissipative systems). For example, chemical elements are (re) cycled through plant and animal bodies in ecosystems. Those that escape are cycled through much larger, slower geological systems, returning eventually to replace the elements lost from ecosystems. As identified in the laws of thermodynamics, the ultimate cause of this relentless change is a *cosmic imperative* to degrade (dissipate) high quality energy (e.g. sunlight) into low quality energy (e.g. heat) as rapidly as possible---usually by doing work on matter of some sort. Whenever anything new comes into existence, be it a new species, a new ecosystem, a new technology etc., it means that a faster way of degrading energy, one which first evolved by chance, has subsequently proven stable enough to persist. But whether my world view is adequate or even helpful for understanding cultural evolution in human societies, where information flow---a very special form of energy flow---is also centrally important, is something I am still pondering.

COMPLEXITY, AGENCY AND OVERSHOOT

Ecosystems, including human ecosystems are made up of occupied niches linked by flows of material inputs and outputs. The *complexity* of an ecosystem depends on how many niches it has and how fully they are linked via transport channels. Ecosystems tend to grow as long as they have access to additional supplies of energy and materials. They tend to collapse (flows stop) when these supplies dry up (e.g. drought), or when links are broken to the extent that materials can no longer circulate (e.g. when species die out). Understanding and modelling the 'behaviour rules' of complex systems and the extent to which human agents can manage such systems is one of the great, largely unsolved, challenges of modern science. I have included a piece on 'Living with Complexity.'

Humans, individually and collectively, can be thought of as complex sub-systems affecting and being affected by the rest of the global ecosystem. Modelling people's behaviour rules or propensities to act in particular ways is the domain of the social and psychological sciences. Instinct and habit govern most behaviour, but when novel or problematic situations arise, modern humans choose a 'problem-solving' response based on their beliefs, preferences and mental models of their environment. I have developed a particular interest in the parts played by the human ability to become conscious and by language (spoken, written and internal) in formulating and making such choices. Reflecting that interest, I have included one piece about writing as a cognitive (thinking) and communication tool and one on Julian Jaynes' challenging ideas about consciousness.

Finally, the questions of where we are going and where we have come from lead naturally to a third question, 'Where are we now?' My conclusion, and it has occupied much of my worry-time in recent years, is that where the extended past meets the extended future an overshoot crisis is probably engulfing global society. My final piece from the past explores how people of different temperaments might react to the prospect of a global-scale catastrophe; a new 'dark age,' and how adaptive their responses might be.

Re-reading this introduction, it comes home to me that much of my post-1970 intellectual life has been a series of attempts to understand a particular issue of concern to the Australian or other community, well enough to reach a conclusion as to what should be done or less proactively, how the issue should be viewed. When I have felt I was understanding things 'well enough,' my curiosity has turned to the next issue or question and I have moved on.

But not in a random way. One thing leads to another. Exploring any question always opens up further questions, even as it is building up intellectual capital (ideas) which will help one to better answer those further questions. Thus, asking questions about the future raises questions about the past; asking questions about Australia prompts comparable questions about rest-of-world; and so on. And, as noted, the other thread guiding my probings into matters problematic has been a concern for the ongoing welfare of those embedded in the situations I have chosen to explore.

To round out my overview of the intellectual journey which this book samples, I have, in an end piece, attempted a sketch of my current world view, i.e my fundamental working hypotheses about the ecology of *H.sapiens* and how these fit together.

RATIONALITY AND EFFECTIVENESS IN LOCAL GOVERNMENT AND RESOURCE AGENCY PLANNING¹

ABSTRACT

The paper reflects on ten years of observing the activities of land use planners, resource planners, environmental planners and management planners in local government and natural resource agencies such as parks, lands, soils, water, coastal and forestry agencies.

It is argued that achieving effectiveness in meeting ever widening demands from politicians and publics is the challenge facing such planners and that the key to doing this is increased technical competence, the prospects for which are quite good.

INTRODUCTION

Ten years ago the then CSIRO Division of Land research was asked to undertake a long term study of the land resources of the South Coast of New South Wales with a view to providing useful information on how they should be used, a request taken to be far more than just an integrated resource survey of the type pioneered and developed by the Division.

Two years later we realised that this could sensibly be taken to mean providing information of value for land use planning, a topic we knew nothing about.

Another year later we realized that we couldn't find any established land use planning methods which could readily and explicitly incorporate much of the information which intuitively seemed as though it should be used by land use planners. We would have to develop our own method if that was the line we were going to take.

By 1978 we had produced a four volume report, *Land Use on the South Coast of New South Wales: A Study in Methods of Acquiring and Using Information to Analyse Regional Land Use Options*.² It presented and applied the land use planning method which, in not greatly different form, we nowadays hawk around the country like snake oil as SIRO-PLAN, the local government and resource agency planner's step-by-step guide to systematic planning.

It was in fact at about that time that we decided there was enough initial interest in our fledgling planning method to warrant making it the focus of a small extension and development program. The selected strategy was to write and talk about the method whenever possible, help in any practical applications that came our way and use feedback from these experiences to clarify and adapt to the method's strengths and weaknesses.

The SIRO-PLAN extension/development program has now been running four years and we have had sufficient modest success to feel that the decision to initiate it was correct.

¹ Paper to 15th Pacific Science Congress, Dunedin, New Zealand, February, 1983.

² Austin, M.P., and Cocks, K.D. (eds.) (1978) *Land Use on the South Coast of New South Wales: a Study in Methods of Acquiring and Using Information to Analyse Regional Land Use Options*. 4 vols (CSIRO: Melbourne).

For instance, we are pleased that some thirty serious applications of the method have now been made in all Australian states except Western Australia. The nearest thing to an application in New Zealand is a currently running exploratory exercise to assess the suitability of the method for use in the Rotorua Lakes district.

The method has been favourably reviewed in the overseas literature³ and the original south coast volumes are on reading lists in several North American universities. Closer to home, the method is being taught in various tertiary institutions, most energetically at Griffith University, Queensland and Canberra College of Advanced Education.

Several government agencies (e.g. NSW Lands Department, Great Barrier Reef Marine Park Authority) have formally accepted SIRO-PLAN as the technique to be used in discharging their statutory planning responsibilities; and we get a regular flow of enquiries from local government planners interested in finding out more about the method.

The reason for starting with this short history of the SIRO-PLAN program is that the author has been part of that program since its inception and it is this experience which is now to be drawn on in addressing the central topic of this paper, rationality and effectiveness in local government and resource agency planning.

I will organize my remarks around two questions:

- Are local government and resource agency planners rational?
- What are the prospects for more effective planning in local government and resource agencies?

ARE LOCAL GOVERNMENT AND RESOURCE AGENCY PLANNERS RATIONAL?

What on Earth, you say, could have prompted a question like that? 'Rationality has always been an important word in the planning profession's vocabulary but thanks largely to a political scientist called Lindblom⁴ who pointed out the impossibility of undertaking something called 'rational comprehensive planning' it was, for a while in the sixties, considered naïve to claim to be rational---probably because people thought you were proclaiming the need to choose from amongst all conceivable actions. Just a few years later, the heyday of cost-benefit analysis, 'rationality'' was being equated with 'economic rationality,' a synonym for 'narrow minded' in the eyes of many planners, particularly those with social and environmental interests. Nevertheless the word still carries connotations of over-arching intellectual virtue, an 'idea in good currency' to quote Donald Schon⁵ and seems (or seemed) a suitable starting point for developing an appraisal of public planning.

Philosophically, the essence of rational behaviour is the idea that one consciously chooses a course of action from amongst perceived alternatives on the basis of relative preference for the perceived consequences of one of those alternatives.

Thus a planner is rational if he (sic) chooses to implement some particular plan out of a set of candidate plans on the basis of preferring the perceived consequences of that plan to the consequences perceived for the other candidate plan(s).

³ For example, Tivy, J., (1980) Information for Regional Land Use Options: A Review Article, *Town Plg. Rev.* **51** (3), 339-350.

⁴ Lindblom, C.E., (1959) The Science of Muddling Through, *Publ. Admin. Rev.* **19**, 79-88; Lindblom, C.E., (1965) *The Intelligence of Democracy*, Free Press, New York.

⁵ Schon, D., (1971) *Beyond the Stable State*, Random House, New York.

By this definition it is pretty hard not to be rational; the only alternative I can think of is divination. All you need is a vague sense that you have made an act of choice and that it somehow implies consequences which are more rather than less preferred. I therefore have no hesitation in declaring all planners to be rational.

But wait, there are two sorts of commonly recognised rationality. The use of the rational paradigm to choose between ends or goals or plans is called *substantive rationality*.⁶ Are planners also *procedurally rational*,⁷ i.e. do they consider alternative *ways of making plans* and choose one on the basis of conscious preference?

Again, it seems as easy to be procedurally rational as to be substantively rational. All you need is some awareness of choice. I must say I have some difficulty in getting planners to describe their plan making methods but I am prepared to assume they have them.

O.K. Let's play 'get the planners' from another angle. Are planners rational *enough*? Can *degrees of rationality* be measured by the effort one expends on carrying through the steps of the rational paradigm? Do planners put enough effort into identifying and applying planning methods; or to choosing between plans?

Well, I don't think planners are any lazier than the rest of us and, within the limits of their perceptiveness and resources, by circular definition, by their definition, they spend just the right amount of effort in choosing amongst plan-making methods and plans.

No, from my perspective the problem with local government and resource agency planners is not their rationality but their *effectiveness*.

Albeit for many and varied reasons, local government, and resource agency planners are not particularly effective at producing the sorts of plans which are already being demanded of them today and which will be increasingly demanded of them in the future.

In a sentence, what is being increasingly demanded of planners is what we might call *convincing comprehensiveness*. Unlike the straw man of 'rational comprehensiveness,' which was supposed to involve the consideration of all consequences of all alternatives, the demand now is that the planner be seen to be choosing plans from a diversity of alternatives reflecting a diversity of viewpoints using explicit criteria based on acceptable values. For instance, a choice based just on economic criteria (economic rationality) would generally be considered unconvincing nowadays.

In local government we are entering an era of *environmental planning* where local planning schemes are being viewed not only as protection devices for incumbent interests but as frameworks for guiding community development and as vehicles for implementing environmental policy or satisfying environmental demands. Vision and implementation don't always match unfortunately.

Commonly, because of lack of powers of local planning authorities to (e.g.)

- impose performance standards on the way land uses are implemented (e.g. choice of technologies, equipment and not just health and safety considerations)

⁶ Diesing, P., (1962) *Reason in Society: Five Types of Decisions and Their Social Conditions*, Greenwood Press, Westport, CT.

⁷ Simon, H.A., (1979) On How to Decide What to Do, *Econ. Impact* No 7, 28-34.

- demand project impact assessments for non-designated developments, i.e. developments which are not obviously and invariably disruptive of the landscape
- introduce differential rating

environmental planning is often little more than old-style zoning-based land use planning but with an environmental quality emphasis.

Notwithstanding this failure of planning instruments to evolve in line with demands on the local government planner he (sic) is still expected to cope with things such as:

- demands for a much wider range of issues to be addressed in planning schemes
- greater demands for public participation in the planning process
- demands for transparent plans, i.e. plans in which the assumptions and values are explicit
- demands for more output from static or declining resources in planning offices, e.g. acts which demand frequent periodic revision of plans
- more complex planning schemes involving numerous zone types
- demands for plans which can be demonstrated (not just asserted) to be consistent with local, regional and state planning policies
- demands for planning to incorporate negotiations between interest groups in conflict.

It is these sorts of demands which local government planning must be able to satisfy if it is to be judged effective. To date this has not happened, at least in any general way.

So much for local government, what of resource agencies? Just as the last ten years have seen increasing demands for more, and more comprehensive, planning in local government, the decade has seen a big increase in the requirements for resource agencies to produce what are commonly called management plans for the parks, forests, Crown lands, coastlines etc. under their control.

Briefly, acts and regulations which resource agencies work under tend to be no more demanding than the equivalent acts for local government as to the need for convincing comprehensiveness. It is up to planners themselves to try and recognise and incorporate the determinants of effectiveness into their work, at least insofar as institutional constraints will allow.

This ends my initial diagnosis as to the health of local government and resource agency planning. Faced with increasing demands for convincing comprehensiveness, planning is proving to be somewhat ineffective. We turn now to prognosis and a little prescription.

WHAT ARE THE PROSPECTS FOR MORE EFFECTIVE PLANNING IN LOCAL GOVERNMENT AND RESOURCE AGENCIES?

Effectiveness, it is being asserted, is largely a matter of recognizing and successfully meeting external demands on the planning system, demands such as those identified a moment ago.

To a considerable extent the causes of ineffectiveness in planning lie beyond the control of the individual practitioner:-

- As mentioned, the range of control instruments available to the planner has failed to evolve in line with the demands placed on him (sic).
- Publics fail to recognize and accept that in the face of incompatible demands, any plan must be a compromise.
- You can't make bricks without straw. Even the most efficient of planners needs threshold amounts of time and money to make decent plans and it is my impression that most planners in local government (but not so much in resource agencies) are not given those minimal resources.

Under what scenarios might these external barriers to effectiveness be lifted?

Enough new control instruments are being tried (differential rating, environmental studies, impact assessments etc.) for the question to be on of which ones work without offending powerful interests and how long will their adoption take to diffuse through the system. I am confident of continuing slow improvement in the range of available planning instruments but we must not forget that the range of problems they allow us to address will not be standing still either.

Educating the public as to the inescapability of compromise lies outside the practitioner's role but not outside the control of the planning profession as a whole. It is the profession's own fault to some extent. They have projected an image of the professional planner as the creator of plans that which will solve all problems, provided nobody sabotages them. Perhaps part of the problem is that the profession has even managed to fool itself a little on this one.

I can see little prospect of the third external barrier, inadequate resources for planning, being lifted in the near future. Firstly there is the 'little government' movement to contend with. Secondly planning has the wrong attributes when it comes to competing for limited funds. Its successes are largely in 'avoiding the bad' and hence are invisible. Its failures are patent and hence evidence of the futility of funding planning departments. Planners are going to have to learn to do more with less.

This brings us to the 'internal' barriers to effectiveness and I can get my head-kicking boots on again.

I have developed a number of complaints about the planning profession over the years. You are only hearing a selection of these today and, to show you how balanced my judgements are, I will lead off with a little faint praise.

I have found planners to be honest men and women. They try to balance up diverse interests without too much fear or too much favour. But, sheltering behind the idea that planning is largely a matter of politics, of bargaining and negotiating, and that these are not tasks which can be approached systematically, the planning profession has not displayed a rising level of technical competence, i.e. an ability to use available technologies and analytical techniques in their plan-making.

This is not a disguised complaint that planners haven't embraced SIRO-PLAN as the Holy Grail. Your average planner, to pick two simple examples, is frightened of computers, even as information storage devices, and does not have working knowledge of basic econometric and demographic techniques. Even 'softer' systems engineering techniques⁸ which are concerned with bargaining and negotiating questions (interpretive structural modelling say) or such things as scenario generation have not been tried and found wanting. To a large extent, they have not been tried.

At this point our average planner bursts at the seams. 'What makes you think that greater technical competence is the key to more effective planning?' he (sic) asks. He's probably thinking of all the technocrats he's ever known who can't see the wood for the trees and who work to the wild west motto of 'have technique, will travel.'

Well, the full Socratic debate thus opened is too long and serious for the present forum. I will content myself with arguing in a paragraph or so that technical competence is the key to convincing comprehensiveness in planning.

A technically competent planner, aided perhaps by a cheap micro-computer but otherwise without new resources, can hold and manipulate large quantities of plan relevant information in an explicit and consistent fashion, i.e. what he (sic) does with his information can be traced through and his decision criteria do not drift as the plan grows.

Provided he (sic) can accept available techniques for converting issues, government policies and interest group demands into plan-making guidelines (and these techniques are a bit dodgy) he can plan in a way which allows

- greater issue recognition (including environmental management issues)
- more public participation, e.g. knowing what to try and get from the public, not just accepting what arrives
- inter-party negotiations
- more zone types in planning schemes
- consistency with government policy to be demonstrated.

The key to all these things is *turnaround time*. If a plan can be rapidly modified to express a somewhat different emphasis, the new plan can be tested for improved acceptability immediately and a decision taken to stop or experiment further. Planning problems are computationally trivial and can be set up on cheap (less than \$1000) home computers in most cases.

Plan-making is still a matter of trial and error but the technically competent planner makes his (sic) trials in systematically chosen directions and makes many more of them. He does not necessarily produce more effective plans than the technically incompetent planner. He produces more effective plans than he himself would produce if he were technically incompetent!

Being technically competent allows the planner to be more rational in the currently fashionable 'well-bounded and well-based' sense of the word, i.e. allowing him to be potentially more effective and satisfying public and government demands by choosing his plans from amongst more, better selected and better defined alternatives.

⁸ For example, Sage, A.P., (1977) *Methodology for Large Scale Systems*, McGraw-Hill, New York.

I believe the prospects for increasing technical competence in the planning profession to be quite good, albeit for the ‘wrong’ reasons perhaps.

Tasks and techniques which currently require time and determination to master and apply will be available as user-friendly software packages on unbelievably cheap computers in ten years time. Graduates will be better trained and routinely available data bases for feeding the analysts’s skills will be of much higher quality than we enjoy today. There may even be new and powerful analytical techniques of which we have no inkling. For those who accept it, technical competence will be a background given, treated much as the ability to drive a car is treated today.

CONCLUSION

This brings us to a suitably cheerful stopping point. The diagnosis was unpromising and the medicine unpalatable to some, but the prognosis is good. Let us charge our medicine glasses and drink to a golden age of rational and effective planning.

POSTSCRIPT 2012

I don’t know what our clients in resource agencies and local government in the eighties really thought of our proselytising and enthusiasm. Perhaps as clever, naïve and politically useful? The CSIRO name was highly respected then and following CSIRO’s advice was good public relations.

Not only did planners have more resources then, and more faith in planning, but their task was easier. Why? Because in most situations there was less competition for local land resources and more choices available simply because land use patterns had not moved as far down the one-way street associated with the replacement of less-intensive with more-intensive land uses. I suspect that, despite their increasingly difficult task, politicians and bureaucrats still do not really want a land use planning process which is, as far as possible, objective. They want to retain their *ad hoc* discretionary powers.

MANAGING AUSTRALIA'S NATURAL RESOURCES IN THE 21ST CENTURY⁹

GREEN, BROWN AND OLIVE

Many people are interested in but confused by Australia's piecemeal and bitter public debate about protecting versus using natural resources. I am not here under the colours of either side. My colour is olive rather than green or brown. The specific contribution I want to make is to clarify the debate between entrepreneurs in the primary industries and preservationists, a convenient name for those concerned, quote, 'with the preservation of environmental values', unquote.

Entrepreneurs want to use the country's natural resources to produce profits, jobs and export dollars. Tourism, agriculture, forestry, fishing, and mining are the main primary or resource-based industries and the natural resources they depend on (let's call them industrial natural resources) include soils, water, landscapes, trees, rangeland and fish stocks. I include tourism as a primary industry because Australia's tourists largely travel to enjoy landscapes and the plants and animals they contain.

Preservationists, because of a concern for people's physical and spiritual health, want particular natural resources called amenity resources to remain as undisturbed as possible. That is, to remain free of pollution residues, degradation of function, premature exhaustion and outright destruction. Lists of amenity resources include air for breathing, water for drinking, ecosystems for marvelling at and landscapes for playing in.

So, Nature provides amenity resources and industrial resources. Note the overlap between my examples of each. It is important to the argument. Conflicts between entrepreneurs and preservationists arise, largely, because the entrepreneurs' industrial resources are simultaneously the preservationists' amenity resources.

The preservationists' foremost concern is that entrepreneurial activities destroy, degrade, exhaust or pollute amenity resources. The entrepreneurs' foremost concern is that lobbying by preservationists triggers the locking up of resources or the imposition of taxes, charges and regulations which make industrial resources less profitable to exploit.

An example

The Murray River is irrigation water for Mildura farmers but drinking water for Adelaideans; impounding upstream water for irrigation commonly leads to less and saltier drinking water downstream. Releasing water to rejuvenate Barmah's redgum forests reduces irrigation supplies. Even when an industrial resource is not directly part of the preservationists' environment - on-farm topsoil is an example - the way in which entrepreneurs use that resource can still affect amenity resources. For example, sediment produced by soil erosion reduces the number of fish that anglers catch.

⁹ Talk on the ABC's Ockham's Razor program, 1992, n.d.

A third community group central to the natural resources debate is the building industry. Urbanisation, to a greater or lesser extent, always destroys and degrades amenity resources. Reclaiming mangrove mudflats in Cairns for building sites is a clear-cut example. Inadequately treated town sewage is as much a factor in creating toxic algal blooms in the Murray-Darling Basin as fertiliser runoff from Namoi cotton farms. Given that Australia looks like having to house twice its present population by the middle of next century, we appear to be committed to building over another one per cent of the country including ten per cent of the coastal fringe between Cairns and Adelaide.

We would have a much better chance of reducing the impact of urbanisation on amenity resources if we had an agreed long term population target and some guidelines on where and where not to put people. The starting point for reducing the environmental impacts of urbanisation is to design more people into existing towns and cities and to discourage new urbanisation outside these.

AMBIT CLAIMS

If the ambit claim of preservationists is zero human disturbance of amenity resources, what is it for entrepreneurs? It's that all industrial natural resources should be available through the market place to the highest bidder and that any disturbance of amenity resources associated with their industrial use need only be self-regulated.

Suppose that extreme preservationists, let's call them ecological fundamentalists, got their way. Australians would be forced back into an Aboriginal-style hunter-gatherer society and about 15 million of us would have to ship out or slip into a short, brutish existence.

What if the more rabid entrepreneurs of the resource-based industries, let's call them economic fundamentalists, got their way? There is no reason to suppose that the ongoing degradation and destruction of amenity and industrial resources which has characterised Australia's last two hundred years would then slow down. We might well enjoy an initial development boom in jobs, exports and profits but, at some stage, the primary industries would no longer be able to live on their declining natural capital and amenity resources would be truly buggered, a wasteland of pollution and genetically impoverished ecosystems.

Yes, really. All development requires energy and all energy use produces residues which pollute natural systems. The simple Malthusian view of pollution is that unless pollution per unit of output can be reduced at a faster rate than total output is increasing, the limited assimilative capacity of natural pollution sinks (airsheds, watersheds) must eventually be over-taxed and air and water quality further reduced.

FUNDAMENTALISTS ARE DANGEROUS

Pretty fanciful stuff perhaps, but clearly both economic and ecological fundamentalists are dangerous. It is up to the rest of us to keep them in line while trying to make the strategic decisions and develop the material and social technologies which will allow the resource-based industries to prosper (goal 1) and the quality of amenity resources to be largely maintained (goal 2).

Internationally, we have little choice beyond the primary industries if we want wages, profits and exports. Even with active diversification, the Australian economy will remain commodity-based for many years. Australia's major export industries in 2020 will be mining, agriculture and tourism.

Catastrophes aside (they do lurk), there are grounds for wary optimism that we can and will progress towards both wealth and amenity goals.

As a bonus, there is room for a few so-called win-win programs which will help both primary industry profits and amenity levels; gas-fuelled electrical power plants are an example; protecting fish nurseries in estuaries and mangroves is another.

DEVELOPMENT IS A ONE-WAY STREET

But, more generally, development, meaning here the expansion of output from the resource-based industries, is a one-way street. We cannot travel down it without losing something in the way of irreplaceable amenity resources and without permanently decreasing the range of future possibilities for using what's left. There are no free trips, no refunds.

Australia's primary task in natural resource management is to decide how far and fast to travel down that one-way street while developing strategies and technologies which will allow us to improve the trade-off rate between amenity costs and economic benefits.

I will put it in parable form. If amenity costs are the 'fuel' which propels the primary industries 'engine', we have to decide how much fuel to put in the tank and see if we can improve fuel consumption. In that parable, driving slowly qualifies as conservative development. Let me move on to some driving hints or principles of conservative development.

PRINCIPLES OF CONSERVATIVE DEVELOPMENT

Principle 1: Think ahead

The first principle of conservative development is to think very carefully before destroying things which we can never recover. This means using social technologies such as land use planning and project impact assessment and enlightened cost-benefit analysis to select minimally damaging sites and technologies for development projects. The Great Barrier Reef Marine Park is our best example of what can be achieved in balancing production and protection; key regions which are crying out for similar sorts of planning include the Kimberleys, the high country, the Central Australian Ranges and Cape York.

Principle 2: Reduce inputs

Principle 2 is to continue developing cost-cutting material technologies, those which reduce the quantities of resources and energy needed to produce a unit of output; in parable terms, to improve 'fuel' consumption. The biotechnologies and information/communication technologies are the advanced technologies likely to have most impact on primary industry profits. More traditionally, improvements in transport and power technologies and infrastructure will also be important for the profitability of primary industries. Australia is very good at producing new technologies for primary production and processing and we will have to stay that way because the relative prices of our commodity exports are unlikely to rise.

Over the past 50 years numerous technologies have been developed which allow us to produce the same output from less input. The trouble is that we do not use less input. Because of population growth, declining terms of trade and so on, we invariably use technology to produce much more output with the same input. Thus, technology has not been able to fulfil its promise of allowing pressure on natural resources and environments to be reduced.

The downside of technological change is that it commonly produces indirect losses like jobs and established social structures as well as direct winners, meaning industry and consumers. As of now, we have little skill or enthusiasm for assessing these impacts in advance and attempting to ameliorate them.

Principle 3: Explore social technologies

Social technologies is an umbrella term to cover all those bright ideas which help people to interact more equitably and efficiently. Principle 3 is to make appropriate use of existing social technologies and learn how to design new ones, particularly for improving market signals and for balancing competing interest group demands.

Existing social technologies for resource management include environmental impact assessment, technology assessment, risk assessment, decision support systems, information systems, land use planning and that old favourite, cost-benefit analysis.

All of these have a place in decision making, and people should know about them, but none must be allowed to assume delphic authority because all have major limitations, conceptually or in terms of their extended data and knowledge requirements.

Remember too that no decision aids or social technologies can reconcile the values of a deep ecologist and a Hugh Morgan; they can clarify possibilities for compromise though and help legitimise the eventual political decisions. Making good decisions with the help of available social technologies is in fact hard work, somewhat boring and unlikely to be notably successful. There are no short cuts to conservative development.

What are the prospects for new social technologies? Promising candidates include new forms of resource use rights, such as transferable water rights for irrigators. New types of taxes and charges on polluters, degraders and destroyers are also being thought through. Natural resource accounting is the developing art of working out what to charge.

Another idea is that leases allocated through competitive bidding and subject to periodically reviewed covenants are a better system than outright ownership for making farmlands, minerals and forests available to entrepreneurs. Responsible resource users are entitled to leases long enough to expect to make normal profits and the community is entitled to levy resource rent tax on super-normal profits.

Principle 4: Intelligent trial-and-error

Principle 4 in the conservative development driver's manual states that intelligent trial-and-error has to be society's basic strategy for improving things. More than anything, our society needs to be willing and able to energetically identify, prioritise and respond to diverse and changing issues in an experimental and learning way; building on successes and moving away from failures. For example, if we want to work out how to control pressure on dwindling fish stocks we should be trying different combinations of regulations and resource rights in different fisheries.

There are two major problems with such proactive social learning. One is that our pluralistic society is highly confrontationist and nobody likes admitting to errors even though these are the basis for most learning. The other is that we do not seem to be able to muster the social energy which will allow us to experiment with and compare different approaches to a problem.

Notwithstanding, the role of government is central in a learning society. Taxes are the keystone in the arch of civilisation; they mobilise the funds which allow us to try different solutions to problems and pick the best.

Provided we can accept that government has an important role to play in resource management, we can design collective strategies for those important goals which markets cannot consciously seek. These include:

- continued availability of the nation's mineral, forestry, farmland and fishing resources for primary production;
- creation of high quality national systems for transport, communications, energy and water supply, conservation reserves, recreation lands, Aboriginal lands and socio-economic infrastructure.
- minimal loss of industrial and amenity resources

The paramount example of an important strategic decision is what we do about controlling population growth. We need more people in this country like we need a poke in the eye with a burnt stick but there is no time to develop that scholarly thesis here. Suffice to say that the idea of sharply reduced immigration is slowly becoming an idea in good currency.

IN CONCLUSION

It is all too easy to paint a gloomy scenario of resource management in Australia in fifty years time:-

- . enclaves of illegal immigrants and Greenhouse refugees on the northern coastline
- . gradual reversion of much of northern Australia to an Aborigines-only society
- . domination of resource industries by multi-national companies
- . decline in living standards as population approaches 30 million
- . social disruption during adaptation to Greenhouse effects
- . debilitating social bitterness between the ever-richer and the ever-poorer
- . massive air and water pollution and land degradation
- . unstoppable destruction of more and more natural ecosystems

But a cheerful scenario is also plausible:-

- . a stable population living long, healthy, self-fulfilling lives
- . a strong economy based on a high-volume low-disturbance tourist industry and on our technologically innovative primary industries processing and exporting minerals, food and fibre
- . amenity resources protected by an upward shift in the community's idea of the acceptable trade-off rate between development benefits and amenity costs
- . a rich suite of social technologies for adjusting opportunities and cost-price signals for entrepreneurs in the public interest

The next century is going to be a difficult one. By making haste slowly, by continuously thinking about and experimenting with the options, it should be possible to muddle through flexibly and improve the way we use our natural resources to create a good mix of amenity and conventional wealth.

POSTSCRIPT 2012

This piece was written 20 years ago. Issues and attitudes are much the same now as then. I may be guilty of overstatement but, to put it bluntly, we Australians have learned very little in that time about how to better manage the balance between protecting resources for their non-market values and managing them for profit.

SCENARIOS FOR AUSTRALIAN LANDSCAPES¹⁰

ABSTRACT

The paper begins by recalling the country's natural features and the past land use/management decisions which have produced today's rural and peri-urban landscapes. It touches on how utilitarian and other perceptions of Australian landscapes have changed with time.

The remainder of the paper develops a simple model, and gives examples, of how Australian landscapes might evolve in coming decades. It is suggested that gross change at continental scale would be surprising but that, at local and regional scale, very real forces for no-change stand to be perceived as having been overwhelmed by social, technical, environmental and economic forces for change, particularly towards more intensive land uses. And the degree to which such change is balanced between seeking post-materialist and materialist ends will depend on community attitudes and how these are mediated by an evolving institutional framework.

LONG-PAST LANDSCAPES

It was 400m years ago that the land around this building began to emerge from the sea and start taking the shapes we now see---the marine sandstones of Black Mountain, the lava flows of Mt Ainslie and the effervescent Mt Painter which threw rocks from Belconnen at least as far as the spot we are standing on. But because it had no human presence, a true *terra nullius*, this land, by definition, did not become landscape until the arrival of the Ngunnawal people some thousands of years ago. The word landscape entered the English language, along with herring and bleached linen, as a Dutch import at the end of the sixteenth century. *Landschap*, like its German root, *landschaft*, signified a unit of human occupation (Schama 1995).

Ever since people arrived here, like a canvas which is continually being over-painted, each generation sees the ghostly figures of past inhabitants and their handiwork through the wet paint, even as it is seeing its surroundings in contemporary terms. While there may be a cultural core of shared ideas about past landscapes, such visions are also highly personal. Thus I personally see the quartz implements of yesterday's hunter-gatherers everywhere when I roam the banks of the Molonglo-Murrumbidgee--glinting in the pinescapes first planted by relief gangs in the great depression and scattered around the 'outcrop' factories. I see European axemen clearing the lower slopes of the hills around us and stop to gaze at the remains of their post-and-rail fences. And as I come to my own time in this landscape, I see protestors gathering in vain to stop the building of the Black Mountain tower. What do you see?

Or, more to the point of today's talk, what did they see, these dead generations? Adopting Charles Dodgshon's views of how hunter-gatherer societies regarded the passage of time, the Ngunnawal would have viewed their ancestors as living in a landscape and seasonally-cyclical environment identical to their own (Dodgshon 1998). Not only was the landscape the direct source of sustenance for the Ngunnawal; the enormous body of knowledge required for survival was mapped, as an aide-memoir, onto the physical landscape and passed down by story-telling.

¹⁰ Paper to Fenner Conference, *Visions of Future Landscapes*, Canberra, May 1999.

Remnant records, poetry, painting, literature, artefacts and, more recently, photography and film all offer clues as to how our European predecessors perceived and used the landscape. Australia's excellent historians have sieved much of this evidence and given us a distillation of those post-1788 perceptions. In writing about changing perceptions of the land, the venerable George Seddon (1976) particularly notes such works as Keith Hancock's *Discovering Monaro* (1972) Les Heathcote's *Drought in Australia: A problem of perception* (1969) and Geoffrey Blainey's *Tyranny of distance* (1966). How well such would survive a volley of post-modern deconstruction I do not know.

It would seem that we came only slowly to accept that Australia's outstanding natural attributes are a dry climate and a geologically ancient land surface. Taken together, these factors have produced landscapes which, by global standards, are noteworthy in at least the following ways (Cocks 1992):

- climates characterised by low variable rainfall, strong climatic gradients between coast and inland, droughts and floods;
- generally unproductive soils - infertile, shallow, stony and salt-prone;
- limited occurrences of perennial surface water and snow fields;
- a long diverse coastline;
- featureless vistas with little mountainous terrain;
- a rich and unique complement of native plants and animals;
- limited areas of natural grassland and of relatively unproductive forests.

Some of the land use implications of this situation have been:

- intensive settlement has only been possible over a modest fraction of the country;
- major forestry activities have not been possible;
- intensive agriculture has only been possible in the wetter fringes of the country;
- the coastline and inland waters have become the foci for recreation activities;
- ground transport systems have been slow to develop over the country's long distances and have been of poor quality;
- production of minerals for export has been and continues to be a major economic activity;
- methods of adapting European agricultural systems to the Australian environment have had to be developed *de novo*.

Some spectacular historical misjudgements

Let me further consider the case of agricultural landscapes. Because European settlers had to learn to understand the Australian environment from scratch, it is inevitable that they should have made misjudgements as to the consequences of various land management practices. Amongst the more spectacular of these have been misjudgements as to:

- long term stock carrying capacity and crop yields in inland areas;
- the impact of introducing feral animals (particularly rabbits and foxes) on pasture and range productivity and on native mammal populations;
- the effects of introducing exotic plants destined to become weeds, eg prickly pear;
- the unforeseen consequences of excessive clearing of timber, eg salinisation, erosion, woody regrowth;
- the effects of uncontrolled irrigation, eg salinisation of soil and water;
- the susceptibility of bare soil to water and wind erosion;
- the risks and consequences of floods and fires.

Such technical misjudgements have been an important factor in explaining Australia's changing land use patterns since European settlement. And the social fallout from such misjudgments undoubtedly helped to create an image of Australia's inland landscapes as ungenerous and unforgiving. This view, focused on the exploitability of the landscape, changed slowly from perhaps the time gold was discovered---a pleasant surprise---and as farming technologies that seemed to be subduing the landscape into productivity began to appear. It was only with Britain's entry into the Common Market in 1973 and the resources boom that never happened that this rosier view darkened once again. Now that the unrelenting historical decline in commodity prices is accepted, that period of beneficent landscapes is even seen as a delusion that has locked us into an economic structure which has no future.

Other perspectives

In addition to changing utilitarian perceptions of Australian landscapes, several other changing historical perspectives can be readily identified. There is a scientific perspective which can be generalised as one of ever-increasing understanding of the processes at work in landscapes and empirical knowledge of what those processes have created. There is a conservation perspective which, from about the turn of the century, has been one of increasing fear for the survival of diverse ecosystems and their component species. There is an Aboriginal perspective that I would not presume to identify beyond recognising a central concern over a declining standard of 'caring for country' or, in my language, landscape management.

Amongst European Australians there has been an evolving spiritual-emotional-aesthetic perspective on non-urban landscapes which defies easy analysis. They have complex and ambiguous reactions to 'the bush' in all its forms. Aboriginal lawyer Pat O'Shane has said white Australians are frightened of the place. Park planners have told me that an axiom they follow in designing walking tracks is that Australians will not venture more than 600 m from their cars.

Nonetheless, while the majority may not respond passionately to their ugly-beautiful land, Australian landscapes raise powerful emotions in many of us. To no small extent, this is because modern Australia has produced a group of extraordinary painters who have 'crystallised the mute stirrings of our responses to the land'. Fred Williams discovered that the Australian landscape just goes on and on. And had anybody ever seen a country town before Russell Drysdale painted pictures like 'Sofala'? Now it is hard to see one any other way. Every time you take a trip to the back country, you see Drysdales all over the place! (Laurie Thomas, *Australian* Nov. 19 1968).

It is not just the painters who have deepened our perceptions of Australian landscapes of course. It is writers like George Seddon and Eric Rolls. It is poets like Judith Wright and, dare I say, Dorothea MacKellar. It is composers like Sculthorpe. And, for many here today, it is particularly scientists. Let me pay tribute in passing to a handful of the many scientists who have been important in developing my perceptions of landscapes: Christian, Stewart and Mabbutt of land systems fame; the continental-scale resource mappers Carnahan, Northcote and Nix; and that trio of big picture thinkers---Flannery, White and Ollier. From my own Division of CSIRO I have been enlightened by Ratcliffe, Tongway and two Braithwaites; and, from Water and Land Resources, by John Williams.

CONTEMPORARY LANDSCAPES

Let me turn now to some brief comments on contemporary landscapes before indulging in a little future-gazing. At this moment, from Tasmania to Arnhem Land, the Australian landscape is a fleeting synthesis of all that humans and nature have ever done to the land. However, the short-term balance of power in that partnership has now moved firmly into human hands in rural landscapes, just as has been the case in urban landscapes for centuries. The turning point in this annexation of nature by culture was the introduction of the tractor perhaps, the first instrument for flexibly applying large quantities of fossil energy to the land.

Humans change landscapes by changing land use and land management practices. In the foreword to the 1939 edition of their classic text *Land utilisation in Australia*, Wadham and Wood (Wadham et al 1957) say that land utilisation is usefully viewed as a matter of balance between land uses, a balance which can be tipped one way or another by technological advances, commodity and other price changes, evolving individual and community attitudes etc. Sixty years later this is still an insightful way to view land-use change although a full list of those 'tipping factors' would be long.

What Wadham and Wood do not say is that land use change is a one-way street, an ongoing process of intensification within and between uses. Nor do they say that it is a process characterised by perennial and pervasive conflict.

Land uses can be put on an ordinal intensity scale ranging from 'pristine non-use' to 'highly intensive', the latter involving some mix of high human presence, high energy and materials throughput, landform sculpting, surface hardening and vegetation modification. Where we are here, the intensity scale runs from near-wilderness in the Brindabellas to highly intensive in Civic.

Within historic time scales and under historic cost structures, a tract's use normally progresses, in fits and starts, from less to more intensive. Conversely, it is expensive, and from difficult to impossible technically, to return land to a similitude of a former less intensive use. Exceptions can be proposed and debated (eg reforestation, restoration ecology) but the general tendency is clear.

The significance for this forum of this observation is that it follows that land use options, whether considered locally or nationally, and whether being perceived by public or private land managers, narrow over time. Ultimately it has been public recognition of the 'practical irreversibility' of the process of land use change which has led to concern for the gradual irrecoverable loss of values associated with less intensive land uses.

A second major source of land use conflict is perceptions of uncompensated external impacts or spillover effects associated with land use change and expressed in the NIMBY or 'not in my back yard' attitude.

Spillovers and/or irreversibilities can be uncovered in most contemporary land use issues including:

(a) issues concerned with the location and management of major land uses such as urbanisation, agriculture, mining, recreation, forestry, parks and physical infrastructure.

(b) issues concerned with the management and use to be made of critical regions and resources such as coastal lands, arid lands, alpine areas, water resource areas, forests, minerals and soils.

More specifically, what are some of these issues? Urbanisation is and will continue to be the single most important source of land use conflict. In the major metropolitan fringe areas (within a half day's drive, say) rising demands for accessible sites for diverse uses will be bumping against a fixed supply of land, eg as seen in the displacement of agriculture by urban subdivisions. Other contending peri-urban uses are active recreation, base minerals extraction, water catchments, hobby farms and landscape appreciation.

Agriculture comes second to urbanisation as an issue generator, generally as a land use under threat from subdivision and hobby farms as noted but also from uncertain markets, costs, erosion, salinity and mining. On the other hand, there is concern about intensive agricultural practices, particularly the use of fertilisers and chemicals and factory farming.

In contrast to agriculture, mining (notably of uranium, bauxite, coal and beach sands) is seen as a strongly competitive land use with significant impacts on Aboriginal lands, farmlands, recreation and conservation areas, scenic landscapes, water catchments, forests and fisheries. The other side of the mining issue appears as a concern for the 'sterilisation' of valuable deposits in national parks, heritage areas, catchments and built-up areas.

Overall, while issues cannot always be seen in tight geographic terms they are more likely to be found where population pressures are high; where scarce, accessible, versatile, fragile or particularly attractive resources are involved; and around industries experiencing changing economic fortunes.

MID-FUTURE LANDSCAPES

Now that we have some feel for historical and contemporary landscapes and perceptions thereof, we can turn to how things might change over coming decades.

Continental landscapes

At a continental scale, I for one would be quite unsurprised if there were little change in what might be called landscapes from space. Despite what appears to many as breakneck change in land use around them, it is extremely doubtful, assuming a reasonably orderly world, that the gross pattern of land use in Australia as summarised in Table 1 will be startlingly different in another fifty years.

Table 1 Land use in Australia---the broad picture

(Percentage of country)

Arid and semi-arid grazing	43.7
Unused land	26.0
Non-arid grazing	17.4
Extensive cropping	5.8
Nature conservation reserves	3.5
Forestry	2.0
Transport corridors	1.2
Intensive cropping	0.3
Urban land	0.1

Note: Size of country is 7.7 m sq km.

Source: State of the environment in Australia 1985

The reasons for this macro-scale inertia are fairly obvious. The pastoral and other arid-semi-arid lands have few foreseeable alternative uses and they occupy 70 per cent of the continent and dominate national land use figures. A best-bet scenario for the sparselands is one of emerging and disappearing islands of mining, tourism and settlement in a sea of pastoralism which is itself ebbing and running at the margins.

Non-arid grazing and extensive cropping both have some prospects for expansion and contraction at their geographic margins under the influence of climate change, technology and product prices but major shifts would leave most observers surprised.

Of the remaining land uses in Table 1, even large proportional changes will make little difference to the face of Australia as viewed from space. For example, at plausible rates of population growth, urban areas could conceivably double by the middle of next century (Cocks 1996) but this still represent less than one per cent of the country.

Of the global-scale forces which could overturn this perception, massive climate change is of most interest to the present audience (Walker et al 1989) but, from a broader perspective, is only one of several contingencies which could rework the face of the continent, eg war, uncontrolled mass migration.

Local landscape change

Descending to the local and regional scale, there will be ongoing forces for landscape change and inertial forces opposing change. Thus, all regions carry customary, institutional and geographic constraints that make change from the past less likely. For example, while the nodes and links of the national transport system will continue to be upgraded, their coverage has stabilised. A rapid rise in transport costs would dampen landscape change dramatically. Conversely, population movements, technological change, economic restructuring and political attitudes are all examples of powerful forces promoting landscape change. And because our perceptions are attuned to what has changed rather than what has not, we will almost certainly see ourselves living in times of rapid landscape evolution, characterised by ever-intensifying land uses.

Political and community attitudes

Consider political and community attitudes as a source of landscape change. It would be surprising but not totally surprising if, over coming decades, Australians became more concerned with environmental, social and sustainability issues and less with economic growth (Ellyard 1998 p128). If this were to happen, it would be plausible to foresee a stabilised population but with each person placing a large, light footprint on the landscape. For example, there could be:

- more wind farms and solar farms;
- more timber plantations and farm forestry;
- more land producing renewable substitutes for non-renewable mineral resources;
- more native forests committed to light selective logging;
- more hobby farms and rural retreats;
- more dedicated (single use) water catchments;
- more parks, reserves and wilderness areas;
- more low intensity, low chemical agriculture;
- more urban forests and garden cities;
- more large urban residential blocks supporting a self-sufficient lifestyle;
- more biomass fuel farms growing deep rooted perennial species;
- more containment of the 90 or so existing urban areas with populations greater than 10 000; in particular, the state capitals. Because it is difficult and costly to maintain environmental quality in large cities, a more post-materialist society might seek to encourage growth in medium-sized cities and clusters of smaller cities and towns.

If however economic growth remains Australian society's dominant goal we might anticipate seeing, for example:

- more land clearing, particularly in Queensland and New South Wales poplar box woodlands suited to the use of arboricides; but also rainforest, brigalow, mallee and saltbush;
- more high country grazing;

- more cropping activities which increase nutrient loads on Great Barrier Reef waters (Kinsey 1991);
- more cropping involving short rotations and intensive cultivation schedules;
- more summer cropping in erosion-prone areas of north central Queensland (Williams 1989);
- more integrated harvesting for woodchips and logging of 'old growth' forests;
- more offshore oil and gas production near ocean and coastal areas judged to be of high conservation value, eg whale calving grounds, mangrove forests;
- more mining in areas of perceived high conservation value eg Shellburne Bay;
- more mining operations that produce intractable residues such as cyanide residues from gold mining and radioactive spoil;
- more husbandry, both extensive and semi-intensive, of crustaceans, molluscs and fin fish in estuaries with significantly urbanised catchments;
- more 'overfishing' of commercial species;
- more hotel developments involving high numbers of rooms in non-urban areas, particularly isolated and coastal areas;
- more snowfield developments;
- more developments threatening significant groundwater contamination or rapid groundwater drawdown (Ghassemi et al 1991);
- more urban sprawl onto open space and natural systems in the coastal zone and onto high value agricultural lands such as sugar and horticultural lands;
- more utility corridors dissecting forested and other semi-natural lands and cleaving intact habitats;
- more major structures in non-urban areas, eg spaceports, rocket ranges;
- more depletion of 'environmental' (habitat-conserving) flows in rivers, eg periodic flooding of the Barmah forest.

Institutional arrangements

Political and community attitudes, whether pro-growth or post-materialist, must find expression through various institutional arrangements. Thus, currently, community decisions to question certain land uses in certain situations can emerge from any of a range of social technologies including land use zoning schemes, environmental impact assessment processes, formal management planning, enlightened cost-benefit analysis and the application of environmental standards.

While these social technologies are now being used less extensively by governments, they show no sign of disappearing, just of continuing to undergo change. Specifically, stakeholders are participating more directly in land-use decision-making rather than just being corporately consulted, no matter how sympathetically. Simultaneously, we are seeing the emergence of self-help groups, such as Landcare groups, confident of their capacity to manage change without depending heavily on government.

CLOSING THOUGHTS

This completes my simple model, with examples, of how Australian landscapes might evolve in coming decades. I am suggesting that gross change at continental scale would be surprising but that, at local and regional scale, very real forces for no-change stand to be perceived as having been overwhelmed by social, technical, environmental and economic forces for change, particularly towards more intensive land uses. And the degree to which such change is balanced between seeking post-materialist and materialist ends will depend on community attitudes and how these are mediated by an evolving institutional framework.

Mine has been a small excursion into a large topic and I regret that time has not permitted me to talk about seascapes and townscapes as I have about rural and peri-urban landscapes. And while I am not here today to weep for lost landscapes I would have liked to have been able to discuss how we might better go about designing future landscapes. Perhaps these are matters that will get an airing from later speakers.

REFERENCES

- Blainey, G., (1966), *The Tyranny of Distance*, Sun Books, Melbourne.
- Cocks, D., (1996) *People Policy: Australia's Population Choices*, University of New South Wales Press, Sydney.
- Cocks, K.D., (1992) *Use With Care: Managing Australia's Natural Resources in the 21st Century*, University of New South Wales Press, Sydney, 340 pp.
- Dodgshon, C., (1998) *Society in Time and Space : A Geographical Perspective*, Cambridge University Press, Cambridge.
- Ellyard, P., (1998) *Ideas for the New Millennium*, Melbourne University Press, Melbourne.
- Ghassemi, F., Jacobson, G. and Jakeman, A.J., (1991) Major Australian Aquifers: Potential Climatic Change Impacts, *Water International*, **16**, 38-44.
- Hancock, W.K., (1972), *Discovering Monaro: A Study of Man's Impact on his Environment*, Cambridge University Press, Cambridge.
- Heathcote, R.L., (1969) Drought in Australia: A Problem of Perception, *Geographical Review*, **59**, 175-94.
- Kinsey, D.W., (1991) Can we Resolve the Nutrient Issue for the Reef? *Search*, **22 (4)**, 119-21.
- Schama, S., (1995) *Landscape and Memory*, Knopf, New York.
- Seddon, G., (1976) The Evolution of Perceptual Attitudes In Seddon G., and Davis, M. (eds) *Man and Landscape in Australia: Towards an Ecological Vision*, AGPS, Canberra.
- Seddon, G., (1997) *Landprints: Reflections on Place and Landscape*, Cambridge University Press, Cambridge.
- Wadham, S., Wilson, R.K., and Wood, J., (1957) *Land Utilisation in Australia*, (1st ed. 1939) Melbourne University Press, Melbourne.

Walker, B.H., Young, M.D., Parslow, J.S., Cocks, K.D., Fleming, P.M., Margules, C.R., Landsberg, J.J., (1989) Global Climate Change and Australia: Effects on Renewable Natural Resources. In *Global Climate Change - Issues for Australia*, Prime Minister's Science Council, AGPS, Canberra.

Williams, J., (1989) Land Degradation: Evidence that Current Australian Farming Practice is not Sustainable, in *Management for Sustainable Farming, Proceedings 16th National conference, Australian Farm Management Society*, 1-23.

POSTSCRIPT 2012

In the dozen or so years since the writing of this paper, the suite of land uses, land use issues and land use conflicts in Australia has changed markedly. Two, logging native forests and capping irrigation in the Murray Darling Basin, have been foci for major government attempts at balancing stakeholder interests. It is clear that the 'solutions' in both cases owe more to political expediency and obeisance to market forces than rational analysis and a serious concern for the public interest. I am disappointed but not surprised.

RESOLVING CONFLICTS OVER LAND AND RESOURCE USE¹¹

PERENNIAL AND PERVASIVE CONFLICT

The players differ, but the game is the same. In all parts of Australia, there is conflict and competition for the rights to use the local natural resources for anything from wilderness to Japanese retirement villages. Basically, the intensity of this conflict varies with

- local and regional population density
- rate of population increase
- number of potential land uses

Within the heavily settled parts of the coastal zone, areas within half a day's drive of major cities particularly satisfy these conditions and experience a never-ending series of disputes. At the other extreme, not even the great unpopulated deserts are free of argument. Should the Nullarbor be a World Heritage area? Should the Woomera rocket range be reopened?

Vigorous debate about resource use is an indicator of a healthy democracy, provided this is not a substitute for protection of the public interest. Some of the commonest issues generating debate are given in List 1.

List 1: Resource-use issues which generate significant debate in Australia

1. Land degradation
2. Air pollution
3. Extinction of plant and animal species
4. Loss of historic and prehistoric sites
5. Lack of national parks in some areas
7. Reduced availability of prime forestry, farming and mineral areas
8. Deterioration in quality of physical infrastructure (roads, water supplies, power supplies etc.)
9. Coastal degradation
10. Over-exploitation and degradation of the oceans
11. Disposal of nuclear and toxic waste
12. Pollution of lakes and rivers
13. Depletion of native forests

¹¹ Prepared as a contribution to a text book published by Australian Academy of Science, 1990, *Environmental Science*, Australian Academy of Science, Canberra..

14. Impacts of possible climatic change

15. Urban sprawl

So much for diagnosis. What about treatment? The commonest suggestions for dealing with resource use problems boil down to three injunctions on the Australian community:

1. To learn more about the extent and nature of our natural resources and the techniques by which they might be used and conserved.
2. To develop appropriate attitudes (ethics, values and policies) towards resources and their use.
3. To develop appropriate controls over and methods of conflict resolution for resource use.

Here, our interest is in 3 and, to a lesser extent 2, rather than in 1.

RIGID SOCIAL ATTITUDES TO LAND

There are a number of hard-line social attitudes towards land and its use which have played a part in setting the stage for resource conflict. Old-established examples include:

- landowners have the right to use their land as they wish
- a productive (i.e. commodity-producing) land use is always better than a non-productive or consumptive use
- Australia has more than enough land for all purposes
- all land is much the same, apart from its location
- left alone, degraded land rehabilitates itself
- when resources run out, you move on.

More recent attitudes which can be widely detected include

- any extension of the area devoted to productive uses is wrong
- land development of any type, industrial or primary, should be regulated to the point where the side effects on third parties are undetectable.

MANAGING PRIVATE LAND USE

The main institutional factor affecting the use of privately owned land in Australia is that most such land is subject to local zoning schemes which restrict (or, occasionally, encourage) the land uses the owner can practise or the ways in which s/he can practise them. These schemes are usually developed and administered by local government authorities subject to State government supervision through State planning departments.

Land-use planning by local government and resource agencies is primarily a political instrument for resolving, ameliorating, avoiding or forestalling conflicts of interest over land use. These can occur between land users of different categories (e.g. farming and commercial forestry), or between land users and non-users directly affected by decisions on the use and management of land within the jurisdiction of the agency or authority (e.g. loggers and conservationists).

Land-use planning is also an instrument for identifying, representing and protecting the interests of those indirectly affected by land-use and management decisions---the wider community and future generations. Its popularity is a recognition of the inability of land markets to cope with equity issues, externalities (side effects) and the use of common-property resources.

In spatial terms, a land-use plan is a 'map' showing 'where' particular land uses and land-management practices are proscribed or prescribed and showing where and how the authority's resources are to be used to encourage/discourage nominated uses and practices.

ENVIRONMENTAL PLANNING

Fairly recently, local authorities have begun to try and control land uses which are 'socially' uneconomic, which are environmentally degrading or which are incompatible with local community goals and objectives. Also, in addition to discouraging undesirable land uses, local authorities are nowadays trying actively to encourage private land uses which they regard as likely to be beneficial to the local community, e.g. new industries, new recreation facilities, new styles of residential areas. Because they are generally poor, there is usually not a lot that local authorities can do to encourage beneficial land uses.

Land-use planning which attempts to balance many such considerations in controlling local land-use, planning which looks beyond just balancing private interests, is sometimes called environmental planning. It often appears to involve the tacit transfer of non-explicit property rights from individual landowners to the larger community, e.g. landscape preservation orders.

MANAGING PUBLIC LAND USE

Public or Crown land, which comprises some 90% of the country, is largely managed in disjoint tracts by various special-purpose State resource agencies such as those with responsibility for forestry, national parks, vacant Crown land, the coastal zone and catchment areas.

In Victoria the allocation of public land between agencies is handled by the Land Conservation Council, but the other States lack comparable bodies, and allocation by interdepartmental committees is the norm.

In all States, there is an increasing requirement for public land to be managed according to the dictates of formally prepared management plans. The content of these is variable but they usually identify zones to be used for different purposes, development works to be undertaken and the policies which will guide management decisions.

Stages in planning public land

Planning the use of public land is a two-stage process:

Stage 1. Individual tracts of public land are placed under the control of particular agencies---lands, forestry and so on. This stage has been largely completed by now in most States, although there are always odd transfers being negotiated between agencies.

Stage 2. Once given responsibility for a particular tract, it is becoming increasingly common and legally necessary for the agency to manage that land in accordance with a formally prepared management plan. This is a document setting out how an area is to be used over coming years. Different land-management agencies have widely different specifications about the content and legal status of such plans (i.e. the extent to which they must be followed). Among other components, they can include zoning schemes, development schedules and performance standards.

MANAGING PUBLIC LAND THROUGH ZONING

In some ways the planning task facing agency managers of public land is much simpler than that facing local government planners. The land uses to be considered by the agency will generally be indicated by an Act of Parliament, and decisions to use land in particular ways can be implemented by the authority itself, rather than having to rely on appropriate private decisions.

Zoning of public land is a way of changing an uncontrolled 'open access' situation to a managed 'common property' situation. The Great Barrier Reef Marine Park is a successful example. All the traditional activities such as fishing, shipping and yachting continue, but in nominated locations and under management guidelines designed to protect the resource base. The same approach deserves to be considered for other large intricate offshore areas such as Bass Strait, the South Australian gulfs, the Gulf of Carpentaria and the Western Australian reef-island complex.

MAJOR PROJECTS AND LAND-USE PLANNING

The other main institutional device affecting both public and private land is the use of environmental impact assessment procedures. Under both Federal and State legislation, designated major development proposals may be required to demonstrate acceptable predicted impact on the bio-physical and, increasingly, the socioeconomic environment before being approved.

For the great bulk of more or less conventional proposals to use land in a particular way, land-use planning is a time-saving and effective way of applying available planning instruments. For 'one-of-a-kind' decisions such as the approving of major development proposals, fully planned control becomes difficult, and reactive control through instruments such as social, environmental or socioenvironmental project-impact assessment is probably inescapable. These two important social technologies are thus complementary rather than alternatives.

Particularly where the form and location of a proposed development is flexible, land-use planning can be an instrument of compromise. Unfortunately neither the pro- nor anti-development lobbies are much interested in compromise. Both would rather try for total victory by forcing a political decision in their own favour. Mistrust between the camps is now chronic and it would be difficult to go back now. The fact that there are alternative sites for many activities is irrelevant to a company which has a lease on only one site and to greens who envisage death by a thousand cuts if they give way on a single issue. Still, if the range of site options is known, decisions can be given some context.

PROSPECTS FOR IMPROVED RESOURCE ALLOCATION

Evaluating the system

Land-use planning by local government is viewed very cynically by the public. There have been too many cases where land developers and officials have made fortunes through the up-zoning of land that they just happen to have purchased. Also, there are too many cases where State ministers have overridden the decisions of local councils for dubious reasons. There would appear to be every reason for 'windfall' profits created by rezoning to be very heavily taxed. Apart from the equity of this, it would perhaps reduce the incidence of socially questionable developments. Conversely, landholders whose land is 'down-zoned' have a case for compensation for loss of the right to sell that land in a particular way.

Other common criticisms of the local government planning system include delays in processing development proposals, high costs, the need to use legal processes rather than negotiation, lack of consistency and co-ordination in decision processes.

Community participation

It has become increasingly common in recent years to offer people standing to be affected by land-use plans the chance to participate in the development of these plans. Dozens of social technologies for community or public participation have been identified ranging from seeking comments on draft plans to giving interest groups full membership of the planning team.

Unfortunately, planning is a complex and time-consuming activity in which only those with considerable backup resources can reasonably engage. Less privileged stakeholders really have little chance of participating equally in the planning process; they are likely to feel threatened by the massive resources which can be marshalled by the powerful. Intellectually, they may not even recognise their own true interests if they cannot escape from such powerful ideologies as 'development is a good thing'. In the 'environmental' area, increasingly better-resourced action groups are changing this imbalance as regards 'big' issues, but most local planning still serves establishment interests. It remains the responsibility of professional planners to protect all interests as far as they possibly can. This probably involves 'erring' on the side of 'little people'.

Community involvement in park planning has mushroomed in recent years under the slogan of 'planning with, not for, people'. The assumption that the public has a right and responsibility to influence decisions relating to public resources is now accepted. The problems of how to get comprehensive identification of community values and expectations and of how best to analyse and use community input remain largely unresolved.

Emerging and improving social technologies

Social technologies for helping with conflict resolution are being created and/or improved regularly. These include:

- active conflict resolution, including multi-party planning, environmental mediation and environmental arbitration
- systematic public consultation/participation
- formation of community action groups
- social impact assessment

- environmental auditing, which can take many forms, but is essentially concerned with identifying changes to an existing enterprise's operations standing to reduce the environmental impact of those operations.

All of these have a general goal of improving the equity, the distributive justice, of decisions. Mediation can be either passive, simply assisting the parties to reach an agreement, or active, which involves directing the search for an equitable and technically sensible outcome. In either role, the mediator helps to identify data gaps and ways of filling them, facilitates joint evaluation of data and the drafting of an eventual agreement.

Because the focus is on the conflicting interests of the immediate stakeholders in a mediated dispute, the interests of the broader public can get neglected. Social impact assessment, on the other hand, specifically considers the interests of third parties. None however particularly consider the interests of 'fourth parties', namely, future generations.

Jobs and the environment

The short term economic future of Australia rests on making more and better use of our natural resources. We may well be able to improve our capacity for producing competitive manufacturing exports but this is proving a slow business and, meanwhile, agriculture, mining and tourism will continue to be our major export industries.

It is fairly clear how agriculture and mining use natural resources and have impacts on environmental values such as soil, air and water quality. What about tourism? Tourism imposes depreciation costs on the country's natural capital just as surely as does primary production. It is difficult to develop a uniquely Australian tourist experience without getting close to the land, and this is what is damaging when it involves large numbers of people.

For example: resorts displace natural ecosystems such as the mudflats off Cairns; visitors wear out the vegetation around Ayers Rock and the depositional formations in caves in Tasmania; repeatedly disturbing magpie geese rookeries to get 'mass flight' photos leads to rookery abandonment; anchor chains reduce coral reefs to rubble; and so on. Understandably, there is growing tension between the tourist industry and environmentalists.

Will economic growth based on natural resources enhance job prospects in coming decades and how will demands for rising environmental standards in the community affect these prospects?

Mining is a notoriously capital-intensive industry and adds few jobs for every extra million dollars of investment. The number of people employed in Australian agriculture continues to fall as farms get bigger and output rises. Tourism is a service industry and investment in tourist facilities does create large numbers of low to medium-skill jobs. A big hotel employs about a thousand people.

It seems likely then that even if the Australian economy prospers, prospects for conventional jobs are not all that good. Will community demands for rising environmental standards make those prospects even less bright?

Not necessarily, even though having to meet rising environmental standards is likely to increase production costs for minerals, agricultural produce and tourist services by a few per cent.

For example, a recent Industries Assistance Commission discussion paper on the environmental impact of tourism and travel calls for greater accountability over the development of resorts. The position is taken that tourist projects should be subject to an initial socio-environmental impact assessment and be monitored once they begin operating. The paper canvasses the radical question of whether the approving agency or the developer should be liable for environmental damage unforeseen initially. Up till now there has been no suggestion that anyone be liable for unforeseen or, indeed, foreseen impacts. Naturally enough, the tourist industry has not welcomed the report. By mid-1990 the Australian Tourism Industry Association had nevertheless formulated a document setting out 'standards on the issues of assessment, protection, responsibility and information'.

It has to be remembered that countries competing with Australia in her export markets also face rising demands for improved environmental standards. Australian exporters need not necessarily be disadvantaged when everyone is required to 'clean up their act'. In fact, because environmental degradation is not as advanced in many respects in Australia as in Europe and North America, we may well be able to achieve required standards more cheaply than elsewhere. By adopting particularly rigorous standards for the use of agricultural chemicals we may be able to exploit the world-wide rising demand for chemical-free food, creating jobs as we do so.

POSTSCRIPT 2012

This piece, part of a larger contribution to an Academy of Science textbook, took a more positive view of State and Federal efforts to manage conflicts over how natural resources are to be used than the view I would take today. It is my impression that apart from, or perhaps in response to, more competition for a fixed and increasingly committed land base (they aren't making any more), today's stakeholders and would-be land users are more strident in their demands and more naked in their self-interest. Governments and resource agencies, on the other hand, appear to have fewer resources now and to be less determined in their efforts to find a sensible balance between disparate private interests and between private interests and the public interest.

EUROPEAN SETTLEMENT IN AUSTRALIA: EXERCISE IN ADAPTATION¹²

ABSTRACT

The paper recognises the adaptation of a European human population to the Australian environment as being a process of social learning rather than of biological evolution. Key learning experiences since European settlement are identified and discussed, particularly those associated with the responses of natural ecosystems to disturbance. A conventional judgement would be that Australians have learned to use their resources to build a prosperous and pleasant society.

Looking to the future, attention is focussed on Australia's internal social learning challenges rather than potentially overwhelming challenges coming from the outside world. With respect to resource management, these group into issues concerning (a) the location and management of such major land uses as urbanisation, agriculture, mining, recreation, forestry, parks and physical infrastructure (b) the management and use to be made of critical regions and resources such as coastal lands, arid lands, alpine areas, water catchments, forests, minerals and soils, and (c) maintenance of environmental quality, particularly the 'health' of water, air, biodiversity and earth materials resources.

Central to meeting these challenges is learning how to actively design social technologies, ie procedural theories for addressing social needs and problems and for converging on explicit social goals. Equally important is the monitoring of progress towards goals and a willingness to try anew when progress is unsatisfactory.

WHAT IS ADAPTATION?

Adaptation is and always has been a slippery concept.
Reeve and Sherman, (1993)¹³

An individual member of a particular species is well adapted to its environment when it has a high probability of surviving until it has reproduced and changed into post-reproductive form. A population of individual members of a species is well adapted to its environment when it has a high probability of surviving until it evolves into a different population. A species is well adapted to its environment when it has a high probability of surviving within an evolutionary time frame.¹⁴

The problem with these definitions is that they are non-operational, ie survival probabilities cannot be measured in advance. It is only hindsight which allows the observation that an individual, population or species surviving till it changed into something else was probably, although not necessarily, well adapted.

¹² Paper to 1992 Conference of Australian Society for Human Biology, Canberra.

¹³ Reeve, H.K., and Sherman, P.W., (1993). Adaptation and the Goals of Evolutionary Research, *The Quarterly Review of Biology*, **68** (1) 1-10.

¹⁴ Williams, G.C., (1966) *Adaptation and Natural Selection: A Critique of some Current Evolutionary Thought*, Princeton University Press, Princeton, NJ,.

The focus of the present paper is on the adaptation of populations rather than species or individuals; in particular the adaptation of one human population to one environment, namely Australia. Even more specifically, the focus is on adaptation to Australia by post-1788 populations rather than adaptation by pre-European Aboriginal populations over 50 000-plus years. The ever-unfolding story of how the Aborigines adapted to the Australian continent and forever changed its flora and fauna through firestick farming and by their hunting techniques, including the introduction of the Dingo, is fascinating but needs fuller treatment than is possible here.¹⁵

SOCIAL LEARNING VS BIOLOGICAL EVOLUTION

Because post-1788 society is only two hundred years old, the process of adaptation has been one of behavioural change based on social learning rather than genetic change through biological evolution. Perhaps Australia's early convict settlers were selected for alcohol tolerance and probably today's Australians are being slowly selected for skin types which resist the formation of skin cancers, but genetic change in the Australian population, at present, is almost wholly through immigration.

In social learning a population finds out by trial and error that some recurring problem can be solved or avoided by a new form of collective behaviour, e.g. establishing a land titles register reduces conflicts over land ownership. Humans, as individuals and as populations, have the power to reprogram themselves, to reconfigure their behavioural repertoire, within a single generation.

The idea of adaptation through social learning is less familiar than that of adaptation through biological evolution and is best clarified by drawing out several comparisons between the two:

1. In social learning, speech and writing are the analogue of genes in biological evolution. With social learning information can be transmitted without a generation gap which means that adaptation can be speeded up.
2. Bright new ideas which spread from person to person are the analogue in social learning of mutations in genes. They have been given names such as *memes* by Richard Dawkins and *culturgenes* by E.O.Wilson.¹⁶ As in biological evolution, most bright ideas do not survive. To quote Edgar Dunn, who anticipated some of Wilson's and Dawkins' thinking:¹⁷

'Like biological mutation, human 'idea mutation' does not always generate relevant ideas. Those idea inventions or behavioural innovations that are not consistent with the interplay between operating environment and operating goals tend to lose force. Those that promote a convergence between environment and social goals are reinforced.'

Dunn's reference to social goals flags a critical difference between biological evolution and social learning. It is what writers like Sartre and Camus¹⁸ have identified as the 'existential burden'. By this they mean that humans have to consciously choose the goals they want their behaviour to achieve.

¹⁵ For example, Flannery, T., (1989). Australian wilderness: an impossible dream?, *Australian Natural History*, **23** (2), 180.

¹⁶ Wilson, E.O., (1975) *Sociobiology: The New Synthesis*, Harvard University Press, Cambridge, Ma.

¹⁷ Dunn, E.S., (1971). *Economic and Social Development: A Process of Social Learning*, Johns Hopkins Press for Resources for the Future, . Baltimore.

¹⁸ Camus, A., (1946) *The Stranger*, Alfred Knopf; New York; Sartre, J.P., (1975) *Existentialism and Humanism*, Methuen, London (reprint of 1948 edition).

The difficulty with this imperative is that it carries with it little idea of whether the chosen goals lead up an evolutionary blind alley - as has been the case for most species changing through biological evolution. Being teleological for a moment and thinking of a species as a single sentient being, the best that any species can hope for is that it will evolve smoothly into another species.

The embodied inference is that the super-goal of social learning should be to maximise the probability of a smooth transition to a new society, whatever it may be, ie, without violence, hunger, disease and other sources of misery. Perhaps this goal, more operationally, equates with trying to build a society in which people can lead long healthy self-fulfilling lives. In practice it is often easier to identify nega-goals, things unwanted rather than things wanted.

Taking a different tack, perhaps the goal of social learning is nothing more than to become better at social learning. This is what confers the flexibility to adapt quickly when strange and unforeseen problems emerge to threaten group (national) survival. Maintaining options and increasing richness of choice are fundamental to successful goal-seeking. The history of evolution suggests that a wise society is one prepared to sacrifice a good deal of visible efficiency for future flexibility. Adaptation is good; adaptability is better.

So, recapitulating, social learning is the foremost process by which modern Australians have adapted to their environment. It is a process which has both similarities to and differences from phylogenesis or biological evolution.

The remainder of the paper is a comment on Australian society's past efforts at social learning and on its future social learning task during the next two hundred or two thousand or even two million years.

LOOKING BACKWARDS - 200 YEARS OF ADAPTATION THROUGH SOCIAL LEARNING

It is helpful to start by putting the Australian environment into a global context. Apart from size (the sixth largest country in the world) and location (isolated in the southern oceans), Australia's outstanding natural attributes are a dry climate and a geologically ancient land surface. Taken together, these factors have produced a resources complement which, by global standards, is noteworthy in at least the following ways:¹⁹

- a climate characterised by low variable rainfall, strong climatic gradients between coast and inland, droughts and floods
- generally unproductive soils---infertile, shallow, stony and salt-prone. Over much of the country, tightly coupled natural ecosystems evolved which ensured little loss of the limited available nutrients (Flannery pers. comm.).
- limited occurrences of perennial surface water and snowfields
- a long varying coastline abutting a biologically diverse but commercially unproductive continental shelf
- a featureless landscape with little mountainous terrain
- a rich and unique complement of native plants and animals
- limited areas of (a) natural grassland and (b) relatively unproductive forests.

¹⁹ Cocks, K.D., (1992) *Use With Care: Managing Australia's Natural Resources in the 21st Century*, University of New South Wales Press, Sydney, 340 pp.

Some of the land use implications of this situation have been:

- intensive settlement has only been possible over a modest fraction of the country²⁰
- large-scale forestry activities have not been possible
- intensive agriculture has only been possible in the wetter fringes of the country
- the coastline and inland waters have become the foci for recreation activities
- ground transport systems have been slow to develop over the country's long distances and have been of poor quality
- production of minerals for export has been and continues to be an important economic activity
- methods of adapting European agricultural systems to the Australian environment have had to be developed *de novo*

Some spectacular historical misjudgements

Because European settlers had to learn to understand the Australian environment from scratch, it is inevitable that they should have made misjudgements about the consequences of various land management practices. Among the more spectacular of these have been misjudgements about:

- long-term livestock-carrying capacity and crop yields in inland areas²¹
- the impact of introducing feral animals (particularly rabbits and foxes) on pasture and range productivity and on native mammals²²
- the effects of introducing exotic plants destined to become weeds. One thing that has been learned is that exotic plants can remain in situ for decades and then explode across the landscape. *Mimosa pigra* slumbered in the Darwin botanic gardens for more than eighty years before running wild²³
- the unforeseen consequences of excessive clearing of timber, eg salinisation, erosion, woody regrowth, species extinction. It has been learned that an abundant species can disappear with startling rapidity; localised species occurring over only limited areas are in particular danger, as are species occupying specialised habitats²⁴

²⁰ Holmes, J.H., (1985) Policy Issues Concerning Rural Settlement In Australia's Pastoral Zone, *Australian Geographical Studies*, **23**, 3-27.

²¹ For example, Campbell, K.O., (1966), Problems of Adaptation of Pastoral Businesses in the Arid Zone, *Aust. J. of Agric. Econ.*, **10**, 14-26.

²² For example, Rolls, E.C., (1969), *They All Ran Wild: The Story of Pests on the Land in Australia*, Angus and Robertson, Sydney; Ratcliffe, F.N., (1947), *Flying Fox and Drifting Sand*, Angus and Robertson, Sydney.

²³ Braithwaite, R.W., Lonsdale, W.M., and Estbergs, J.A., (1989) Alien Vegetation and Native Biota in Tropical Australia: The Impact of *Mimosa pigra*, *Biological Conservation*, **48**, 189-210.

²⁴ Woinarski, J.C.Z., and Braithwaite, R.W., (1990) Conservation Foci for Australian Birds and Mammals, *Search*, **21(2)**, 65-8.

- the effects of uncontrolled irrigation, eg salinisation of soil and water as rising water tables carry the salt of ancient marine sediments upwards²⁵
- the susceptibility of bare soil to water and wind erosion
- the risks and consequences of floods and fires²⁶.

Such technical misjudgements have been an important factor in explaining Australia's changing land use patterns since white settlement. While many individuals have paid dearly for their own misjudgements, the social costs of individual mistakes have dwarfed the private costs in many cases. Salinisation in the Murray Darling Basin, the source of a third of the country's agricultural production,²⁷ is a national disaster as well as a disaster for farmers forced off their land.

PASSING JUDGEMENT

So, how well have post-1788 Australians adapted to their environment? How well are they using their island continent today?

Within the perceptions of times past, they have made reasonably good use of the opportunities presented by Nature:

- The population is sensibly concentrated in pleasant, medium-sized, relatively unpolluted cities in the subtropical to cool-temperate regions²⁸
- After a late start, the continent's great mineral wealth is being efficiently exploited²⁹.
- Maximum use has been made of limited timber resources, running down native hardwood supplies, but building up high-yielding softwood plantations³⁰
- Australian farmers have achieved major status as suppliers to the world of wool, meat and wheat, developing numerous innovative technologies along the way³¹.
- At least in the south, the little available surface water has been comprehensively harnessed³²

²⁵ Peck, A.J., Thomas, J.F., and Williamson, D.R., (1983) *Salinity issues: Effects of Man on Salinity in Australia*, Water 2000 Consultants Report No.8, Department of Resources and Energy, Australian Government Publishing Service, Canberra.

²⁶ Luke, R.H., and McArthur, A.G., (1978) *Bushfires in Australia*, Australian Government Publishing Service, Canberra.

²⁷ Cocks, K.D., (1992) *ibid*.

²⁸ Commonwealth of Australia, (1992) *Patterns of Urban Settlement: Consolidating the Future?* Report of the House of Representatives Standing Committee for Long Term Strategies, Australian Government Publishing Service, Canberra.

²⁹ Duncan, C., (1987) Mineral Resources and Mining Industries, Ch 13 in Jeans, D.N., (ed) *Australia - A Geography, Vol.Two: Space and Society*, Sydney University Press, Sydney.

³⁰ Resource Assessment Commission, (1992) *Forest and Timber Inquiry: Final report*, 2 vols., Australian Government Publishing Service, Canberra.

³¹ Donald, A., (1988) *Australian Agriculture: Sunrise Industry*, CSIRO Occasional paper No.2, Canberra.

³² Day, D.G., (1988) Water allocation in eastern Australia, in Heathcote, R.L., and Mabbutt, J.A., (eds), *Land, Water and People: Geographical Essays in Australian Resource Management*, Allen and Unwin, Sydney.

- Major natural features such as the Barrier Reef and the rainforests have been protected from single-valued exploitation. The national parks system is extremely well developed by world standards
- In conventional terms, Australians have used their resources to build a prosperous and pleasant society.

The Australian social learning experience has also led to some particularly successful social technologies. A social technology or social invention is a procedural theory or recipe for amplifying the effectiveness of a class of interactions or transactions between people.³³ Examples in the field of natural resource management include:

- the Torrens land-title system, named after its developer, eliminates conflict over land ownership because the State guarantees the information in the titles register book.
- the Victorian Land Conservation Council is a government body that for many years allocated that State's public lands amongst interest groups with relatively little conflict.³⁴ Its success rested on wide consultation and open decision making.
- the Great Barrier Reef Marine Park Authority has balanced Commonwealth, State and local interests to successfully manage this 300 000 sq km World Heritage area³⁵
- the national park system³⁶
- rural adjustment schemes for helping debt-ridden farmers leave agriculture
- Aboriginal land rights have given indigenous Australians some (belated) recognition of their unextinguished claims to the continent³⁷

Obversely, even the optimists admit, Australians have not learned how to use productively and sustainably the wet-dry tropics, the drier, droughtier rangelands or the nutrient-poor continental shelf. Their temperate and subtropical crop-pasture systems are massively threatened by soil erosion, salinisation and acidification. Sectors of the country's small fishing industry face closure following overfishing and much of the seventy per cent of Australia classified as rangelands supports ever-declining stock numbers.

Notwithstanding, it is an `idea in good currency'³⁸ that if these changes are taken as warnings which are then heeded and as opportunities to be grasped, such difficulties will be overcome. Such optimism has its place. It is important nationally, just as it is personally, to have a positive view of oneself and one's achievements. But remember Easter Island.³⁹

LOOKING FORWARDS - THE NEXT TWO HUNDRED YEARS

³³ Cocks, K.D., (1992) *ibid.*

³⁴ Land Conservation Council, Victoria, (1988) *Statewide Assessment of Public Land Use*, Land Conservation Council, Melbourne.

³⁵ Kelleher, G.G., and Kenchington, R.A., (1982) Australia's Great Barrier Reef Marine Park: Making Development Compatible with Conservation, *Ambio*, **11** (5), 262-7.

³⁶ Australian National Parks and Wildlife Service, (1988) *Nature Conservation Reserves in Australia*, Occasional paper No. 19, Australian National Parks and Wildlife Service, Canberra.

³⁷ Reynolds, H., (1987) *The Law of the Land*, Penguin, Melbourne.

³⁸ Schon, D.A., (1971) *Beyond the Stable State*, Temple Smith, London.

³⁹ Heyerdahl, T., (1989) *Easter Island: The Mystery Solved*, Souvenir Press, London.

Adaptation challenges

Given the recently reduced threat of nuclear war and nuclear winter, the outstanding social learning challenge Australia faces is how to adapt to a world with ten billion people in it. Or is conventional wisdom wrong? Will increasing interaction between humans and animals such as rodents, as the world fills with people, assist more diseases like AIDS to cross the inter-species barrier (Frank Fenner, personal communication) and send world population into decline?

Like world population growth, many of the challenges to Australia's capacity for social learning will come from outside, from the external environment.

Will the greenhouse effect turn out to be more disruptive than anything so far imagined?

Will there be pressures on Australia to accept perhaps millions of refugees?

In an age when manufactures and information are the goods and services in demand, will the world want to buy Australia's food and mineral exports at profitable prices?

Will energy costs soar again as they did in the seventies?

Will Australia continue to unthinkingly import political, social and economic ideas from other cultures in the hope that they will transplant successfully?

To what extent will multinational companies be able to dictate the use of the country's rich mineral and energy resources?

Internal matters for concern

Certainly the external environment is going to provide Australia with numerous adaptation challenges but what of the internal environment? What are some of the features of the Australian bio-physical and socio-economic environment which demand adaptation? which offer opportunities?

One general point to make is that much more is being asked of the environment than in 1788. The population has expanded to perhaps fifty times what it was then. Because of that and an affluent energy-intensive lifestyle, demands on the natural resource base have been expanded by a factor of perhaps 1500 in 200 years.

This has led to a range of social learning challenges. From a resource management perspective, the need is to learn how to better cope with two categories of issues.⁴⁰

The first category is issues concerning the location and management of such major land uses as urbanisation, agriculture, mining, recreation, forestry, parks and physical infrastructure.

The second category is issues concerning the management and use to be made of critical regions and resources such as coastal lands, arid lands, alpine areas, water catchments, forests, minerals and soils.

⁴⁰ Cocks K.D., McConnell G. and Walker, P.A. (1980). *Matters for Concern - Tomorrow's Land Use Issues*, Divisional Report 80/1, CSIRO Division of Land Use Research, Canberra.

Under the heading of land use issues, the main metropolitan fringe areas (within a half-day's drive, say) will particularly continue to be the setting for conflict, competition and controversy in coming decades. Rising demands for accessible sites for diverse uses such as agriculture, active recreation, base minerals extraction, water catchments, hobby farms and landscape appreciation will be bumping against a fixed supply of land in the metropolitan environs.

Dipping into the second category of issues, resource management issues, concern is most commonly expressed for the future of strongly demanded resources in relatively short supply. Coasts and native forests are good examples.

Australia is a relatively unforested continent and clearing for grazing, mining and settlement and clearfelling (woodchipping) are seen as contentious activities, as is reforestation with exotic species. The heart of the forests issue lies in the reconciliation of increasing demands for access to the forest resource - demands for recreation, national parks, water supply, timber etc.⁴¹

Australia has 30 000 km of coastline, still predominantly uninhabited. Residential and recreation demands are high along much of the continent's south east rim but spotty elsewhere. The adaptation challenge in the coastal zone centres on the impact of these demands on a resource which is essentially fragile in its scenery, landforms, waterbodies and vegetation.⁴²

Finally, straddling both the land-use and the key-resource categories, there are issues concerned with maintenance of environmental quality. Attention here is focussed on indicators of the 'health status' of water, air, biodiversity and earth materials resources. Perhaps landscapes could be added to that list. State of environment reporting is just beginning in Australia.⁴³ Processes and practices commonly noted as issues here include erosion, desertification, waste disposal methods, air and water pollution, grazing in the arid zone, irrigation methods, crop rotations, recreation in off-road vehicles and open-cast or strip mining.

The fact is that in what is a very large country there is an increasing scarcity of land for most forms of land use and the causes and effects of this scarcity are at the heart of Australia's resource management problems.

As one expression of Australia's growing national wealth, there have been increasing marketplace demands for land for both established uses and new uses such as hobby farming. Simultaneously, there have been increasing political or non-market demands for land to be made available for consumptive uses such as recreation and conservation.

This confluence of increasing demand and decreasing supply has intensified marketplace competition for private land and political conflict over the use of public land.⁴⁴

⁴¹ Resource Assessment Commission (1992). *Forest and Timber Inquiry: Final Report*, 2 vols., Australian Government Publishing Service, Canberra.

⁴² Crawford, D., (1992) 'The Injured Coastline'- A Parliamentary Report on Coastal Protection in Australia, *Coastal Management*, **20**, 189-98.

⁴³ Commonwealth Environment Protection Agency (1992) *Development of a National State of the Environment Reporting System*, Discussion paper, Commonwealth Environment Protection Agency, Canberra.

⁴⁴ Cocks, K.D., 1992) *ibid*

Improving the capacity for social learning

How does a country learn to cope better with these hosts of issues and problems? One difficulty is that because social, technological, and now natural environments are changing so rapidly, behaviour based on successful past experiences is likely to be irrelevant or even misleading. Basing farming decisions on past rainfall records may already be an example.

So can Australia, as a society, learn better how to learn? This is too big a question to fully explore here but some core tasks can be noted.

One is to learn how to purposively generate ideas for new social technologies which better address major resource-management problems and exploit opportunities.⁴⁵ Better procedures for project impact assessment and land use planning are particularly needed.

Another task is to develop a non-confrontationist political framework within which alternative approaches to particular problems can be seriously debated, tried and compared.⁴⁶

A third task is to establish national goals for resource use and the environment; and be prepared to change these as necessary. Appendix 1 lists some suggestions here.

A fourth task is to establish a monitoring and evaluation system which checks progress against goals and restarts the learning system over again when progress is unsatisfactory. Goal convergence is the test for successful adaptive behaviour.⁴⁷ Formal program evaluation of the type beginning to be practised by Australian governments is an attempt to do this,⁴⁸ e.g. are agricultural extension services successful?

These tasks ask nothing more than thoughtful trial and error characterised by a willingness to acknowledge failure. In Australia, there is a reluctance to recognise that all changes in social organisation are essentially experimental. Unfortunately, the confrontationist political system does not allow, say, a government minister to describe a new resource management program as experimental and standing to be wound down if it does not meet certain objectives. The pervasive pretence is that competent policy makers will always get it right first time.

CONCLUSION

Historically, adapting to the Australian environment has been a task of learning to understand the natural resource base well enough to exploit it. The stage has now been reached where social learning must be directed towards maintaining that resource base and environmental quality but, even more importantly, a special effort has to be made to understand and master the social learning process itself. Adaptability is better than adaptation!

⁴⁵ Platt, J., (1966) *The Step to Man*, Wiley, New York.

⁴⁶ Mercer, D., (1991) *A Question of Balance*, The Federation Press, Sydney.

⁴⁷ Dunn, E.S., (1971) *Economic and Social Development: A Process of Social Learning*, Johns Hopkins Press for Resources for the Future, Baltimore.

⁴⁸ Noon, A., (1992) Accounting for Results: Portfolio Explanatory Notes Become Program Performance Statements, *Aust. J. Pub. Admin.* **51** (1), 27-34.

In particular, there is a need to acknowledge the powerful and extremely useful idea of social technologies, procedural theories for addressing social needs and problems and for converging on explicit social goals. Society must actively teach itself to design social technologies as efficiently as it now develops material technologies. Flowering social technologies are the hallmark of a learning society.

APPENDIX: SUGGESTED NATIONAL RESOURCE MANAGEMENT GOALS

The following 15 goals⁴⁹ identify aspects of resource management in Australia where a variety of people feel that important options are under threat or where choices could be significantly and effectively expanded.

Five conservation goals

1. maintenance of the productive capability of the nation's soil resources
2. maintenance of the supply and quality of the nation's air and water resources
3. maintenance of the diversity and distribution of the nation's plant and animal resources
4. preservation of historic and prehistoric sites of national cultural significance
5. creation of a high quality system of national parks and other conservation reserves

Three primary production goals

6. continued availability of the nation's prime mineral, forestry, farmland and fishing resources for primary production
7. implementation of socially beneficial natural resource development projects
8. maintenance of the socio-economic and physical infrastructure necessary to ensure the continuation of industries based on natural resources

Seven community-management goals

9. creation of a high quality national transport and communications system
10. creation of a high quality national system for supplying water and energy
11. provision of high quality physical infrastructure for community services in the nation's urban settlements
12. protection of life and property from the impact of natural hazards and hazards associated with the use of natural resources
13. creation of a high quality system of public recreation lands
14. satisfaction of legitimate demands for land for Aboriginal occupation
15. adequate investigation and evaluation of available policy and program options whenever there is significant controversy over the use of land and natural resources.

⁴⁹ Cocks, K.D., (1992), *ibid.*

POSTSCRIPT 2012

Rereading this paper brings home to me that it is the idea of *adaptation* which is the key to thinking ecologically and evolutionarily about human history. Adaptations are cultural and genetic innovations which persist because they are judged to enhance the group's survival prospects. The paper focuses on the historical and future development of social and material technologies for managing and using the bio-physical environment--- landscapes, plants, animals and climates. What the paper doesn't address, thinking more comprehensively about Australia as an evolving ecosystem, is the co-adaptation of different groups (e.g. Aboriginals-Europeans, Protestants-Catholics) to each other; nor the adaptation of the biota to the disturbances imposed by the settlers.

THOUGHTS ON BEING ASKED TO TALK ABOUT 'AN OVERUSED CONTINENT'⁵⁰

SUMMARY

Earlier generations of Australians imposed massive change on the natural resources of the continent. This includes the Aborigines who practised firestick farming over vast areas and who probably hunted the megafauna to extinction. Much of the change has been the result of settlers' misjudgments as to the nature of the resource base and ignorance of the consequences of their actions.

Some actions like the release of rabbits and foxes would almost certainly never have been made if the consequences could have been foreseen. Other actions, like stocking the rangelands heavily and cropping erodible soils may have gone on irrespective of any awareness of the consequences. Each generation, consciously or unconsciously, chooses the degree to which it sacrifices natural resources for development and commodity production. It is important that the present generation learn from the past but there is little point in dwelling on it.

The present generation continues to exchange natural resources for development and resource-based production in much of Australia, although at a much reduced rate. The focus of community attention on this exchange is shifting from farmlands to forests and the coastal zone and from land degradation issues to pollution issues, particularly water pollution.

The general resource depletion issue which is dividing the community is whether or not we have the right mix of (a) economic benefits flowing from natural resource use and (b) the environmental disbenefits of losing service and amenity functions of natural resources.

The umbrella task in managing Australia's natural resources is to decide how far and fast to travel down this one-way street while developing strategies and technologies which will allow us to improve the trade-off rate between amenity/service costs and economic benefits.

To get this balance right in coming decades we need a range of well-developed strategies, policies, and social technologies. These include:

- national population and settlement strategies
- price-signalling instruments which ensure that those who deplete the community's natural resources pay the full cost. These include regulations, resource use rights, royalties set by tender and resource rent taxes.
- social technologies which allow the economic benefits and environmental costs of local and regional activities to be considered fully. These crucially include land use planning, project impact assessment and state of environment reporting.

INTRODUCTION

⁵⁰ Talk to Australians for an Ecologically Sustainable Population ,October 1992.

When I was asked a week ago to stand in as a speaker on the theme of an overexploited continent I decided that I did not want to deliver yet another 'exposé,' of how Australians have overused their country. I would rather talk about the short and long term benefits and disbenefits of what we are doing with our natural resources today, or about how we could be planning to manage our natural resources in the future.

Catalogues of environmental disasters only breed anger or depression and eventually overwhelm our capacity to act. Certainly we need enough history to know what to avoid but the question of where we go from here is more important than where we have come from. For example, the livestock carrying capacity of our rangelands has declined markedly this century, mainly due to overstocking. The question which matters now is whether we can profitably stabilise production from the rangelands at reduced levels and whether we can prevent further extinctions of pastoral zone mammals and birds. We have learned the lesson from history that an abundant species can disappear with startling rapidity. Localised species occurring over only limited areas are in particular danger, as are species occupying specialised habitats.

Another example of learning. We have learned that exotic plants can sit around doing nothing for decades and then explode across the landscape. *Mimosa pigra* slumbered in the Darwin botanic gardens for more than eighty years before running wild. And so on.

SOME SPECTACULAR HISTORICAL MISJUDGMENTS

Because European settlers had to learn to understand the Australian environment from scratch, it is inevitable that they should have made misjudgements about the consequences of various land management practices. Four of the more spectacular of these have been what I will call 'high regret' misjudgements about

- long-term livestock-carrying capacity and crop yields in inland areas
- the impact of introducing feral animals (particularly rabbits and foxes) on pasture and range productivity
- the effects of introducing exotic plants destined to become weeds of agricultural and natural systems, e.g. prickly pear
- the risks and consequences of floods and fires.

I call these 'high regret' misjudgments to make the point that, with foresight, earlier generations would have almost certainly acted differently with respect to these matters.

These can be compared with what we might term 'don't know' misjudgments such as:

- the unforeseen consequences of excessive clearing of timber, e.g. salinisation, erosion, woody regrowth
- the effects of uncontrolled irrigation, e.g. salinisation of soil and water
- the susceptibility of bare soil to water and wind erosion
- the effects of agricultural and pastoral development on biodiversity

I call these 'don't know' misjudgments because even with foresight as to what their actions were setting in train, earlier generations of Australians may still have decided, either as individuals or as a society, to accept the resource degradation, the loss of natural capital accompanying their activities in return for the cash in hand and the chance to exchange natural capital for built capital. We just don't know.

The reason why I suspect that things would not be greatly different even if our ancestors had been clairvoyant is that we continue to do the same sorts of things today even

- when we can see the effects of past practices;
- when the natural capital which is being degraded is in much greater demand/shorter supply than one or two generations ago.
- when we know much more about cause- effect links than our grandparents.

While I might wish that our grandparents had acted differently, they were nonetheless doing what every community does and that is to make trade-off choices between resource conservation values and resource development values.

It may be correct to be trenchantly pro- or anti-development for political reasons but not when we are trying to think about our options rationally, if I can invoke a much-abused word. Development, meaning here urbanisation and the expansion of output from the resource-based industries, is a one-way street. We can never travel down it without losing something in the way of irreplaceable amenity resources and without permanently decreasing the range of future possibilities for using what's left. There seems to be a widespread unwillingness to accept this blindingly obvious fact. This does not mean we should never travel the development path.

I will put it in parable form. If loss of conservation values is the 'fuel' which propels the primary industries 'engine', we have to (a) decide how much fuel to put in the tank and (b) see if we can improve fuel consumption.

Developed resources cannot be undeveloped and a conservative or precautionary approach to resource management is therefore appealing. Conservatism in resource management is the philosophy that one needs to think very carefully (and this takes time) about the gains and the losses before embarking on irreversible development, especially of relatively undisturbed areas.

THE PRESENT

Let me turn more explicitly to the present.

Population growth, a central concern of the present audience, is only one in a long list of societal processes/activities customarily seen as contributing to loss of environmental quality. Others on the list are population re-distribution, increasing consumption of material goods, waste and residue disposal practices, intensification and extensification of primary and secondary industries, urban expansion, income redistribution, resource allocation procedures, etc. etc.

Collectively, these processes, even as they generate benefits for some, (a) consume, (b) ration, (c) degrade and (d) pollute natural resources, normally meaning water, air, biodiversity and earth materials resources. This is what I mean by loss of environmental quality.

More concretely, concern over the impacts of human activity (not just population growth) on water, air, biodiversity and earth materials resources takes three main forms:

(a) decline in the availability and functionality (productivity) of natural resources valued for primary or resource-based industries. These are tourism, mining, farming, forestry and fishing and the natural resources they depend on (industrial natural resources) include, for example, soils, water supplies, landscapes, forests, rangeland and fish stocks.

The concern here is essentially economic - for the viability or sustainability of primary industries which are depleting their natural capital.

(b) decline in the availability and functionality of natural resources valued for their direct contribution to people's physical and spiritual health - amenity resources. Lists of amenity resources include air for breathing, water for drinking, biodiversity for marvelling at and landscapes for playing in.

Let me take one example in the area of biodiversity. Today, threats to wildlife are indirect rather than direct. It is not like 1924 when we exported 2 m koala skins. The basic threat now is destruction of habitat. We know that the geographic range of many species is decreasing as their habitats are developed or destroyed. It is true that the massive land clearing for agriculture of the 1950s and 1960s is over. Nevertheless,

- small-scale clearing of patches of native vegetation continues at a reduced rate in temperate Australia
- woodchipping threatens large areas of forest habitat in New South Wales and Tasmania
- there may yet be a sizeable expansion of cropping in central Queensland
- there are some significant areas which might still be opened up to pastoralism, notably in Western Australia
- chemical thinning of very large areas of Poplar Box woodlands in Queensland and northern New South Wales remains a possibility
- droughts will continue
- predators are still spreading
- most importantly, species conservation efforts are insufficient to significantly throw the odds back in favour of threatened plants and animals.

(c) decline in the availability and functionality of natural resources valued for their capacity to provide environmental services, that is, to improve the functioning of natural resources with productive and/or amenity values. Most environmental services can be viewed as recycling of some sort. Lists of service resources include vegetation for maintaining atmospheric oxygen levels, wetlands for removing pollutants from water supplies, ecosystems for recycling nutrients through the food chain.

The phrase 'decline in the availability and functionality of natural resources' is an accurate but cumbersome description for the type of environmental quality loss of interest here. Shorthand alternatives are 'environmental impacts', 'environmental costs' and 'natural resource depletion'.

While most of the processes which historically reduced environmental quality remain with us today in some form, two particularly fast-growing inter-related threats need to be clearly flagged. One is water pollution and the other is coastal development.

The Australian coastal zone provides sites for a wider range of uses and functions than any other part of the continent. These include residential and commercial use, recreational use, commercial fishing, ports (about 120 in all) and sea transport, waste disposal, tourism, conservation of natural environments and industrial uses such as cooling, salt production, pulp production, mining and agriculture. Not only do Australians want to live (and hence work) near the coast, it is a major focus for outdoor recreation and local and international tourism.

For some decades now, about a quarter of the Australian population has chosen to live within three km of the coast (McDonald et al., in press). If this proportion holds as total population grows towards a projected level of 27 million by 2051, there plausibly could be another three million people living in the coastal fringe by then. McDonald et al. (in press) conclude that three urban regions (based on Sydney, Brisbane and Perth) will not be able to accommodate their projected coastal fringe populations without resorting to some combination of (a) high population density (b) building on depositional terrain which has considerable service value (c) urbanising currently unpopulated open space and rare vegetation associations, both of which have high amenity value.

The impacts on environmental quality of future population growth will be concentrated in coastal areas, particularly the twenty per cent of coastal Australia which is urbanised or urbanising.

Water pollution and waste disposal are already widespread, although generally localised, issues in coastal zone management. Examples include runoff of agricultural chemicals, pulp mill effluents, sediment loads, offshore sewage disposal, heavy metal pollution, eutrophication from urban runoff and fertiliser leachates, oil spills, depletion of seagrass fish nursery areas, overdevelopment of biologically important estuaries and coastal waterbodies (Cocks 1992). Unless much greater efforts are made to manage such problems, they can only get worse as population growth leads to the growth of coastal cities.

THE FUTURE

My own ideas for developing, conserving and managing Australia's natural resources in the 21st century have been built up around a suite of 15 goals identified as needing to be achieved on the way to ensuring that those resources satisfy the most important of our material, spiritual and emotional needs as far as possible; in short, to ensure that Australia remains a good place in which to live. They include conservation goals (soil, air, water, plants, animals, cultural sites), primary production goals (farming, forestry, fishing and mining), other land use goals (settlements, Aboriginal lands, parks, tourist areas) and community management goals (social and physical infrastructure).

Making and implementing resource management strategies to achieve these goals is constrained by the extent and type of knowledge we have of our natural resources and of techniques by which these might be used and conserved; by the dominant values of the Australian socio-political system; and by the sheer technical difficulties and uncertainties of efficiently and effectively identifying and evaluating candidate strategies.

Discussion of how to proceed in the face of these constraints particularly highlights the challenges of developing social technologies for trading off competing interest group demands (what is equity?), making multi-valued choices (how many apples equal one orange?) and accumulating sufficient actionable knowledge (what if..?) to develop creative options.

To get the balance between resource-based economic activity and natural resource depletion right in coming decades we will need a range of well-developed strategies, policies, and social technologies. These include:

(i) national population and settlement strategies. There is a strong prima facie case for the negative impact of population growth on environmental quality but it still has to be convincingly demonstrated and disentangled from factors such as affluence and others mentioned earlier.

(ii) price-signalling instruments which ensure that those who pollute, degrade, and destroy the community's natural resources pay the community full compensation. These include regulations where appropriate, resource use rights, royalties set by tender and resource rent taxes.

(iii) social technologies which allow the economic benefits and environmental costs of local and regional activities to be considered fully. These crucially include land use planning, project impact assessment and state of environment monitoring.

The last of these is very new to Australia and aims to develop indicators of the functionality and availability of water, air, biodiversity and earth materials resources.

Land use planning and project impact assessment have been around for many years, but still lack teeth and suffer strong opposition from business interests.

CONCLUSION

The availability and functionality of Australia's natural capital (water, air, biodiversity and earth materials resources) has been declining for a very long time and will continue to decline. Whether the increases in consumption and in built capital made possible by this loss justify it remains a matter of personal values, probably with no blanket answer.

Looking to the future however, we need to question just how much consumption and built capital we want and how we can minimise the cost, in environmental terms, of getting what we want. Alternatively, we need to ask what natural resources we want to retain and how we can maximise economic benefits subject to that constraint.

POSTSCRIPT 2012

Yet another warning to think very carefully before irreversibly reducing the range of ways in which the benefits of natural-resource ownership can be enjoyed

PROSPECTS FOR ENVIRONMENTAL QUALITY: AN EDITORIAL⁵¹

I can remember clearly the interest and enthusiasm with which scientists in Division of Land Use Research greeted the first issue of *Ecos* in 1975. At that time we were well into the process of expanding our research interests beyond agricultural production and northern development. Environmental issues like urban climates, land degradation, water as a resource and balanced land use were beginning to attract our attention.

Around that time Mike Austin and I were leading a large regional land use study called the South Coast Project (over 30 scientists were involved including some from the newly established Centre for Resource and Environmental studies at ANU) and we were delighted when *Ecos* devoted a complete issue to that study's findings.

That is all a long time ago now and, while not neglecting to congratulate *Ecos* on 25 years of sterling service to the environment, I prefer to look forward rather than backward in this editorial opportunity. The environment has come and gone as an issue in recent years. While it is an issue that regularly scores well in polls to identify public perceptions of matters for concern it is not high on any political agendas. This is evidenced by the fact that both main parties fought the last federal election with barely a mention of the environment during campaigning. Another example of this loss of profile was the *Australia Unlimited* conference organised by *The Australian* newspaper in May this year. It was a showcase for elite opinion on how we should manage our future as a society and economy. It revealed general support for a strategy of trying to clamber aboard the globalisation train before it accelerated but managed to avoid mentioning the environment except in passing.

This indifference in the corridors of power may reflect a view abroad that we can safely turn our attention from the environment to other pressing problems because governments have implemented a number of environmental programs addressing issues ranging from biodiversity and landcare to air and water quality. But that is not the picture that emerged at a series of expert workshops on *Environmental Futures* run by the Division of Wildlife and Ecology in late 1995. One general conclusion from the soil experts present there is that prospects for soil and landscape quality are grim, not only in the agricultural and inland areas but in coastal and urban areas as well. Prospects for future air quality are not so uniformly grim. Improvements in inland and farming areas are foreseeable---but not in coastal and urban areas. The experts' best-case scenario for water quality is that quality might hold up in urban and inland areas but not in farming, coastal and marine areas. As for biodiversity, it is difficult, the experts say, to see anything other than further decline in and around the big cities and in the coastal/marine zone. Biological controls for weeds and feral animals and the cessation of clearing offer some hope of improving biodiversity in the farming and inland areas. But if these improvement do not eventuate the outlook remains bleak.

⁵¹ Guest editorial for the 100th edition of CSIRO's environmental magazine *Ecos*.

These gloomy prognoses for coming decades by people who study environmental issues professionally assume that Australian society continues to muddle along in 'business as usual' mode. One implication of that assumption is that if the value placed by society on protecting natural capital were higher, the resources to improve environmental quality would be found. But that is doubtful for two reasons. One is that we just do not really know with any confidence what to do about many environmental problems---dryland salinity and various weeds are good examples. The other is that the resources required to tackle major environmental problems with any hope of success are vast relative to the size of government budgets. That is why the wide range of government-backed environmental programs can give a misleading impression. Most are just very, very small relative to the size of the problems they address.

While there are many specific reasons for the long-term degradation of natural capital, there is also one quite general reason and that is the ever-increasing use of energy. Historically, energy throughput has been strongly correlated with both economic growth and environmental impact. Putting this another way, environmental impact is the collateral damage accompanying our drive for economic growth. As we move to a services economy and away from a goods economy the impact of economic growth on the environment may stabilise because energy consumption is stabilising, but this is far from certain. Similarly, the environmental impact of energy use will probably decline as we make the inescapable imminent transition from fossil energy to alternative energy. Looking to be proactive, the most basic principle to be followed if we want to reduce the rate of loss of Australia's natural capital is to reduce the quantities of energy and virgin raw materials that we use. If and how this principle will get to be implemented, I do not know. I am pessimistic about it happening as a result of deliberate political choice.

Meanwhile, monitoring environmental quality remains fundamentally important. Humans are both adaptable and forgetful. The boiling frog would have done better if she'd had a pocket thermometer. Beyond that the kids are our best hope. We have to show them the difference between high quality and low quality environments because what humans have never known they never miss, not enough to fight for anyway. If we can do that, they will do the rest.

For the rest of us, the basic strategy for defending environmental quality has to be for each community to work at taking control of local land and resource use and management. We have to use every trick in the book to force the development of participatory institutions in which people have a powerful say in all decisions which affect their lives. Good luck folks!

POSTSCRIPT 2012

Apart from a dip in global energy use during the 2008 global financial crisis, humans are still increasing the rate at which they use energy, particularly fossil energy. Broadly speaking, the benefits here are increased production of goods and services and the disbenefits come in the form of reduced environmental quality including degradation, destruction and pollution of the resource base. As conventional energy resources are depleted, there will be fewer goods and more environmental impact . produced from each additional unit of (total) energy throughput.

THE LOADED RABBIT⁵²

We had been blowing tree stumps all day so it was only natural that the evening's bull-session should get around to the dangers of using explosives; their percussion and repercussions so to speak.

Now I haven't knocked about like Ern and Laurie have and I was feeling a bit out of it when I remembered that I had brought a copy of Henry Lawson's short stories with me---read them in their true setting and all that sort of thing I thought. They were a bit dubious when I said I was going to read 'The Loaded Dog' but they played along. I put a couple more pieces of pencil pine on the fire to get a good blaze for reading and gave it to them.

'Bloody good,' was Laurie's verdict when I'd finished, 'Bloody good'.

Ern dragged on his cigarette and said reflectively, "'The Loaded Dog' eh---I reckon I know a story about a 'loaded rabbit.'" .

Just after the war I was a Lands Department inspector at a place called Weealarnah in Gippsland. Myxo hadn't started and the rabbits were pretty bad. There was an old bloke called Frank Morley living a few miles out and I was always on his back to clean up his rabbits. One day I went out there and bugger me if there wasn't a rabbit on the place.

I asked who'd duffed them and all he'd say was that he'd used Morley's Method. When I hinted that the Government would probably pay good money for a clue like that he unbuttoned. It seems that he'd caught a few live bunnies one day using ferrets. He grabbed one and tied a stick of gelignite between its legs, trimmed the wick to four seconds and let the bastard go, right on top of its warren. One cat and dog. Two cat and dog. Three cat and dog. Four cat and dog. Whoomph! I reckon that rabbit took two seconds to get to the centre of the warren, two seconds to repent and that was that. No warren. No rabbits. Much easier than digging them out.

I was pretty taken with Morley's method and decided to arrange a field day to show the local cockies how it worked.

Jim Smee said we could use his place for the demonstration so I brought along a bag of rabbits and Frank Morley brought the gelignite. Fifty odd cockies turned up and we put them behind ropes about four chain from a nice big warren. Frank let his dog Arthur sniff round the bag to get the rabbits frightened before we let them go. Arthur was the pride of Frank's life, a big leggy bastard, least half greyhound I'd say, which, as it happened, turned out to be a good thing.

I pulled out a big buck rabbit like a bloody magician and Frank tied the gelignite on. While I held the rabbit at the mouth of the warren Frank lit the fuse. Now I've heard since that rabbits have a pretty close family circle and don't like going into other rabbits' warrens and I reckon this is probably true 'cos that rabbit twitched his nose, dived between Frank's legs and lit out for the crowd. Arthur yelped and belted after the rabbit. The cockies bolted in all directions and I heard Frank saying 'Two cat and dog.' Forty yards from the ropes the rabbit was still leading. Arthur jumped. Whoomph. No rabbit. No Arthur.

⁵² A "resource management" story from earlier, simpler times.

They didn't kick the shit out of Frank and they didn't put up a statue of Arthur, but, from then on, whenever anybody buggered anything up he was asked if he'd used Morley's method and whenever anybody did anything dicey, they were told they'd end up like Arthur. All goes to show you've got to watch your step when you play round with explosives.

THE CASE FOR STABILISING AUSTRALIA'S POPULATION⁵³

BACKGROUND

This article draws on my book *People policy: Australia's population choices* published in February 1996 by University of New South Wales Press. The book grew out of my disappointment that the 1994 inquiry by Barry Jones' House of Representatives Long Term Strategies Committee into Australia's 'population carrying capacity' (to which I was seconded for six months) did not make stronger recommendations than it did.

While the Committee said unequivocally enough that Australia needed a population policy (which is what a variety of commentators and inquiries have been saying for two generations), it gave no guidance as to what it thought that policy should be or even what the attributes of a good policy might be. It called for the community to debate the pros and cons of having a small, medium or large population---the very topic on which many people had hoped the Committee would give some guidance.

Also, because I think population size is a paramount issue, I have been frustrated at the lack of comprehensive community debate on Australia's population choices. There just is no forum. The political process ignores the population issue because, rightly or wrongly, it is seen as an issue on which parties can only lose more votes than they gain. There is an occasional superficial TV program and an occasional article in the quality press, and that's it. *People policy* is my contribution to getting this topic onto the policy agenda.

Population size is an important issue because a large number of people believe the consequences of getting it wrong could be quite unpleasant or that getting it right could be quite rewarding. Also, from a policy perspective, Australia is in an extremely fortunate position. Our population, unlike many countries, is not yet out of control and, through migration controls, can still be managed. Apart from possibilities such as war, uncontrolled mass migration, major disease epidemics and mass starvation, Australia has the political choice, through adjustments to its immigration program, to bequeath to the people of c2045 anything between a near-stable population some 15% larger than at present and a rapidly growing population over twice the size of the present population.

Australia's implicit population policy

In one sense it is incorrect to say Australia has no population policy. Having a population policy, at least by default, is an existential choice. Just as those who are not bald must choose a hairstyle, a country must have an implicit or explicit population policy. So, perhaps the answer to the 'Why no policy?' question is that though Australia does not have an explicit population policy it has an implicit population policy consistent with majority views? Not so. A fair attempt to infer Australia's unstated population policy is as follows:

Australia is happy to accept whatever population eventuates by taking in up to 100 000 immigrants a year for the foreseeable future, with the actual annual number depending on an intuitive political judgement in the range between:

(a) a maximum number that anti-immigration and stablist groups will accept without protesting at a level that cannot be ignored in a democratic system;

⁵³ Published in *Search*, 27 (4), (1996), pp. 120-123. *Search* is the journal of the Australian and New Zealand Association for the Advancement of Science.

(b) a minimum number that pro-immigration and populationist groups will accept without threatening to withdraw electoral, financial or other support from the Government.

REVIEWING THE ARGUMENTS

A large part of *People Policy* is devoted to presenting arguments for and against a major population increase under the respective headings of *economic arguments*, *resource availability arguments*, *environmental arguments*, *social arguments*, *international arguments* and *general or 'other' arguments*.

Historically, the two best arguments for population growth were economic and military. Both have collapsed in recent years. Population growth certainly brings economic growth but few economists now think it does much at all for economic growth per head. Defending Australia is seen by today's defence experts as a matter of sophisticated equipment, not bodies. The 1994 Defence White Paper did not even mention population.

Resources and population

With present international trade and factor substitution possibilities, it is not defensible to argue that any particular natural resource such as water or mercury is so limited in Australia that doubling (say) the population over coming decades is impossible. Certainly the real marginal cost of supplying some important goods (clean domestic water, for example) will rise with population growth, and positional goods like wilderness will have to be rationed. But, while Australia might become a less pleasant country in which to live, there is no foreseeable combination of material shortages that would make Australia uninhabitable for 36 million people in 2045, a not implausible demographic scenario.

If it is deemed essential for Australia to remain self-sufficient in food for many generations and if there is a widespread conviction that amenity resources will degrade at an increasing rate with further population growth, resource availability arguments suggest that Australia should not set itself a long-term population target much outside the 18-36 million range. If Australians do not want to pay increasing real prices for basic services nor to be increasingly rationed in their access to unique natural resources, the target will be much nearer 18 million than 36 million.

Population and environmental quality

Population growth is neither a necessary nor a sufficient condition for environmental degradation; it is however, a strong predisposing factor.

In 1960 about 10 million Australians produced a real GDP of about \$7200 per head. In 1991 about 17 million Australians produced a real GDP of about \$16 200 per head. If GDP per head is assumed to be a rough measure of per capita impact on the environment, then, in population units called '1960 Australians' the total environmental impact of the 1991 population was equivalent to about 40 million '1960 Australians'.

Australia and the world

While many Australians accept that each nation is ultimately responsible for managing its own environment, economy and population, most also accept that Australia has a responsibility to help other nations do these things.

But just what constitutes a program of responsible and effective assistance? It probably involves taking migrants, managing Australia's contributions to global pollution and various forms of foreign aid.

Nevertheless, there could be advantages in terms of a *world food strategy* (if there was one!) if Australia remained a major food exporter instead of using this same food to feed a larger domestic population. For example, Australia is one of few countries that can rapidly deliver large quantities of food to famine and other disaster areas and this will become more noticeable as agricultural protection diminishes around the world. Again, given the seasonal variability of agricultural production, humanity becomes more vulnerable as the geographical spread of food exporting countries narrows. If this line of reasoning stands up to closer analysis (and it probably does), it is an argument for minimal population growth in Australia.

Foreign aid arguments

The basic argument here is that if we stopped increasing the population we would be able to increase Australia's foreign aid by using savings made on the costs of establishing migrants and of bringing up more children. But, politically speaking, there is no reason why savings in these areas would be diverted into foreign aid. In fact, since aid is commonly thought of as some percentage of GDP, the larger economy required for a larger population might actually generate more foreign aid.

Still, if reducing population growth did allow Australia to increase foreign aid by using the funds it now spends on settling immigrants, its limited resources would end up helping more people more fundamentally than the current immigration program does. For example, providing aid to dig wells in third world villages is more useful than providing an immigrant with a job that allows a new car to be purchased.

There could be advantages in terms of a *world food strategy* (if there were one!) if Australia remained a major food exporter instead of using this same food to feed a larger domestic population. For example, Australia is one of few countries that can rapidly deliver large quantities of food to famine and other disaster areas and this will become more noticeable as agricultural protection diminishes around the world. Again, given the seasonal variability of agricultural production, humanity becomes more vulnerable as the geographical spread of food exporting countries narrows. If this line of reasoning stands up to closer analysis (and it probably does), it is an argument for minimal population growth in Australia.

Defence arguments

It has been recognised for many years that 'we could easily become a focus for political pressures stemming from a more general resentment of inequities in the global distribution of wealth' (Priorities Review Staff 1976). A few Jones Inquiry submissions present or recall the traditional argument, widely accepted till the 1970s, that Australia must encourage population growth to deter hostility or even invasion from other nations (Submissions 169, 179, 184, 203). However, the hope that a larger population might forestall 'land envy' from overseas seems naive and futile (Submission 241). Whatever we do, Australia is going to have about 1% of the east Asian population in 2030.

The more standard rebuttal to the 'large army' argument is that modern warfare depends more on sophisticated weapons than on the 'cannon fodder' obtainable only from a large population. Sweden and Israel are examples of small-population countries regarded as having well-developed defence capabilities. Nonetheless, note that if the cost-effectiveness of a modern defence system is somewhat independent of population size (and it probably is), then a larger population implies a smaller defence cost per head (McGlynn 1992). For what it is worth, World War II found the biggest economies on the winners' dais.

But again, is this another spurious either-or argument? Surely more bodies plus sophisticated weapons provide the best defence? Perhaps, but if a larger national population would imply larger populations in north Queensland, the Top End of the Northern Territory and the Kimberleys, it can be argued that a more populous Australia would in fact be easier to invade. This is because urban infrastructure would make it easier for invaders to establish beachheads than if they had to land on rugged uninhabited roadless coastlines---an Australian version of the Russian defence strategy against Hitler and Napoleon. Also, any population-induced infrastructure in the north, such as a Lake Argyle-Perth water pipeline, would be vulnerable to attack.

Population density arguments

The population density argument involves the naive view that if country A can be made like country B in one respect (e.g. population density), then it will become like it in other respects (e.g. high quality of life). It rests on comparing Australia's population size and population density with those of other (carefully selected) countries and arguing that we should be more in line with those countries.

At its most simplistic this line of argument sees value in conformity for its own sake. For example: 'Why shouldn't we be more like Europe'? (Submission 155). A more developed form of the argument is that if Australia had a population density comparable to that of countries it regards as having a high standard of living/ quality of life, then it too would have a high quality of life. This 'magic' argument offers no reasons why this would be so and ignores the fact that quality of life in Australia is already amongst the best the world has to offer (Submission 215).

Since the countries of western Europe and North America are the most often mentioned in this context (Submission 21), the implication is that Australia should have a population of perhaps several hundred million. Yet in environmental terms Australia is actually more like Africa than Europe or North America (Submission 170). But even that is a red herring. The inescapable conclusion is that the physical size of Australia is largely irrelevant to discussions of the optimal size of its population (Submissions 22, 170, 114, 224). Unfortunately the simplistic argument that being different must be wrong continues to hold great sway over unthinking minds.

SOME CONCLUSIONS

- Given (a) a strong balance of argument against population growth (particularly rapid population growth), (b) uncertainty about the effects of population decline and (c) an inability to identify an optimal population level, I conclude that while there is no balance of argument for seeking any particular population level there is a balance of argument for seeking to avoid population change.

- The Australian Government should therefore develop and carry out a population policy which has as its central objective the achievement and maintenance of a more or less stable population; that is, a population which, though inevitably fluctuating somewhat from year to year, does so within fairly narrow limits.
- Australia should try to stabilise its population as expeditiously as possible. This means starting now, not in a generation's time. The core of a demographically feasible and politically acceptable way of achieving a more or less stable population by the year 2045 is to restrict annual net migration to a figure somewhere between zero and 50 000. This will produce an approximately stable population of between c.20 million and c.23 million in 2045, depending on the choice and constancy of the net migration figure.
- Net migration above 50 000 per annum will inevitably promote further population growth for several generations. Keeping net migration below this figure is the key to avoiding the problematic prospect of open-ended population growth.

Take home messages

- The core message of *People Policy* is that a much better case can be made out for Australia to adopt an explicit population policy centred on 'stabilisation within a generation or so' than can be made for the present tacit policy of doubling population every few generations. The postscript to that message is that a choice between these alternatives is (still) ours to make.
- A third policy of actively reducing population could possibly be superior to a stabilisation policy but the book has not explored this option in any depth because, in terms of what is politically possible, a policy of stopping population growth will have to be widely accepted before debate on reducing population size can seriously begin.
- The Australian Government, whether Labor or Coalition, is unlikely to adopt low immigration and population stabilisation policies unless such shifts are prompted by powerful ideas and disturbing events which demand a political response. New ideas currently emerging point towards a shift away from rather than a consolidation of the present tacit policy. Nevertheless, in the absence of an effective political movement for change, it is difficult to find evidence that change may come about soon.
- The politics of population policy bring little credit to the major political parties. Both act as though they care mostly about gaining of immediate political power and little for the long-term well-being of the Australian people. Immigration is the cause of population growth and the political parties have come to the conclusion that, in the short term, they can gain more votes than they lose by maintaining a strong immigration program. They conspire to ignore the strong likelihood that the population growth they are generating as a by-product of immigration is having and will continue to have severe adverse consequences for the quality of life of most present and future Australians.
- In fact, urban quality of life emerges from the present book's analysis as the single most important issue in the population debate. It is therefore important to monitor closely Australians' quality of life so that it can be modelled and projected into the future as well as providing a much-needed improvement to the factual base underlying this core debate. That is, while working conclusions about policy have to be drawn from present knowledge, the debate must become better-informed.

- The traditional arguments in favour of a significantly larger population are that it improves our defence capability and our economic well-being. While being quite willing to look generously on these, and to accept that they may once have been persuasive, my reading of these arguments brings me to the working conclusion that they are worth little.

What the debate is not about

The population debate is so easily and so frequently side-tracked that a last useful thing I can do for the reader is to recall, from what has gone before, the common red herrings to be gracefully declined when offered.

1. The debate is not about whether we could cope with a much larger population.

If a 'world government' decreed that Australia's population was to double by 2045 or reach 100 million by 2100, I have no doubt that we, as a society, would make a pretty good fist of feeding, clothing and educating the population and that we might well be a reasonably civilised harmonious society. The price we would have to pay would probably include losses of freedoms, amenities and opportunities to do things we value.

But that is not the point. As things stand, we do not have to 'cope'. We have the comfort of deciding for ourselves whether life would be better or worse with a much larger population. Nonetheless, we would be wise to have contingency plans for a greatly increased population in case we have to 'cope' with such.

2. The debate is not about whether Sydney, Brisbane and Melbourne are good cities to live in.

By world standards they are. The debate is about whether they will be better or worse cities to live in if they are allowed to grow. Nor is the debate about whether Australians could live reasonably satisfying lives if these cities doubled in size. They might well. The debate is about whether they could lead better lives if these cities did not double in size.

3. The debate is not about past migration

The fact that post-war immigration has been generally judged a success (although no-one asks 'What if it had not happened?') is only marginally relevant to whether substantial future migration is in the country's best interests. Economic, social and environmental parameters have changed dramatically in the interim.

4. The debate is not about individual migrants, each of whom is a person to be respected and valued for their contribution to Australian society. It is most certainly not about whether migrants should be encouraged to return from whence they came.

5. The population debate is not about multiculturalism; the multiculturalism debate is about multiculturalism. Positions in the population debate and the multiculturalism debate have no logically necessary correspondences.

For the record, my book takes no position on how migrants and migrant communities should be treated by government, apart from subscribing to the principle that they should be treated equitably and in ways that minimise the possibility of ethnic tension.

6. The debate is not about whether we should have a markedly smaller population than at present. The option of allowing the population to decline may be an issue in 20 years, but not now.

7. The debate is not about any 50-year population target greater than 40 million. This population is the extreme limit of what would be politically feasible to impose on the community without risking massive social unrest.

8. The debate is not about how many Australians could be fed with home-grown food, sometimes called the national carrying capacity. The answer here is 'a moveable feast' and gets bigger and bigger as you presume smaller and smaller calorific intakes and greater and greater emphasis in the economy on diverting resources into single-minded food production. When obtained, the answer is not an 'instant population target' but one modest input to analysis of the population question.

9. The debate is not about whether environmental problems should be tackled by population management or by more direct means. This is not an either-or question and, like all problems, should be tackled by an appropriate mix of all available instruments. Stopping migration cannot, by itself, ameliorate our current problems; but it could reduce the rate at which they become exacerbated and new problems arise.

10. The debate is not about identifying an 'optimum' population. No plausible, defensible method for doing this has been proposed or is foreseeable. Nevertheless, various population trajectories are available, and we must choose amongst these, either actively or by default.

POSTSCRIPT 2012

In the 15 years since writing this paper, the population horse has bolted. Despite the Australian community continuing to be strongly in favour of low immigration and hence low population growth, political parties and business interests have quietly succeeded in growing the population by 1-2 per cent a year. Backed by political and media power, their sloganeering and short-term self-interest have largely gone unchallenged. Rational discussion of the population issue is minimal. Only once, in 2010, when Prime Minister Rudd enthused publicly about a projection of a population of 36 million Australians by 2050 was there anything like community outrage. Rudd's successor, Prime Minister Gillard, hosed the outrage down by setting up an inquiry into how to achieve a 'sustainable population', an inquiry which, in the blink of an eye, produced a 150 page masterpiece of glossy spin and bullshit.

POPULATION, CONSUMPTION AND ENVIRONMENTAL DEGRADATION⁵⁴

ABSTRACT: Economic growth, as conventionally measured, is a 'good news' scenario for many; not so good if you think city life is polluted and congested enough already; not so good if you hate seeing ecosystems degraded and destroyed; not so good if you think that successive increments of economic growth are less and less beneficial to the average Australian. Should the community come to agree that economic growth needs to be slowed, reducing the rate of population growth is one effective readily-available way of doing so.

It is Saturday May 25 2001 and I have just heard an Earthbeat program on ABC Radio National in which Paul Ehrlich, Tim Flannery and David Buckingham (of the Business Council of Australia) have been debating what Australia's population policy should be. Buckingham wanted strong population growth, Ehrlich wanted a much smaller population than at present and Flannery, recanting on his sometime population target of 6-12 million, didn't seem to know what he wanted---figures of 10, 12 and 20 million were offered as possible working targets along with the idea that we should set a target and somehow revise it every few years, depending on how the environment is faring at the time.

Before going any further, I should place my own position on population policy on record. In my 1996 book, *People Policy: Australia's Population Choices* (UNSW Press), I concluded that a sensible population policy for Australia would be to aim at stabilising the population within a generation or so and that this was quite feasible if net immigration of something below about 50 000 a year could be maintained. Population would then more-or-less stabilise somewhere between 19 and 23 million (depending on actual immigration) sometime before 2050. To get to that conclusion I examined, as disinterestedly, as honestly, as I could all the environmental, economic and social arguments I could find both for and against a much larger population. I did have a prior predisposition in favour of a stable population but I bent over backwards to discount my own prejudices (pre-judgements).

If the contributions I heard on the Earthbeat program are representative of the contemporary population debate, then things have not gone anywhere in the six years since my book was published.

⁵⁴ Paper for *Food---For Healthy People and a Healthy Planet*, Internet conference organised by Nature and Society Forum, July 2001, www.natsoc.aust.com/~natsoc

As then, business people and their economist friends are the main proponents of strong population growth and it's the biologists who want stable or reduced populations. Try as I might I cannot escape the feeling that business basically wants strong population growth because they see bigger markets as being good for immediate profits. If they could only admit that making maximum profits right now is extremely important to them then the grounds of the debate could be shifted, eg to asking why high profits are so desirable. Instead, they have started talking about the importance of pursuing a triple bottom line (TBL), ie environmental and social objectives as well as (less-than-maximum) profits. But, with a few exceptions, I feel that they are paying lip service to what their public relations friends tell them is good marketing strategy. Their talk is all at the level of the individual firm, not the society as a whole. I wonder if the stablists could develop a line of debate here---ask business what TBL thinking means in terms of guidelines for managing the whole economy?

Turning to the stablists---the biologists and ecologists---their basic message is still that population growth is strongly correlated with economic growth and that economic growth requires rates of energy and material throughput that destroy or disable ecosystems. But they have made no progress in crafting a convincing argument that something really, really awful will happen if we do not stop destroying and disabling ecosystems. After all we have been doing this for 12 000 years. Historically, we have just folded tents and moved on, admittedly creating a lot of misery in the process. But having now filled the world with people, moving on when ecosystems stop delivering the services that the economy requires is no longer an option.

If I were a hired gun for the growth lobby I would agree that it is a pity that ecosystem services are no longer being provided free. If that's the case, I would say, flicking a speck of dust off my Italian suit, the economy will just have to start buying human-made versions of those services. You know, water purification plants, soil conditioners, plantation timber, minesite rehabilitation and so on. Or, I'd say, we entrepreneurs might have to move towards a product mix that is less dependent on the natural resource base. Sure, profits might go down as costs go up but the name of the game will be to see that your costs go up more slowly than the competition's. And anyway, offsetting technologies might appear. As for those ecosystem services that aren't being traded in the market, like smelling the flowers and bushwalking, well, people will just have to start paying for them if they want the remaining supply to be protected.

And smug business will be right. As long as the community values the marginal net products of the growth cocktail (population growth and higher consumption per head) more highly than the amenity losses associated with lost ecosystem services, it is perfectly rational to keep on destroying and disabling ecosystems. And the community will let it happen.

Of course it won't go on forever. First, people will start valuing the natural world more highly as it disappears, and tell the politicians. Second, the proportion of additional GDP coming as things people want will keep falling relative to the proportion devoted to suppressing things people do not want or to replacing things they once had. This 'useless' component of GDP includes not only the costs of replacing lost ecosystem services but the market costs of ameliorating the growth cocktail's impacts on urban quality of life---air pollution, congestion etc. And to the extent that those impacts are not ameliorated, they need to be recognised as non-market costs to be set against the value of additional GDP.

Unfortunately, there are several reasons why GDP growth will not stop even when the net value of additional GDP reaches zero (which it already has for many people). One is that many of the costs that business is imposing on the community are *externalities* (unpriced side-effects) for which business does not have to pay. Indeed, many externalities are not even recognised as such (eg urban sprawl, increasing energy dependency). So it remains profitable for business to expand output beyond the point where extra benefits to the community (but not business) are less than the extra disbenefits. In economist-speak, marginal social net benefits go negative at a lower GDP than marginal private net benefits.

The recognised remedy for this, even among laissez-faire free marketeers, is to internalise (sheet home to business) those externalities by making entrepreneurs pay compensation in various ways for the external disbenefits they are imposing on the community, and hence discourage them. Another is for the community to directly regulate to stop business imposing the worst of these disbenefits on people.

The more general point though is that only the community as a whole can decide when the net benefits of further economic growth have fallen below the net disbenefits of further ecosystem and cityscape degradation. But there is no institution in place to even attempt this evaluation in a disinterested manner. There is not even a public debate in which opposing sides are willing to concede legitimate points to each other. What we call public debate is better described as aggressive adversarialism. Ant it is not just useless, it is worse than useless. Why? Because it gives some illusion that we are trying to address the issue when all we are doing is providing a sideshow while the growthists proceed on their merry way. Spare us the population inquiry that Labor is promising if it wins the next election.

Should the community become convinced that the social net benefits of further economic growth are zero or negative, the population argument comes right back into the picture. While increasing consumption per head is an important part of the growth cocktail, the single simplest, most effective action for slowing economic growth is to slash population growth. In Australia, we are fortunate in being able to do this by simply slashing immigration.

Let me see if I can reduce the above argument to a few assertions around which I would like to see the population debate framed:

- As the Australian economy grows, the rate at which the natural and urban environment is being degraded and destroyed increases
-
- As the Australian economy grows, the fraction of that growth which people are likely to regard as useful will decrease. This is because of increased costs per unit of growth as a result of (a) having to use degraded resources and (b) having to pay to ameliorate an increasing degradation of the natural and urban environment
-
- Therefore, at some stage, technology notwithstanding, the decreasing benefits of additional growth will fall below the increasing disbenefits of natural and urban environmental degradation.
-
- If the community can recognise that this point has been reached, economic growth can be slowed by reducing population growth or reducing growth in output per head, or both.

These assertions need to be debated in two ways. Are they correct in principle? If so, what are the numbers? That is, what are socially acceptable measures of wildscape and cityscape degradation and destruction; what is a socially acceptable measure of 'useful' GDP; what is a socially acceptable trade-off rate or exchange rate between environmental losses and 'useful' GDP? The sorts of social technologies that can help the community decide whether the value of extra economic growth is going negative include *state of environment monitoring* and constructing alternatives to GDP such as the *genuine progress indicator*.

POSTSCRIPT 2012

Rereading this paper brings home to me, not the failure of my strenuous attempts to have population issues properly debated and treated in a balanced way in the formation of public policy, but the dishonesty, imbalance and irrelevance of most public discussions of major policy issues in Australian society. Free speech is a value that must not to be compromised but, within that constraint, I believe that Australia would get better what-to-do policies if it could develop social technologies for addressing:

- people's deliberate and ignorant misuse of language;
- people's failure to understand the nature and importance of evidence, and their associated unwillingness to seek it out;
- people's inability to think clearly and critically;
- abuse of its opinion-forming power by much of the media
- society's failure to develop mechanisms for holding people accountable for their public statements.

TAKING THE LONG VIEW ⁵⁵

I spoke recently to a man who is concerned about the sort of society in which his grandchildren will grow old, starting somewhere around 2050. Will Australia 2050 be a violent and divided society thrashing around in a polluted and degraded environment? A rich but empty society perhaps? Or will it be the sort of society that he wanted, one offering high quality of life to nearly all Australians?

Much as I might have wished to answer his question, and answer it reassuringly, no one can foresee what a future Australia will be like. Any of those scenarios is possible. Instead, I want to discuss a related question---one which still has no right answer but is more manageable and not unhelpful. I want to discuss Australia's capacity to successfully manage its longer-term future, by which I mean the next 50 years and beyond. I'm asking 'What sorts of things, if any, can we do, today and tomorrow, to improve the chances of this being a good society for our grandchildren to live in?' And I will take my vision of the good society from that concerned grandfather---one in which most people in coming generations have the opportunity to enjoy high quality of life. This means people who will be able to satisfy their higher needs for creative activity, esteem and participation in community life, as well as for basic needs such as food, shelter, and security.

In any discussion about managing the future it is critically important to articulate, as I just did, what you want from it. As someone said, 'If you don't know where you're going, it doesn't matter which bus you catch'.

So, how might we improve quality of life prospects for our grandchildren? My question appears straightforward enough but it is surely loaded with presumptions.

Most obviously, I've presumed that improving future Australians' quality of life is a task for the community as a whole, acting collectively, and not just for individuals acting independently. But maybe we're wasting our time trying to act collectively? There is certainly one school of thought which claims that if we each make self-interested decisions an 'invisible hand' will increase community well-being or at least we will do no worse than we would by funding government efforts to improve people's lives. I have to declare my somewhat more visible hand here. I am a meliorist. Meliorism is the optimistic doctrine that the world can be made better by human effort. I believe in the ability of societies, acting through the agency of government, to both envisage a better world and to change the world. This in no way means I am convinced that tomorrow's world will be a good place to arrive at. Tomorrow's world may be a bugger of a place which we can do little to avoid but, if we try to make it better, it's unlikely to be worse than if we hadn't tried.

What if the world subjects Australia to global shocks of such ferocity that we're too busy coping and surviving to worry about improving quality of life for anyone, much less future generations? For us, the four horsemen of the Apocalypse are world war, pandemic disease, a global climate shift and global economic collapse. All are plausible possibilities. The only protection we can take out against such shock-driven futures is active membership of the world community. We have to simultaneously dialogue to forestall such catastrophes and make plans on the assumption that catastrophe will not strike.

⁵⁵ Radio talk, ABC Radio National's *Ockham's Razor*, 23 Jan, 2000.

So, catastrophes aside, will the nation state called Australia be around to manage itself for the next 50 years? Many commentators see national governments being reduced to impotence as globalisation proceeds. If I might be game enough to define globalisation, it is the process under which once-separate societies are moving towards functioning as a single society, albeit one that is pretty chaotic and under-governed. Globalisation may be disturbing but it is certainly not mysterious. It is an accelerating expression of the same great forces that have moulded the world for the last 200 years---capitalism, technological change and the search for political emancipation.

The alternative to the impotent-state view, the one I'm taking today, is that national governments will continue to be important agents of change and stability in a globalising world. I'm presuming that over the next fifty years Australia will remain a middle-ranking first-world power, making a small contribution to global governance while working out its own ways of responding to widespread domestic concerns about various obstacles to high quality of life. The four widely-recognised obstacles I have in mind here are environmental degradation, a shortage of social justice in the form of life opportunities, deteriorating social relationships and a rate of economic growth which, depending on your viewpoint, is either too high or too low.

Just how successful we might be in tackling this obstacle course is an open question. We will be limited in what we can achieve by the constraints of our history and geography, by tradition and custom. And by the effort of adapting to the slings and arrows of outrageous fortune as some scribbler put it. Conversely, we will be helped by our considerable stocks of capital in all its forms---built and natural capital like roads and national parks; personal and social capital, like educated workers and respect for the law. When it comes to managing the future, we are both future makers and future takers, responding to both opportunities and threats.

While Australians as individuals are richly talented we do seem to make heavy weather of reforming outdated institutions---perhaps for the very reason that they have been historically successful. Still, even a flexible society is like a giant oil tanker and takes a long time to turn around. Think of how long it takes to replace a city's housing stock or upgrade the Hume highway, not to mention changing the tax system; I mean really changing it. Some of the big challenges already bearing down on us, apart from lagging institutions, are soil salinisation, an ageing population, worn-out cities and the imminent decline of Australian oil supplies. If our plans for producing high quality of life all round involve major changes to values, institutions and markets we can expect to be busy for some decades; and we almost certainly need to start right away.

Now, just one more quibble before rejoining my opening question. Does a desire to improve quality of life for our children's children mean that we don't care about people with limited prospects right now? How much effort should we be putting into thinking about 2050 when we're surrounded by pressing problems today? Street kids and trade deficits and air pollution and you-name-it. The in-principle answer to these questions is that balancing the needs of the present generation against the needs of the future is always a matter of judgement. In practice, we live in a society with a bad case of short-termism, one where anything past Christmas is long-term to quote Treasurer Costello. On this particular matter we have no judgement. The relative amount of effort we put into thinking about present versus future problems is totally skewed towards the here-and-now. Any debate I can stir up today about how to get things right in 2050 will do no more than start to reverse an obvious imbalance.

Well, having argued for the legitimacy of my topic, I can now get down to business and ask if we have a real choice of strategies for tackling the big impediments to mid-future quality of life. The answer is that we do, provided we also remember that no strategy is going to be rigidly followed for decades and that we need to have open minds if we are to recognise the possibilities. Beware the person who has found the truth!

There is a very strong conventional wisdom around that, in the face of globalisation, governments can't do much except educate the kids, reduce taxes, run a tight monetary and fiscal policy, provide a minimal safety net for the disadvantaged, cut tariffs and be a cheer squad for business. This is a strategy built around a belief in the power of self-regulated markets to deliver what supporters see as the two most important determinants of high quality of life, namely high environmental quality and a high rate of economic growth. I'll call this an economic growth strategy or a growth first strategy.

Another strategy with significant support in its various versions can be called conservative development. It is built around the ideas of a big national government, high taxes and a belief in the power of government-funded programs to overcome what supporters see as the two key quality-of-life obstacles, namely environmental degradation and a lack of life opportunities, particularly employment. It is a strategy which seeks to achieve environmental and social goals by non-market means---without significantly reducing the rate of economic growth.

A third strategy which I call post-materialism starts from the premises that economic growth is very much a mixed blessing and that pathological social relations involving alienation, confrontation and mistrust are a major problem. It is built around the ideas of capping the physical size of the economy, strong regional and local government, moderate taxes, and a belief that a society where people are helped to participate widely in the institutions that affect them will produce brotherly and sisterly relations between people and a dark green economy which allows most people to live in modest comfort.

There's nothing here to frighten the horses. All three of my candidate strategies accept the basic structure of the existing society and present themselves as proposals for evolutionary change over decades, not revolutionary change to escape an intolerable present. All are proactive 'recipes' for root change in the way Australian society is managed and stand in contrast to a reactive non-strategy of managing the future by 'muddling along', making only pragmatic, electorally-driven changes. All three envisage a mixed economy in which a market system of some kind constitutes the principal means of co-ordination. Much of the difference between strategies lies in the size, shape and reach of government. In fact, most of these strategies' core ideas for change already exist in contemporary Australia, at least in embryonic form; I am merely trying to make such more visible.

Now, while each of these strategies is defensible and not to be arrogantly dismissed, each could go wrong in its own plausible way.

Under the economic growth strategy, even if high growth eventuates, market forces might not protect environmental quality, jobs or social health. Increasing income and wealth inequality could trigger, in the worst possible case, a total breakdown of Australian society.

The conservative development strategy could bog down in pluralistic compromise and bureaucratisation, with business being stifled to the point where growth is choked off and little real progress made in achieving improved environmental quality or people's access to the tools of opportunity.

Again, the economy could decline sharply under post-materialism's strong 'greening' policies and policies to ensure participation. And, without a non-declining economy, it would be difficult, perhaps impossible, to finance other reforms or avoid widespread poverty.

So, there you have it. We do have real but risky choices. My task today has been to convince you of this, not to advocate one strategy over another. I will deem myself successful if this talk, and the book it is based on, fire up a serious debate about where Australian society is going over the next several generations---not the next electoral cycle---and how it might plan to get there.

POSTSCRIPT 2012

Especially since the collapse of the Soviet Union in 1989, it has become increasingly fashionable to decry political ideologies, particularly the recently failed ones, such as fascism, communism and socialism. Somehow, *liberal democracy* seems to have escaped this opprobrium, in the West at least, even though it too meets the criterion that it is an understanding of the role of government in society which defines a political ideology. From the tangle of ideas around 'liberal democracy,' this talk extracts and briefly introduces three 'mini-ideologies'---economic growth, conservative development and post-materialism. It is left to the next piece in this collection (*Future Takers, Future Makers*) to delve further into the 'nuts and bolts' and possible long-term consequences of Australian society adopting one of these three.

While any society which adheres rigidly to a political ideology loses adaptability, accepting, as a non-binding rule, and for the moment, that their collective decisions will be guided by a particular ideology allows a society to make plans and set goals for the longer term, these being strategic activities which promote stability and build confidence. Perhaps there is an association with the negative connotations of the term 'ideology,' or the world's massive uncertainties, but, as it was ten years ago, Australia's 'elites' are still not much interested in thinking comprehensively and strategically about the country's future. Government policy-making in particular is driven by, in Harold Macmillan's immortal words, 'Events, dear boy, events.'

FUTURE TAKERS, FUTURE MAKERS⁵⁶

Men make their own history, but they do not make it just as they please (Karl Marx, quoted in Burns 1935⁵⁷).

Robert Heilbroner detects three broadly different attitudes towards shaping the future in humankind's long history.⁵⁸ For most of that time, up till about 1750, most people accepted, with resignation, that the future would be much the same as the present, with the social and economic order changing little from generation to generation; and that the future was largely beyond human control. From about 1700 onwards, under the influence of three great forces, namely the capitalist mode of production, technology, and political emancipation, people began to believe in 'progress' and expected the future to be better than the past. But, from about the middle of our own century, the prevailing attitude towards the future has become more one of 'post-modern' apprehension. These historical attitudes resonate in contemporary perceptions of the power of present choice. First, choice cannot influence the future (resignation); second, choice can influence the future for the better (progress) and third, choice influences the future but, for better or worse we know not (apprehension).

Ultimately, it cannot be demonstrated that a society such as ours can purposively improve its 'quality survival' prospects to a degree that is worth the effort, over and above the prospects of a no-intervention strategy. All that can be said is that optimists believe it can and pessimists do not.

According to Paul Kelly, in *The Dismissal*, Gough Whitlam and Malcolm Fraser each optimistically thought they could, as Prime Minister, guide Australia towards the future they envisaged for it, without demanding unacceptably large sacrifices in contemporary wellbeing---jam tomorrow and, yes, jam today too.⁵⁹ Twenty years later when many changes in both the world system and the domestic system seem to be getting bigger and faster (Toffler's future shock), unmatched by any obvious improvement in governments' capacities to counter or adapt to such changes, a shift towards Heilbroner's 'apprehension' becomes understandable.

More modestly, I too have been thinking about Australia's future. What quality of life will our grandchildren be experiencing in 2050 and, indeed, what quality of life will our descendants be experiencing in a thousand years? Or, more pointedly, will Australians still be here in a thousand years?

⁵⁶ *Australian Quarterly*, **70** (6) Nov-Dec 1998, pp.26-31.

⁵⁷ Burns, E., (ed) (1935) *A Handbook of Marxism*, Random House, New York.

⁵⁸ Heilbroner, R., (1995), *Visions of the Future: The Distant Past, Yesterday, Today, and Tomorrow*, Oxford University Press, New York.

⁵⁹ Kelly, P., (1983) *The Dismissal : Australia's Most Sensational Power Struggle: The Dramatic Fall of Gough Whitlam*, Angus & Robertson, Sydney; London.

Once you start asking, continuously, what the future beyond Millennium night might be like---long-term stuff by Australian standards---the world assumes a whole new aspect. Everything you read, hear and see contains hints about ‘the shape of things to come’ (HG Wells’ phrase) and you find yourself thrashing in a maelstrom of ideas where the challenge is to find pattern and order.

The key insight here is to realise that while the future is unknowable, it is not unimaginable; that one can find or compose scenarios of believable and, with hindsight, unsurprising futures. Or scenarios of implausible, unbelievable futures for that matter. Such can be as enlightening as futures that unfold step-by-plausible-step.

Fiction provides ready-made scenarios. I know of two novels set in Australia's mid-to-distant future, *Tomorrow and Tomorrow* by M. Barnard Eldershaw and *The Sea and Summer* by Robert Turner. Turner's work paints a dystopian picture of Australia in the middle of the 21st century, grossly overpopulated and poor and beset by the problems of atmospheric warming and land degradation. Eldershaw's, set some 400 years away, is more utopian. It depicts a civilised Eurasian society which has solved the problems of violence and distributive justice, but suffers a spiritual malaise stemming from some rather heavy social engineering. Generalising, fictional futures tend to depict either chaotic dystopias or utopias that look backwards to an unachievable Arcadian ‘golden age’ or forward to an inevitable ‘technophilic’ future.

Next come the professional future-gazers, driven usually by an interest in how we might better manage the future. They create scenarios using methods as diverse as mathematical modelling, brainstorming (anything goes) and iteratively harvesting the collective foresight of experts by what is called the 'Delphi' method. Most professionals seeking to describe ‘maybe’ Australias in a non-fictional way, avoid apocalyptic presumptions and evoke possibilities they see as evolving readily from the status quo. Little of immediate value can be learned from dystopian musings.

There are other disciplines, not directly concerned with futuristics, that yield hints on how to create more rather than less plausible scenarios. History, systems theory and ecology are three.

History suggests factors behind the evolution, survival and demise of past societies, and hence, perhaps, of future societies. It alerts us to the possibilities of strong past trends (eg population growth, technological change) and cycles (economic, social) continuing into the future. Most macrohistorians see societies developing in organisational complexity and then declining, in a process of serial replacement. For only some is such cycling superimposed on a progressive trend towards greater enlightenment and civilisation.

Amongst the processes that have operated to rudely thwart the growth strategies of societies through history, two stand out---parasitism and resource degradation. William McNeill's revelatory book *Plagues and People* makes it abundantly clear that disease has played a large and often unrecognised part in the rise and fall of the world's communities and civilisations.⁶⁰ The best known examples are the impacts of European diseases on the aboriginals of Australia and the Americas; but there are many others. There are good reasons for believing that disease remains a major latent threat to modern societies.

While well-recognised as important in isolated cases (eg Easter Island), resource degradation has also been the repeating process behind the steady westward movement of the centre of western civilisation over several millennia. Particularly in arid and variable climates, deforestation, time and again, has led to soil erosion and the destruction of dams and terraces. As a rule of thumb, irrigation-based civilisations such as first arose in Egypt, Mesopotamia and the Indus Valley several thousand years BC seldom last more than a few centuries before degrading the soil resource through salting and water-logging. There is no reason to expect Australia's irrigation regions to escape this fate.

Régis Debray, theorist of revolution, cautions us that history can be both a help and a hindrance in thinking about the future:

History advances in disguise; it appears on stage wearing the mask of the preceding scene, and we tend to lose the meaning of the play. ...We see the past superimposed on the present, even when the present is a revolution.⁶¹

Next, what does systems theory have to offer the earnest futurist? Systems are more-or-less self-contained sets of interacting components. When such systems are particularly complex and include goal-seeking individuals and social groups as components, their future behaviour is extraordinarily difficult to understand well enough to predict. Individuals and groups in such systems can only learn to survive by developing behavioural 'rules of thumb' through trial-and-error. Systems theory suggests that such complex adaptive systems can only be managed by equally adaptive methods---having a contingency plan for each foreseeable state of the system. Unfortunately, methodology for routinely and systematically developing such feedback policies is not yet available. They have to be developed on a 'learning while doing' basis.

⁶⁰ McNeill, W.H., (1979) *Plagues and People*, Penguin, London.

⁶¹ Debray, R., (1967) *Revolution in the Revolution? Armed Struggle and Political Struggle in Latin America*, Penguin, London.

Ecology, the study of ecosystems, provides archetypal examples of complex adaptive systems at work. If ecosystems are taken as analogous to human communities (there are many differences as well as the similarities), ecology provides a range of insights into guidelines and principles that need to be adopted by human communities intent on long-term survival. Thus Capra identifies five principles of successful ecological organisation which may offer guidance to human communities seeking to survive in acceptable form for hundreds of years: recycling; reliance on solar power; balancing co-operative and competitive behaviour; resilience under extreme events; and high species diversity.⁶² The basic relationship between parts of ecosystems is one of mutual interdependence. Competition for resources is good insofar as it weeds out those that use resources inefficiently. Co-operation, the pursuit of mutually agreed goals, is good insofar as it allows resources to be saved through the benefits of specialisation.

My primary conclusion from these cross-disciplinary rummagings is that the appropriate accumulation of redundant societal capital---institutional, human, intellectual, natural, built etc---and a capacity for social learning through trial-and-error are the two keys to adaptability and hence to any society's long-term survival. Under a *Learning Society* scenario Australians would learn to manage their society in accordance with the rules of successful evolution and adaptation, as revealed by the study of complex adaptive systems. Unfortunately, while becoming a Learning Society may offer us our best chance for long-term survival, our adopting of such a strategy is an implausible scenario. We don't yet know enough about efficient social learning and, anyway, the notion is just too radical for most to accept as a realistic option.

If the Learning Society scenario is implausible, just what is the spectrum of future-making strategies which Australians might not-inconceivably pursue over coming decades? And here I am thinking beyond a reactive *Muddling Along* scenario of making frequent small changes in the 'right' direction without particular reference to ultimate destinations. I am seeking to imagine contrasting strategy-driven futures that are based on applying alternative theories of social organisation to the amelioration of the over-arching hazards of our late 20th century society, namely: an inappropriate rate of economic growth (too low? too high?); increasing environmental degradation; increasing social injustice; and declining sociality (social health) mirrored by rising sociopathy (social decay).

My first such possibility is a scenario based on a *Conservative Development* philosophy:

Environmental degradation and social injustice are important impediments to high quality of life which will only be ameliorated if they are managed directly within the context of a more hierarchical, reconstructed form of social organisation. Nonetheless, it is desirable, and should be possible, to do this and simultaneously reach and maintain a high rate of economic growth. Sociopathy however is a collateral problem rather than a priority problem.

⁶² Capra, F., (1996) *The Web of Life: A New Scientific Understanding of Living Systems*, Doubleday, New York.

The strategy proposed for implementing this philosophy centres on achieving full employment, this being the best way to address both social injustice and social decay. A Jobs and Incomes Program will be funded by a major tax reform program. Environmental degradation will be addressed by an Environment Management Program which will have a significant 'green jobs' component. Environmental damage is strongly related to energy consumption and to the quantities of raw materials entering the economy as inputs and leaving the economy as pollutants. Regulatory, fiscal and market-based measures will be used to stabilise net materials-use and energy use as rapidly as possible and to cap the rate at which land is converted from low-intensity to high-intensity uses. Other priority components of this strategy are industry support programs, trade management programs and population stabilisation.

My second possibility is a scenario based on an *Economic Growth* philosophy:

While it is true that environmental degradation and social injustice are important impediments to achieving high quality of life, these hazards will be ameliorated without resorting to any serious collective intervention if we move towards a more individualistic form of social organisation focused on the feasible objective of reaching and maintaining a high rate of economic growth. Sociopathy is not a priority problem.

The two-pronged strategy proposed for implementing this philosophy is to selectively remove significant barriers to profit-making by entrepreneurs (eg environmental regulations) while focusing a small (by today's standards) government sector on the task of providing business with cost-saving infrastructure such as transport and communications and with productive human capital in the form of a technically educated workforce. Other priority components of this strategy are: population growth; extended property rights; a flexible labour market; and free trade.

My third possibility is a scenario based on a *Post-Materialism* philosophy:

Environmental degradation, social injustice and sociopathy are all important impediments to high quality of life which will only be ameliorated if managed within the context of a more mutualistic, participatory form of social organisation. Economic growth is also a priority problem requiring management, but in the sense that it is too high rather than too low, with social and environmental costs exceeding the benefits.

The strategy proposed for implementing this philosophy focuses on transforming the economy, redistributing power in society and radically reforming the socialisation system, these being the starting points for ameliorating environmental degradation, social injustice and pervasive social decay.

The socialisation system, assisted by a formalisation of citizens' rights and responsibilities, will concentrate on producing responsible, collaborative and useful community members. Power redistribution will be sought through the widespread development of participatory, non-adversarial institutions and the devolution of State and Commonwealth powers to strong regional governments. A range of tools (eg comprehensive recycling, population stabilisation, decentralisation, import replacement, a cap on personal consumption) will be used to diversify and localise and 'green' the economy and the cities so as to conserve energy, materials and natural systems. Stabilising consumption will facilitate investment in social, human and institutional capital at the expense of 'output-increasing' capital.

While it would be surprising to see the Australian electorate vote for and persist with any of these strategies strictly as described, it would be most surprising to see the Post-Materialism strategy adopted. It implies a greater change from reigning values and ideas than the other two scenarios. Adopting an Economic Growth strategy or a Conservative Development strategy would be less surprising in the sense that these strategies simulate positions towards the ends of the range of current conventional wisdom (marketization versus intervention) in first world countries.

For those who are not blinkered to the point of denying the legitimacy of any doctrine other than their own, all three strategies have their attractions and their hazards. For the Conservative Development strategy the lure is social justice and the embedded fishhook is a gridlocked society. For the Economic Growth strategy the lure is affluence and the fishhook is social chaos. For the Post-Materialism strategy the lure is a nurturing society and the fishhook is poverty.

So much for future making, what about future taking scenarios? What can be said about the larger world we will have to accept and be part of, irrespective of any chosen strategy? While there is a common view abroad that global society is in a state of flux from which clear patterns have yet to emerge, there is in fact a remarkable consensus amongst futurists about many aspects of the world's mid-term future, now that 1970s perceptions of a world going forward into an age of abundance and leisure have been decisively rejected. In the 1990s, what does seem clear is that global change in coming decades will take place within a cage formed by the same giant forces as those moulding recent centuries---capitalism, technology and the search for political emancipation.

What then are these conventional wisdoms about the world's future? Certainly there are contingencies, both catastrophes and windfalls, that would trigger an unknowable restructuring of the global system if they came to pass (eg world war; cheap fusion power), and there are existing trends which also could trigger fundamental change eventually, eg the consequences for world order in a generation or so of global population growth. But, catastrophes and windfalls aside, it can be taken as 'given' that the world of 2050 will still be divided into first, second and third world countries, much as it is now and that the world will be populated by a billion or so 'rich' people and eight or nine billion poor people. Driven by the communications and information industries and other knowledge-intensive industries, the world economy will be dominated by capitalist countries and will continue to globalise (function as a single system), grow and shift towards service industries.

The possibility of some democracies being reduced to token or nominal status is also plausible as nation states fight to survive at home and in a global economy. Many sub-national groups will successfully struggle for recognition and more autonomy and many national powers will be ceded to supranational bodies. The global environment and resource base will continue to degrade. Large or small increases in crime and violence in first world countries would be unsurprising. Various strengthening social movements (eg female emancipation, environmentalism) will begin to impose their values on their societies, perhaps slowly, perhaps more rapidly. It would be more rather than less surprising if first world life expectancies were to decline rather than creep up.

And where does Australia fit into all this? We can be fairly confident that if most of the world enjoys rising quality of life, so will Australia. If most of the world descends into chaos, Australia will be dragged down too. But, between these two juggernaut global scenarios, Australia could, all with equal plausibility, be implementing a strategy-driven future, or Muddling Along or, in a worst-case scenario, *Struggling to Cope*.

Most modern societies have the resilience to cope with small crises or even one or two large crises, but what happens when a complex society like ours is beset by five or six major crises in the space of a few years? Crises such as:

- A nuclear reactor in Java is destroyed by an earthquake and spreads a Chernobyl-like cloud across Australia, along with a wave of environmental refugees.
- By 2020, we find that we have sold off most of our natural gas. Domestic oil, which started running out rapidly after 2002 has almost gone. The price of oil imports has escalated and we find we haven't started the long capital-intensive transition to renewable energy sources.
- By 2030, the combination of a long-lasting El Nino event, climate change, soil degradation in the Murray Darling Basin and the Western Australian wheat belt and high transport costs raises the cost of supplying 23 million people with domestically-produced food.
- Export prices for primary products continue the long slow decline relative to manufactured goods we have been witnessing, with some minor exceptions, for the past century. We find we can no longer pay for imports of consumer goods or the high technology hardware needed to keep our manufacturing sector competitive.
- Australian democracy breaks down with, e.g. political rejection of various minority groups; bitter struggles between vernacular Australia and the social movements of the new politics; rise of an angry underclass willing to see the fabric of society destroyed because they have little to lose.
- Australia becomes involved in a major regional war.
- Australia becomes involved in managing and ameliorating a major regional famine.
- Several-many epidemics of new or old unmanageable diseases erupt, including diseases of humans, domestic livestock (eg foot and mouth disease) and native fauna.

Under a multiplicity of shocks like these, a complex society runs a very high risk of quickly reverting to a much simpler form of organisation. In extreme cases we call this a social collapse. The symptoms of collapse include breakdown in law and order, pervasive fear in everyday life, declining life expectancy, loss of cultural life, loss of civil and political rights, loss of health and education services and loss of basics like running water and sewerage. In a sentence, quality of life goes through the floor.

In a *Muddling Along* scenario, quality of life declines less dramatically under what we might call 'do nothing' governments which only act under extreme political pressure or under gridlocked governments which find they can only take actions that do not offend any of society's numerous pressure groups. So much energy is used up in arguing about who gets what that things just slowly stop working, they clog up; not just services and utilities and markets but institutions like parliament and the legal system. In a rapidly changing world like ours, a society that does little to adapt to changed circumstances stands to go into slow decline even if it is not exposed to major shocks. Under this scenario we end up living in hovels and taking our goods to market in horse-drawn carts along disintegrating highways.

So, after all this, where might we be in 2050? Have I convincingly scoped Australia's futures into a handful of scenarios? Provided that the global environment is not overwhelmingly difficult, we will, at worst, find ourselves *Struggling to Cope*, to keep Australian society from reverting to a much simpler form characterised by plummeting quality of life indicators. Less traumatically, we will *Muddle Along*, declining slowly. But we could also be proactively implementing a strategy-driven future, the question here being whether the three strategies I have suggested--- *Conservative Development, Economic Growth and Post-Materialism*---are a good sample of what is plausible and possible. The *Learning Society* scenario, which was presented as a strategy with good prospects for long-term quality survival, remains implausible at this time. I do not need to point out that the implications of these sketches of possible futures for today's collective actions remain unexplored.

POSTSCRIPT 2012

It is interesting to ask whether, in the dozen or so years since this article was written, Australian society has discernibly moved down any---more than one perhaps---of the six possible paths to the future I identified at that time. For example, establishment thinkers continue to subscribe to the belief that single-minded pursuit of *Economic Growth* is the way to a rosy future; and established power elites have driven the economy accordingly. It is only since the global financial crisis of 2007-9 that the correlation between rapid economic growth and inequality of wealth distribution has become an issue of widespread concern, laced with premonitions of social unrest. But what of the other scenarios I evoked?

The scenario of a country *Struggling to Cope* is one future that, fairly clearly, has not eventuated. Yes, there have been sizeable disruptions to social organisation in the last decade or so, including natural disasters and financial-economic crises, and there have been strong but less abrupt forces imposing social, political and economic change, e.g. economic restructuring, global markets, refugee and migrant flows, the 'war on terror.' However these have not come together in an interacting confluence with sufficient impact to disrupt the daily lives of large numbers of people; there has not been a sufficient fall in quality of life among enough people to warrant the label of *Struggling to Cope*.

It would ring truer to say that the country has been *Muddling Along*. Advocates of a *Conservative Development* strategy, with its focus on building up societal capital via 'tax and spend interventionism' have had little success in pushing public investment beyond what is needed to service a rapidly growing population and the demands of an influential business lobby. The quality of education, health, housing and social services has largely stagnated. There seems to be a widespread blindness to the contradiction between the community's aversion to taxation and its unquenchable demand for services which are normally funded by taxation

Post-Materialism, my third 'proactive' scenario, is still an idea whose time has not come in Australia. While there have been increasing concerns, and a degree of policy response to a variety of environmental and resource allocation issues, there is still a widespread unwillingness to accept or acknowledge that reducing energy use and material throughputs is a necessary condition for improving environmental quality.

Nor is there any sign that Australia is on the way to becoming a *Learning Society* or *Experimental Society* where there is a widespread recognition that society's primary task is one of consciously adapting and pre-adapting to changes and foreseeable changes in our global and domestic circumstances. Australia would benefit from such a cultural transformation but this would seem to require an improbable shift in political consciousness or, more dangerously, a rapid fall in quality of life

POWERING UP TIMESHIP AUSTRALIA⁶³

Ockham's Razor fans are more likely than most to understand the power of compounding. The Australian population grew by 1.2% last year (2000) and, if that growth rate continues, we will have another 18 m Australians when your new grandchild turns 50. And there will be four times the present Gross Domestic Product (GDP) to spread around that doubled population if we can hold a 3% annual economic growth rate over the same period. Given our fondness for flocking together most of our cities will be twice their present size in 2050 with Sydney well above that.

Growth is a 'good news' scenario for many; not so good if you think city life is polluted and congested enough already. Air pollution in a congested city with Sydney's proportion of diesel engines is equivalent to smoking a packet of cigarettes a day. And you may have doubts about national GDP as a measure of quality of life for your middle-aged grandchild. Will she get her share? How much of her share will come as things she wants and how much will be the costs of suppressing the things she does not want?

What fewer listeners will appreciate is that, for 100 years, GDP has grown in tight correlation with the nation's primary energy consumption. Seems you can't have one without the other. A graph of this remarkable partnership should be displayed in the offices of every bureaucrat, politician and CEO in the country, even if it means displacing the Queen. Why? Because it is at the heart of several of the biggest challenges the Australian community will face between now and 2050:

- Managing the national energy mix
- Managing lifestyle demands
- Managing environmental quality
- Managing the big cities
- Managing society's complexity

This bold assertion rests on three working hypotheses:

- Nearly all economic growth requires growth in energy use and (nearly) all energy use produces residues and impacts which pollute and degrade natural systems.
- Doubling population may well double GDP but will have little impact on GDP per capita (as a number of respectable studies show). It is productivity gains generated by capital growth which raise GDP per capita.
- Doubling the size of the population and the economy more than doubles the management effort required to keep society running smoothly or, more

⁶³ Clearly written for the ABC radio program *Ockham's Razor*, but I can find no record of its having been presented. Perhaps Robyn Williams, the show's presenter, didn't like it! The piece is based on a series of three articles written for Australian Financial Review's, Friday Review, July-August 2001.

pessimistically, to stop society collapsing (systems theory asserts that a bigger society is not only more complex but more fragile). This hypothesis is picking up the fashionable idea that there are diminishing marginal returns to further complexifying the way governments and markets organise society. Why? One reason is that it is harder for decision-makers to predict the consequences of their actions in a complex society.

Whatever strategy we come up with for managing the nation's future energy mix, it will have to recognise two inescapable boundary conditions. One is that long-term oil prices are likely to rise in real terms. The other is that as the effects of global warming begin to bite, the world community is not going to allow Australia's economy to be based as strongly on the use of fossil energy as it is now. That is unfortunate because our present energy 'strategy' can be summarised as oil for transport and coal for electricity generation.

On present indications, Australian and global production of the transport sector's magic fluid is going to start declining soon. The conventional estimate (International Energy Agency) is that world oil production---currently 40% per cent of the world's energy supply--- will peak somewhere between 2010 and 2025. Thereafter, oil production could halve every 25 years or so. Its share of a much larger world energy market could be less than 10% by 2050. The energy breakeven point for USA oil production (when it takes a barrel to retrieve a barrel) will probably occur in the first decade of this century and others will follow. Plainly, the real price of oil is going to rise, and rise again, and economies which steadily reduce oil use per dollar of GDP will be advantaged.

Fortunately, of its own accord, the Australian economy is restructuring towards services, dematerialisation (using relatively less physical stuff), miniaturisation and more efficient energy use. All of these will help to decouple growth in energy use from economic growth and economic growth from environmental losses. Unfortunately, even in combination, these particular trends are only going to make a difference at the margin---especially in Australia where decoupling has been less marked than in the OECD which reduced the energy intensity of its collective economy by 31% between 1973-1996. Still, while important, decoupling is not the main game. What we do about our basic oil-coal strategy is.

BEYOND A COAL-OIL STRATEGY

No worries about options on that front for a lucky, farsighted country (LFC). Stabilising the population would reduce growth in energy use till 2050 by, perhaps, a third. If the P word makes the pollies feel faint, remember that we have natural gas coming out our ears (as the Western Australians say). Everyone knows that natural gas is the bridging fuel between the oil economy and the hydrogen economy. And that using natural gas reduces carbon emissions. Well done Australia.

What does seem to have been overlooked in the aforementioned LFC is that if you subtract a projection to 2050 of domestic use plus sales abroad from the sum of Australia's Category 1 and 2 gas reserves (data from Australian Geological Survey Organisation), the answer is negative. At least it will be negative if we continue to double the number of gas trains constructed on the North West shelf every five years or so.

Perhaps we shouldn't write off the biomass option. Excuse me? We have the technology, the land and the sunshine to produce biodiesel and fuel (m)ethanol in abundance from plantations and field crops. The bonus from the biomass option would be a boost for the regions, a carbon-neutral transport-fuel system and, for our agricultural soils, a lowering of salty water tables. Costs and prices are converging on the breakeven point but the capital investment would be awesome. As a minimum we need to revive serious biofuel research and demonstration programs. Alternatively, (ssshhh) we could just stop locking ourselves into massive long-term gas export contracts.

How to provide liquid fuels for transport is half of the energy-mix question. The other half asks how commercial and domestic electricity will be generated as pressure comes first on the coal option and then the gas option. The precise energy mix after about 2020 will depend on today's choices of both research and investment paths. Improvements to fuel cells (these are something like batteries you recharge by adding fuel) have the potential to trigger 'the big switch' from a combustion-based polluting economy to a sustainable hydrogen/electro-chemical economy. In one way or another, permanently rising oil prices and, eventually, gas prices will stimulate the development of renewable energy technologies like solar power, geothermal and ocean thermal power, wind power, tidal power and hydro power. Cornucopian possibilities for all of these except hydro power exist in Australia.

A practical method of harnessing the power of nuclear fusion for electricity generation would transform the world but Mark Oliphant's most optimistic delivery date for that technology at any meaningful scale was 2040 (And you thought coal-based electricity generation was capital intensive?). Other ways of drawing energy from collapsing hydrogen atoms are even further away. Still, unless such technologies emerge, the choice for an energy-hungry economy, as timid about renewables as we are, may be between learning to clean up coal-based generation and learning to live with the hazards of power from nuclear fission. Now, where *did* all those options go?.

Improving what you are already good at doing is not necessarily the right strategy when there is a paradigm shift on the way (as the mammal said to the dinosaur). Nevertheless, new methods of sequestering (locking up) carbon dioxide away from the atmosphere or new 'clean' technologies may allow the increasing use of 'dirty' fossil fuels such as coal and tar sands. For example, carbon dioxide and heat from coal power stations could be used to grow edible micro-algae in vats.

Whether from nuclear, renewable or fossil sources, it would not surprise if the primary function of large-scale electricity generation in the late 21st century was to produce hydrogen from water and pipe it to where needed. Under this scenario, hydrogen, if we can learn to safely store it, gets to be used both as a transport fuel and in free-standing fuel cells supplying local-area power.

So, what do we know after all this? We know that we are going to have to exit our oil-coal strategy for providing industry and consumers with energy. Global warming and finite oil reserves (bring back the Club of Rome!) will ensure that. We know that if we want to follow the 'good news' scenario of doubling population and quadrupling GDP by 2050 we are going to have to increase primary energy production by 3% a year (more compounding) less a temporary correction for whatever decoupling we manage to achieve.

The enormity of the investment task implicit in this scenario, irrespective of which technology mix we adopt (clean coal, gas, nuclear, biomass, renewables) now begins to emerge. By 2050 we not only have to replace the existing coal-oil infrastructure with something else, we have to build a further three versions of such a system. The metaphor that springs to mind is keeping the supertanker off the rocks---put the wheel hard down, keep it down, pray. In other words, somebody has to start picking winners and then backing them. If nothing else will convince you, look at it this way. By 2050, the extra energy required to service an economy with a strong growth record will be 120 times the capacity output of that nation-builders' icon, the Snowy Mountains scheme.

Unfortunately, the sort of 'carbon restraint' strategies discussed do not have a snowball's chance in hell of bringing Australia's share of carbon emissions down to a level where pre-industrial levels of atmospheric carbon would return (assuming all countries to be similarly assiduous). What Kyoto reaffirmed is that politics is the art of the possible not the preferable. The startling fact here is that, under current technologies, global energy use would have to fall to a third of the present level to produce levels of carbon emissions which could lead back to a pre-industrial atmosphere. Did you hear what I said? Energy use at a third of present levels, not projected levels. Our quota as a developed country could be even less.

Perhaps it does not matter that the world cannot tackle this problem meaningfully. A few hundred years of global warming (even 'runaway' global warming where warmer conditions trigger the release of carbon locked up in the tundra) might be just the ticket for deferring a coming ice age which is already well overdue. It is an argument (flawed as it happens) which defenders of global growth do not seem to have discovered yet.

HOW TO USE ENERGY

Let me turn from the challenges of how we are going to produce energy to the question of how we are going to use energy over the next five decades.

The contemporary focus on carbon emissions as the big environmental problem obscures the pervasive two-edged role of energy in both developing and destroying the natural world. All development of natural resources, whether for production (e.g. land clearing) or consumption (eg tourist resorts), requires energy and all energy use involves physical transformations which reduce the amenity value and services provided by natural systems.

Take pollutants, the unprocessed residues of such transformations. The simple Malthusian view of pollution is that unless pollution per unit of output can be reduced at a faster rate than total output is increasing, the limited assimilative capacity of natural pollution sinks (airsheds, watersheds) must eventually be over-taxed and air and water quality further reduced. QED. So far, no can do.

It has to be accepted that, with a few win-win exceptions (e.g. protecting fish nurseries in estuaries and mangroves), development---meaning expansion of output from the resource-based industries---is a one-way street. We cannot travel down it without losing something in the way of irreplaceable amenity resources and without permanently decreasing the range of future possibilities for using what's left. There are no free trips, no refunds. The umbrella task in natural resource management is to decide how far and fast to travel down this one-way street while developing strategies and technologies which will allow us to improve the tradeoff rate between economic benefits and the loss of ecosystem services which run from water filtering to spiritual renewal.

A decision to stabilise Australia's population at 24-25 million within a generation or so instead of doubling our numbers by 2050 would do more to slow growth in energy use than almost anything else. The modest levels of net migration that would ensure stabilisation would be politically popular. Business and a few elites would grumble but their traditional arguments for a doubled population, domestic market size and international influence, seem thinner by the day.

The biggest and boldest policy option for managing energy consumption would be to cap it. In a volatile political climate where the middle class is already flirting with post-materialist values and looking beyond more commodity-consumption for improving quality of life, the word 'impossible' has to be used carefully. If energy producers had to bid for permits to supply Gigajoules to a fixed-size market or one growing at a capped rate, market forces would quickly eliminate profligate energy use. Splitting that overall Gigajoule limit into separate limits for solid fossil fuel, liquid fossil fuel and renewables would further improve policy flexibility; and Gigajoule quotas could still be combined with tradeable carbon quotas, that other idea in good currency.

The natural corollary of energy limits in a post-materialist green society is materials limits. The idea here is to impose tradeable upper bounds on overall materials consumption (net throughput) as a way of stabilising and then reducing the amazing 200 tonnes of materials processed annually per Australian. The figure includes exports. Currently, under increasing average real incomes, energy and materials consumption per head is actually rising, albeit somewhat tempered by an ageing population and efficiency gains. One factor accentuating per capita consumption trends is the legitimate aspirations of poorer people to consume as richer people do. Another is the acceptability of conspicuous consumption which tends to be both resource intensive (eg holiday homes) and environmentally degrading (eg jet skis, 4-wheel-drive bush-bashing).

In successful ecosystems, nutrients and other materials are largely recycled, with small losses from the system being balanced by small gains from the outside world. The analogue in a post-materialist Australia would be to encourage an 'industrial ecology' approach to managing the use and re-use of physical materials. The objective would be for all wastes to find an economic use or be put into the environment without disruption. Eventually, all consumable products would be biodegradable and all durable service-providing products would be fully recyclable.

Further complementing economy-wide limits on total materials throughput, more targeted programs for actively pursuing dematerialisation of the Australian economy would need to be considered, initiatives such as :

- Introducing full-cost pricing for the use of land-fill sites
- Promoting recycling by encouraging 'closed loop' manufacturing, based on the automated identification of components, analysis of product 'life cycles', technologies that encapsulate waste in new products and composites and regulations that permit use of recycled materials
- Developing official design standards for products that allow them to be identified as environmentally friendly (like low-temperature washing powders and low-phosphate detergents) or dangerous to health or the environment (eg building materials that emit toxic gases, leave toxic residues)
- Encouraging the production of high quality, long-lived (20 years?) consumer durables that can be readily repaired and reconditioned. It would be a mistake

to regulate to achieve durability because goods that are too durable may become obsolete in terms of energy efficiency, speed, pollution etc

- Introducing preferences in government purchasing for goods that are biodegradable and readily recycled
- Introducing excise duties for goods that contain a high proportion of virgin materials or produce residues that are difficult to recycle or are highly polluting at any stage of their life cycle.

Growing uneasiness about what we are doing to the environment may yet lead to a permanent change in community values---from consumerism to 'voluntary simplicity', this being the view that increasing consumption fails to satisfy real needs, increases pollution, depletes our grandchildren's resources and contributes to other social problems; that personal development is more strongly associated with quality leisure than with conspicuous consumption. Perhaps any move towards voluntary simplicity as a way of improving quality of life will be nudged along with less-than-voluntary marginal tax rates which impact particularly on the consumption of 'luxury' and 'novelty' goods.

Finally, along with population growth, energy and materials throughput, and consumerism, the way in which our ugly-beautiful landscapes are used will be the fourth broad determinant of environmental quality in 2050. This is most easily demonstrated by examples. If Australians do turn towards post-materialism in coming decades, we will see:

- more wind farms and solar farms
- more dedicated (single use) water catchments
- more low intensity, low chemical agriculture
- more large urban residential blocks supporting a self-sufficient lifestyle
- more biomass fuel farms growing deep rooted perennial species

If however economic growth remains Australian society's dominant goal we might anticipate seeing, for example:

- more cropping involving short rotations and intensive cultivation schedules
- more mining operations that produce intractable residues such as cyanide residues from gold mining and radioactive spoil
- more hotel developments involving high numbers of rooms in non-urban areas, particularly isolated and coastal areas
- more developments threatening significant groundwater contamination or rapid groundwater drawdown
- more urban sprawl onto open space and natural systems in the coastal zone and onto high value agricultural lands such as sugar and horticultural lands

Tackling consumerism, managing population and land use and using market-based instruments for containing energy and materials use are powerful ways indeed of moving towards an environmentally-friendly economy. But would the patient survive? Remember, even with active diversification, Australia's major export industries in the competitive global markets of 2020 will be mining, agriculture and tourism. And, whatever the rhetoric about triple bottom lines, exporters won't want to be burdened with pesky impact assessments and codes of environmental practice.

While niches for eco-tourism and clean green agriculture might proliferate under a strong swing to a post-materialist society, competition for energy, materials and workers, strong environmental regulation and weak home markets stand to drive growth and profits towards zero.

This is the fear, but we just do not know. We do not know if pushing for a dark green post-materialist society would wreck the economy or, conversely, rejuvenate it and improve its capacity to provide what tomorrow's people will need. No more do we know what would be delivered if we pushed for a doubled population and a quadrupled GDP by 2050, the 'good news' scenario. The world is far too complex a place to allow the consequences of such strategies to be modelled. with confidence.

And yet if we are not going to be wholly reactive, we do have to think about picking a way forward through the incompatibilities and complexities of the energy-environment-population-economy maze. It is a complex system. It is because the choices are so ravelled and uncertain that we need to be suspicious of comforting beacons like *sustainable development*.

THE COMPLEXITY PARADOX

Did you know that ecosystems which process high quantities of energy are more complex than ecosystems which process low quantities of energy? That is they have more plant and animal species interacting in more ways. Tropical rainforests are more complex than alpine meadows. And if the energy available to any mature ecosystem declines, complexity is lost and the system simplifies---collapses in the extreme case. There is a lesson here for human societies, particularly those mainlining on Gigajoules.

When our ancestors first learned to access higher quantities of energy per worker by growing cereals they began complexifying society through a process of population growth and role specialisation which, with ups and downs, has progressed to this day. First it was priests, healers and soldiers. Today it is spin doctors, biotechnologists and sports stars. Ever more energy became available as we moved from animal power, via water, wind and wood, to coal, oil and uranium.

In tandem with growing energy supplies came a succession of technologies which guided the extra energy into increasing output per worker. For example, stirrups, horse collars, barbed wire and tractors have successively transformed agriculture. Even with more mouths to be fed, workers were thereby released from farming to work at providing enhanced or new services and products, usually with the assistance of yet more energy and technologies. Population grew with the food supply. The whole process accelerated with the industrial revolution but has been the same in principle from Mesopotamia to Silicon Valley.

Taken together, the interconnectedness in a country like Australia between energy supplies, economic activity, population dynamics, technological change and environmental quality produces what can only be called a complex system of natural resource management. That is, changes in any of these components affect the other components in the system in ways which often are not easy to predict and hence to manage.

Some examples. Technology will continue to squeeze human labour out of the production of goods and services, without necessarily providing either enough work of the same kind for those jettisoned, or the guarantee of a rate of economic growth sufficient to absorb them. A baby boom produces unemployment a generation later. Technologies bite back in all sorts of unexpected ways, the classic example being DDT which, thirty years after earning its inventor a Nobel prize, was widely banned. The 'rebound effect' is a phenomenon where, to take one example, an increase in the fuel efficiency of cars leads to higher, not lower, fuel use as people drive increased distances. Such counterintuitive results blossom in complex systems. Our ignorance is breathtaking. Economists can model the short-term effects of a new tax system but not long-term structural change in the economy. Scientists do not know if global warming will stall the Gulf Stream.

And so on. Complex systems can be wracked by waves of change at one moment and in stubbornly intractable gridlock at another. Feedback, the process whereby attempts to change one part of a complex system end up being stifled or, conversely, magnified, is ubiquitous in complex systems. Land clearing usually speeds up when attempts are made to stop it. But land rights claims encounter new obstacles at every turn. Long-chain dependency in modern societies means that disasters reverberate across the system; failures in utility grids are a good example. Not only are complex systems unpredictable, they are fragile under disturbance. Fragility is the price we pay for efficiency and specialisation. A company which produces the cheapest widgets cannot switch easily to producing gew-gaws if the market changes. A company which is geared to switching between these items will probably never be the cheapest supplier.

Why is it critically important to recognise that Australian society operates as a complex system? Especially when, as systems analysts themselves acknowledge, we do not know how to manage complex systems to get the results we want, or even what results are possible---not to mention the challenge of articulating what we want.

Perhaps the first and most important reason is to puncture hubris and braggadocio. Buoyed by our success at inventing material technologies, some, the technological optimists, envisage a technical solution for every problem, every desire (raise up the Tassie Tiger). Certainly we know how to turn out a stream of new technology but the problems needing technologies are proliferating even as the 'big science' cost per technology developed is escalating. More to the point, solving social problems requires 'social technologies', not (just) material technologies. For example, in the ailing Murray Darling Basin, Landcare programs which change behaviour are needed as well as salt pumps and trickle irrigation.

And then there is ideological hubris. One would have thought that this siren would be dead after the Berlin Wall and the subsequent failed triumphalism of liberal democracy. In Australia though it lives on as unreconstructed economic rationalism. The idea that by leaving a complex socio-economic system alone it will do what you want is even more naïve than hoping you might be able to nudge it into doing the right thing.

The second reward from seeing our society as a complex system is to remind us that (don't laugh) societies do collapse. Historian Arnold Toynbee documented 21 civilisations which have risen, flourished and collapsed and found that what they had in common was that they became so complicated to run that relatively minor challenges were sufficient to destroy them. OK, so none of us really expect social collapse. But what about a paradigm shift in social organisation triggered, say, by a final oil crisis? From growthism to post-materialism? From democracy to soft authoritarianism?

The erosion of the invisible part of the consensus that assures social stability is often unseen and unnoticed until the accommodation is destroyed and there is an unexpected catastrophic overturn---Boulding's 'iceberg effect'. While small changes can produce big effects, areas of highest leverage are often not obvious. Complexity theory warns us to beware of 'breakpoints', spasmodic changes that occur when slow forces for change eventually gain ascendancy over powerful but deadlocked forces; and that we should be prepared to capitalise on breakpoints when they occur. Happily, there is a warning signal to hand---paradigm shifts in social organisation occur when the old paradigm is breaking down (failing to deliver) and society, as in contemporary Australia, is becoming more turbulent.

The third payoff from viewing society as inescapably complex is that it opens the way to managing society as an evolving learning system rather than as an equilibrium-seeking system as is suggested in much social and economic theory. In a learning society there are no right answers, at least not before the event. Politicians would no longer be forced to declare their policies to be revealed truth and then have to seek scapegoats when things don't work out. In a learning society, governments would present their programs as carefully chosen experiments in ameliorating causes rather than symptoms. Meaning what?

Controlled experiments on complex social systems are clearly infeasible but government programs can still be chosen to learn something about the system's inbuilt behaviour rules as well as improve system performance. Social learning is unashamedly a trial and error approach in which, ideally, every attempt is made to look widely at all the downstream, indirect and unintended consequences of the 'experiment' and, after monitoring the results in terms of goal convergence, decide whether to continue or try something different. Tackling groups of problems collectively instead of one at a time is also part of the social learning philosophy.

The social learning process is like natural selection in evolution to the extent that variants are tried against reality and selected if found 'fit'. But that is about as far as the analogy goes. For example, variations are not generated by the blind chance of gene mutation but by purposeful attempts to design an experiment with, hopefully, favourable consequences. And humans can seek to actively avoid what has been called evolution's 'fatal flaw', namely its myopic concern for improved performance right now with nary a thought for what blind alleys the evolving species is being led into. But the prospect of Australia Inc switching from 'bandaiding' to a learning approach to policy making seems dim without the prodding of a disaster or a crisis of legitimacy.

Finally, dabbling with a systemic approach to long-term natural resource management suggests a list of trouble-maker questions that Australians ought to be asking. In particular:

- Do we accept, as working hypotheses, that there is a looming greenhouse problem of major proportions, that world oil production will peak around 2020?
- Do we really want to try to think about the energy-environment-economy conundrum as far ahead as 2050? If so, what sort of political system could do this? What sort of institutional framework would allow us to manage these issues collectively?
- How can we tell if the present system is vulnerable to collapse or on the edge of drastic spontaneous reorganisation? If it is, what are our options for

deliberately simplifying it or, alternatively, managing it to improve its resilience?

- Is the umbrella choice really just between low-energy post-materialism and high-energy growthism? Would active post-materialism destroy the economy? How can we let go of the growth tiger's tail? If sustainable development is something more than rhetoric, what is it?
- If we are going to be forced to abandon our coal-oil energy strategy, one way or another, what are we going to put in its place? And, seeing that massive investment will be required whichever way we go, when do we start? Or are we prepared to leave this fundamental question to the market? Is anyone in charge out there?

Here's wishing your new grandchild a happy fiftieth.

POSTSCRIPT 2012

When writing ten years ago there were several of today's energy issues which I failed to foresee. I didn't imagine current concerns about the impacts of biofuel production and coal seam gas production on the availability of prime agricultural land. Also, the year 2020 was my plausible date for global peak oil production but such may well have already occurred.

More broadly, I note that that the passing of a decade has seen no sizeable coherent move to seriously reshape our still problematic coal-oil strategy. At the margin, a fear that we are exporting too much of our finite gas reserves has emerged; and there have been many small attempts to introduce renewable energy technologies. As the planet warms, opposition to nuclear power is declining somewhat. But there is still little perception of the enormous capital 'hump' that has to be climbed if the energy economy is to be transformed.

Those who will be relatively disadvantaged by a transformation in the energy economy, mostly the privileged and politically powerful, continue to fight tenaciously on many fronts to protect their interests and their oligarchic system of government. Overall, I feel I am living in a time-warp where energy policy is made up reactively, in response to political pressure, events and ideas of the moment.

THE FUTURE IS ANOTHER COUNTRY⁶⁴

The future is indeed another country, one where they do things differently. It is a country which we can only explore inside our heads no matter what the number-crunchers and modellers would have you believe. As the late BA Santamaria said, 'Nothing is certain till it happens.' Keep that in mind as you read on. As future-gaziers, we are limited to imagining possible futures and grandly labelling them 'scenarios'. Some of these scenarios would really surprise an Australian Rip Van Winkle waking up in 2025 and some would seem little different from today's society.

A worst case scenario would be an Australia without people perhaps, killed by a nuclear winter (no sunlight) and a Chernobyl-like cloud of radiation. It is a possibility which is still real but one which most see as receding since the Fall of the Wall.

At the optimistic end of the scale we can imagine various scenarios built around the idea of a confident and competent people constructing a society offering high quality of life to most Australians. Which road to such an Eldorado would a really lucky country choose? Self-regulated capitalism based on a strategy of free markets and small government? Managed capitalism based on 'tax and spend' interventionism by a strong central government? Subordinated capitalism based on greening, localising and capping the economy and fostering participation by ordinary people in all the decisions that affect them?

Such sharp ideological choices have never appealed to Australians and the least surprising future for Australia, provided that the outside world does not intrude too rapidly and too nastily, is that we will muddle along, changing what has to be changed, often lagging but generally going in the right direction. Historically, our lack of confidence to declare an 'Australian way' has led to an over-willingness to copy others but, for whatever reason, our pragmatic style has still produced a society which is successful by world standards. Under a 'hesitant pragmatism' scenario we would still continue to nudge established trends---economic, social, environmental---in preferred directions and chip away at entrenched problems. And other trends would emerge spontaneously as new ideas and technologies came into fashion.

Specifically, what are some of the developments that would fit unsurprisingly into a future shaped by hesitant pragmatism?

Unless there is a flood of official refugees or illegal immigrants or a turnaround in fertility or mortality rates, the population in 2025 stands to be somewhere between 21 million and 23 million, depending on where the sanctioned net immigration rate sits between zero and 100 000 people a year. A not-implausible fall in the fertility rate from 1.8 to 1.3 births per woman (as in today's Germany) would reduce these numbers by a million or so. Ignoring immigration, deaths will outnumber births from about 2025 onwards. Despite the efforts of business lobby groups it would be surprising to see net immigration topping 100 000 annually while voters retain their present clear preference for low immigration levels.

People born in Europe (including the United Kingdom and Ireland) would comprise 6-7% of the total population while those born in Asia would constitute 7-9%, depending on the level of immigration. Projections of the population by birthplace can be contrasted with projections by ethnic origin. The latter indicate that in 2025 some 62% of the gene pool would be Anglo-Celtic, 15% other-European, 16% Asian and 4% Middle Eastern.

⁶⁴ Published under the title 'Healthier Little Vegemites' in *The Age Good Weekend Magazine* Jan 1, 2000, 24-25.

Most of the country's much larger population would still live in and around a few capital cities. Sydney would be Australia's one global-scale city with a teeming population battling pollution and congestion as the price for being players in the global information economy. High fuel prices will hasten the inevitable move back to public transport. Elsewhere, the current trend for people to migrate to the north-eastern and south-western seaboard might or might not continue. Employment and lifestyle considerations would be important determinants of the outcome here. For example, Queensland, with its growing tourist industry, offers jobs and, in many people's eyes, an attractive lifestyle.

Australia will be a slowly ageing society over coming decades. Some 3 million people, say 15% of the population, will be over 65 in 2015. By 2030 the dependency ratio (aged persons per person of working age) in Australia will be 0.33 compared with an OECD average of 0.37. This is not the major problem some warn of. Our age structure then would be comparable to Sweden's now, and we see the Swedes as travelling reasonably well. Older people will finance their lives by a mixture of state pension, job pension or superannuation, savings and some paid work. The pensionable age will rise by as much as five years as we stay healthy longer and under pressure from cash-strapped governments. And if there were a looming ageing crisis, the myth that immigration is an effective tool for either permanently or temporarily reducing the average age of the population collapses under simple demographic analysis.

Not only will Australian families be ageing, they will be playing musical partners as they do so. Families and households will take diverse forms and, as women come to routinely work throughout life, there will be more two-income nuclear families, perhaps with more boys than girls as sex-selection procedures spread.

With luck, it will be a slightly healthier society with both males and, more so, females expecting over 70 years of healthy life and seven years of poor health. And surely by 2025 we will have rationalised our clunky (nine systems) fee-for-service, cost-shifting (States versus Commonwealth) health system? Hospitals will have become treatment centres rather than treatment and recuperation centres as they are at present. General practitioners will largely be in group practices in order to share resources and streamline services. Do-it-yourself diagnosis and treatment with the help of Web and computer-based expert systems will increase. Vaccines will remain the most cost-effective tool in the public health system, including immunotherapeutic vaccines for cancer and auto-immune disorders such as diabetes. Meanwhile, about 1.5 million Australians will have diabetes by 2010, at a cost of more than \$1 billion a year, unless people stop eating too much and doing too little exercise.

We will still be dying largely from heart disease, stroke, cancers and, increasingly, from dementias (up from six to 12% of deaths perhaps). By 2010, management of neurodegenerative disorders of the elderly, such as Alzheimer's disease, will be a very major problem. Mental health problems in the community could rise dramatically as people's capacity to adapt is challenged by accelerating change in four areas---personal contacts, ideas, organisations and possessions. This is what Alvin Toffler meant by 'future shock'. The 'wild card' in the health pack could be the increasingly problematic dangers of 'chemicalisation' of our personal environments including air, water, food, clothing and housing.

What prospects for education? Depending on government funding policies, the proportion of children being educated in private schools could continue to rise, perhaps from 30 per cent to 40 per cent. The mix of useful skills pursued by the education system will continue to move towards information processing, computing and mathematical skills. While not all skills would be taught in school, schools would remain the organisational hubs for managing learning.

At the tertiary level, education will increasingly be privatised and focused on meeting the economy's need for entrant workers to have highly technical skills. As in America already, 90 per cent of students (up from 60 per cent) will go on to a university education of some quality. Meanwhile, the universities will increasingly lose their influence on public life, including setting and debating the national agenda. Learning for personal enrichment will become more the province of the young aged than the young.

Government funding for universities will continue to fall as technological advances make a sort of productivity growth possible in education. Broadband networks combined with intelligent software will facilitate the delivery of interactive learning media and communications to anyone anywhere. Rote memorisation will be a computer-assisted individual activity. Material to be rote-learned will be comprehensively packaged. Distance learning will become increasingly practicable and campus life will become a less important part of the university experience.

Governments of the future will find it increasingly difficult to earn the respect of those they govern. Firstly, governments are losing influence to international bodies and transnational corporations. Secondly, with social values dictating ever-lower taxes, the resources needed by interventionist governments to tackle new problems with new policies continue to decline; not that the debate over the legitimacy of tax increases to fund improvements to Australian society is over yet. Relations between citizens and governments will be mediated by a 'Charter of the Rights and Duties of Australian Citizens' as suggested by Donald Horne. An increase in single issue, green and independent parliamentarians will reflect a weakening of loyalties to traditional parties.

The costs and benefits of state governments will come under increasing scrutiny. By 2025 the states may have been reduced to token status (the Sheffield Shield!) and their powers devolved to regional bodies closer to an electorate demanding genuine participation in the decisions that mould their lives. Commonwealth activity will be limited to defence, environment, law, revenue collection and distribution, economic management and international relations. Trade and defence will still be the focus of Australia's overseas interests in 2025. But defence expenditure will not jump markedly unless regional stability crumbles under something like a China-Japan or China-US confrontation. At home, increasing use of private arbitration and mediation will have produced a de facto privatisation of the law.

Will we still be obsessed with the economy in 2025? Economically, Australia is already in transition from a declining industrial age to an emerging post-industrial, post-agricultural era, as evidenced, for example, by the growth of the service sector of the economy, particularly its exports of tourism, health services and education. Service industries, underpinned by information technology and telecommunications, will continue to represent a growing proportion (up from 80 to, say, 90 per cent of activity) of a growing economy. Energy consumption per dollar of output will soon begin to fall, ending a century of fossil fuel consumption rising in lock-step with GDP and environmental degradation. But environmental quality will only be improving in 2025 if total energy consumption is stable and total recycling widespread. Agriculture and mining will still be important and, along with urbanisation, still be the major threats to biodiversity and air and water quality.

The elite of the 2025 workforce will be those who manipulate and commercialise ideas. Others can look forward to an increase in unemployment and part-time work; more self-employment; unpredictable wages and conditions; and action against discrimination in the workplace. At least a third of the workforce will be holding down one or several part-time jobs. Aspects of today's working life which will have gone forever include: one job for life; little movement between occupations; vertical career paths; the clearly defined working day and week; hierarchical command lines; and the place of work as the central part of the individual's life cycle. And unions cannot be written out of the script just yet. For those with time and money, travel and organised entertainment will occupy leisure time while home-based activities will occupy the less affluent.

Undoubtedly, technological change will continue to drive much social change, creeping into our lives, changing the way services are provided, the productivity of labour, the range of goods we buy and the way we do things. But, ultimately, it is attitudes and values that give a society its distinctive flavour, not its technologies nor its industrial mix. For example, will Australia 2025 be a caring society? Future quality of life for Aboriginals and currently disadvantaged ethnic minorities such as the Indochinese will largely depend on whether the majority of Australians regard these groups with indifference, with hostility or with respect and as warranting positive discrimination.

The major religions, our historical source of values, will continue to lose their appeal, even as they more bitterly divide between liberals and fundamentalists. Islam will grow fast, but not enough to overtake other major religions. Social movements which are set for long term expansion include women's rights, minority rights and animal rights, environmentalism, and vegetarianism. Less predictable are the next generation's attitudes towards becoming wealthy, paying taxes, education, individuality and individualism, personal consumption health, work, living in a global society, the dissociation of rural Australia and patriotism.

So, all up, will Australians in 2025 be happy little vegemites? We just do not know. People are very adaptable and just because some of the changes canvassed here might not appeal to today's readers, things will look quite different to those who grow up with them. As it always does, time will tell.

POSTSCRIPT 2012

In writing this short piece for readers of a 'weekend magazine insert' I can remember wanting to be reasonably cheerful, which I was after a passing reference to Armageddon. I stayed away from 'social collapse' scenarios which become believable when the problems of global warming, overpopulation, resource depletion and intractable complexity are put together. I did not elaborate on how largely-hidden 'fish hook' problems like mental illness and chemicalisation of the environment had the potential to massively disrupt society.

Equally, I omitted any discussion of the possibility of transformative change in Australian society, meaning major changes across key institutions and in everyday life for most people. Indeed, unless it is imposed from the outside, transformative change in Australian society is unlikely while the Australian approach to government remains, as I described it, 'hesitant pragmatism.' Ten years on, this conservative society remains suspicious of strategic thinking, willing to muddle along and change only what, imperatively, has to be changed. Our sense of the future lacks vision.

So, much of what this article was hypothesising was little more than straightforward extrapolation of trends already under way---identifying changes to be adapted to, but happening slowly enough to avoid radical breaks in individuals' activity patterns, e.g. health and demography scenarios. And then I identified a few 'wish list' changes, things I would like to see happen rather than things I felt would be unsurprising if they did happen. For example, a 'charter of citizen rights and duties' seems as far away as ever; similarly the 'caring society.' Still, who knows? My target year was 2025 which is still more than a decade away.

LIVING WITH COMPLEXITY: CAN WE DO BETTER?⁶⁵

A POTTED HISTORY OF COMPLEXITY

The history of the human mind can be written as a steady upgrading in our power to conceptualise the world, once we cracked the master technology---syntactic language. Yes, there were hiccups when our search for meaning led us down the paths of animism and magic. But the Greeks, talking and writing to each other, decided that the truth was something to be discovered. Indeed, it was they who discovered that there might be something called the truth! Fast forwarding through the Dark Ages following the fall of Rome and arriving at the Renaissance we find Europeans learning how to systematically discover tentative truths by observation and experiment (Induction was never the Greeks' strong point). We call their recipes the scientific method. And it has served us well. By the early 20th century farm mechanisation was releasing the Western world's agricultural workforce from centuries of grinding, backbreaking labour. Electricity could suck the darkness out of night. And so on.

But, despite its successes, the mechanistic materialism with which Galileo, Descartes and Newton launched modern science took a simplified 'clockwork' view of Nature, one which had no place for the indeterminacies of natural selection, quantum mechanics etc. Physical relationships were reduced to motions which correlated in time and space. This Cartesian apparatus, as AN Whitehead called it, was blind to and blind-sided by complexity. How to study lumps of the physical, biological or social world where everything that happens depends on everything else that happens? What to do when nothing stays still long enough to make reliable repeated observations from which lawful generalisations can be abstracted? Heraclitus the Greek said it 2600 years ago, "You can't stand in the same river twice."

Twentieth century science pushed on through these background rumblings. Good scientists continued to "carve Nature at the joints" (thanks Plato), finding chunks where strong simple relationships overrode complexity. Some disciplines, notably economics and population genetics, resorted to equilibrium thinking---assume that the things you are interested in will keep changing smoothly towards a state where forces for change die away. The researcher's challenge is to identify one or more such states. In the real world something always comes along to upset this traverse, but meantime we gain rich insights. How powerful is the idea that in a perfect market the rate at which goods are supplied will, under the force of price, grope its way towards a balance with the rate at which goods are bought.

By mid-century people were scratching the complexity itch with systems thinking. In this narrative, the world could be parsed into *systems*, these being collections of parts which interacted much more amongst themselves than with the environment. With patience the way each link behaved could be quantified and the trajectory of the system over time simulated, on paper or in one of those new-fangled computers. The rewards were further powerful insights into how systems can be nudged and steered. But the frustrations accumulated. Many links were wilfully unstable and modellers could not cope with "system shifts," the appetency of complex systems to jump unpredictably from one pattern of behaviour to another.

⁶⁵ Talk to Independent Scholars Association, Canberra, August 2007.

Then came a rush of ideas for explaining and describing change-over-time in complex systems, including system shifts. Ilya Prigogine, Nobel Laureate, explained such “self-reorganising” behaviour as being like a camel flopping unpredictably to the left or the right as the last straw was added. More scientifically, the world, indeed the universe, is crammed with dissipative (energy degrading) systems which scoop in high quality energy (eg sunlight) and stuff at one end, so to speak, cycle these around various complicated pathways for a while and then excrete waste heat and rubbish at the other end. You, dear reader, are a dissipative system.

Within certain limits, systems adjust to changes in the stocks and flows of energy in their environment and still persist. But, if the amount of energy reaching a system exceeds some threshold, the system is forcibly broken up into simpler, smaller bits; post-war Europe for example. Conversely, if material or energy supplies from the outside world dry up, as in a volcanic winter, the system “dies.” These possible fates may be avoided should the system act as if to resist (eg store energy) or replace (eg migration) the threatening environment.

In between those deadly limits, a social or bio-physical system may grow as if to take advantage of energy flows that are not being used, eg wind farms. Or it may, without changing its structure, change the rate at which it processes energy (eg food rationing). This is called homeostasis, and it too has its limits, eg our ability to control body temperature. When a system is forced past its homeostatic limits, it sometimes has one last trick in its survival kit. And that is to spontaneously self-reorganise into a new structure capable of processing a modified pattern of energy flows. The chrysalis becomes a butterfly.

In all these cases the system is *evolving*, that is, it is changing piece-wise over time. Evolution is a universal process, not just a biological process.

Dissipation is the way in which the universe complies with the second law of thermodynamics, namely that, over the universe as a whole, energy quality keeps falling. When not reorganising themselves, most dissipative systems are behaving *chaotically* meaning that while they keep cycling stuff around and around in much the same way, it is never quite the same. Not what most of us mean by chaotic!

A WORLD OF COMPLEX EVOLVING SYSTEMS

In recent decades, this basic model of an active universe full of dissipative systems, each embedded in a changing environment and ticking over chaotically till prodded into jump-shifting, has been applied to an ever-widening suite of physical, chemical, biological, psychological and social systems; from galaxies to nation states. The particularities and elaborations differ but the central idea of regarding what one is studying as a complex evolving system has generally proved workable and plausible. This common central idea has encouraged cross-fertilisation.

In biology for example, our understanding of the evolution of species has moved beyond Darwinism and neo-Darwinism. Its not that Darwinism---heritable variation followed by natural selection---is wrong, just incomplete. Tracing out a plausible history for a species nowadays requires consideration of various forms of coevolution (circular causation) including adaptation and pre-adaptation to changing environments, how species change their own environments and symbiotic relations with other species.

Consider next an example from cultural evolution, our main interest in this essay. Joseph Tainter, one of the few archaeologists to have made a comparative study of collapsed societies concluded that each time a society brings in measures to solve a problem it makes the society more complex (you can never do just one thing) and the next problem even harder to solve. Eventually, at some point the costs of additional reorganisation exceed the benefits. Tainter's insight is that reactive problem solving is often successful in the short term but, in the long term, it is a recipe for "gridlock" and may well increase that society's vulnerability to collapse. Another insight which comes directly from applying complexity thinking to cultural evolution is that uncontrollable runaway change is always a possibility.

At very least, such insights help us understand past cultural evolution a little better. Maybe the Roman Empire got too complex to manage and maybe Eurasia suffered self-amplifying warfare in the Bronze Age. But the science of complex evolving systems is still adolescent and, as yet, has little to offer the future-gazer. Look at the uncertainties surrounding the prediction of climate change despite great efforts in that direction. Even worse, what we do know of complex evolving systems suggests that future-gazers have every right to be pessimistic.

HOW TO FRIGHTEN THE COMPLEXITY PROBLEM

Despite the prediction deficit, there is still reason to believe that the insights which are dribbling in from the science of complex evolving systems can help with this pervasive complexity problem. Pardon? The world is a complex place in which societies are constantly under threat of disruption, destruction, regression and stasis (lack of "progress"). In that contrary world, societies face a suite of interdependent ever-changing problems which they do not know how to tackle with confidence. This be the complexity problem.

The first thing complexity thinking can offer societies wanting to guide their own cultural evolution is an updated world view. Rather than seeing Australian (say) society in ideological, reductionist (eg, growth solves all problems) or fundamentalist terms, why not see it as a complex evolving system? Naming something is the starting point for thinking productively about it. The suggestion being made here is that we should extract as much as possible from studying Australian society as a self-reorganising system which keeps experimenting with its technology mix (and that includes social as well as material technologies), changing the way it does things when and if change promises to solve a problem or capitalise on an opportunity. Attempting to change the Constitution is a good example.

The over-arching lesson that comes from seeing societies as irrepressibly, complexly and unpredictably evolving is *Be prepared*, this being a punchier version of the more academic injunction to *Embrace proactive adaptation*.

Many guidelines for implementing a strategy of proactive adaptation suggest themselves. Here are a few.

Guideline: Draw on history and other disciplines to identify principles of cultural evolution which need to be recognised by policy makers.

Example: Some societies, we call them resilient, tend to resist shocks.

Policy response: Use periods between crises (good times) to accumulate capital, redundancy, slack etc for countering shocks when they arrive.

Example: Many new technologies have unforeseen side effects ('biteback') which soon demand that they be modified or withdrawn.

Policy response: Attempt to foresee bitebacks in advance and have response mechanisms ready. It is common enough for bitebacks to be foreseen (asbestos, global warming) but uncommon for early remedial action to be taken.

Example: Social technologies (eg institutional arrangements) for dealing with new material technologies tend to lag.

Policy response: While markets foster material technologies, special generation and selection mechanisms may need to be set up for social technologies. Australia once had a Commission for the Future which could have done just this if it had been better funded and managed.

Scenario construction and *adaptive management* are other examples from a stable of tools for helping to make what-to-do decisions about managing unpredictable technology mixes. *Scenarios* are plausible alternative stories (not formal models) about what the future might be like, depending on what one does now and the whims of the environment. The challenge is to choose what to do today in such a way that the future is acceptable enough whichever story turns out to be true. Scenario construction is a popular way of developing strategies for managing highly uncertain but significant processes like pandemics, industry policy, energy supplies...

Adaptive management is a “suck it and see” philosophy where one deliberately pokes the system in various ways to get a preliminary idea of how it tends to respond to manipulation. For example, indigenous health policy would benefit from randomised trials of different approaches. One of the under-recognised virtues of the Australian federal system is that the different approaches of the States to common problems mimic a set of “treatments” in a large-scale experiment. Education systems are a good example.

BUT IS IT PROGRESS?

At one level there is nothing new in what is being said above. Big-thinking historians like Arnold Toynbee and WH McNeill have been willing to generalise about why societies do and don't survive and thrive. Folk wisdom is full of maxims which translate readily to whole societies (A stitch in time...). Management tools can be developed without asking why the world is unpredictable. There is no shortage of good advice.

Nor is there any suggestion that complexity thinking can, at this stage, dramatically improve society's prospects for long term quality survival. There may be very powerful insights on the way but honest researchers make no promises. An example of a recent win is the idea that when social networks reach a critical point, just a handful of extra random connections transforms the society from being highly modular to being highly connected.

But there is this damned heffalump in the room. As in the Great Depression there is a pervasive feeling that we live in a time of great change, maybe even permanent collapse of our society. Increasing complexity plus rapid social change is making reform ever more difficult. There is little feeling that our political institutions have the capacity to guide this change towards achieving high quality of life for most people.

The time is ripe for a sea change in how ordinary educated people view the world--- and it may just happen. And if such does happen, the political system will follow. That change could be a frightened retreat to a nasty populism or an iron bar fundamentalism. The suggestion here is that there is another candidate, one being created piecemeal by serious thinkers in a dozen disciplines. I am tempted to call it Preparationism. Its starting point is that the fundamental responsibility of any society is to be prepared. It asks what are we truly prepared for? What are we unprepared for? What should we be preparing for? And, what currently allocated resources should be reallocated to those preparations? Perhaps the sustainability movement is a bell-wether for proactive adaptation? I don't know. What I do remain convinced of is that we can lift our game even if there are no magic bullets for shooting the heffalump.

POSTSCRIPT 2012

This talk was a reflection on my long-held belief that understanding how complex systems behave, how they can be classified and the degree to which they can be managed is science's paramount challenge, one that confronts all disciplines. Apart from a sketch of how thinking about complex dissipative systems has developed historically, it offered a few modest suggestions to those trying to make what-to-do decisions in an unpredictable and ever-changing world---a world of complex dissipative systems. Thus, being adaptable, prepared for diverse contingencies, willing to experiment, willing to respond to early warning signs, and willing to simplify the system being managed (e.g. by capping energy throughput) all stand to help somewhat. In a longer piece I would have tried to assemble a larger collection of insights, principles and pragmatic guidelines for living with complexity.

Rereading this piece, I realise I am still not clear why some complexifying systems collapse into smaller simpler systems and others freeze up or gridlock, e.g. a society which becomes slowly dysfunctional because it cannot adapt to change in its environment or in its own internal organisation. Perhaps gridlock is simply collapse in slow motion?

A LOVELY BIRTHDAY⁶⁶

On Nelo's 25th birthday he rose early, printed off his customised copy of the First World Chronicle for Jan 1 2020 and sauntered onto the balcony for a long lazy breakfast with his partner Merede and their daughter Benita.

'Great to have a day off' he said as he turned on the whole-wall screen by simply thinking 'screen' and carefully enunciated his grandparents' universal access code in the direction of the Integrated Communication System (ICS). 'The trouble with being one of the lucky ones with a job, a symbolic analyst's job at that, is that you have to work 80 hours a week to get there and then 70 hours a week to stay there'.

From their fifth floor balcony Nelo could see beyond the walls of Safehaven Park, the suburb they had lived in since moving from Melbourne to be in Sydney, Australia's only world gateway city and home to a quarter of the country's 25 million people. 'What's the weather like?' said Merede. 'No smoggier than usual; certainly not a breathing unit day. I can just see the new wall they are putting up around Sowetoville, that underclass suburb near the University. That should make policing easier' he said. 'Why don't they fit every underclasser with an electronic bracelet to keep track of where they are. It would be easier than walling them out and the overclass in' she said. 'But you have to be convicted of something to be punished like that. Anyhow, the trick in managing the underclass is to make sure they vent their frustration and anger on their own, not on us or the service workers who live in the open suburbs'.

At that moment the ICS flashed and hiccupped discreetly and Grandpa Wong's smiling Eurasian face came up on the holocube. 'I wasn't going to answer till the ICS said it was you calling. This expensive retirement village you got us into has such an intensive activity program that we're desperate for some peace and quiet. When I was young, the old people weren't healthy enough to play and learn and socialise. And now there are so many of us. Three retirement villages in our suburb alone, you know'.

'Grandpa', said Merede, 'Nelo and I have a free day so we were calling to see if you and Grandma Wong could join us for lunch at the Safehaven Precinct Club. We're off to the Safehaven Fitness Center soon but we could pick you up around twelve'.

I don't know why you work such long hours Nelo', said Grandpa Wong, 'When I retired 10 years ago we were only working four days a week, eight hours a day'. 'It's still like that for industrial and service workers', said Nelo, 'and so they get lots of leisure time, but we brain workers, the symbolic analysts, are only a third of the workforce and can't be easily replaced. Anyhow, I'm not sure if I would know what to do with more leisure time. Travel isn't much fun now that you have to move around in big groups for safety in most countries. Experiencing Alaska by virtual reality in my own entertainment room is more to my taste. No wonder the tourist industry is in the doldrums'.

Merede, Nelo and Benita set off from the Fitness Center to pick up the oldies at Mon Repos Retirement Village. The electric motors in the wheels of their hybrid car made no noise and all they could hear was the small constant-speed diesel engine generating power for the lightweight batteries. They took a roundabout route so that they could stay on the main roads where carjacking was rare and where the Highway Security Service they had joined guaranteed a seven minute maximum response time from the moment you pressed the alarm button.

⁶⁶ Highly commended finalist in 2010 Marjorie Graber-McInnis Short Story Award.

‘We’ll have to go screen-shopping after lunch’ said Nelo, deftly avoiding a series of large potholes in the middle of the freeway. ‘This walk-through computer shopping is all very well but the door-to-door delivery system hasn’t been too reliable recently and I used the last of the fresh Indonesian mangoes for breakfast’.

‘Can I stay on at the Club after lunch and play in the virtual reality arcade?’ said Benita. ‘No, you have to log up more computer-assisted rote learning hours if you ever want to get to University and get a symbolic analyst’s job one day. And don’t forget to take your Easylearning pill first. We are happy to pay exorbitant University fees but you have to do your share. You wouldn’t want to become a service worker would you?’

‘What’s so bad about being a service worker?’ said Benita. We went on an excursion through their suburbs and I like those old-fashioned shops where people serve you’. ‘For a start’, said Nelo severely, ‘you would be dependent on the public health system which is no system at all and you would not be able to afford new clothes every season and you would have to cook meals in a tiny kitchen and wash your clothes at home and you couldn’t afford to be on the Webnet so you would never know what was happening around the world and...and...’ He finally ran out of breath.

Merede tried to make peace. ‘At least it would be better being a hairdresser or a medico than being an underclasser living in a shantytown suburb like Sowetoville she said. ‘They have no police, broken sewers and water every second day’. ‘And all those billboards pushing all those drugs’ added Nelo. ‘They haven’t introduced segmented advertising like the overclass and service suburbs get on the Webnet. I got quite a shock the other night when the Newheineken Group put an ad into the subscription opera on Webnet inviting me personally, Nelo Marten, to try their new Safehaven organic beer. Just how much further can they customise goods and services? Still, they don’t saturate the shows with ads like the old days; it’s called ‘pulse’ advertising and works just as well I’m told’.

‘Also, there’s no antipathy to advertising like there used to be,’ said Merede. ‘People rely on it to coach them in how to be sophisticated consumers. How do people know what they are meant to like and use to maintain their status ’til they see what the upmarket advertisers are pushing’? ‘I think megacorp sponsorship of the arts and global sport has helped a lot too,’ said Nelo. ‘With the decline in government, people need the corporations.’ ‘Sydney,’ said Benita, with a wisdom beyond her years, is really three cities isn’t it. One for the rich like us, one for the poor and one for the inbetweens’.

Grandma Wong was sitting on her verandah at Mon Repos when they arrived. ‘I’m listening to Mozart’ she said. ‘Classical music is one of the few things linking us to our past. And I’m not sure if we have any future. I read the other day that 200 mega-corporations now control 80 per cent of the global economy. Where will it all end’?

‘Come on Grandma’, said Merede cheerfully as Grandpa Wong appeared wearing his favourite kaftan. ‘Let’s eat’.

The meal at the Safehaven Precinct Club was as deliciously cosmopolitan, nutritious and organically fresh as usual, although interrupted several times by Merede and Nelo pausing to greet friends. Grandpa Wong had to be coaxed into having a hot salad rather than the meat-rich meal he wanted. At the Committee’s insistence, the Club only bought food containing natural biological preservatives and packed in film impregnated with freshness biosensors.

The Club, with its mainly local members, fellow symbolic analysts, was central to Nelo and Merede's social life. And Benita's too. She enjoyed the Children's Sport and Culture Program there while waiting for Merede and Nelo to return in the evenings. She especially liked holofilms of extinct species like giraffes and eagles. At Nelo's insistence they tried Newheineken's Safehaven organic beer. 'They have about eighty recipes', he explained, 'and they package them up by suburb and social class and for special interests like religious groups and environmental groups. You know-- Pilgrim's beer! Last Elephant beer! It's really an extension of the boutique beer movement of the 1990s. And they are working on an enzyme beer that instantly detoxifies the acetaldehyde byproducts of alcohol breakdown, would you believe'?

'I see the underclassers are starting a new party for the elections,' said Grandpa Wong, sipping on his beer and gazing at the smoke rising above Sowetoville. 'They don't seem to understand that as long as the service classes vote with the overclass they don't have a chance. Their main policy is complete deregulation of all mind-altering substances. Bit pointless I would have thought now that any kid can brew up and swallow a culture of genetically-engineered cocaine bugs or hash bugs or even Château Lafitte bugs. Not to mention registered designer drugs'. 'Seeing that it's mostly underclassers making up our 30 per cent unemployment rate, why don't they concentrate on employment policy'? said Grandma Wong. 'Waste of time,' said Merede. 'With middle classes growing all round the world, the mega-corporations don't need the buying power of our local underclass.'

'Would you two like to mind Benita next week while I'm in Amsterdam and Merede's in Seoul?' said Nelo. 'We can get a nannytemp in if you are too busy'. 'Love to', said Grandma and Grandpa simultaneously. But they secretly hoped Benita was scheduled for a home-learning week and not a learning center week. So with that arranged they drove the Wongs back to Mon Repos and made it safely home without incident---just in time for a group spa with the neighbours downstairs and a light omelette ordered in from the Homemeals people. They excused themselves early and, after some quick personal and business networking, headed for bed.

'Thankyou for a lovely birthday darling', said Nelo, as he reached for the excitation cream and snuggled up to Merede in the big double bed. 'Life is so good.' The lights turned themselves off.

THE REMARKABLE MIND OF JULIAN JAYNES---CRACKPOT OR GENIUS?⁶⁷

WHO WAS JULIAN JAYNES AND WHAT DID HE DO?

Julian Jaynes was a Princeton university psychologist who had a totally conventional academic career with one exception. In 1976 he published a book which, whilst still largely unknown, has nonetheless managed to excite both ridicule and fulsome admiration. *The Origin of Consciousness in the Breakdown of the Bicameral Mind* can be described as an abductive exercise in psycho-history and psycho-archaeology⁶⁸. It attempts to trace out; as plausibly as possible, consistent with the archaeological and historical record, some stages in the evolution of modern human consciousness. It starts with the origins of spoken language and effectively ends with consciousness as it flowered in classical Greece in the first millennium BCE.

Along the way, his story takes in the origins of religion and it is in that area that his speculations have stirred particularly strong responses. For example, David Stove, a brilliant larrikin philosopher at Sydney University had this to say when reviewing *Origin in Encounter*⁶⁹:

The weight of original thought in it (*Origin*) is so great that it makes me uneasy for the author's well-being: the human mind is not built to support such a burden. I would not be Julian Jaynes if they paid me a thousand dollars an hour.

I did think of starting by baldly presenting Jaynes' most outrageous idea and then trying to demonstrate something of how he got there. But I do not trust your open-mindedness, your willingness to suspend disbelief. So I am going to sneak up on you by first presenting some scene-setting concepts and then letting you have it right between the eyes.

SOME BACKGROUND FOR UNDERSTANDING JAYNES' THINKING

⁶⁷ Talk to Independent Scholars Association of Australia, Canberra, February 2006.

⁶⁸ Jaynes, J., (1976, 1979) *The Origin of Consciousness in the Breakdown of the Bicameral Mind*, Houghton Mifflin, New York. (1976); Allen and Lane, London, (1979).

⁶⁹ Stove, D.C., (1989) The Oracles and their Cessation: A Tribute to Julian Jaynes *Encounter*, April 1989, **72**, 30-38.

Consciousness

I will start with consciousness whilst quickly saying that I do not wish to get into questions like 'Are tadpoles conscious'? I am interested in human consciousness, what is sometimes called *subjective consciousness* (Richard Singer on the website of the Julian Jaynes Society⁷⁰) or to use the term favoured by ISAA member Zoltan Torey, author of a marvellous book called 'The Crucible of Consciousness', *reflective awareness*. Both terms are trying to avoid any confusion from using the unadorned word in discussion. While the essence of human consciousness is being aware of one's own thoughts, Jaynes is particularly interested in the evolution of such awareness in what-to-do situations and what-to-think situations. These are situations of hesitancy or doubt or stress where none of habit, tradition, custom, instinct etc dictates automatically how to behave. What-to-do situations have existed for as long as animals have had nervous systems but Jaynes' interest starts with how human minds have responded to such situations beginning with the emergence of spoken language and ending with the Greek civilisation of the first millennium BCE. Perhaps I can bound Jaynes' interests even more. He is particularly interested in what-to-do situations which arise as people play out their roles as members of social groups, ranging from tribes to complex urban civilisations.

Animism

Animism is the belief system widely believed to have been at the heart of the primitive or pre-critical mode of thinking and conceptualising the world which emerged in parallel with the emergence of spoken language. To put a date on this, language is widely believed to have reached full development by the Upper Paleolithic revolution in culture, technology etc, some 50 000 years ago.

In animism the behaviour of natural phenomena, both living and non-living, is explained by assigning objects and processes a human-like agency, a capacity to act⁷¹. For the present discussion we can note that this means that dead people are still alive in some sense. That might further mean, for instance, that one leaves food for corpses or that the dead can still speak.

Thinking

If you introspect in an open-minded way, you will see---that is, you will be conscious ---that a large part of what we call *thinking* in the everyday world is talking to oneself. Sometimes the conversation is one-sided, sometimes not. *Thoughts* are the separate sentences in that conversation. Note that, for most of us, the conversation is sub-vocal. We form the words mentally but stop short of carrying out the motor actions which would turn them into speech.

We don't know how the thoughts which are accessible to consciousness are formed; that happens in an inaccessible part of the brain which delivers them to the accessible part of the brain where we then know what we are thinking just as we know what we are seeing, hearing etc.

⁷⁰ www.julianjaynes.org (accessed 6 Feb 2006)

⁷¹ Another central aspect of pre-critical thinking is that the name of an object is part of that object in the sense that operating on the name or image of an object is the same as operating on the object itself. In the same vein, the words, notions and rules of one's culture are treated as unconditional givens, absolute and inseparable from other elements of reality. Because the relationship between language and thought has not yet itself become an object of thought, this means that, once established, assertions and rules in primitive-thinking societies will not change easily.

Voluntary control

While we do not know in any detail how thoughts are formed, we do know that they are under a degree of *voluntary control*. For example, if I focus on a particular word in a particular thought, further thoughts associated with that word begin to emerge from the inaccessible part of my brain.

Deliberative action

People like us, with a capacity for subjective consciousness/ reflective awareness have a particular way of thinking in what-to-do situations. We can voluntarily generate and become aware of alternative actions and their consequences. And then, in the inaccessible part of the brain, we can choose between those alternative actions and communicate the decision to the accessible part of the brain. In descriptive psychology this process is called *deliberative action*. The essence of subjective consciousness, at least in what-to-do situations, is the ability to routinely engage in deliberative action. Conversely, subjective consciousness is only needed for what-to-do and what-to-think problems.

Auditory hallucinations

During an auditory hallucination, you perceive something that is not happening, namely that some other person (s) is speaking to you. Auditory hallucinations are not uncommon amongst people in general, and very common amongst schizophrenics. While hallucinated voices may be friendly or unfriendly, schizophrenics report a high incidence of admonitory, insistent and commanding voices, voices that are very difficult to ignore or disobey.

Social control mechanisms

All societies and individuals need mechanisms for resolving what-to-do situations if they are to survive. Such mechanisms may not necessarily be successful of course. Indeed, it seems reasonable to assume that they have evolved over time in step with the evolution of social organisation.

For example, in pre-linguistic hunter-gatherer bands we can speculate that in situations where behaviour was not dictated by custom, habit etc, individuals might respond with *random exploratory behaviour* (a well-established primate drive) and the group might respond collectively by all *imitating* (another primate appetency) the exploratory behaviour of one or more individuals.

During the Middle to Upper Palaeolithic, as social groups enlarged and complexified, for example through role specialisation, the (cultural) evolution of new control mechanisms may have become necessary for survival. The response would appear to have been the invention of stratified societies---chiefs, leaders, headmen etc---in which the tribe followed the leader's behaviour or the leader's spoken commands.

Furthermore, the archaeological record suggests that over succeeding millennia an animistic mindset gave rise to somewhat more 'religious' beliefs in which the commands of former chiefs---now reduced to skeletons---were handed down, serving perhaps to buttress the current chief's authority. And it was such former chiefs who, in time, became 'gods'. Preserving the skulls of the dead in prominent places may have acted as *aides memoires* on how to behave for people with limited memories and attention spans.

ONCE WERE SCHIZOPHRENICS

We can fast forward now to the next revolution in humanity's evolution, the Neolithic revolution. Some ten thousand years ago, in the 'fertile crescent' of the Middle East, social organisation began switching from hunting and gathering to herding and farming. Villages, sometime with hundreds of residents, became common. The 'what-to-do' demands on individuals and societies in these new circumstances would have increased enormously. One can suspect that the plain vanilla chiefdom as a mechanism for social control became inadequate.

Jaynes postulated that, from somewhere around this time, and lasting till around the first millennium BCE, individuals, including leaders, were guided in what-to-do situations by auditory hallucinations that were interpreted as the commands of their chief, king or 'the gods'. Jaynes hypothesised, and this has since been confirmed, that the areas in the right hemisphere of the brain corresponding to the speech areas in the left hemisphere were responsible for the generation of (these) auditory hallucinations. They were transmitted across the inter-hemisphere bridge of nerve fibres called the *corpus callosum* to the auditory areas of the left brain. Jaynes called this pre-deliberative mentality the *bicameral mind*, a reference to the two 'chambers' of the brain. I can highlight the boldness of Jaynes' thinking by saying, to paraphrase him, 'we were all schizophrenics then'.

Jaynes assemble an enormous amount of circumstantial evidence, particularly from the period after the invention of writing, to back up his hypothesis. His list of early bicameral theocracies includes Mesopotamia, Egypt and Meso-America.

He follows the evidence for the bicameral mind from the age of polytheism down to what Karl Jaspers (1953) calls the 'axial age' of new religions, ie the period c. 2800 BP to 2200 BP which saw the emergence of Taoism and Confucianism in China, Buddhism and Hinduism in India, monotheism in Iran and the Middle East and Greek rationalism in Europe.⁷² And, by letting the evidence speak for itself, he comes to another startling conclusion: the 'voices of the gods' gradually fell silent. That is, the hallucinated voices grew fainter or multiple or confusing and became audible only after elaborate induction procedures (prayer, purification etc) or audible only to people in specialised castes (priests, prophets etc) or audible only at special places favoured by gods (temples, oracles etc).. This was the breakdown of the bicameral mind.

DISCUSSION

That completes the briefest of outlines of Jaynes' speculative history of human consciousness. His book is engrossingly interesting whatever your thoughts about its plausibility. It leads to all sorts of further speculation. For example, are we still in transition from bicamerality to deliberative consciousness? Will we sometime learn to access aspects of deliberative action and deliberative thinking which are currently inaccessible? And so on.

There are two lacunae in Jaynes' speculations which even his fertile brain could not fill. What caused the bicameral mind to appear and what caused it to eventually disappear? He talks about the second millennium BCE being catastrophic in various ways to the point where the bicameral mechanism was unable to formulate useful decisions in complex what-to-do situations. For example, you can't question the decisions delivered by the voices. You can't even take them or leave them. You take them. But once language had evolved sufficiently, behavioural options could be formulated in words and deliberative thinking could be learned and could replace bicameral thinking.

⁷² Jaspers, K., (1953) *The Origin and Goal Of History*, Routledge and K Paul, New York.

While I for one do not find that story convincing, I think it is correct to search for possible explanations at the 'software' level rather than the 'hardware' level of the brain. Anatomically, the brain has not changed significantly for tens of thousands of years but, as we increasingly learn, its organisation is immensely plastic. Perhaps new brain tasks simply took over, at a young age, the right-brain areas responsible for hallucinations? Who knows? But debating such questions is one of the pleasures awaiting you after you have read Julian Jaynes. I commend him to you.

POSTSCRIPT 2012

I continue to be captivated by the massive originality of Jaynes' thinking. While neuroscience has developed enormously since he wrote the *Bicameral Mind*, nothing has been discovered that invalidates his core hypotheses or, putting it more positively, Jaynes' thinking is wholly compatible with contemporary ideas about how the brain works. Indeed, imaging studies show the speech area of the right hemisphere to be active during auditory hallucinations. From a human-ecology perspective, Jaynes' model of consciousness still provides me with a template for thinking about how humans have made what-to-do decisions when adapting to the world in which they have found themselves; and how that capacity evolved.

WRITING AND THE FORMATION OF THE MODERN MIND⁷³

Father Walter Ong, a famous and unlikely student of the differences between oral and literate cultures, described writing as the most momentous of all human technological inventions, the technology which has shaped and powered the intellectual activity of modern man.⁷⁴ Presumably, that is, after syntactic language itself.

Table 1: Chronology of reading-writing technologies

Ideographs 4000 BCE	Rag paper 105 CE	Typewriter 1873
Pictographs 3500 BCE	Stable ink 400 CE	Carbon filament light globe 1880
Cuneiform writing 3000 BCE	Quill pen 700 CE	Radio telegraphy 1890s
Phonograms, Hieroglyphics 3000 BCE	Porcelain movable type 1040	Photocopier 1958
Dictionaries 2800 BCE	Spectacles 1250	Word processors 1970s
Books (papyrus rolls) 2800 BCE	Press with metal type 1436	Proto-internet connected 1980
Archives 2500 BCE	Cursive handwriting 1495	Fax 1980s
Mail 2100 BCE	Printed books 1500	World wide web 1989
Encyclopaedia 1800 BCE	First printed newspaper 1605	Electronic libraries 1980s
Steles 1760 BCE	Electric telegraph 1843	Text messaging 2000
Phonetic alphabet 1500-1400 BCE	Paper from wood pulp 1844	
Public libraries 300 BCE		

Writing systems developed and spread in two waves (see Table 1). The first, based on pictographic forms, began in Sumer some 3500 BCE and dispersed from there through Mesopotamia to Egypt, Europe, India and China. Writing systems in the second wave, beginning in the late Bronze Age, were alphabetic, meaning that they used one sign to represent one sound. A good example is the Phoenician alphabetic system which gave rise to Hebrew, Aramaic and early Greek; and then, via Greek, to Latin and Cyrillic. Around 800 BCE the Greeks invented signs for vowel sounds, making theirs the first complete alphabet with both consonants and vowels.

⁷³ Paper to annual conference of Independent Scholars Association of Australia, Canberra, October, 2007.

⁷⁴ Ong, W., (1982) *Orality and Literacy: The Technologizing of the Word*, Methuen, London.

As the Bronze Age progressed, and societies became more complex, writing was increasingly used for practical purposes such as keeping records of transactions and contracts; transmitting instructions from supervisors to workers; and providing permanent, accessible public statements of proclaimed laws. In this context writing was a technology which provided certainty as to what had been communicated and which allowed communication across time and space.

It was towards the end of the Bronze Age that culturally-important stories and narratives which, till then, could only be transmitted orally began to be written down, the first perhaps being the Zoroastrian Vesta (c.1500 BCE). The oldest of the Indian Upanishads has been dated to around the eighth century BCE---it is the philosophy of the Upanishads which underpins Hinduism, Jainism and Buddhism. In China Confucian writings date from c.500 BCE. The first-written book of the Hebrew bible, Amos, is now dated at 750 BCE.⁷⁵

It is hard to see how the great religions could have spread and matured without such sacred authoritative texts, unchallengeable as they were by the mindset of the time. Because they record what was said by God or prophet or enlightened one, they have the authority of the spoken voice, especially when read aloud. Think also of the importance of the New Testament and the Koran in the following millennium. Certainly the Greeks and Romans had no sacred or revealed texts of any stature and their religions withered. Rather, texts, particularly for the Greeks, became vehicles for the elaboration of philosophical and scientific inquiries and for the 'fixing' of foundation myths such as 'Homer's' two epic poems, the Iliad and the Odyssey (transcribed c. 700-650 BCE).

We can speculate that it was only with the transcription of foundation myths and the later realisation that the world was no longer as it was that the concept of historical time entered the consciousness of newly-literate societies. Mircea Eliade in *Cosmos and History* suggested that it was the Hebrews, the first truly alphabetic people, who developed a sense of 'one-way' time---an accreting, non-repeating sequence of events against a backdrop of cosmic cycles. Eliade's bold hypothesis, known as *the myth of the eternal return*, is that preliterate people inhabit a cyclical time wherein, they believe, their periodic ritual reconstructions of mythic events actually recreate (reactualise) those events and return the world to its beginnings.⁷⁶

The unsettling idea that historical time had to be discovered provides a first example of the process which this essay sets out to capture and present as plausible, namely, the coevolution of human thought with writing-reading technologies. Changes in writing-reading technologies have catalysed important changes in the way humans think and in what we think about. We shape our technologies and thereafter they shape us!

Perhaps we should start with the prosaics. A scan through Table 1 suggests that the evolutionary trend in writing-reading technologies has been towards easier recording of the spoken-imagined word and towards facilitating the accumulation-transmission of written words. One result has been that the stock of readers, authors and words available to be read has grown geometrically. "There is no end to the writing of books," said Ecclesiastes.

⁷⁵ Cohn, J., (2007) *The Minds of the Bible: Speculations on the Evolution of Human Consciousness*, <http://www.julianjaynes.org/> (accessed Nov 1, 2007)

⁷⁶ Eliade, M., (1954) *Cosmos and History: The Myth of the Eternal Return*, (trans. W.Trask), Princeton University Press, Princeton, NJ.

As for the mind, vocabulary is the best single indicator of how our minds have changed since, say, the late ice age. While words do get lost over time, the richness of modern vocabularies reflects giant leaps in how we perceive the world, both inner and outer, how we describe and conceptualise it and how we understand linkages between concepts. Another indicator is the increased range of cognitive tasks for which language has become the primary tool, eg simple logical operations which were not available to the People of the Book.

How can we possibly appreciate the pre-literate mentality? How can we think like our ancestors? The answer is that we cannot but, with the aid of intelligent informed speculation by people like Walter Ong, Julian Jaynes and Marshall McLuhan, we can make some plausible inferences⁷⁷. For starters, differences between modern minds and (say) Cro-Magnon minds are cultural. A Cro-Magnon baby could be raised to be a merchant banker. But, raised in Cro-Magnon times, her behaviour would be largely set by custom and tradition. She would have a weak sense of self and be uncritically accepting of verbal commands and assertions. Indeed thinking her own novel thoughts would be discouraged. Perhaps, if Jaynes is right, she was not even conscious, depending how one understands that fraught word, eg could she say “I am aware that I am thinking about this evening’s meal”? Her understanding of how the natural world works would be trapped in the animistic and the magical: stuff happens because spirits make it happen; things which are superficially similar can interact causally.

THE AGE OF MANUSCRIPT CULTURE

The transition from an oral to a literate or scriptal culture can be seen most clearly in the flowering of Greek thought, culminating by the sixth century BCE in a society where an elite had acquired sufficient cognitive skills, sufficient vocabulary (including the vocabulary of subjective consciousness) and sufficient shared knowledge to debate, individually and collectively, the nature of the world and society and how these might be better managed. For example, democracy was a social technology made possible, at least in part, by the Greek recognition that people are individuals as well as class members. Speculation was explicitly recognised and ardently pursued. More generally, the Classical and Alexandrian periods of Greek civilization, through their contributions to language, politics, pedagogy, arts, science, and philosophy, laid the foundations on which, eventually, the European Renaissance would be built.

The Greek capacity for systematic thought equalled ours. They knew how to trial candidate behaviours in the mind at low cost, and how to bring disparate ideas into a consistent harmony. They knew how to use premises to underpin an argument. They were able to challenge the truth of comforting beliefs.

⁷⁷ McLuhan, M., (1962) *The Gutenberg Galaxy: The Making of Typographic Man*, University of Toronto Press, Toronto.

Jaynes, J., (1976), *The Origin of Consciousness in the Breakdown of the Bicameral Mind*, Houghton Mifflin, New York.

Ong, W., (1982) *ibid.*

But long before the Greek awakening, and their invention of the vowels which allowed the elusive world of sound to be captured visually, writing and texts had begun to kill off the tribal mind. When Hammurabi, around 1780 BCE, incised his laws on steles (death to adulterers!), he replaced the previously unquestionable authority of a vocal command with an alternative authority (still read aloud) and, critically, created the novel idea that there might be reasons for not accepting the voice of authority. And if Jaynes is right, writing helped destroy many late Bronze Age gods for the same reason. Mind you, the gods were already in trouble because of their failures, via their priestly mouthpieces, to provide sound advice under the chaotic conditions of the time. In reality, custom and tradition were failing to cope with a changing world and ideas about alternatives were welcome. It then fell to the Greeks to boost this breakthrough into a “technology” of actively seeking and recording speculative ideas.

By now though, the thinking process was being transformed in an even more fundamental way. To a large extent pre-literate thought in clichés abstracted from their prodigious memories. The bards in oral-aural cultures relied on mnemonics and verbal formulae to store stories like the Iliad. The act of creating an original text---the “new” way to store knowledge---turned thinking into an exercise where consciousness is searched for relevant thoughts; visual symbols of those thoughts are then arranged sequentially according to certain rules. By Plato’s time (429- 347 BCE) the Greeks were doing this routinely and the old ways of thinking were being abandoned. This is why Plato wanted to exclude poets from his Republic!

Notwithstanding, visual and oral-aural modes of communicating have co-existed and co-evolved till the present day. Logos never did replace mythos. Even in Plato’s time, the art of rhetoric could only be studied from “written down” speeches. People read aloud and slowly (eg their prayer books) till well after the invention of the printed book. Instruction in mediaeval universities was via dictation and dialogue. In the 20th century there were still prominent philosophers committed to dialogue and opposed to book writing.

While writing out a narrative freezes the words spoken and renders it available in canonical form on demand, it does not wholly capture the experience of listening as the owner of the narrative delivers it. Written words are always a reductive abstraction from a total situation which is more than verbal. Inflections, emotions, emphases etc are lost. Marshall McLuhan has dwelt on the psychological consequences of absorbing information visually rather than aurally. For example, written information is acquired by visually tracking an end-to-end sequence of “word packets” while aural information arrives as a free-wheeling multi-faceted mosaic of meaningful sounds. McLuhan and others credit this upgrading of the visual sense with bringing on the Greek discovery of the concept of Euclidean space with its three uniform, continuous dimensions.⁷⁸

While not so momentous as creating space and time, writing contributed in other important ways to the evolution of cognitive capabilities and the buildup of collective knowledge. First, multiple individuals can learn from the writer of a text (ie, an extended discussion) even if he/she is distant or dead. In principle that can also happen in an oral culture (via teachers) but the scale is likely to be different. Given multiple copies of texts and a core of people able to read (libraries were invented in the late first millennium BCE), more people will be holding more knowledge in common in a literate society than in an oral society of the same size. This in turn will mean more people primed to contribute, through learning, to the creation of further knowledge.

⁷⁸ Gordon, W.T., (1997) *McLuhan for Beginners*, Writers and Readers , New York.

Texts themselves provide a stable starting point for ongoing verbal dialogue about their truth or about how the thinking they embody might be extended.⁷⁹ But a written text has several advantages over verbal discourse as a means of evaluating and upgrading an argument or exposition. Improving a written text can be treated as an iterative task, reviewing and revising one's previous thoughts. Selectively rereading what you have written reloads your working memory, sometimes in novel ways. Rewriting involves a dialectical process in which product and process, content and the tacit rules for writing persuasively and logically, have to be constantly harmonised. Reasons have to be crafted and conclusions synthesised.

In contrast, the tacit rules of *spoken discourse* are much looser, a game of verbal ping-pong which can easily wander. It is much easier to get away with sloppy thinking in discussion than on paper. On balance, you are more likely to "know what you think" when you see what you have written than when you listen to what you say!

Writing, being slower than talking, offers more opportunities to be creative, to reflect, to generalise, to abstract, and to integrate ideas. It encourages introspection, including the push to find words to capture the emotions which are expressed otherwise through gesture, mien etc when speaking. Metaphor is particularly important as a technique for understanding, exploring, capturing and, eventually, naming fuzzy feelings and values.⁸⁰ And insofar as writing gradually evolved syntactical structures capable of expressing metaphors, it may have played a pivotal role in the invention and experiencing of consciousness and selfhood.⁸¹ Ong is one who says that shifts from pre-logical to 'rational' consciousness can be most economically explained as shifts from orality to various stages of literacy.⁸²

Against these positives, the difficulties of using and learning from early texts need to be kept in mind. In Plato's time a library's documents were stored in unlabelled jars; there were no spaces between words, sentences or paragraphs and no punctuation marks or capitals; texts usually had no contents listing and no pages.

THE SHIFT TO A TYPOGRAPHIC CULTURE

Notwithstanding its brilliant start, manuscript culture barely survived the European Dark Ages that followed the fall of the Western Roman Empire. Some Greek and Roman learning from the golden age of manuscript culture was preserved in a few monasteries but, for several hundred years, it fell to Islamic scholars in several great university cities to retain substantial knowledge of Greek learning. It was not till c.1300 CE, beginning in Italy, that a revitalisation (renaissance) of European culture broke out, challenging the power of both the feudal political system and its partner, a deeply conservative and corrupt Christian church.

And then, in 1436, came the trigger that set off a cultural explosion, a period of rapid, accelerating cultural evolution: Johannes Gutenberg combined a number of pre-existing technologies (the wine press, paper, ink, replaceable wooden or metal letters) to produce the first (debatably) printing press. By 1501 there were 1000 printing shops in Europe, which had produced 35,000 titles and 20 million copies of books, almanacs etc.

⁷⁹ Sacred texts are an exception here. Because they cannot be adjusted to reflect a changing world, it is their interpretation that becomes a source of debate.

⁸⁰ A.N. Whitehead notes the difficulties Plato, a metaphysician of genius, had in making language express anything beyond the familiarities of everyday life and goes on to say that it is misleading to study the history of ideas without constant remembrance of the struggle of novel thought with the obtuseness of language. (*Adventures of Ideas* 1933/1967 Free Press, London, p120)

⁸¹ Jaynes, J., (1976) *ibid.*

⁸² Ong, W., (1982) *ibid.* p29

Books that changed the world

The great scholar Erasmus re-translated the New Testament in 1516 and within a year Martin Luther had initiated the Protestant Reformation. As bibles tumbled from the presses, ordinary people could, for the first time, study the Christian story for themselves. The market for books in languages other than Latin boomed and this had the side-effect of fostering senses of regional unity and nationalism. Mercantile capitalism and Protestantism emerged as forces which would create states and empires independent of Rome and feudalism.

The invention of standardisation

Let me turn now to a quite different way in which the invention of printing transformed the human mind. The invention of printing was also the invention of *standardisation*, an idea, a metatechnology (a technology for implementing other technologies), which is fundamental to the practice, *inter alia*, of bureaucratic organisation, industrial capitalism, scientific research, law, education and commerce. Like space and time, standardisation, the explicit adoption of and commitment to behavioural norms, is one of those generic ideas which are so big that, paradoxically, they are all but invisible. It is the background technology which allows people to coordinate with each other.

Book printing was the world's first mass production process. It is a process in which standardised inputs are fed through a repetitive operation to produce standardised outputs. Henry Ford was a copycat! More than this, as books were produced in increasing numbers they became more standardised, more like each other with respect to page layout, letter shapes, spelling, punctuation and word meanings. This loss in variety vis-à-vis the idiosyncrasies of manuscripts gave books a relatively greater usability.

In general, standardisation is a metatechnology which reduces the costs of communicating and implementing recipes for social, cognitive and material technologies. Provided the technology user understands the relevant standards, it does this by increasing their prior confidence as to what a recipe (really) means and in the likely qualities of the product. Once shown the way, the Renaissance mindset was to embrace standardisation. It is not too much to say that, from the Renaissance to the 21st century, it has been standardisation, including standardised money, which has allowed transactions and coordination between the specialist sectors of a multi-sectoral economy to take place.

ELECTRONIC CULTURE

The invention of the telephone in the 1880s and radio broadcasting in the 1890s introduced radically different ways of projecting speech through space. The gramophone allowed speech to be projected in time but it was a mechanical rather than an electronic invention like the much later tape recorder. Television was a prosthesis which allowed both speech and bodily presence to be projected in space and time (and allowed extension of our field of vision).

Marshall McLuhan has argued that these new technologies have effected yet another major shift in the way people think and behave, that we are returning to the oral-aural culture of tribal societies. We are spending much more time talking to each other and relatively less time reading and writing. More than that, he says, the world has become, in his famous phrase, a “global village” where radio and TV have created a shared mythic structure (Hollywood?) and a collective mind. A greater role for the leader’s *voice* in modern politics might explain Eric Fromm’s observation that people in democracies seem increasingly willing to give up their freedom to be individualistic and submit, like tribespeople, to external authority.⁸³

Another symptom of this mind-shift is what might be called a retreat from the standardisation which has been a fundamental and pervasive part of typographic culture or, more generally, the modern world. I certainly have an impression of declining standards in the logical presentation of arguments---coupled with greater use of emotional appeals. Another example is the greater use of a Newspeak in which the meanings of words are deliberately distorted, again to manipulate emotions.

For the present analysis however, the question to be asked is whether electronic technology has changed the way we think by changing the way we read-write? At this stage the answer, I judge, is No. There is no doubt that word processors, hypertext, voice recognition technology, searchable electronic libraries etc have ramped up the efficiency and the reach with which we both read and write. But I cannot see that our thinking processes differ from those of our grandparents. Just to be clear there, the subject matter is obviously different.

BACKTRACKING AND PATHFINDING

So, humans came out of the last ice age some 12-15 k years ago as hunter-gatherers living in aural-oral societies. As they learned to be farmers and herders they slowly established societies where decisions were made by custom and tradition; people believed in animism and magic, and novel thoughts were discouraged and even feared. Eurasia’s people were gradually gathered into city-based states and empires, frequently at war with each other. In the sense of being reflectively aware of their own thoughts, people in these Bronze Age and late Bronze Age societies were probably not even conscious.

Things began to change when, at the end of the Bronze Age, people started writing down their myths. They became aware of one-way time. They became aware that there can be alternative ways of viewing the world. In the last centuries before the Common Era the Greeks were most certainly conscious. They learned to catch their thoughts on the wing, record them and debate them. They carved space and time out of the natural world and they looked inwards to find that the residents were not gods but people called I and Me.

These bright treasures gathered dust through the Middle Ages but emerged, along with the Abrahamic texts, to feed the hungry presses of Renaissance Europe. Book printing as a prototype technology, and the waves of ideas inside the new books drove the world to change, and change again. Once they could be powered by coal and oil, standardised industrial technologies replaced, more than replaced, man and beast. Social organisation and values tagged along behind as Marx said they would. But the knowledge to keep the whole rambunctious show on the road was book knowledge, transmitted and updated from one generation to the next.

⁸³ Fromm, E., (1942) *The Fear of Freedom*, Routledge, London. (see Chapter 1)

We are now in an electronic age in which book knowledge continues to accumulate, not so much to transform an ever more complex society, but to service it. Our electronic prostheses give us the illusion that we can quarry what is needed from mountains of information and even do a little landscaping. The scale at which people can, and do, communicate with others, orally and visually as well as textually, has grown enormously since the 19th century. More than that, there has been a rebalancing of sensory contributions from the textual towards the oral and the visual. Social and employment advantages accruing to people with an aptitude for literacy have declined. At the same time, communications technologies are converging in the sense that interconversions between oral and textual versions of messages are ever easier.

Several conclusions poke through. One is that the task of understanding the role of writing in shaping the human mind has now been absorbed into that of understanding the role of something more generic, namely, digital communications technology. A more tentative conclusion is that while the range and size of tasks being undertaken by human minds continues to grow, the cognitive tools being used for those tasks remain much as they have been for several thousand years. Perhaps they have been sharpened and spread around but they are not fundamentally different: you could have a useful discussion about thinking with Socrates if he turned up. There is bite in the aphorism that the history of Western philosophy is a series of footnotes to Plato.

If so, as a closing question to chew on, we might ask where the mind might go from here? Is the natural brain, through genetic evolution, individual learning, acculturation or self-organising behaviour in collaboration with other brains going to think in a markedly different way as we move through hundreds and thousands of millennia to come? For example, might reasoned behaviour based on knowledge from past learning and a capacity for problem solving increasingly replace instinctual behaviour? Or, putting this another way, will we learn or evolve to better suppress instinctual behaviours which are readily accessible to modern people but which we judge to be maladaptive in a post-Neolithic world?

Will we learn to routinely detect the ego's protective distortions of reality? Some certainly think we are at a transition point on a path between behaviour being controlled by reason and being controlled by instinct and culturally-fixed behaviour. Reason requires dedicated neural networks, is metabolically expensive and is prone to various operating weaknesses such as a poor capacity to estimate and combine probabilities or to factor in longer-term consequences. Freud and Marx both debunked reason in their different ways. Freud saw it as rationalising the satisfying of suppressed desires while Marx saw it as rationalising class interest. Postmodernism revives the perennial view that only experience, not reason, can produce knowledge. For example, might we learn how to experience, at will, a state of heightened awareness of ourselves and our surroundings, what Colin Wilson calls 'perceiving reality directly'? I am thinking of something like Abraham Maslow's 'occasional peak experiences' in which people have moments of intense happiness as they apprehend their life-situation and pay attention to the world around them.⁸⁴

⁸⁴ Maslow, A.H., (1954) *Motivation and Personality*, Harper, New York;
Wilson, C., (1984) *CG Jung: Lord of the Underworld*, Aquarian Press, Northamptonshire.

Or, looking inwards rather than outwards, could we become more mystical? Mystical experiences, what Aldous Huxley called ‘mind-at-large’, are most readily understood as recapitulations of the stage in human evolution which preceded rational thought (giving reasons for choices) and individual consciousness, of times before there were egos.⁸⁵ In other words, the world as experienced through the mind of an early hominid. More prosaically, control by the neocortex is being suppressed in favour of the limbic brain. Achieving widespread access to the mystical state has been foreseen as a basis for universal empathy with others, to foster a sense of oneness with the world and as a foundation for the religious dimension of a universal culture.

More generally, might we learn how to consciously and routinely access the right brain’s activities (the sub-conscious mind) or even the brain stem’s autonomic activities (eg as it regulates blood pressure)? There is evidence that yogic and meditative techniques can show the way here, not to mention psychoanalysis and psychotropic drugs such as mescaline. Carl Jung mastered the ability to dream while awake (not quite like daydreams), what he called *active imagination*, as a means of accessing the unconscious activities of his right brain and of working towards optimal collaboration and understanding between his left brain and right brain ‘selves.’⁸⁶

There are various other presumed improvements that have been foreseen. Alan Snyder has suggested that, in time, everyone might learn to release powers such as *idiot savants* display, eg drawing like da Vinci, composing like Bach and performing amazing mental calculations.⁸⁷ Others foresee that we will learn how to massively improve both short-term and long-term memory, without producing information overload.⁸⁸ In fact, it is commonly believed that humans use only a small fraction of the brain’s information processing capacity and that harnessing such more fully might accelerate both biological and socio-cultural evolution, although not necessarily in expected directions.⁸⁹

Consonant with the idea of the ‘underused brain’, William Calvin, a neurophysiologist, has foreseen the possibility of retraining alternative cortical areas to replace lost functions and to break up obsessions and hallucinations. Nonetheless, competition for cortical ‘territory’ is a well-established principle. Thus if nerves serving a certain function develop early in a particular part of the cortex, then nerves which serve other functions may be inhibited from developing in that same area. This leads to Merlin Donald’s idea of *cognitive tradeoffs* in which training up certain skills can lead to a loss of other skills.⁹⁰ Could one implication of this for the future be that people are trained to be specialist thinkers in certain areas, knowing that this may reduce their capacities in other areas?

At the heart of problem-solving capabilities lies *intelligence* which, in general terms, is the capacity to perceive relationships between things. We may learn how to train this capacity more fully or we may develop psychopharmacological drugs which enhance general or specific intelligences. Under either approach there will be some selection pressure favouring those who learn well or who respond well to ‘smart pills’.

⁸⁵ Huxley, A., (1954) *Doors of Perception*, Harper Collins, New York.

⁸⁶ Wilson, C. (1984) *ibid.* p76

⁸⁷ Snyder, A., (1999) The Genius Within, *The Australian*, Nov 12, p12.

⁸⁸ Broad, C.D., (1925) *The Mind and its Place in Nature*, Routledge & Kegan Paul, London, Chapter 5.

⁸⁹ Wills, C., (1998) *Children of Prometheus: The Accelerating Pace of Human Evolution*, Perseus, Reading, p229.

⁹⁰ Donald, M., (1991) *Origins of the Modern Mind: Three Stages in the Evolution of Culture and Cognition*, Harvard University Press, Cambridge, Mass.

Calvin, W.H., (1997) *How Brains Think: Evolving Intelligence, Then and Now*, Basic Books, New York.

Learning to perceive relationships between things which are widely separated in space or time has not come easily to the human lineage. Hunter-gatherers relied on instinct to cope with seasonal change and variation. The peasant and the herder learned to look ahead a whole year and, eventually understood the 18 year lunar cycle. But looking ahead for several human generations has generally proved too much for our newly developed rational faculties; the part of the brain which controls impulsivity is still developing. Or, perhaps we do have some such capacity but choose not to exercise it? Or, perhaps in an uncertain world it is entirely rational to heavily discount the foreseeable future? If there do not appear to be any net survival or welfare benefits from further extending human planning horizons, long-term planning will not be pursued by our descendants any more actively than we do.

Finally, learning to think in terms of networks of causation (you can't do just one thing) rather than chains of cause and effect has proved similarly difficult. Early humans learned to deal with problems on an *ad hoc* basis and the need to see a problem embedded in the context of other problems rarely arose. We still find it difficult to believe that solving a problem generates other problems, not to mention new selection pressures. Can we move beyond linear thinking?

The verdict must be that, for an adolescent species, we have done quite well and, looking to the future, the panels on Blake's doors of perception are scrubbing up nicely.

WONDERING ABOUT HUMANITY'S DISTANT FUTURE⁹¹

I want to talk about a book I've just written. It's called 'Deep Futures: Our Prospects for Survival'. I wrote it largely because I'm very curious about how our species will fare over coming ages.

Will the human lineage survive, reasonably happily, into the far distant future?

Indeed, will we survive another millennium in reasonably good shape?

Will the next thousand years be just ordinarily difficult or, if the next ice age arrives suddenly, particularly difficult?

Supposing we survive the next thousand years, will we eventually go extinct as most species do, or will we evolve into a new species with which one might empathise?

Or into a whole lineage of species as in Olaf Stapledon's great sci-fi novel, *Last men, first men*?

And, supposing we continue to evolve, will that new species or its descendants survive the death of the sun as an energy and light source in five billion or so years?

Not to mention a clutch of other cosmic challenges ranging from asteroid strikes to 55 hour days.

Beyond that, there is the ultimate question as to if, when and how the universe will end and whether, in some sense, life might best that challenge.

PROSPECTS FOR SURVIVAL

Half my book is about our prospects for survival. It reviews what scientists and other informed future-gazers have foreseen for our lineage, both humans and post-humans, over the century, the millennium, the next ice age and beyond. Let me cut to the chase and summarise what I concluded from my investigations:

I concluded that the future is not predictable but is basically imaginable. If what people say about the future sounds plausible, it is best to think of their insights as scenarios, meaning possible or hypothetical futures. Here's a selection of four of those hypotheses.

1. While every century is difficult, the 21st century is going to be a particularly difficult one for Homo sapiens---politically, socially, psychologically, economically and environmentally.

Politically, it looks as though we will have to live through another century of power politics, one in which America's struggle to strengthen its economic, cultural and political dominance will be increasingly challenged.

Psychologically, we have just left a century which through its barbarity, inequity and indifference has left many people alienated, sociopathic and malevolent; and not just in the third world. By whatever means are available to them, those people and their children will struggle for recognition and justice or for revenge.

⁹¹ A talk on ABC Radio National's *Ockham's Razor* program, 31 Aug 2003.

Socially, societies everywhere will break down unless we can learn how to reform institutions---legal, medical, educational etc---which are failing in the face of rapid change.

Economically, the failure of marketization to solve the problems of poverty and sustainability and the growing possibility of a massive energy crisis threaten capitalism as the dominant form of economic organisation.

Environmentally, the use of increasing quantities of fossil fuels and the need to feed a world population of perhaps 9 billion by 2070 will continue to destroy the awesome beauty of the world and its capacity to feed and water everyone. What Alvin Toffler called 'future shock' is nothing more than having to cope with high rates of change.

2. Moving on, the good news for the third millennium, the next thousand years, is that it would be surprising to see the extinction of *Homo sapiens*. However the third millennium does contain the seeds of two 'worst case scenarios'. One is runaway or accelerating global warming and climate disruption. The other is a rapid start to the next ice age, even as we finally use up the world's supplies of fossil energy (including uranium).

Hypothesis 3. Metaphorically, the even deeper future will be a game of dungeons and dragons with our post-human descendants facing a succession of bigger and bigger challenges (eg permanent drought, long days, Sun-death) as well as random shocks such as volcanic winters and asteroid strikes.

Hypothesis 4. Because human consciousness is a recent development, we are still an adolescent species, particularly in terms of our need for immediate gratification, our need for authority in our lives and our susceptibility to turbulent emotions. While it is no disgrace to be adolescent, the longer we survive, the greater our chances of maturing into a lineage which understands itself and takes responsibility for its own future.

Let me summarise these various prospects with some betting odds. If I thought there was any possibility of collecting, I would set up as a bookmaker and offer:

10 to 1 on that humanity will survive the next millennium

2 to 1 against that the lineage will survive the next ice age

1000 to 1 against that the lineage can last more than a billion years

I won't be taking bets that the lineage will last past Sun-death.

Take note though that these are bets about merely surviving, not bets on whether most people will be achieving high quality of life. That is, I still collect if, in Hobbes famous phrase, life for most is 'solitary, poore, nasty, brutish and short.'

I would want be offering odds of more than 1000 to 1 to those betting on high quality of life for most people this century; and 100 plus to 1 for achieving that goal this millennium. I leave it to others to judge if this makes me an optimist or a pessimist. I am more focused on whether we can improve those odds.

SHAPING THE FUTURE

On that particular point I think we can and that brings me to the second half of the book where, making use of the idea of 'rolling priorities', I suggest a somewhat-prosaic strategy for managing the deep future.

I start to develop this strategy by pointing out that if you don't know where you're going, it doesn't matter what bus you catch. Or, less flippantly, without knowing what you want to achieve, you can't make plans to achieve it.

In *Deep Futures* I therefore suggest that the human lineage could adopt a working goal of what I call *quality survival*. That is, I am envisaging world-society working towards giving most people, now and into the indefinite future, the opportunity to live a high quality life.

What do I mean by a high quality life? I mean being able to meet not only one's basic physiological needs but one's higher needs for love and social bonding, for autonomy, for creative activity and for meaning.

Next in my strategy, I complain that managing the future is a 'wicked' problem, meaning that it has no definitive formulation and no conclusively 'best' solution; and, even worse, that it is constantly shifting. So, what do we do?

Well, one thing we can do is tackle the important things first. My suggested approach to managing the future is based on developing policy guidelines---rules of thumb if you like---for steering world society towards quality survival by responding collectively and selectively to a rolling set of priority issues, that is, to an ever changing set of priority issues.

What are priority issues? The homely principle being invoked here is 'If it itches, scratch it'. Priority issues are those matters judged to have a particular bearing on whether the lineage can achieve quality survival. They are 'rolling' in the sense that they will need periodic revision as circumstances change.

In my book I make a number of suggestions as to what we might designate as today's priority issues. These suggestions fall under the broad headings of the *social stability issue*, the *learning society issue* and the *perennial problems issue*. The first two of these are directed at getting things right in the long term and the third recognises that we have to keep working on that family of problems that never seem to go away. Let me explain, starting with the social stability issue.

(i) The social stability issue

In common with other complex systems driven by large flows of energy, human societies have one tendency to collapse or change direction dramatically, and another tendency to stagnate and fail to adapt to external and internal change. Change is never-ending. Even an apparently stagnant society is bubbling away underneath and moving towards the thresholds and crisis points at which change will boil over.

Understanding this complexity well enough to develop guidelines which will protect societies from their own instability and fragility, and, at times, their excessive stability--- gridlock and senescence if you like---is, in my view, a priority issue.

Getting such understanding is a truly difficult problem which science is only just beginning to address. Some progress has been made---using counter-cyclical economic measures is an example---but considerably more research over a long time will be needed to learn how to manage the stability problem with confidence.

(ii) The 'learning society' issue

Now for the 'learning society' issue. What do I mean here? A learning society is one that allocates a high fraction of its brainpower to the task of acquiring the knowledge that might guarantee high quality of life for most people into the indefinite future. What we know now is not nearly enough---from cosmology and planetary dynamics to biological and social evolution.

Starting immediately, we need to nurture and boost this 'social learning' process. But how? Here are four guidelines to start with.

First of all, we need to learn how to learn. Above all, we need to learn how to create widely-accepted social goals and how to identify the major impediments to achieving such goals.

Next, given the difficulty of predicting complex system behaviour, we must recognise the importance of taking an experimental approach to social learning. What works is what matters.

Equally, how children are educated and nurtured is the foundation of the social learning process---not to mention their chances of achieving fulfilling lives.

For a last sample guideline I will suggest that, despite its many problematic consequences, scientific research must continue to have an increasing role in social learning.

(iii) The 'perennial problems' issue

My remaining family of priority issues includes the perennial social, political, economic and environmental challenges that have plagued the world for, in some cases, thousands of years.

What priorities do I suggest here? Obviously I include the burdens of war, oppression, population growth and resource depletion. And, more positively, I argue for the importance of seeking a world federation and for promoting participatory democracy.

Somewhat less obviously, under social issues, I argue strongly for the need to tackle sociopathy---the problem that many people dislike or even hate most other people. Brotherly-sisterly relations are a big part of any society's social capital.

I also argue the importance of making the social contract more explicit and a better tool for constraining self-interested elites.

RATIONALITY IS NOT ENOUGH

What else then as I come to a close? Apart from looking at what futures have been foreseen and what we might do about shaping the future I also found a place in my book for some reflections on the art and philosophy of future-shaping as distinct from seeing that task only as an exercise in ends-means rationality. Rationality is not enough. Clear thinking will not be enough.

Making plans rationally requires quantities of time and knowledge which we just never have. More than this, rational thinking is not always very rational. For example, under the burden of what is called 'assumption drag' we can't see things that are staring us in the face. Or, as Regis Debray put it, 'We see the past superimposed on the present, even when the present is a revolution'.

Everything in the universe has a life cycle and that includes you, me, the species and the lineage yet to come. The art of managing the life cycle of the lineage is to see it as an existential challenge fully comparable to everyone's challenge of constructing their own successful life.

That means creating and attempting to live out a scenario in which the actor, let's call her Posterity, works her way through a tapestry of big demanding projects. Whether it is something called quality survival that becomes humanity's telos, its inspirational image of the future, is less important than that there be one.

This transcendental view of the future is beautifully captured in some lines from Rainer Rilke:

Once and once only for
each thing-then no more.

For us as well. Once.
Then no more... ever.

But to have been as one,
though but the once,
with this world,
never can be undone.

QUO VADIS HOMO SAPIENS?⁹²

How will our species fare over coming ages? Will the human lineage survive, reasonably happily, into the far distant future? Indeed, will we survive another millennium in reasonably good shape? Will the next thousand years be just ordinarily difficult or, if the next ice age arrives suddenly, particularly difficult? Supposing we survive the next thousand years, will we eventually go extinct as most species do or will we evolve into a new species with which one might empathise? Or into a whole lineage of species as in Olaf Stapledon's great sci-fi novel, *Last Men, First Men*?⁹³ And, supposing we continue to evolve, will that new species or its descendants survive the death of the sun as an energy and light source in five billion or so years? Not to mention a clutch of other cosmic challenges, from asteroids to 55 hour days. Beyond that, there is the ultimate question as to if, when and how the universe will end and whether, in some sense, life might best that challenge.⁹⁴

One suspects that most people are bored witless by such questions. They want the future to be kind to their grandchildren but, beyond that, those with a religious road-map are complacent and those without indifferent. Perhaps it is 'new world order' gloom about even getting to the starting gate for the main event. Or is it that there is just no time to lift one's nose from the grindstone, one's snout from the trough. Fiction set in the future attracts the same sort of passing interest as historical fiction, provided that the props and the setting are exotic enough and the people familiar enough. In a world which has failed so many, few feel any responsibility for the future. As Groucho Marx said, What has the future ever done for me?

But for those who are curious, this is a marvellous time to be speculating about the span and richness of our stay here. We have reached an era where science and history have produced a truckload of exciting and plausible, and sometimes contradictory, stories of how things got to be the way they are. The scientific method has expanded our understanding of life and the universe in spectacular fashion across the entire scale of space and time. Thus 19th century geologists discovered the enormity of time and, in the 20th century, Hubble confirmed the enormity of space. Historians, most of whom have weathered post-modernism, have now accumulated the detail which allows their 'big picture' colleagues like Fernand Braudel, Felipe Fernández-Armesto and Immanuel Wallerstein to start finding trends and patterns in the historical record.⁹⁵ Anyone who takes the trouble to read and try to understand a sample of these scientific and historical stories will be rewarded with a sense of the past which is not unlike memories, albeit memories that are 'false'. You too can feel 14 billion years old. By the same token, we would be foolish to think that our present ideas about 'everything' are more than a small fraction of what will be revealed over the almost endless years ahead.

⁹² Cocks, D., (2004), *Quo Vadis Homo sapiens? Futures*, **36**, 1139-1145.

⁹³ Stapledon, O., (1930 | 1966) *Last and First Men: A Story of the Near and Far Future*, Penguin, London.

⁹⁴ Dyson, F., (1979) Time Without End: Physics and Biology in an Open Universe, *Reviews of Modern Physics*, **51** (3), 447-60.

⁹⁵ Braudel, F., (1985) *Civilization and Capitalism 15th-18th Century: 1 The Structures of Everyday Life, 2 The Wheels of Commerce, 3 The Perspective of the World*, (translated from the French by Siân Reynolds), Harper Collins, New York.; Fernández-Armesto, F., (1996) *Millennium*, Touchstone Books, New York; Wallerstein, I., (1974) *The Modern World System: Capitalist Agriculture and the Origins of the European World Economy in the Sixteenth Century*, Academic Press, New York.

More to the point here, the past is the springboard, the only springboard we have, for constructing believable stories about the future. Reculer pour mieux sauter! While the past can never repeat itself, there is a sense in which everything yet to happen will be like something from the past at some level of 'mix and match' detail.

But not in a predictable way. Even the hardest of sciences is wary of making sharp predictions nowadays and multiple scenarios of plausible possible futures are the future-gazer's primary tool. Scenarios are no more and no less than thoughtful hypotheses which time will test. Knowing what has happened in the deep to near past, and perhaps why, informs the scenariographer's choice of what to ask about the long future and to suggest both optimistic and pessimistic answers.

SURVIVING THE 21ST CENTURY

There is in fact remarkable agreement amongst future-gazers about some possibilities. One is that while every century is difficult, the 21st century is going to be a particularly difficult one for *Homo sapiens*---politically, economically, environmentally and socially. We do not know that of course and insofar as numerous historical ages have seen themselves as uniquely challenged by the circumstances they faced we need to be cautious about such a judgement.

Of all the centuries that comprise humanity's possible future, the 21st is particularly important for two very basic reasons. One is that we are standing in it, most will die in it and our unborn grandchildren will grow old in it; it is the century that captures our personal interests, our self-interest. Another is that the longest journey starts with a single step and this is the century we have to pass through to reach the distant future.

Politically, it looks as though we will have to live through another century of power politics, one in which America's struggle to strengthen its economic, cultural and political dominance will be increasingly challenged. We are entering a world in which for the first time in two centuries there is no international system or structure---as evidenced by the emergence of dozens of new territories without any independent mechanisms for border determination. It is a world in which the First World can win battles against the Third World but not wars, not in the sense of being able to control the conquered territory after 'victory'.

Economically, the failure of marketization to solve the problems of poverty and sustainability and the growing possibility of a massive energy crisis threaten capitalism as the dominant form of economic organisation.

Environmentally, the use of increasing quantities of fossil fuels and the need to feed a world population of perhaps 9 billion by 2070 will continue to destroy the awesome beauty of the world and reduce its capacity to feed and water everyone. All energy use is a two-edged sword which both creates and destroys order.

Socially, we have just left a century which through its barbarity, inequity and indifference has left many people alienated, sociopathic and malevolent; and not just in the third world. By whatever means are available to them, those people and their children will struggle for recognition and justice or for revenge.

Societies everywhere will break down unless we can learn how to reform institutions---legal, medical, educational etc---which are failing in the face of rapid change. What Alvin Toffler called 'future shock' is nothing more than having to cope with high rates of change.

Shrugging and moving on, the good news for the third millennium, the next thousand years, is that it would be surprising to see the extinction of /Homo sapiens/. However the millennium does contain the seeds of two 'worst case scenarios'. One is runaway global warming and climate disruption. The other is a rapid start to the next ice age, even as we exhaust the world's supplies of fossil energy, including uranium. Already, the 12000 year inter-glacial we are enjoying is the longest of the last million years.

Metaphorically, the even deeper future will be a game of dungeons and dragons with our post-human descendants facing a succession of bigger and bigger challenges such as planetary wobbles, permanent drought, and Sun-death as well as random shocks such as volcanic winters and asteroid strikes.

But the deeper future will not just be 'Posterity versus Nature'. The essence of tragedy is greatness felled by its inner weaknesses. Because human consciousness is a recent development, we are still an adolescent species, particularly in terms of our need for immediate gratification, our need for authority in our lives and our susceptibility to turbulent emotions. While it is no disgrace to be adolescent, the longer we survive, the greater our chances of maturing into a lineage which understands itself and takes responsibility for its own future.

Let me summarise these various prospects with some betting odds. If I thought there were any possibility of collecting, I would become a

bookmaker and offer:

- 10 to 1 on that humanity will survive the next millennium
- 2 to 1 against that the lineage will survive the next ice age (it was a close call last time)
- 1000 to 1 against that the lineage can last more than a billion years

And I won't be taking bets that the lineage will last past Sun-death.

Remember though that these are only bets about surviving, not bets about whether our descendants will be enjoying high quality of life. That is, I still collect if, in Hobbes' famous phrase, life for most people is 'solitary, poore, nasty, brutish and short.'⁹⁶

My bookie persona would offer odds of more than 1000 to 1 against to people betting on high quality of life for most people this century and more than 100 to 1 against achieving that goal this millennium. I leave it to others to judge if this makes me an optimist or a pessimist. I am more focused on whether we can improve those odds. Can we, in HG Wells' phrase, 'shape the future'?

In asking that question, I am suggesting that there is, beyond curiosity, another reason for being interested in the future and that is to ask if it can be ameliorated, made 'better' than it would be in the absence of our collective intervention. While such judgements are of course purely subjective, a better future for me is one in which the lineage survives 'indefinitely', maturing all the while in a various ways.

⁹⁶ Hobbes, T., (1651 | 1943) *Leviathan*, Dent, London., Ch xii.

Perhaps we don't want to shape the future?

My innocent question raises ideological hackles on both the left and the right once it is recognised that you can't even begin to purposively shape the future without social goals. If you don't know where you are going, it doesn't matter which bus you catch. Disciples of a-social individualism think there is no 'we' to do any shaping and collectivists, while willing in principle, see no way of integrating diverse individual interests into social goals. This bipolar crankiness is strange because participatory societies everywhere, including those with neo-liberal aspirations, are forever making collective decisions which muster a workable level of acceptance. Rousseau lives!

Perhaps what elites really fear is that making social goals explicit invites dissection of both their inherent worthiness and the speed at which they are being approached. There is also a fear of naïve utopianism with its 3000 years of visions of societies pursuing ideal end-states which are foreseen to remain unchanged once achieved. And then there is that remnant of people who believe that 'progress' will occur without any particular effort on world society's part. Why, these last ask, would we want to deliberately shape the future? The technological optimists and the market liberals are well-represented in this cohort.

Let me leapfrog this impasse on a 'just suppose' basis, taking it as a working hypothesis that the people of the world have made it clear that they want the lineage to survive and survive well (Idea: Why not ask them?). More succinctly, I call this idea 'quality survival' meaning that I am envisaging world-society working towards giving most people, now and into the indefinite future, the opportunity to live a high quality life. Beyond cultural specifics, a high quality life is one where you can meet not only your basic physiological needs but also your higher needs for love and social bonding, for autonomy, for creative activity and for meaning.

Leapfrogging the quandary of contestable ends lands us in the mire of contestable means. Managing the future is a 'wicked' problem, meaning that it has no definitive formulation and no conclusively 'best' solution; and, even worse, that the problem is constantly shifting. So, what do we do?

Well, one thing we can do is tackle the important things first. What about shaping the future by using our limited energies to identify and then respond to a rolling (ever-changing) set of priority issues. I am seeing 'priority issues' as matters judged to have a major influence on whether the lineage can achieve quality survival. They are 'rolling' in the sense that they will need periodic revision as circumstances change. The homely principle being invoked here is 'If it itches, scratch it'.

But don't scratch wildly. The best way to steer between knee-jerk and prescriptive programs is to ensure that societal choices are compatible with well-crafted and wide-ranging policy guidelines---rules of thumb if you will. More prosaically, these are checklists of things to be avoided and things to be included, 'as far as possible', in society's plans. One could give generic examples (eg avoid external costs, look for solutions which satisfy multiple needs) but the best guidelines are likely to be context-specific (eg no clear-felling just here, replant with native species over there).

Obviously at the top of any momentary list of priority issues comes the aforementioned family of difficulties that we face in the 21st century---political, social, economic, environmental. We need guidelines for tackling, *inter alia*, the burdens of war, oppression, population growth and resource depletion.

Should our political guidelines assign highest importance to seeking a world federation and for promoting participatory democracy? And, under social guidelines, is tackling an endemic sociopathy the paramount need? Many people dislike and distrust others. Brotherly-sisterly relations between people are the basis of any society's social capital. Or perhaps the real priority is getting the social contract between citizens and government more explicit and hence better able to constrain self-interested elites.

But, thinking outside the box of 21st century challenges, what are the life skills that our precocious adolescent lineage must start developing if she is to maximise her prospects of surviving well over epochs and eons?

Let me suggest two. One is learning how to manage societal change; the other is learning how to learn---how to increase the pace of social learning and become a learning society.

In common with other complex systems driven by large flows of energy, human societies have a tendency, on one hand, to collapse or change direction dramatically, and, on the other hand, a tendency to stagnate and fail to adapt to external and internal change. Change is never-ending and even an apparently stagnant society is bubbling away underneath and moving towards the thresholds and crises at which change will boil over.

Understanding this complexity well enough to develop guidelines which will protect societies from their own instability and fragility, and, at times, their excessive stability--- gridlock and senescence if you like---is, in my view, a priority issue.

Getting such understanding is however a truly difficult problem which science is only just beginning to address. Some progress has been made---using counter-cyclical economic measures is a simple example---but considerably more research over a long time will be needed to learn how to manage the stability problem with confidence.

The 'learning society'

What do I mean here? A learning society is one that allocates a high fraction of its brainpower to the task of acquiring the knowledge that just might guarantee high quality of life for most people into the indefinite future. What we know today is not nearly enough---from cosmology and planetary dynamics to biological and social evolution.

Starting now, we need to nurture and boost this 'social learning' process. But how? Here are four guidelines to get the ball rolling:

- First of all, we need to learn how to learn more effectively. For example, knowledge has to be organised hierarchically if overload is to be fended off.
- Next, given the difficulty of predicting complex system behaviour, we must recognise the importance of taking an experimental approach to social learning. What works is what matters.
- Also crucial to the social learning process is how we educate and nurture our children so that they develop a passion for learning and understanding.
- Finally, despite its many problematic consequences, scientific research must continue to have an increasing role in social learning.

Rationality is not enough

As drawn out above, the ‘deep futures’ project is ineluctably rational. Here is how it goes. A maturing lineage decides that what it wants from the future is quality survival; and that the best strategy for achieving such is to systematically ameliorate existing constraints on achieving the good life while simultaneously preparing for future challenges by enhancing risk-management and knowledge-making skills. It is a strategy that may well fail but, meanwhile, it offers purpose and answers Lenin’s question ‘What is to be done?’

Yet there is something lacking. Making big plans and implementing demanding programs requires more time and knowledge than we will ever have. If people are to jump the cracks that will appear in the best laid plans, they will need to be buoyed by passion and enthusiasm. And for that they will need to know what story they are part of. History and the historical sciences offer Darwin’s children a ‘creation myth’, but where is the ‘destiny myth’ in modern secular societies? What is the role of the lineage in the unfolding evolutionary play?

The wording of the question suggests the answer and the answer is a metaphor. Everything in the universe has a life cycle and that includes you, me, the species and the lineage yet to come. As distinct from the science, the art of managing our lineage’s life cycle is to see it as an existential challenge fully comparable to the challenge of constructing a successful human life. That means envisaging and then attempting to live out a scenario script in which the actor playing the lineage, let’s call her Posterity, moves through a program of big challenging projects towards fulfilment. Whether it is something called quality survival that becomes humanity’s telos, its inspirational image, is less important than that there be one.

THE ROLE OF HISTORY IN FUTURE-GAZING ⁹⁷

It is hard to side-step George Santayana---Those who cannot remember the past are condemned to repeat it---when contemplating the role of history in future-gazing.⁹⁸ So, let's meet him head on. Santayana's dictum was not a criticism of the modern world as the common interpretation would have it, but a very Euro-centric criticism of indigenous peoples. His preceding sentence ends '...when experience is not retained, as among savages, infancy is perpetual'. My revisionist version of Santayana would be "Those who fail to understand the past will not benefit from it'.

In the nineteenth century, the directionality of history, from savagery to civilisation, was taken for granted; a view which was later judged wrong and dangerous by such luminaries as Isaiah Berlin and Karl Popper. Popper's *Poverty of historicism* drew on the simple argument that history is determined by the growth of knowledge and, because we cannot predict new knowledge, we cannot predict future history.⁹⁹

Undaunted, this article explores the mild assertion that a certain knowledge of history is of value in several ways to those trying to say something sensible and useful about the future of Australia and Australian society over coming decades.

Historical studies suggests factors behind the evolution, survival and demise of past societies, and hence, perhaps, of future societies. They alert the historicist within to the possibilities of strong past trends (eg population growth, technology accumulation) and cycles (economic, social) continuing into the future. They can sometimes identify karmic structures from the past (eg transport systems, political systems) that will constrain the rate at which future change can be achieved. They recall how unique random occurrences (eg horseshoe nails) can channel events.

History further tells us what social problems were once considered important enough to address collectively and how measures to solve those problems succeeded or failed. While such knowledge does not identify *sufficient* measures to solve today's problems, it may assist in the identification of *necessary* conditions for their solution. What history cannot tell us about is the newly emergent, that which has had no time to imprint itself on the historical record. Nor is it always willing to unveil the generic processes behind phenomenologically unique historical stories.

For local future-gaziers, the question here is whether any of the generic patterns and generalised processes revealed by historical study are candidate possibilities for a post-millennial Australia. Or, post 'golden age' (1945-70?), has our society tumbled into a domain where those generic processes will be heavily disguised or even transmogrified?

HOW TO BE A FUTURE-GAZIER

At this point I need to explain my interest in and 'philosophy' of future-gazing, this being the process of looking for answers to the question 'What might the future be like for entity X?' In my own studies, the entity of interest is the quality of life that will be experienced by ordinary people in Australia in 2050 CE and beyond.

⁹⁷ Based on a paper given to the annual conference of the Independent Scholars Association of Australia, Canberra, September 1999.

⁹⁸ Santayana G, (1905 | 1955), *The Life of Reason or The Phases of Human Progress*, Rev.ed. 1955, Scribner, New York.

⁹⁹ Popper, K., (1957), *Poverty of Historicism*, Routledge & Kegan Paul, London.

What I have concluded, after spending the last few years learning how to be a future-gazier, is that, nearly always, the answer to the future-gazier's question can only be expressed as one or more hypothesised or conjectural possibilities---scenarios as they are known in the trade: 'This could happen; or this; or that. I don't know which'.

One virtue of answering the future-gazing question by identifying such multiple possibilities is that it squashes any temptation to presume that the future is thereby, in some sense, being predicted. It is only rarely, and then often trivially (the sun will rise tomorrow) that we feel certain about future events occurring or not occurring, and hence able to predict them in the sense of saying 'This, unconditionally, will happen.'. The operational test for an objective certainty is that most people would be prepared to bet London to a brick on it. The operational test for a subjective certainty is that *you* would be prepared to bet London to a brick on it.

We can also have probabilistic knowledge of the future. Such knowledge can be objective, meaning, again, that most people would agree; the objective probability of drawing a club from a shuffled pack of cards is one quarter. But more complex events that do not have a repetitious history, can only be assigned a subjective probability, meaning a probability estimate that has no basis in history. In a rapidly changing world, fewer and fewer future events can be assigned an objective probability. Rainfall probabilities in the wheat belt are a good example of this receding objectivity.

More than this, it is meaningless to assign even subjective probabilities to members of an open-ended set of scenarios, eg you cannot evaluate the odds on your horse winning till you know all the runners. What I believe is modestly useful though when deciding whether or not to prepare for scenario X is to ask how surprised you would be if scenario X eventuated. If scenario X implies a significant threat or opportunity, and you would be totally unsurprised by its occurrence, then it would seem sensible to act as though it were definitely going to occur.

An example. Within relatively recent geological time, the central New South Wales coast has experienced some large tsunamis. It would be unsurprising for this scenario to re-occur at any time. Given the scale of disaster foreseeable under such a scenario, it would seem prudent to make some preparations.

THREE SOURCES OF IDEAS FOR SCENARIOS

Enough of future-gazing *per se*. Let me turn now to a consideration of where future-gaziers find ideas for scenarios. I intend to concentrate on recent human history as a source of hypotheses about Australia's long-term future but will start by mentioning two other useful sources which still owe much to history, but to natural history rather than recorded human history; namely systems thinking and scientific knowledge of natural processes.

Systems theory

The idea of a 'complex system' is science's formal recognition of the observation that 'everything is connected to everything else'. The developing theory of complex systems, Australian society being a good example of such a thing, provides future-gaziers with all sorts of interesting ideas about how such systems evolve over time under specified conditions. Hence, identifying that a society is in some state well-recognised by systems theory---not necessarily easy--- immediately suggests scenarios for that society's future behaviour.

One fundamental observation here is that complex systems normally contain the seeds of their own dynamics---their own future history---within themselves (lagged feedback loops, mills of the gods, for example) and, consequently, may well evolve in highly surprising, counter-intuitive ways. Here are three examples of systems concepts which provide insight into the phenomenon of paradigm shifts in social organisation:

- *Mode-locking* is an important property of complex systems that tends to accelerate processes of transition and self-organisation. It can be thought of as a tendency for oscillations in various parts of the system to progressively synchronise and act in concert. In the case of social systems, mode-locking involves the focussing of diverse forms of social energy (political economic, social...) onto a single issue, thus making sudden jumps from one development path to another possible, eg the collapse of communism.
- One message from *catastrophe theory* is that when a system changes state, it can, under the right conditions, change extremely rapidly, eg walking over a cliff.
- *Chaos theory* tells us, *inter alia*, that a system in the right condition can be massively changed by an apparently small event, eg as Papua New Guinea found, one steel axe can ruin your stone-age culture.

As an aside here, systems thinking has also reflected back into the conceptual frameworks of a number of eminent historians including Fernand Braudel, Emmanuel Wallerstein, KR Dark¹⁰⁰ and Joseph Tainter.¹⁰¹

Knowledge of macro-scale natural processes

While there are a number of macro-scale natural processes which, if they continue into the future, will strongly constrain or guide the evolution of human societies, many of these are proceeding at a rate that makes them but marginally relevant to the present paper with its arbitrary time horizon of several generations. For example:

- The eventual death of the sun as it consumes itself in perhaps five billion years is the starkest of these constraints.
- In 25 million years Australia will bump into Indonesia and, as a separate continent, Australia will again cease to exist. In perhaps 100 m years all the continents will again come together in a single super-continent like the Pangaeian continent from which Gondwana, including Australia, originally broke free.
- Major ice ages have been coming in hundred thousand year cycles for at least a million or so years and, on this basis another one, delayed perhaps by global warming, could be upon us in a few hundred years.

But, without a doubt, of all the macro-scale natural processes, it is biological evolution that has most to suggest about our immediate future. For example:

- Genetically we will continue to be hunter-gatherers, programmed for some time yet to behave in ways compatible with that lifestyle, eg mixing competition (as occurred between bands) and co-operation (as occurred within bands).

¹⁰⁰ Dark, K.R., (1998), *The Waves of Time: Long Term Change and International Relations*, Pinter, London.

¹⁰¹ Tainter, J., (1988), *The Collapse of Complex Societies*, Cambridge University Press, Cambridge

- Most evolutionary experiments fail; most species that ever were are extinct. Five million years is a good innings for any species but mammals are particularly prone to coming and going. The 'big brain' experiment, built around our capacity to imagine, imitate and communicate, has only been running a short time. We need to be particularly sensitive to signs that our time may have come.
- Evolution's fatal flaw, and this applies to cultural evolution as well as biological evolution, is that it is short-sighted. Evolution will always select variations that are immediately useful, irrespective of how maladaptive that variation might be in the longer run. Just ask the giant pandas whose ancestors decided to occupy a niche called 'No-one eats bamboo shoots'. A knowledge of evolution prompts us to ask if we are being similarly short-sighted in our plans for the future, and, if so, what scenarios that suggests. An irradiated world perhaps?

From a somewhat different perspective, a knowledge of biological evolution (phylogenesis) provides us with a powerful metaphor for understanding cultural evolution (sociogenesis) in general, and hence, at least abstractly, the future of Australian society. Cultural evolution, under this view, is a process of social learning in which innovative behaviours emerges spontaneously, like genetic mutations, and are then selectively passed on, if they are adaptive, ie if they solve problems. It can be argued that history's examples of adaptive behaviour support this emerging paradigm of viewing social evolution as a learning process. Conversely, we need history to help us further understand that process. That is, history both illustrates and illuminates cultural evolution as social learning. I stop short of suggesting social learning as a 'theory of history'.¹⁰²

History

Now we come to what I promised to concentrate on--history proper as a source of ideas for scenarios of Australia's future. I am talking about history as the interpretation of records of social change, not as chronology or as a repository of anecdote.

And, just to clear the decks, future-gaziers do not expect historians to predict the future for them. I am responding to Norman Davies' comment:

It is an irony that historians, who study the past, are invariably pressed to predict the future. It helps to have followed the drift of events, but not much.¹⁰³

Springboard processes

Some of course are more willing to do so than Davies. Hobsbawm (1994), beyond the 'crisis decades' of his twentieth century 'age of extremes', sees an 'unknown and problematic but not necessarily apocalyptic future'---a period of destructuring rather than destruction.¹⁰⁴ Problems he foresees include:

- a world in which there is no international system or structure;
- the privatisation of the means of destruction;

¹⁰² Dunn, E.S., (1971), *Economic and Social Development: A Process of Social Learning*, Johns Hopkins Press for Resources for the Future, Baltimore.

¹⁰³ Davies, N., (1997), *Europe: A History*, Pimlico, London, p.1133.

¹⁰⁴ Hobsbawm, E., (1994) *Age of Extremes: The Short Twentieth Century, 1914-1991*, Michael Joseph, London.

- global population rising above 10 billion, generating great migratory pressures along with regional differences in population;
- ecological consequences of ongoing economic growth which, while not making the world uninhabitable for humans, will change the environments in which people live and perhaps reduce the carrying capacity of the globe dramatically;
- a seemingly-irreversible widening of the gap between rich and poor countries;
- technology continuing to squeeze human labour out of the production of goods and services, without providing either enough work of the same kind for those jettisoned, or the guarantee of a rate of economic growth sufficient to absorb them.

These are precisely the sorts of scenarios of dynamic processes that the future-gazier wants to extract (amongst other things) from the study of history. They provide a starting point for more detailed scenario-building questions such as: What sort of environment would the continuing of processes such as these create for Australian society? In what different ways might Australian society respond to such an environment? Such questions are outside the scope of this article.

Hobsbawm's processes are *springboard processes* in the sense that they are projections of the present and near-past into the future, projections grounded in the belief that large systems are homeostatic (self-correcting) under shock. In the same vein but more sweepingly, Foucault (1969) draws our attention to 'science' as the dominant prevailing discourse, the one which currently has the status of 'truth' and which settles how our era defines and conceives of the world.¹⁰⁵ For the future-gazier the questions here are *When will the paradigm shift* and, before that, *How will this paradigm continue to constrain or shape the future?*

Heilbroner's (1995) springboard processes, and they reach back to about 1700, are the capitalist mode of production, technological change and the search for political emancipation.¹⁰⁶ What has changed under the influence of these three great ongoing forces, from about the middle of our own century, has been the prevailing attitude towards the future. This, as Heilbroner sees it, has moved from a widespread belief in 'progress'---expecting the future to be better than the past---to a somewhat 'post-modern' apprehension.

¹⁰⁵ Foucault, M., (1969) *The Archaeology of Knowledge* (trans. by A.M. Sheridan Smith), Pantheon, New York

¹⁰⁶ Heilbroner, R., (1995) *Visions of the Future: The Distant Past, Yesterday, Today, and Tomorrow*, Oxford University Press, New York.

Cyclical processes

Provided we can identify where we lie in the cycle, cyclical theories of history suggest interesting hypotheses about where we are headed. As reviewed by Galtung and Inayatullah (1997) most macrohistorians see societies developing in organisational complexity and then declining, one replacing the other.¹⁰⁷ For (only) some, is such cycling superimposed on a progressive trend towards greater enlightenment and civilisation. At a finer scale, Strauss and Howe (1997) suggest that over the last five centuries, the national mood in Anglo-American society has swung every two decades or so in a way that can be described in terms of the oppositional waxing and waning of individualism and, on the other hand, civil society.¹⁰⁸ And every 80 or so years, sparked by a crisis, and driven by style-differences between the generations, the cycle starts again--rebirth (renewal), growth, maturation and decay (release). They suggest that about 2005 American (and hence Western) society is likely to begin experiencing a 'decisive era of secular upheaval' (rebirth) that, after several decades, will lead to an era of strengthening institutions and weakening individualism (growth).

The economic historian Kondratieff's (1926) model of long economic cycles since the industrial revolution began is of particular interest to the future-gazier looking for a graspable paradigm that summarises how and why late 20th century industrial capitalism is changing and hence how it might further change.¹⁰⁹ His empirical observation was that many innovations and processes diffuse through society over time in a way which can be described by an S-shaped (sigmoid) curve, ie slow growth at the beginning, followed by accelerating and then decelerating growth culminating in saturation or a full niche, eg mainframe computers 'saturated' around 1995.

Periods of global growth and expansion in economic activities last about 55 years under this model and are punctuated with phases of fundamental change in the structure of the economy, the technological base and many social institutions and relations. Towards the end of a growth phase in the economy, many markets saturate and growth slows. The search for revitalised profits induces a cluster of new technologies which, slowly at first and then more rapidly, penetrate markets.¹¹⁰

Marchetti (1987) nominates 1940 and 1995 as the ends of such Kondratieff growth cycles.¹¹¹ The data supporting such a precise cyclical view of socio-techno-economic history is quite impressive but cannot 'prove' that the world economy is indeed entering a new growth phase that will only begin slowing towards 2050. Nonetheless, there is a cluster of new technologies currently beginning to generate products for growing world markets. These centre around computer and communication technologies and, to a lesser extent, biotechnologies, new energy technologies and new transport technologies.

¹⁰⁷ Galtung, J., and Inayatullah, S., (eds), (1997) *Macrohistory and Macrohistorians: Perspectives on Individual, Social, and Civilisational Change*, Praeger, London.

¹⁰⁸ Strauss, W., and Howe., N., (1997) *The Fourth Turning: An American Prophecy*, Broadway , New York.

¹⁰⁹ Kondratieff, N.D., (1926) Die Langen Wellen der Konjunktur, *Archiv für Sozialwissenschaft und Sozialpolitik*, Band 56, 573-609 (German translation of Russian original).

¹¹⁰ Grubler, A., and Nakicenovic, N., (1991) Long Waves, Technology Diffusion and Substitution, *International Institute for Applied Systems Analysis Review*, XIV(2) 313-42.

¹¹¹ Marchetti, C., (1987) Infrastructures for Movement, *Technological Forecasting and Social Change*, 32, 373-93.

Marchetti (1988) further argues, on the basis of empirical evidence, that many aspects of behaviour in society run in 55 year cycles that match economic cycles, eg suicide, homicide.¹¹² Utilising data on war severity, Goldstein (1988) demonstrates that there is a corresponding 50 to 60 year cycle in the number of battle deaths per year for the period 1495-1975.¹¹³ Beyond merely showing that the Kondratieff cycle and the war cycle are linked in a systematic fashion, Goldstein's research suggests that severe 'core' wars are much more likely to occur late in the upswing phase of the Kondratieff cycle. This finding is interpreted as showing that, while states always desire to go to war, they can afford to do so only when economic growth is providing them with sufficient resources! Watt's (1992) modelling of social systems suggests that the cyclic occurrence of wars and depressions are the alternate consequences of ineffective feedback controls, eg on the rate of repatriation of war debt; on post-war birth rates.¹¹⁴

For what it is worth, both the Kondratieff and Strauss-Howe models suggest that the mid-21st century, the medium-term time horizon of this paper, could be a time of economic and social well-being, at least in the western world.

Recurrent processes

Historians have also perceived important generic processes which, whilst not deterministically cyclical, have re-occurred frequently enough to warrant their recognition into the future as ever-present contingencies.

The work of the Australian economic historian Graeme Snooks (1996) is an ideotypical example. After concluding that 'we have no consistent explanation of the rise and fall of civilisations', Snooks presents his own innovative interpretation of the dynamics of human society over the past 2 million years.¹¹⁵ He suggests that individuals in a competitive environment generate community growth by investing in the four dynamic strategies of family multiplication, conquest, commerce, and technological change. He argues that the rise and fall of societies is an outcome of the opportunistic development and exhaustion of these strategies. He uses his dynamic-strategy model to discuss future outcomes for human society, arguing that far from leading to ecological destruction, growth-inducing technological change is both necessary and liberating.

Less sanguinely, CD Darlington (1969) says that the big lesson from history is that humans destroy the resource base on which they depend.¹¹⁶ It is a lesson reinforced for our part of the world in Tim Flannery's (1994) *The Future Eaters*---a book which is about the past, not the future, of course.¹¹⁷

Diamond (1992) notes three situations in which human populations tend to wreak great damage on their environments:¹¹⁸

¹¹² Marchetti, C, (1988) *Kondratiev Revisited---After One Kondratiev Cycle*, Paper to conference on Regularities of Scientific-Technical Progress and Long-Term Tendencies of Economic Development, Novosibirsk, USSR.

¹¹³ Goldstein, J.S., (1988) *Long Cycles: Prosperity and War in the Modern Age*, Yale UP, New Haven.

¹¹⁴ Watt, K.E.F., (1992) *Taming the Future: A Revolutionary Breakthrough in Scientific Forecasting*, The Contextured Web Press, Davis, Ca.

¹¹⁵ Snooks, G., (1996) *The Dynamic Society: Exploring the Sources of Global Change*, Routledge, London and New York.

¹¹⁶ Darlington, C.D., (1969) *The Evolution of Man and Society*, Allen & Unwin, London.

¹¹⁷ Flannery, T., (1994) *The Future Eaters: An Ecological History of the Australasian Lands and People*, Reed Books, Sydney.

¹¹⁸ Diamond, J.M., (1992) *The Third Chimpanzee : The Evolution and Future of the Human Animal*, 1st ed, Harper Collins, New York.

1. When people suddenly colonise an unfamiliar environment, eg Maoris in New Zealand
2. When people advance along a new frontier (like the first peoples to reach America) and can move on when they have damaged the region behind.
3. When people acquire a new technology whose destructive power they have not had time to appreciate, eg New Guinea pigeon hunters with shotguns.

Diamond says it has always been hard for people to know the rate at which they can safely harvest biological resources indefinitely, without depleting them. Decline may be difficult to distinguish from normal year-to-year fluctuations. By the time the signs are clear enough it may be too late. We of course have no such excuse; we know what has happened and we know how to model sustainable harvesting and the importance of precautionary behaviour. Up till now, as one particular pattern of human exploitation of the environment began to encounter difficulties, thanks to exhaustion of one or another key resource, human ingenuity has always found new ways to live, tapping new resources, and thereby expanding our dominion over animate and inanimate nature, time and again (McNeill 1979).¹¹⁹

Immigrant species of all types---people, plants, animals and microbes---have always boded ill for resident societies and ecosystems. Crosby (1986), for example, shows how the Europeans were able to take over temperate lands because of the rapid and almost automatic triumph of the plants, animals and germs they brought with them.¹²⁰

McNeill's (1979) revelatory book *Plagues and People* makes it abundantly clear that microparasitism (disease) and macroparasitism (see below) have played a large and often unrecognised part in the rise and fall of the world's communities and civilisations.¹²¹ As regards microparasitism, the best known examples are the impacts of European diseases on the aboriginals of Australia and the Americas; but there are many others.

There are good reasons for believing that disease remains a major latent threat to modern societies. Given time and a reasonably stable world, diseases and populations tend to come into balance. However, increased urbanisation and increased interactions between peoples mean that the world community becomes one big disease pool. While this 'global village' means that there are no longer susceptible unexposed local populations waiting to be drastically reduced by diseases new to them, it also means that a virulent new disease could drastically reduce the world population (McNeill 1979).¹²² Or, less apocalyptically, pandemics of Cholera, Yellow Fever and Plague are all possible in coming decades. Loss of children and old people to disease can be tolerated in one sense but the loss of, say, 20% of the adult working population stands to threaten the stability of any society.

¹¹⁹ McNeill, W.H., (1979) *Plagues and People*, Penguin, London.

¹²⁰ Crosby, A.W., (1986) *Ecological Imperialism: The Biological Expansion of Europe, 900-1900*, Cambridge University Press, Cambridge.

¹²¹ McNeill, W.H., (1979) *ibid.*

¹²² McNeill, W.H., (1979) *ibid.*

McNeill's (1979) macroparasites include marauders and ruling classes and landlords who exact an unsustainable toll from the peasantry.¹²³ Indeed Toynbee (1976) concluded that the factors common to the 21 collapsed civilisations he studied were a concentration of wealth in a few hands and inflexibility under stress.¹²⁴ The possibility of macroparasitic greed destroying the productive base of societies or inciting destructive revolt remains a hazard in much of today's world too. Historical generalisation about the conditions under which armed conflicts arise promises to be particularly useful. For example, is it really the case that democratic countries have never fought each other?

The special importance of Australian history

Australian history is obviously of particular interest to an Australian future-gazier. Not only can it be searched for our own examples of springboard, cyclical and recurrent processes, it contains numerous thought-provoking predictions which can be examined to see why they did or did not occur or, as the case may be, might or might not occur. Space precludes a survey here (cf. Cocks 1999¹²⁵) but one historical perception of our transition from the past into the future which I find too illuminating to not mention is Paul Kelly's (1992) development of the idea of the 'Australian settlement'.¹²⁶

According to Kelly, the Australian settlement, something like an Australian *social contract* or *national bargain*, drove the development of Australian society, with bipartisan support, for 70 years post-federation. It had five widely agreed principles for guiding society: white Australia, industry protection, wage arbitration, state paternalism (intervention for the common good) and imperial benevolence (the belief that Australian prosperity and security was underwritten by the Empire).

In the 1990s two of these principles, white Australia and imperial benevolence, have been replaced by new verities and the other three, without being dead, have lost much of their influence and are no longer 'ideas in good currency'. Thus white Australia has been replaced by an acceptance of the idea that Australia is a multicultural society which, as such, is reasonably successful and can and should be kept that way. The idea of imperial---and American---benevolence has been largely replaced by the idea that Australia's defence is in our own hands. The challenge for the future-gazier is to speculate productively and plausibly on whether there might be a new Australian settlement emerging and, if so, what form it might take.

CONCLUDING COMMENTS

As a counterpoint to the general enthusiasm of this article, let me recall those who caution that history can be both a help and a hindrance in thinking about the future. Take Régis Debray (1967), theorist of revolution:

History advances in disguise; it appears on stage wearing the mask of the preceding scene, and we tend to lose the meaning of the play. ...We see the past superimposed on the present, even when the present is a revolution.¹²⁷

¹²³ McNeill, W.H., (1979) *ibid.*

¹²⁴ Toynbee, A., (1976) *Mankind and Mother Earth: A Narrative History of the World*, Oxford University Press, New York & London.

¹²⁵ Cocks, D., (1999) *Future Makers, Future Takers: Life in Australia 2050*, University of New South Wales Press, Sydney.

¹²⁶ Kelly, P., (1992) *The End of Certainty: The Story of the 1980s*, Allen and Unwin, Sydney.

¹²⁷ Debray, R., (1967) *Revolution in the Revolution? Armed Struggle and Political Struggle in Latin America*, Penguin, London.

For example Coates *et al* (c1997) see environmentalism, which they call a 'new world orientation', driving change in the next century, along with information technology, biotechnology etc.¹²⁸ Or there is Senge's (1999) observation that the biggest force for future change, the sleeping dragon, is the uneasy feeling that so many people have that we are managing the world badly, very badly.¹²⁹ And just as history will be ignorant of new processes, it can be blind to old. A good example is the inability of historians, till recently, to see the importance of disease. Perhaps there is an area in which the flow of ideas can be reversed, with the future-gaziers providing the historians with new lenses through which to view the past.

After all this, a fair conclusion is that history suggests useful questions to ask about the future when attempting to get a feel for what it might be like. Could such-and-such happen again (or keep happening) in some form or other? Would the consequences of intervention come to resemble those of their historical counterparts? Provided one is looking for hypotheses and conjectures to apply to the future, not iron laws, history is of great value to the future-gazier.

POSTSCRIPT 2012

Twelve years ago, I was wondering if a replacement for the defunct five-point 'social contract' identified by author Paul Kelly might be emerging. Is there a set of beliefs, widely accepted in the community and on both sides of federal parliament, that *a priori* guide and constrain important policy choices in Australia? Yes. The two that stand out in recent history are a widespread commitment to Australia as a liberal democracy and a similarly widespread commitment to economic growth. The implied social contract is that government and citizens will each, in their own ways, do their best to protect and pursue these ends.

But, even accepting that there has indeed been such a contract, it is now under threat. Thus, we have recent governments badgering people to meet their obligations to make greater contributions to the economy but making little mention of peoples' rights to a share in economic growth and to play a meaningful role in policy formation. There is a perception that governments are failing to meet their side of the social bargain. Increasingly, Australians believe they are not being governed well and do not respect their political masters. For example, there are angry perceptions:

- of governments being captured by rent-seeking sectional interests
- that governments are incapable of solving significant problems, either because of incompetence or because those problems are intractably complex
- that governments are deceitful and untrustworthy; and hubristic in their claims
- that a not-insignificant proportion of politicians are corrupt
- that politicians and governments have very narrow world views---little vision of the good society, no big goals
- that governments have ceded too much influence and too many policy instruments to international bodies and transnational corporations

¹²⁸ Coates, J., Mahaffie, J.B. & Hines, A., (c1997) *2025---Scenarios of US and Global Society Reshaped by Science and Technology*, Oak hill Press, Greenboro, NC.

¹²⁹ Senge, P., (1999) *Though the Eye of the Needle*, in Gibson R, *Rethinking the Future*, Nicholas Brealey, London.

- that while the electoral system *per se* is honest, parliamentary and party-political processes need major reform

History will one day tell us whether Australia's governance system lumbered along till it was destructured by internal or external shocks or whether it managed to transform itself of its own volition.

GLOBAL OVERSHOOT: CONTEMPLATING THE WORLD'S CONVERGING PROBLEMS¹³⁰

My talk today is about a book I am writing.¹³¹ That is, the talk's title is the same as the book's working title. Let me start by tracing this project back to an epiphanic change in perspective.

In 2006 I wrote a book called Deep Futures: Our Prospects for Survival.¹³² While recognising that this would be a difficult century, it foresaw a long Indian summer for humanity, provided we turned our minds to building a better world.

Today's story started from the nagging perception that our prospects could be much worse than I had previously thought and that perhaps we should be seeing our primary task for the foreseeable future as one of defending what we've got, not improving on it; more a case of sandbagging the levees than irrigating the desert. Or, putting it less metaphorically, the need to focus our energies on defensive programs rather than development ventures.

HAS AN OVERSHOOT CRISIS BEGUN?

This is the open-minded question I chose as a starting point for my analysis. The first thing to say about a crisis is that it is not a catastrophe, but a situation of high uncertainty, as when a mother is waiting to see if her child's fever will break.; or the news that an asteroid is approaching the Earth. Crises may or may not turn into catastrophes.

I am using the term *overshoot* to describe those situations where one thinks that some process of cumulative change is approaching some limit, a "tipping point," at which some sort of major reorganisation could be triggered. The term has connotations of finding you have gone somewhere you wish you hadn't; and that it might be difficult to return to the status quo ante. Like overshooting your destination and then finding you are about to run out of petrol!

What sort of crisis was suggesting itself? I have long held that humanity's master goal, its overarching goal, should be what I call *quality survival* by which I mean the achievement of high quality of life (QOL) for most people into the indefinite future. And without going into details I favour a measure based on Abraham Maslow's hierarchy of needs, from the physiological to the spiritual.¹³³ What I could imagine as a plausible scenario was a large and rapid drop in QOL across the world. Remember that a scenario is nothing more than a *plausible future*. I am not making a prediction and I am not the boy crying wolf. I am the boy who says there may be wolves out there in the forest.

To keep discussion manageable, I will restrict myself to identifying just four processes which, if they continue, threaten, singly to some extent, but more so in combination, a large and rapid drop in QOL across the world:

¹³⁰ Talk to Independent Scholars Association of Australia, Canberra, October 2010; Published in *Dissent* Summer 2010-2011 Number 34 pp. 6-9.

¹³¹ <http://www.labshop.com.au/dougcocks/STARCHILDREN3B%20Jan%2030%20%20pdf.pdf>

¹³² Cocks, D., (2006) *Deep Futures: Our Prospects for Survival*, University of New South Wales Press, Sydney.

¹³³ Maslow, A., (1968) *Toward a Psychology of Being*, Van Nostrand, New York.

Overpopulation---The world's population is projected to increase by 50% before peaking in 60 or so years.

Global overheating---The world's average temperature has increased by 0.8 degrees in the past century and, if greenhouse gas emissions are not cut more-or-less immediately by 50-60% we might well get another degree of warming in this century. That doesn't sound much but it stands to reshape the geography of the habitable world. Unfortunately we get a third of our emissions and most of our electricity from coal-fired power stations

Overextraction of resources---The world's transport system runs largely on oil. No really big oil fields have been discovered in recent decades and the phenomenon known as "peak oil" is either here now or on our doorstep. That is production will decline from here on, even if the price rises. Along with oil, phosphatic and nitrogenous fertilisers underpin the world's highly productive food system. Phosphate reserves are limited and we are approaching "peak phosphate," although not for some decades probably. The size of the "capital hump" which would have to be clambered over in order to run something like the present global economy on recycled and renewable resources rather than non-renewable resources is vastly under-appreciated.

Overconnectedness or runaway complexification---As world energy use increases, global society is becoming increasingly complex and unpredictable, summed up in the observation that every solution seems to create more problems than it solves. Complex systems are characterised by lots of circular causation (virtuous and vicious circles!), long-chain dependencies (for want of a horseshoe nail!) and unforeseen outcomes, e.g. China's one-child policy. When systems reach a certain degree of complexity they have a tendency to either freeze up (nothing happens for a long time) or run amok when perturbed, i.e much of their structure disappears. Rational analysis seems to be increasingly inadequate as a way of deciding "what-to-do." about such systems. While complexification is far from being just an economic problem, the economic sphere does provide some splendid examples; with a couple of exceptions, nobody foresaw the Global Financial Crisis.

Before moving on, the point needs to be made that no one has set out to create these threats to global quality of life. They are side-effects, spillovers from self-interested behaviours which most of us have hitherto regarded as quite legitimate, e.g. capitalism's pursuit of profit, a family's wish for a third child..

THE STUFF OF APOCALYPTIC NOVELS

It requires only a little imagination and some knowledge of how the contemporary world "reproduces" itself to envisage how, quite plausibly, my four overshoot "juggernauts" might converge and interact to produce a destructuring of world society in ways such as:

- The large-scale abandonment of cities bereft of food and power
- The large-scale collapse of energy- and import-dependent industries
- The extinction or dispersal, on every continent, of numerous regional and national populations and communities
- The loss of all sorts of inter-regional and international linkages and joint ventures, including economic, socio-cultural and political

For example, the abandonment of cities and the departure of the experts who live there (e.g. electrical and telecommunications engineers) would quickly bring organised society, including the economy, to a standstill, starting with import-dependent industries perhaps. Breaks in long supply chains soon ramify.

Let me evoke a “Dark Age” scenario of how such breakdowns in social organisation might come to impact on the lives of ordinary people:

Irrespective of good intentions, existing problems of war, poverty, injustice, inequity, environmental degradation and sociopathy will grow, not shrink.

Under the combined effects of drought, famine, war, mass migration, poverty, disease, resource exhaustion and economic disruption, the world’s population will start falling well before current estimates of a peak in 2070. Many indicators of quality of life, including life expectancy, will slump.

In all countries, especially failed and war-torn states, it will become much harder for most people to meet their everyday needs. Women and children, the old and the sick will be most affected. Jobs will be few. Supply chains for basic commodities (eg food, fuel, medicines) will break. Barter will become normal. Inflation will escalate. Health, education, transport and police services will degrade. Power and water supplies will become unreliable or worse. Roads and other infrastructure will be poorly maintained. Crime and group violence will escalate. Violent protest and looting will be commonplace. Ordinary people will live in fear. Mental illness will be endemic. People will turn to authoritarian regimes for respite.

In brief, cities everywhere will struggle to avoid becoming giant lawless slums. Rural populations will be vulnerable to marauders and incursions from displaced persons. Life will be an exhausting wretched struggle.

ATTITUDES TO A DARK AGE SCENARIO

How might people of different temperaments react to being presented with a scenario like this? Of all the possibilities from fundamentalism to indifference, I have chosen to elaborate on three ways of responding which I regard as legitimate, i.e. as standing to produce useful insights and not to be dismissed out of hand. Expressed in colloquial and in more formal terms, they are:

Empiricism or “Let’s wait and see what happens before doing anything.”

Interventionism or “Stop fiddling while Rome burns. This catastrophe is inevitable unless we act to stop it right now.”

Reconstructionism or ‘Rise like a phoenix. This catastrophe is already inevitable. Let’s do what we can now to help our descendants rebuild civilisation after the Dark Age passes.’

Space allows a few words about the nature and implications of each of these stances:

Empiricists believe that one’s conclusions should not stray far from the immediate evidence, preferably observational (empirical) evidence. They are first cousins to sceptics who believe that people’s assertions need to be justified. They believe in the “precautionary principle” to the extent of not acting before one is confident of the consequences. Their critics see them as the butt of the one-line joke, “Wait a minute, wait a minute, wait a minuteBang!” The difficult question of course is “What is the right amount of empiricism and scepticism?” A perennial problem with the Empiricists’ stance is that it is readily assumed (hijacked) by vested interests devoted to protecting the status quo, e.g. climate change “deniers.”

Reconstructionists are taking the long view and asking what life will be like after the Dark Age and what, if anything, can be done now, before the lights go out, to help the survivors who, plausibly, will be subsistence peasants. Noah and his Ark are their inspiration. It turns out to be surprisingly hard to see how to transmit useful knowledge about material and social technologies across several generations of traumatised people to a generation which is struggling to feed itself. George Stewart's novel, *Earth Abides*, captures these difficulties well.¹³⁴ Does one prepare an "Encyclopedia Galactica" as in Asimov's Foundation trilogy?¹³⁵ What might be the equivalent of the monasteries which kept "the flame of learning" alive during Europe's dark ages?

I am inclined to label *Interventionism* as the "conventional wisdom" response to my Dark Age scenario. Its perception is that if we work cooperatively and intelligently we should be able to adapt to and mitigate the worst consequences of Global Overshoot with relatively little loss in quality of life. Conflicts over resources and disjoint world views can be resolved. Famines can be forestalled. Greenhouse emissions can be slashed through cooperative action. And so on. I am sure that much can and will be done, but the task is enormous and, drawing on my understanding of human society as a combined evolutionary and ecological system, I can see two grossly under-recognised impediments to the success of this strategy. One, which I call the "virtual species problem" is that humans readily "speciate" into groups which have great difficulty in working cooperatively, e.g. Copenhagen, Israel. There is no "We." The other is that human society is a complex system and 'We' do not understand how to manage complex systems, bedevilled as they are by pervasive circular causation and latent externalities.

WHAT TO DO? WHAT WILL HAPPEN?

While I have sympathy for all three ways of responding to my Dark Age scenario, none leads me to any conclusions about what, if anything, I, as an individual, should be doing about the Overshoot Crisis. As the title of my talk suggests, I remain a contemplative, not an activist. Perhaps what I have said might prove more helpful to others.

But despite my professed passivity, I do have ideas I want to inject into this existential dialogue. In capsular form, what I am offering, under the label *Ecohumanism*, is a philosophy with two foci. One is a humanism based on quality survival. The other is an awareness of the evolutionary and ecological nature of the human situation.

I see it as extremely important that people keep at the front of their minds that what ultimately matters is not economic growth, or some other instrumental goal, but high quality of life for most people into the indefinite future.

Our ideas about ecology and evolution have been largely developed by studying the pre-cultural ecosphere, but these powerful concepts for understanding change (albeit, not predicting it) are equally applicable to a world experiencing Global Overshoot. Being aware of these dynamic ideas does not solve the "what-to-do" problem but does provide a perspective from which "what-to-do" suggestions stand to emerge (e.g. Why not cap energy use?) and from which such suggestions can be evaluated. Space precludes further discussion but, as an example, it is a perspective which suggests there is an urgent need to advance our understanding of how complex systems work and also our understanding of the roots of the "virtual species" problem.

¹³⁴ Stewart, G., (1949 (1999)) *Earth Abides*, Millennium, London.

¹³⁵ Asimov, I., (1955, 1996) *The Foundation Saga (Foundation, Foundation and Empire, Second Foundation)*, Paperback editions, Harper & Collins, London.

While I am convinced that the Overshoot Crisis is real I am not convinced that it will turn into a Dark Age catastrophe. It would be unsurprising if it did but, equally, with lots of luck, and some increasingly desperate efforts as the juggernauts converge, we could “muddle through” with a bearable amount of pain.

POSTSCRIPT 2012

It would be enormously useful for recognising and arguing persuasively that a transition from global crisis to global catastrophe was occurring if plausible indicators of worldwide quality of life could be calculated and seen to be trending down over time. Obviously there are major conceptual and data-collection difficulties involved in creating such indicators but the various versions of the United Nations Development Program’s (UNDP) *Human Development Index*¹³⁶ are an excellent starting point. Up till 2010 these indicators were showing no sign of a plunge in global “quality of life;” indeed, life has been getting better for most of the world’s peoples over the last 40 years.

¹³⁶ United Nations Development Programme, (2010) *2010 Human Development Report: The Real Wealth of Nations: Pathways to Human Development*, Palgrave Macmillan, New York.

DOES THE LONG PAST MATTER?

Does the long past matter? Here we have one of those questions which needs lots of teasing before an answer can be attempted. That is, unlike a request for directions to Dublin, we need some context and clarification before bloviating. Who wants to know? Why do they want to know? What is their purpose? What do they want to achieve? What do they mean by the 'long past'? Do we care if they are asking a second-best question? Remember, if you don't know where you are going, it doesn't matter which bus you catch.

Let us suppose then that the questioner, apart from being strangely like the author, is concerned that global society appears to be heading towards an 'overshoot' catastrophe in which several converging global trends – population growth, atmospheric warming, resource depletion (e.g. oil, fisheries) and the growing complexity of human affairs (e.g. information overload) – are imminently threatening a large fraction of the world's people with a cruel drop in their quality of life. And not just those with but a little way to fall. Destructuring shocks such as deurbanisation (abandoned cities), deindustrialisation (shattered economies), depopulation (megadeaths), and deglobalisation (loss of international links; trade, aid, currencies, institutions etc.) stand to make daily life an exhausting wretched struggle for billions of people.

Further suppose the inquirer's moral intuition to be that everything possible should be done to prevent what is, so far, a global crisis from becoming a global catastrophe.

Against that background, we can take the 'long past' to be the story of how global society came into being and arrived at its current crisis point and we can suppose that whether this story matters depends on whether it provides some useful understanding of 'what's happening' or some 'what-to-do' guidance to those interventionists who would put a proverbial finger in the dyke.

History of course has long been viewed as a source of 'what-not-to-do' guidelines. Santayana's dictum presumes that the past is peppered with behaviours which, in certain generic situations, will turn out to be mistakes (land armies should not advance on Moscow in winter). Equally though, a knowledge of history enriches people's awareness of the strategies they might, depending on the challenge, be able to attempt. Graeme Snooks, for example, is an economic historian who sees war, population growth, trade and technological innovation as the four main strategies that have traditionally been employed by societies intent on securing their own long-term survival.¹³⁷

¹³⁷ Snooks, G.D., (1996) *The Dynamic Society: Exploring the Sources of Global Change*, Routledge, New York.

Using history to produce policy guidelines is an art, not a science. It cannot be reduced to a routine procedure. It requires experienced historians who understand the present as much as the past; who may or may not find something useful to say about *what to do*. Less ambitiously, policymakers confronted with an issue or a crisis – for example, the debate around ‘the right to bear arms’ – may find it expands their thinking to be briefed on the historical origins of their problem. Immanuel Wallerstein, father of world-systems theory, is one historian who regularly provides long views on contemporary issues around the world.¹³⁸ He points out, for instance, that it has proved difficult to ‘parachute’ democracy into cultures which have almost no middle class and no history of independent institutions. In Australia, the Australian Policy and History network works to link historians with policy-makers, the media and the public.¹³⁹

Enough. The case for fostering the study of recorded history and facilitating its introjection into civil society, government and the economy is well-recognised and does not particularly need to be further developed here. But, while history clearly matters, the historical record is but a small portion of the ‘long past.’ What about prehistory, what about the Proterozoic, what about the pre-life Earth, what about cosmology? The long past is very long indeed.

We will come presently to these earlier chapters, but first a reminder that the story of the long past is a moveable feast; not in the sense that what happened did not really happen, but in the sense that our understanding of what happened keeps changing. As told by science, the step-by-step narrative of what happened in the long past gets better by the year as researchers collect and interpret more and more data about the natural world and the universe, using ever-better measurement and experimental methods and organising frameworks.

Cosilience is making an important contribution here – insights from different scientific disciplines are, more than ever, being brought to bear on common puzzles; ecology, for example, is as important as genetics for understanding biological evolution. So, while there is much debate over the ‘best’ interpretation of particular events, concepts and sequences (dates of past events are particularly subject to revision), there are no glaring contradictions in the story in its outline form; it is eminently plausible. It is important to emphasise that this story is much more than a chronology. It also attempts to explain why things happened when and how they did – a large part of the story’s value to people trying to understand and manage comparable happenings in today’s world. Perhaps I should start with the briefest of synopses.

ORIGINS OF THIS DIFFICULT WORLD

A small bubble containing all the universe’s energy exploded in a ‘big bang’ 13.7 billion years ago. As the universe expanded, its suffusion of super-hot radiant energy began to cool and, as temperatures fell, photons (packets of energy) condensed into a succession of material products – sub-atomic particles, atoms and then molecules of (mainly) hydrogen. It was these molecules which, under the force of gravity, aggregated into stars and galaxies of stars. Stars turned out to be fusion reactors within which the universe’s stock of heavier elements formed. In the distant future, the universe’s galaxies, stars, molecules, and atoms will decay back to elementary particles. Everything, from atoms to civilisations, has a finite life.

¹³⁸ comment@listserv.binghamton.edu

¹³⁹ <http://www.aph.org.au/>

Our Sun is a typical star, 4.6 billion years old. Our planet, the Earth, formed from a pile of 'cosmic rubble', which imploded into a molten sphere that has been cooling ever since. In less than a billion years, it was cool enough for liquid oceans to condense out of Earth's primitive atmosphere. Continents, built up from undersea magma flows, began to form. Soon after, the first simple bacterial life forms had emerged in the still-warm oceans. A clutch of floating-drifting continents began colliding and separating periodically about 3 billion years ago.

Single-celled bacteria had begun evolving into multi-celled plants and animals, on land and sea, by Cambrian times, 542 million years ago. Thereafter, the dominant animal life evolved through an 'age of fishes,' an 'age of amphibians,' an 'age of reptiles,' and, from 65 million years ago, an 'age of mammals,' which includes humans. Birds and flowering plants began appearing about 140 million years ago.

It is not only the world's biota – its combined plant and animal life – which has kept changing. Under a universal evolutionary process, driven ultimately by the Sun's radiant energy and the Earth's internal energy, everything on Earth has been changing and continues to change; that includes the continents, the atmosphere, the oceans and, after life began, the ecosphere – our planet's comprehensive patchwork quilt of biological communities or ecosystems (e.g. forests, deserts, grasslands, reefs, estuaries).

How can this story of ceaseless change be summarised and explained? On a geological timescale (thinking in millennia and mega-years), the species mix and the ecosystem mix have, irregularly, gone through both longer periods of slow change and shorter periods of faster change. Depending on the number and timing of species' comings and goings, such changes sometimes qualify as mass extinctions or mass diversifications. More generally, the result has been an evolutionary 'tree' of life which records how each species has come into existence by 'branching' off from some pre-existing species under a process of natural selection; all members of a species are different and those that have the genes to survive and reproduce more successfully pass their genes on to their offspring. This means that the average genetic makeup of any species changes slowly from generation to generation and, in time, becomes different enough to be called a new species.

All the time that a species' gene-pool is changing, so is its environment, meaning all the factors that make it harder or easier to survive and reproduce, such as light and temperature, carbon dioxide and oxygen levels, food and water supplies, competitors and predators. If the rate of change for the worse of the mix of environmental factors is fast enough, faster than the species' capacity to evolve, the species becomes extinct, a 'dead branch' on the tree of life – as indeed most species do. Or, given that the environment does not change uniformly in all parts of a species' habitat, a species may flourish in one ecosystem and go extinct in another.

Thinking worldwide and in mega-years and millennia, there are a number of trends, fluctuations, recurrences and cycles in the dynamics of the non-biological world which, over many generations (usually), and often in roundabout ways, change the environment for large numbers of species and communities. Collectively these environmental changes have been as important as genetic changes in driving the evolution of the world's species mix and ecosystem mix. Without spelling out just how these environmental changes have shaped and channelled that evolutionary story (and each other), we can list some of the most consequential: the continents, five or six times now, have drifted together and then parted, changing regional climates and migration routes each time; continents have been uplifted and then eroded to form soils and landscapes; the oceans have warmed and cooled, risen and fallen, changed their levels of acids and other chemicals and, usually, flowed as convection currents around the continents and between poles and tropics; glaciation has waxed and waned between the limits of an ice-free world and a 'snowball Earth'; regional and global climates (e.g. long-run temperatures and rainfall) have fluctuated; the atmosphere's composition, especially its concentrations of water vapour, oxygen and carbon dioxide, has fluctuated; volcanic activity has induced periods of reduced temperatures and sunlight, conditions inimical to plant growth; the sun's luminosity has increased significantly; large extra-terrestrial bodies have occasionally struck Earth.

Late in the last ice age, some forty thousand years ago, even as their genetic evolution was continuing, modern humans began to evolve culturally at an accelerated rate. That is, they were developing new social and material technologies (e.g. recipes for painting, tool-making) more frequently and, assisted by spoken language and a capacity to learn by imitation, were passing the new technologies from generation to generation. As with genetic evolution, technological innovations have persisted or disappeared in accord with a process of universal selection analogous to biological natural selection – the most useful new technologies are the ones that tend to persist.

A NATURALISTIC WORLD VIEW

What we are asking is whether this narrative, or, more demandingly, a much-expanded version of it, matters in a 21st century world experiencing an overshoot crisis brought on by resource depletion, global warming, massive population growth and a paralysing complexification of human affairs. Will this crisis turn into a quality-of-life catastrophe for billions, and can this narrative help avoid such a scenario?

The short answers here could easily enough be 'Don't know' and 'Probably not,' but there are several ways in which a familiarity with this story stands to support and inform those exercised by perceptions of an overshoot crisis.

Overall, it is a story from which elements of a science-based, naturalistic world view – a coherent system of fundamental beliefs that describe reality¹⁴⁰ – can be extracted. At the heart of this world view is *process thinking*, the idea that everything changes (albeit slowly by human standards) all the time. Change is the norm. Under this world view, 'things' are simply standing waves (attractors) in a continuous dynamic process and have no inherent absolute properties – like eddies on a river. As Heraclitus said in 500 BCE, 'You cannot step twice into the same river.' Even a stone is a slow-moving dynamic process! If the story of the long past is listened to carefully, it has the potential to bring home to people that it is often more productive to think of reality as a process of ongoing, ubiquitous change, punctuated by periods of relative stability, rather than the other way round.¹⁴¹

¹⁴⁰ Aerts, D., Apostel, L., *et al.*, (1994) *World Views: From Fragmentation to Integration*, VUB Press, Brussels; Internet edition 2007, <http://www.vub.ac.be/CLEA/pub/books/worldviews.pdf> (Accessed 3 Jan 2011)

¹⁴¹ Whitehead, A.N., (1933) *Adventures of Ideas*, Free Press, New York

For example, the current global overshoot crisis may (or may not) be a period of ‘calm before the storm.’ Unfortunately, process thinking does not allow any prediction of the moment when a complex system like global society might move from changing slowly to changing rapidly. There are pointers such as increasing and fluctuating rates of change in system behaviour (e.g. oil prices) but such are not definitive. Nor does process thinking indicate what a system’s trajectory will be if and when rapid change sets in.

However, while process thinking can’t predict when and how change will happen in a complex situation like a global overshoot crisis, it can draw on thermodynamics, the science of energy flows, to explain *why* change occurs and, in a general way, *how* it occurs

Everything that has happened in the universe since the ‘big bang’ (and everything that will happen in the future) has been an instantiation, an expression of just one pervasive conversion process or equilibration process, namely, the ongoing conversion of that original bolus of high-grade (also called low-entropy) locally-concentrated energy into low-grade (high-entropy) locally-dispersed or spread-out energy. Call it the *cosmic equilibration process*. And *everything* means just that. It includes the formation, persistence and destruction of matter, galaxies, stars, planets, plants, animals, brains, ideas and societies. Nature abhors disequilibrium! The cosmic equilibration process is spontaneous in the sense that whenever conditions allow (and such are many) the conversion process proceeds at the maximum speed compatible with those conditions

As for understanding *how* change occurs, the story of the long past contains numerous examples of the illuminating idea that reality is made up of nested layers of *energy-degrading* systems, also known as *dissipative* systems.¹⁴² Ours is a ‘Chinese boxes’ universe where smaller, faster-running systems nestle inside, and draw their energy from, larger, slower-running ‘parent’ systems, e.g. Earth sits inside the solar system. The fundamental property of energy-degrading systems is that they continuously take in energy, physical materials and information from their environment and continuously excrete (dissipate) materials, information and degraded energy (energy of a lowered quality in terms of its capacity to do work) back into the environment. For example, multi-species communities or ecosystems can, in some sense, be considered as energy-processing systems which are transforming high-quality solar energy into chemical energy and then distributing this to all of the community’s members to be dispelled, eventually, as heat, a low-quality (useless) form of energy. Equally, one can think of any evolving species (humans included) as a dissipative system which processes more and more energy as long as it is spreading and adapting successfully.

As long as the flow of energy through a dissipative system remains more-or-less steady, the system cycles materials and degrades energy in a repetitive way. But when the materials or energy supplied by the parent system changes sharply, up or down, the system either reorganises itself, or collapses. This may be the current situation for the human ecosystem, our global society and the more-or-less natural world in which it is embedded. For example, global society is highly dependent on fossil oil which is beginning to run out. Global society will collapse if it does not reorganise. That is not so much a prediction as a truism. A more general lesson here is that one should never be more than momentarily surprised when a complex system, suddenly and unexpectedly, changes its structure and behaviour – we have seen this in the recent Middle East unrest, and the Global Financial Crisis.

¹⁴² Salthe, S.N., (1985), *Evolving Hierarchical Systems: Their Structure and Representation*, Columbia University Press, New York.

The long past's procession of dissipative systems passing through their life cycles provides strong empirical support for the validity of a world view based on process thinking. That procession's participants range from notable and spectacular – continental drift, ice ages and mass extinctions of species – to the slow cycling of various elements (e.g. phosphorus, carbon, sulphur) through the oceans, the atmosphere, the biosphere and the Earth's crust.

CONTRASTING PERSPECTIVES

Before coming to several more concrete benefits from a world view based on understanding the *what* and *why* of the long past, let me argue for its 'philosophical' and psychological value.

Alongside strong instinctive drives for autonomy (self-assertion) and for bonding with others, modern humans have long had a powerful urge to find meaning in what is happening and what exists. For most of human history and prehistory, this urge to understand and explain has been satisfied by animistic and deistic belief systems. In animism, the behaviour of natural phenomena both living and non-living is explained by assigning (all) objects (including places) and processes a human-like agency, a *spirit*, with a capacity to act intentionally. Deism extends the animist solution to explaining life's mysteries by recognising supernatural beings (gods) which, among other activities, have created the universe and the Earth and directed subsequent changes there, particularly human affairs.

It is against such religious world views that a naturalistic world view can be most readily contrasted. Where did we come from? Unlike the 'origin stories,' of many religions, science's story, despite its residual gaps, has no place for capricious supernatural forces; life does not have to be lived as a desperate attempt to secure a place in the next world. This is the only heaven there is, and if humans do not destroy themselves (an unlikely scenario) they have millennia, probably mega-years, in which to achieve high quality of life for most people. That is a deeply optimistic perspective, certainly more so than end-time thinking which sees no point in labouring to improve the short time we have left. Optimism may be the ability to believe in the improbable but its real value is that optimists will always be more likely than pessimists to seek, and perhaps find, solutions to big problems.

Next, the scholars' story of the long past is a narrative for all humanity. No one is excluded. It emphasises that we are all members of one species, the product of one continuous evolutionary process extending back to the beginning of the universe.¹⁴³ Science has demonstrated that physiognomic and physiological differences between peoples rest on minor genetic differences. From there, it is a small step to accepting that strangers have minds like one's own and, notwithstanding cultural differences, needs like one's own. Strangers lose their strangeness. For many people, once this common biological inheritance is accepted, the inherent concern they have for the wellbeing of their immediate relatives expands to embrace the species as a whole.

¹⁴³ Christian, D., (2003) World History in Context, *Journal of World History* , **14** (4), pp.437-458.

The importance of this perspective, this idea that all people, present and future, are one's 'brothers and sisters' or, at least, one's 'neighbours', is that were it to spread, it would be an ameliorant for a fundamental problem which emerges as a great under-recognised truth from the story of the long past – there is no We. Even before our ancestors came down from the treetops, they were organised, very effectively, into troops that each defended a well-defined territory against other troops. This was the evolutionary crucible for a dual moral code that persists to this day. Morality is largely a willingness to take the interests of others into account when making decisions. The suggestion here is that within the troop or tribe attitudes towards others were driven more by amity than enmity whereas this was reversed in dealing with strangers.

The claim 'there is no We' is just an extravagant way of making the point that it is normally difficult, and often impossible, for groups with divergent interests to find and take coordinated actions that will benefit all, or even to find reasonable compromises. This inability to cooperate with outsiders has been the case throughout history and prehistory and, *prima facie*, it is the case today. Perhaps the single most important lesson from the story of the long past is that humanity, understandably, has this ever-present background problem and that facing and learning to overcome it is at least as important as finding social and material technologies for directly tackling overshoot problems such as population growth, global warming, complexification and resource depletion.

Fortunately, staying with the assumption of an extended future, there is every reason to believe that sociality can and should be widely taught and learned. Human behaviour is very malleable and children can be brought up to hate, or to be fraternal-sisterly and cooperative. There already exist social technologies with demonstrated capacity for fostering our inbuilt appetency to cooperate, such as conflict resolution, rules of dialogue, clear thinking, and so on. Democracy, with its appeal to humanity's evolved sense of fairness, remains the social technology with the brightest prospects for constraining sociopathic self-interest at a political level.

RECULER POUR MIEUX SAUTER

Consider now the question of whether delving into the story of the long past can more directly help those who are looking to create social and material technologies which might ameliorate or reverse the overshoot processes threatening a new dark age.

When dealing with such 'what-to-do' situations, the most immediately usable information to be gleaned from the long past is its stock of facts and inferences about strategically important recurrent phenomena and their causes – natural disasters, climate change, cosmic weather, species extinction rates, reserves of non-renewable resources, sustainable harvests of renewable resources, epidemics and population dynamics, and so on. An excellent example is the inductive generalisation ('rule of thumb') that whenever atmospheric carbon dioxide levels have reached and remained above 500 parts-per-million, the Earth has become ice-free. So, humanity's knowledge of the past is telling us that if 'we' want to avoid the massive sea level rises that come with an ice-free world, we 'know' what we have to do. The information in this case is about a 'tipping point' but the past is equally able to yield parameter estimates for measures such as, for example, limits to change, rates of change, trajectories over time, extreme values, thresholds and historical probabilities.

While this sort of empirical and inferred knowledge from the past does not allow specific predictions (any more than personal memory does), it underpins the construction of scenarios of plausible futures, best- and worst-case scenarios. Objective knowledge of the past makes the future less surprising and more explicable when it happens. More generally, technocrats and mandarins call on society's knowledge of the long past so extensively in today's world that they may well be unaware of what they are doing. What does a goldfish know about water? Even interventionists, who regard the long past as 'bunk', behave as though it were anything but.

Designing better technologies

A large part of any society's culture is its technology mix. Technologies are the 'recipes' which societies use to maintain themselves. They range from the material (turning stuff and energy into products and processes) to the social, meaning technologies which organise and control human behaviour to create 'problem-solving' institutions. Thus democracy and nuclear power are both equally 'technologies'.

Apart from providing technocrats with practical 'factual' knowledge, the story of the long past is also a rich source of guidelines and ideas for designing better technologies and avoiding problematic technologies. In particular, these come from accumulated efforts to understand and make generalisations about evolutionary and ecological processes.

The concept of *evolution* is the cornerstone of process thinking. At its simplest, evolution is any process of piecemeal or bit-by-bit change over time. Understood at this level, evolutionary change pervades nature in all its forms. And of all macro-scale natural processes, it is biological evolution that has most to suggest about managing humanity's immediate future. For example, genetically speaking, we will continue to be hunter-gatherers, programmed for some time yet to behave in ways compatible with that lifestyle. More to the point, we would not want to try and breed our way out of any looming overshoot crisis.

Evolution's fatal flaw, and this applies to cultural evolution as well as biological evolution, is that it is short-sighted. Evolution will always select variations that are immediately useful, irrespective of how maladaptive that variation might be in the longer run. Just ask the giant pandas, whose ancestors decided to occupy a niche called 'No-one eats bamboo shoots.' A knowledge of evolution prompts us to ask if we are being similarly short-sighted in our plans for the future, and, if so, what scenarios suggest themselves. An irradiated world, perhaps?

As emphasised in popular texts such as Fritjof Capra's *Web of Life*,¹⁴⁴ the reigning paradigm in ecological science is to see ecosystems in terms of 'food chains' or 'nutrient cycling.' Carnivores, at the top of the food chain, eat nutrients in the form of herbivores which eat nutrients in the form of plants. Plant and animal by-products and plants and animals which die uneaten are broken down by micro-organisms (the decomposers) from complex to simple nutrients which are taken up by plants to be cycled up the food chain once more. Ecosystems differ primarily in the groups of species which play these generic roles. These same generic roles have existed for much of the time of life on Earth and, to the best of our knowledge, will continue, albeit played by different species, into the deep future{ XE "deep future" }.

¹⁴⁴ Capra, F., (1996) *The Web of Life*, Doubleday, New York

More generally, the basic relationship between members of ecosystems{ XE "ecosystems: cooperation and competition" } is one of mutual interdependence or symbiosis{ XE "ecosystems: symbiosis" } – a process of unwitting ‘invisible hand’ cooperation. Certainly there is often competition between species seeking to occupy the same niche (e.g. plants which shade each other out) but, popular prejudice notwithstanding, competition and cooperation play necessary and complementary roles in persistent ecosystems.

As an example of the value of ecological thinking, Capra identifies five common characteristics of long-lasting ecosystems which provide context for interventionists looking to develop long-sighted problem-solving technologies. Apart from the cooperation-competition balance, these focus on the importance of materials recycling, solar power and diversity of species and on the need to be resilient. Resilience or ‘bouncebackability’ is an ecosystem’s ability to recover from shocks and disturbances and often depends on having ‘slack capacity’ available – such as seed reservoirs.

HUMANITY’S VIRTUAL MEMORY

How do I know what I think till I see what I say? This essay is an attempt to capture my conviction that the story of the long past, apart from being a towering cultural achievement and a treasury of mind-expanding revelations, has value at several levels for a world wondering if it is in overshoot crisis.

At the highest level, conceptually speaking, it supports an optimistic, meaningful and inclusive world view. An understanding of this story, viewed through the lens of process thinking, stands to equip protagonists with the spiritual energy and positive mindset which would seem to be necessary prerequisites for successfully addressing the converging and interconnected problems of population growth, atmospheric warming, resource depletion and complexification.

At an intermediate level, a knowledge of the complex systemic nature of eons of ecological and genetic processes provides planners with a context within which to better weigh-up proposals for experimental technologies, including categories of technologies which (probably) should or should not be pursued .

At the ‘hands on’ level of designing and improving specific technologies for addressing specific overshoot problems, the long-past story often contains empirical and inferential knowledge that demands to be turned into firm design criteria.

Valid as they are, these benefits are abstractions. Is there a way of encapsulating the argument for the importance of this story in a ‘take home message’? In fact, a very apt metaphor suggests itself: *The story of the long past matters to the human species in the same fundamental way that memories and their interpretations matter to the individual.* While a store of personal memories and reflections cannot ensure correct decisions, such does stand to improve one’s *intuitive* capacity – all that one normally has – to make what-to-do choices in complex situations.¹⁴⁵

Humanity as such has no memory, but, if we personify the species, the story of the long past, as stored in the scientific and historical record, functions as a ‘virtual’ memory for the collective ‘we.’ In ways that are sometimes tacit and implicit, it too is available to be drawn on at any time.

145 McKenzie, C., and James, .K., (2004) Aesthetics as an Aid to Understanding Complex Systems and Decision Judgement in Operating Complex Systems, *E:CO*, 6 (1-2), pp.32-39

The metaphor goes further. Like personal memory, the species memory contains contradictions and bits which have become inaccessible or have been reworked. The big difference, as exemplified by consilience, is that humanity's virtual memory gets better by the year. That is fortunate but it may not be enough. To finish with a warning, a reworking of Santayana, those who do not remember the past will not benefit from it. Let us hope that the owl of Minerva takes flight before the dusk.

POSTSCRIPT 2012

As part of my efforts to understand the origins of the overshoot crisis I believe global society to be in, and what might be done ameliorate that crisis,¹⁴⁶ I constructed my own short pre-history of the world and its antecedents.

While never doubting the importance of that story for understanding and responding to the global overshoot crisis, I did doubt that I had assembled my case for the story of the 'long past' as well as I might have. The present essay is an attempt to draw the threads of that case into an organised overview. While I think it succeeds up to a point on that score, the part of the exercise that gave me most pleasure was the insight that, metaphorically, the story of the long past functions as our species' virtual memory.

¹⁴⁶ <http://www.labshop.com.au/dougcocks/STARCHILDREN3B%20Jan%2030%20%20pdf.pdf>

MY UNFINISHED WORLD VIEW

A poem is never finished, only abandoned.
Paul Valéry

Succinctly defined, a world view is a coherent system of fundamental beliefs that describe some reality of interest. In terms of its function, the job it does for its owner, a world view presents as a thinking tool, a *cognitive technology*, which provides a first-stop mental model when seeking understanding (What's happening?) or when making decisions (What-to-do?). At its best, a world view can be a powerful sieving device which suggests, in a general way, not only what is happening but what is not happening; not only what you might do but what you should not do in puzzling situations. While a world view does not have to be coherent, meaning internally consistent, and, recognising that cognitive dissonance (holding contradictory ideas) might even be helpful on occasions (e.g. by suggesting alternative ways of viewing intractable questions), it is difficult to maintain an incoherent world view once one is aware of doing so. Notwithstanding, humans have a great capacity for self-deception in such matters.

Was Manning Clark's understanding of the Australian story as one of competition between Enlightenment, Protestant and Catholic values a world view? Yes, and a fine one according to his biographer, Mark McKenna.¹⁴⁷ But it brings home that world views are rarely about the world. They are about the universe, or Australia or Yackandandah. And they carry the corollary that a world view normally gains depth by sacrificing breadth, and conversely. That is disheartening for someone like myself who, deep down, is a reductionist, a totaliser. It would be so nice if the application of a few key ideas could routinely expand the breadth and the depth of one's thinking (some such comfort must warm those who think that absolutely everything can be explained in terms of physics).

Something else that is disheartening for humanists who want the best for everyone is that most people have world views that have stopped growing. People acquire and stay with a formula, a recipe, for understanding how their reality-of-interest works--- unless the facts make nonsense of their perspective. How could a loving omnipotent God take my child?

One reason I continue to be satisfied with the science-based, naturalistic world view which I began to acquire as a teenager is that it is open to, indeed welcomes, revision. Its rootstock is the belief that, *without invoking supernatural forces, continued application of the scientific method is building a growing body of plausible propositions, and raising ever-deeper questions, about the nature of reality.* A scientific world view is unfinished in the way a growing tree is unfinished, with bigger branches continuing to subtend smaller branches. Correspondingly, each new insight into the nature of reality evokes further questions and answers. Thus, a developing (scientific) world view has an ever-branching hierarchical (equals strongly ordered) structure.

¹⁴⁷ McKenna, M., (2011) *An Eye for Eternity: The Life of Manning Clark*, Melbourne University Press, Melbourne.

Having raised the supernatural, let me confront it. Notwithstanding 300 years of enlightenment (think for yourself), a belief that immaterial anthropomorphic forces guide the unfolding of reality is central to the world views propagated by most religions, including animism. Throughout the recent history of modern humans, terror and religion based on supernatural external authority have been the main social technologies for guaranteeing behaviour supportive of the existing social order. People who have had something of a scientific education, including exposure to Ockham's maxim that it is the simplest explanation that should be accepted, see how, in principle, the world can be understood without recourse to frightening beliefs that have no evidential basis. One reason, apart from opportunity, that religion outpolls science as a world view is that while a good preacher can spell out a coherent world view in half an hour, it takes time and effort to learn to see the world through scientific eyes.

Along with religion and science, politics and economics are the foci around which people in the western world most commonly develop world views. A Catholic free marketeer who believes in democracy already has three world views, three starting points for answering the *what's happening?* and *what-to-do?* questions that are puzzling him. My task of the moment is not to delve into other people's world views, but to display some of the building blocks that make up my science-based world view and say something of how these have helped me approach various *what-to-do* and *what's happening* puzzles.

I am a human ecologist (no, not a human who studies ecology), meaning that my 'reality of interest,' my research interest, centres on how, and how successfully (adaptively), groups of humans manage their collective behaviour and their longer-term interactions with the non-human environment. Just as calling yourself a classical composer commits you to working within certain rules and makes your output understandable to others, calling yourself a human ecologist commits you to certain provisional beliefs or working hypotheses.

The lowest 'branches' on my rootstock belief in science *per se*, are the dual ideas that most of what happens in human ecosystems can be interpreted as evolutionary processes---those based on selective retention of variation---or/and as ecological processes---those characterised by interdependent behaviour amongst adaptive entities like plants, non-human animals and people. While these are two powerful perspectives for beginning to understand what is happening or could happen in human ecosystems, they are of little use, by themselves, for making what-to-do decisions. For that, they need to be linked to a normative or 'prescriptive' assumption about the purpose or goals or intentions of the decision makers, e.g. economists assume people are basically materialistic. Without knowledge of such goals, candidate decisions cannot be ranked from most to least preferred (note the unstated assumption that decision-makers will have goals). Neither can one begin to speculate as to why human societies evolved as they have, influenced by both agency (purposeful rational behaviour) and the environment's whims.

In recent years, when the choice has been mine, my preferred assumption about goals has been that decision-makers seek some version of high quality of life for those they see themselves as responsible for (perhaps only themselves or including future generations perhaps). My preference reflects the humanistic personal ethic I have long held and continue to hold, humanism being a philosophy which, above all, aspires to human progress. Now we can give my world view a name: science plus humanism equals scientific humanism.

To be a useful tool for understanding and then suggesting cultural adjustments in human societies, a world view needs to be much more layered than a belief in the explanatory power of evolutionary and ecological thinking, combined with an acceptance of high quality of life as a pervasive human goal. That primary insight has to be elaborated with further insights (provisional beliefs) into how evolutionary processes or ecological processes tends to operate in particular situations. And, to complete the toolkit, ideas that elaborate the components of a quality life in various situations, and how to assess these, are needed.

To be specific, I continue to be happy enough with psychologist Abraham Maslow's *theory of human needs* as a basis for analysing quality of life. He sees people as striving to satisfy received physiological and psychological needs for life, safety and security, for belongingness and affection, for esteem, for respect and self-respect and for self-actualisation (personal development, realisation of latent potentialities).¹⁴⁸ As more basic needs (e.g. food) are met, attention switches, in a hierarchical fashion, to satisfying higher needs (e.g. for creative activity). A need, in general, is 'that which persons must achieve if they are to avoid sustained and serious harm.' The notion of a *needs hierarchy* leads directly to the idea that a person enjoying high quality of life is someone who is largely able to satisfy his or her higher needs.

TWO PARTICULARLY USEFUL IDEAS

When it comes to applying evolutionary and ecological thinking to human sociocultural systems, one is looking to find plausible analogues in human social organisation for powerful concepts and principles that have been largely developed for understanding purely biological systems. Here, while my thinking is glaringly unfinished, let me mention two ideas which I frequently find to be productive starting points when trying to understand what is happening in Australian or global society.

The centrality of technological change

One is the parallel between the role played by a species' *gene pool* in biological evolution and the role played in sociocultural evolution by a society's *suite of technology recipes*. Technology recipes are like genes and vice versa. Both are information carriers. Implementing technology recipes is the way in which societies maintain themselves. While mostly applied routinely and repeatedly, they can appear or change spontaneously (like mutations), after which they become available for adaptive use, i.e. as a basis for doing things differently. But, unlike gene mutations, technology (short for technology recipe) production is also a goal-seeking activity, undertaken to better satisfy human needs. This bypassing of the hit-and-miss randomness of gene mutation etc. is the reason that sociocultural evolution is normally recognised to be a much faster process than purely biological evolution.

As with biological adaptations, new technologies tend to get developed and used and remembered on the basis of their immediate or short-term benefits. A few, such as the invention of agriculture, slavery and the steam engine, are transformational, changing the structure, infrastructure and (mental) superstructure of societies everywhere. In my world view, technologies range from the material (turning stuff and energy into products and processes) to the social, meaning technologies which organise and coordinate human behaviour to create 'problem-solving' institutions. I also have a place for 'cognitive' and 'communicative' technologies. Thus, democracy and nuclear power are equally technologies.

¹⁴⁸ Maslow, A., (1968) *Toward a Psychology of Being*, Van Nostrand, New York

Virtual species

A second idea I have frequently found to be fertile is that each of the various common-interest groups into which any modern society's members can be classified can be thought of as 'virtual species' which interact and are interdependent in ways comparable in many respects to the ways biological species interact in human-free ecosystems. That is, society's various interest groups, its virtual species, are like biological species and vice versa. For example, pursuing this idea, one can see that specialist *groups* in the economy (e.g. producers, consumers) are unwittingly *cooperating* for their mutual benefit--an extension of Adam Smith's recognition of a metaphorical 'invisible hand' guiding self-interested *individual* behaviours towards socially optimal outcomes.

Equally, virtual species can often be found *competing* for the same resources, as when, for example, European colonial powers occupied the New World, e.g. competing for arable land, slaves, gold. The further ecological concept of *parasitism* provides a perspective on the exploitation of one virtual species by another, a good example being the idea that we live in an imperialistic world system where there is extreme economic exploitation of 'peripheral' nations by the world's 'core' nations. In brief, the virtual species making up human ecosystems interact in a variety of ways, many of them close analogues of processes in non-human ecosystems.

In my world view, the link between the two perspectives, ecological and evolutionary, is that not only do virtual species interact with each other in line with established behaviours which we can think of as their technologies, they periodically develop and evolve new technologies intended to improve their members' survival and quality-of-life prospects. They are following the master principle of pristine systems, 'evolve or die out.' Thus, human ecosystems not only regularly reproduce themselves, they evolve over time as their virtual-species members develop and apply new social and material technologies. For example, an ecosystem with an intermingling of two virtual species, farmers and graziers, might move towards having more farmers if the farmers develop more reliable crop varieties.

EXPECTATIONS

Drawing on my knowledge of what has recurred in history and human affairs and on my understanding of evolutionary and ecological processes, my world view has come to include a 'default' set of expectations which I routinely interrogate when asking 'What's happening?' questions.

Self-interest

For example, I initially expect any virtual species to be behaving in a self-interested way. But not rigidly so; I equally recognise that social character is very malleable and that people, especially when young, can be taught to have concern for the wellbeing of others, including strangers. While there are many technologies for suppressing self-interest within groups (e.g. shaming), most virtual species find it very difficult to wittingly cooperate with other virtual species, whether searching for compromise or win-win benefits.

This pervasive inability to agree, what I call the *virtual-species problem*, is more conventionally known among political scientists as *agonism*, a term borrowed from biologists. For biologists, agonism is that combination of aggressive, defensive and avoiding behaviours which allow members of a species to regulate their spatial distribution; and, probably, access to food and mates. Amongst political scientists, agonists are sceptical of the capacity of politics to eliminate, overcome or circumvent deep divisions within societies, e.g. of class, culture, gender etc. They find many models of political behaviour, including liberalism and communitarianism, to be far too optimistic about the possibility of finding an harmonious and peaceful pattern of political and social cooperation.¹⁴⁹ While most virtual species are likely to be at least sympathetic to the proposal that humans should collectively pursue high quality of life for all, any agreed program (e.g. through the United Nations) for doing so seems unlikely. Indeed, parties will find it very hard to even agree on an operational definition of quality of life.

Grasshopperism

Another of my expectations is that individuals and groups, when making what-to-do decisions, will frame and compare their behaviour options in, by my standards, an unduly narrow way, commonly by ranking a too-small number of options in terms of too-few performance measures over a too-short time horizon. Too many significant decisions appear to carry an avoidable risk of being confounded by the unforeseen but foreseeable.

Politicians, for example, are notorious for not thinking beyond the next election. Just as it takes many kilometres to change a supertanker's course, it takes decades to transform a society's values, attitudes, perceptions and institutions. Western societies' current inability to factor these sorts of longer-term implications into their decision-making processes in a balanced way is widely recognised as a blind spot that has been given a name---short-termism or, for those who remember Aesop's fable of *The Ant and the Grasshopper*, grasshopperism.

Notwithstanding, what I find myself criticising as poorly-considered myopic decisions, collective or personal, can often be plausibly explained---not defended---after a little investigation:

Of first importance here is that because it is always difficult to predict the consequences of candidate behaviours in complex sociocultural systems, it might be judged, legitimately, that the perceived benefits of attempting comprehensive decision-making do not warrant the effort involved. Taking the same point even further, until we gain a better understanding of how complex systems---those containing multiple feedback loops---evolve over time, it might be judged too costly to use so-called rational methods for making decisions, even in a superficial way. I have some sympathy for people who rely only on intuition when making decisions. But there is a middle way between relying on unharnessed intuition and attempting to tease out the full consequences of a spread of possible actions. It is to build imaginative wide-ranging scenarios (stories) of the plausible possible consequences of one's alternative actions and, only then, allow intuition to choose between these. Sometimes it is illuminating to construct scenarios of both the 'best case' and 'worst case' consequences that can be imagined..

¹⁴⁹ <http://en.wikipedia.org/wiki/Agonism> (Accessed 27 Nov 2008)

There are other reasons, more prosaic, for the prevalence of myopic decision-making. Most people are poorly served by their education and find it difficult to think about their options in an analytical way or, indeed, even understand that they have 'options.' Equally, people find it difficult to think expansively, beyond the everyday, when asking what could happen. Also, as societies grow, complexify and specialise, 'negotiation overload' sets in. As the number of 'urgent' decisions to be made blows out, the time available to make each decision shrinks, taking its quality with it. This time-pressure effect is particularly noticeable in executive government where the goal of evidence-based policy-making is becoming harder to achieve.

FOUR HIGHLIGHTS

My world view, as it relates to the behaviour of human ecosystems, has evolved in fits and starts over the past 40 years. But I don't think it has passed through any 'paradigm shifts' in that time in the sense of my discarding an important idea and replacing it with an antithetical idea. Nor do I anticipate such a shift soon. If I sensed a coming breakthrough in science's ability to unravel the unpredictable behaviour of complex systems, that is where I would be looking to radically update my present understanding of 'what's happening' and what to do about it. But I don't.

Rather, my world view grows by selectively assimilating new ideas (meaning new relationships between entities) which support, extend or re-frame my existing ideas about how human ecosystems work. I also look for ideas which I sense, nothing more, might lead me to a new way of thinking about the processes which occur in human ecosystems. For example, recent research on the adaptive value of so-called 'junk' DNA in biological evolution makes me wonder if 'memes,' a culture's 'imitable behaviours,' play a comparable role in cultural evolution. While some of the new ideas I have assimilated have been my own, I largely draw such from my reading in, particularly, two areas. One is the biological, human and social sciences; and the other is 'comparative history,' meaning histories which follow a theme doggedly through time/space, e.g. histories of energy capture, cruelty, violence, truth...

While my list, restricted to four, would probably change on reflection, here is a group of ideas which within the time-span of this essay, have dramatically expanded my thinking:

Dissipative systems and maximum entropy

A powerful and relatively recent idea for understanding change is that all reality is made up of nested layers of *dissipative* or *energy-degrading* systems¹⁵⁰---smaller, faster-running systems nestling inside larger, slower-running systems. The fundamental property of dissipative systems is that they continuously take in energy, physical materials and information (energy in the form of meaningful patterns) from their environment and continuously excrete (dissipate) materials, information and degraded energy---energy of a lowered quality in terms of its capacity to do work---back into the environment. For example, the multi-species assemblages which ecologists refer to as *communities* or *ecosystems* can, in some sense, be considered as energy-processing systems which are transforming high-quality solar energy into chemical energy and then distributing this to all of the community members to be dispelled, eventually, as heat, a low-quality (useless) form of energy. The link here to evolution is that evolution can be understood as a process which creates, maintains and destroys dissipative systems.

¹⁵⁰ Salthe, S.N., (1985) *Evolving Hierarchical Systems: Their Structure and Representation*, Columbia University Press, New York.

The *principle of maximum entropy production* is an ‘unproven’ corollary of the second law of thermodynamics. It asserts that, whenever such a change becomes feasible, any dissipative system spontaneously self-organises into a new state where higher quality energy is degraded into lower quality energy more rapidly than in its previous state; and it keeps moving, step by step, through a sequence of feasible but unstable states towards a stable state where energy is being degraded (i.e. entropy is being produced) at a maximum rate. So, while energy can be neither created nor destroyed (first law of thermodynamics), the evolution of the universe conforms to the constraint (and strict selection principle) that higher quality energy is always being degraded to lower quality energy as fast as is physically possible. For example, it can be shown that the world’s system of winds and ocean currents transfers heat from the tropics to the poles as fast as is physically possible.

Usually of course, this principle won’t be particularly helpful for constraining (narrowing down) what might happen next in any local situation. Notwithstanding, it is intellectually very satisfying to always have a first order answer to any ‘What’s happening?’ question. Dissipative systems and maximum entropy are the metaphysical foundation of my world view.

Universal selection

Since Darwin’s time, the basic idea behind evolution through natural selection, namely, the *selective (non-random) retention of variation*, has been co-opted to explain evolutionary change in all manner of *systems*. Under the banner of *Universal Darwinism* or, to be less biological, *Universal selection*,¹⁵¹ temporal changes in various physical, chemical, psychological, cultural (including economic and technological) and other types of systems have been ‘explained’ using one or another version of this powerful idea. For example, solving problems by ‘trial-and-error’ involves generating a sequence of potential solutions until one which works is found and adopted, i.e. selected and retained. My particular interest lies in applying universal-selection thinking to cultural evolution, e.g. seeing cultural evolution in terms of the selective (trial and success) retention of newly-formulated technologies.

Every dissipative system has a finite life

This, first, is the idea that all of the universe’s dissipative systems have come into existence by diverting portion of the material-energy flows in some parent system into an offspring system which, while processing material less rapidly *in toto* than its parent system, processes more energy per unit mass than its parent, i.e. it is, according to Eric Chaisson’s ideas, more ‘complex’ than its parent.¹⁵² If material-energy flows being drawn from the parent system surge or decline markedly for any length of time, the offspring system will, metaphorically speaking, ‘die,’ starved or overwhelmed as the case may be, e.g. when the sun dies, our biosphere will die. ‘Dying’ means that the offspring system’s structure---its network of transport channels and ‘transformation nodes’---is substantially destroyed.

¹⁵¹ Hull, D.L., (1988) *Science as a Process: An Evolutionary Account of the Social and Conceptual Development of Science*, University of Chicago Press, Chicago; Nelson R.R., and Winter,S.G.,(1982) *An Evolutionary Theory of Economic Change*, Belknap Press, Cambridge, Mass.

¹⁵² Chaisson, E., (2001) *Cosmic Evolution: The Rise of Complexity in Nature*, Harvard UP, Cambridge, Mass.

But even in the absence of gross changes in the flows of materials and energy in the parent system, offspring systems typically pass through a birth-to-death life cycle characterised by three stages---immaturity, maturity and senescence. Nothing lasts forever! An immature system is a system which keeps growing by developing structures which capture increasing quantities of the parent system's material-energy flows, e.g. a plant grows more light-capturing leaves. The specific (or relative) growth rate of an immature system increases over time. A mature system is one whose specific growth rate has started to fall because it is approaching a constraint, a limit to the material-energy inputs it can capture for its further growth, e.g. a plant canopy which is capturing all incident sunlight. A maturing system needs to add ever-more structure to capture each additional unit of energy, e.g. think of the rising unit cost of exploiting depleting oil fields.

At some point every mature system becomes senescent, meaning the system has more-or-less stopped growing and is using most of its energy flow to maintain (not grow or adapt) its existing energy-capturing and energy-processing structures. In such a state, the offspring system is processing less energy per unit mass than its parent system and becomes vulnerable to small random fluctuations in material-energy flows (called homeostatic weakening or loss of 'bouncebackability') either within the parent system or within the transport channels of the offspring system. In a senescent system, small fluctuations will eventually precipitate a loss of structure and a decline in the system's capacity to capture energy flows from the environment and dissipate energy back into the environment. Once initiated, loss of structure spreads, domino-style, as the closure of one transport channel leads to the closure of all channels connected to it; although a *resilient* system may be able to switch to alternative channels. Think how the loss of one line in a power grid has sometimes closed down the whole grid.

Memento mori. Locating a system (you, me, the universe) within its putative life cycle focuses one's view of it remarkably, as Samuel Johnson might have said.

Consciousness is a recently evolved cognitive technology

Consciousness remains a puzzle for psychologists, neuroscientists and philosophers alike. My current working hypothesis, drawing on the ideas of Julian Jaynes¹⁵³ and Zoltan Torey¹⁵⁴, is that it is a cognitive technology for helping post-infantile humans decide what to do in situations where neither habit, custom, nor instinct provide a behavioural template, and something more than blind trial-and-error is required. As recently as the 1st century BCE, it evolved from and replaced what Jaynes calls the *bicameral mind*, an earlier cognitive technology in which a single behavioural response is formulated at a sub-conscious level and acted out in obedience to an insistent hallucinated command, often in the voice of a leader, king, god or other authority figure.

Consciousness, by contrast, is more like a dialectical dialogue with oneself. It allows the pre-conscious to throw up 'solutions' to a what-to-do problem, one after the other, describing each in words, albeit silently, until a solution is reached which is both plausible (i.e. appears to be implementable) and emotionally acceptable.

'Yes, but do you have any other suggestions'?

'Ah, thankyou, that's "good enough."'

¹⁵³ Jaynes, J., (1976) *The Origin of Consciousness in the Breakdown of the Bicameral Mind*, Houghton Mifflin, New York.

¹⁵⁴ Torey, Z., (1999) *The Crucible of Consciousness: A Personal Exploration of the Conscious Mind*, Oxford University Press, Melbourne.

Both the bicameral mind and consciousness are language-demanding technologies meaning neither could have evolved before language evolved (and, in passing, that babies cannot use this technology). Alternatively, language and consciousness co-evolved. Consciousness uses sub-vocal language to efficiently convey a tentative solution to a what-to-do problem across the corpus callosum, from left to right hemisphere, to a site where it can be evaluated for its acceptability. The bicameral mind uses language to convey an hallucinated command over the same pathway. The changeover in technologies may have been facilitated by the increasing failures of authoritarian commands in tumultuous times and by the flowering in Greece of a vocabulary for describing one's thoughts and feelings in terms which recognised such to be self-generated, e.g. I feel sick. Consciousness is a *social technology* to the extent that without the language we learn from others, it would not exist.

Consciousness, a process, is different from 'being conscious' which is an experience. Being conscious is an experience of seeing, metaphorically, that one's problem-detecting processes are currently receiving information about something, from either internal (pre-conscious) or external (sensory) sources. Because it is difficult (but not impossible) to be conscious of something one cannot describe, the range of 'somethings' one can be conscious of expands with one's vocabulary. Speech can be an indicator of the experience of being conscious; if you can hear yourself describe or refer to something, a thought or sense impression, it can be assumed that you are or were conscious of that something.

What-to-do problems can range from 'fight or flight' to where to put a comma; from how to classify an object (What bird is that?) to ascribing causes (Nature or nurture?) to checking patterns (Has something changed here? Do I have a problem?).

Consciousness deals with problems constructed by oneself as well as problems presented by the environment, e.g. How do I devise a piece of music within the following compositional rules? The very use of language generates its own suite of what-to-do problems, e.g. what is the definition of gollywog?

These then are some of the enormous ideas that have come my way. Several are strange and I ask the reader to not reject them too quickly. While I hope there are more grand ideas to come, I expect, at very least, to be regularly amazed and pleased at humanity's growing understanding of nature and society. More prosaically, I will be looking for 'factual' generalisations and concepts which I can add to my world view's stock of working hypotheses or, less elegantly, 'rules of thumb.'

WHERE TO NOW?

Hermes told Socrates that asking questions was the way to wisdom. Let me close by listing some of the bigger and smaller questions which I need to continue researching if I am to become a wiser human ecologist. Some of these reflect no more than a wish to redress my ignorance of a particular body of literature but others stem from more informed doubts about the robustness/ adequacy of various of my current hypotheses; or, conversely, an intuition that some existing idea can be improved:

Language and adaptation

Language and writing are humanity's greatest inventions, supreme tools for communicating and creating information, both inside heads and between people. Without them, complex societies and the social, material and cognitive technologies which sustain such societies would not be possible. People have always lied, but is language becoming a maladaptation now that it is so widely used for propaganda, disinformation, emotional manipulation, framing etc.? Just what is a maladaptation? How does one diagnose maladaptation? When can a maladaptation prove fatal? When trust is lost and all information is suspect? Should we be surprised at this debasement? Can language be rescued without emasculating it? Is the counter-enlightenment finally winning? How does language constrain and enhance entropy production? What more can be done with this tool? Does it have unrecognised potentialities? Is language, as distinct from vocabulary, still evolving? Is all language metaphorical and, ultimately, private? What is the relation between a society's or an individual's world view and their vocabulary?

Culture and technology

How powerful is the idea that cultural evolution can be largely understood in terms of the evolution and ecology of technologies and ideas? I am very attached to this reductionist proposition, but am I asking too much of it? Have I just rediscovered cultural materialism and technological determinism? How do technologies evolve and spread? Do stable, persistent technologies provide a nurturing environment, one where fragile technologies can emerge and adapt to those that are enduring? How do technologies co-evolve? Does a new recipe have to be used repeatedly before it can be called a technology; for example, is a revolution a social technology? Can methods of foreseeing the full consequences of new technologies be improved? How does one develop maximally useful technologies? What triggers the search for new technology? What limits what is technologically possible? What role do emotions and consciousness play in technological change? What is the relationship between technologies and ideas? Can technological change explain giant social transformations?

Agency and idealism

When do ideas change the world, e.g. the Protestant ethic and the rise of capitalism? In what ways do ordinary individuals contribute (a) to reproducing (maintaining) society and (b) to changing society? Under what conditions can would-be reformers achieve significant reform? Under what conditions can power-seekers achieve power? Is agency something more than conscious rational behaviour subject to the constraints of being a member of society? How did it evolve? What motivates or causes goal-seeking behaviour? Is it reasonable to assume that agents are constrained to be rational? Can individuals make decisions which violate the principle of maximum entropy production? What are the bio-physical and social limits on agent behaviour?

Cognitive technologies

Is there a place for rational thought in a world where nothing can be proved or disproved? How useful is the concept of 'bounded' rationality? Are plausible evidence-based stories a good-enough cognitive technology for provisionally understanding nature and society? What are the alternatives? What does *plausible* mean? Does quantitative modelling have a role in understanding the world? What is an *explanation*? Is a moral code a cognitive technology? How does a person's world view determine their choice of cognitive technologies? How can cognitive technologies be best classified?

Virtual species

All individuals belong to a variety of virtual species or interest groups and frequently move between these; how should the dynamics of these oscillations be conceptualised? Can virtual species be usefully thought of as occupying ecological niches---nodes in a network of nodes, each of which can be described in terms of their imports, exports and transformations of materials, energy and information? How will this description change between steady-state and evolving societies? How do virtual species choose their collective actions? When is it useful to think of the populations of city regions (that is, cities plus their hinterlands) as virtual species? How do people become members of a virtual species? How does the membership of a virtual species grow? How does a network of niches grow or contract? How does one virtual species manage to exploit another? What are the limits to such exploitation?

The questions are legion and time is short. I accept that my world view will remain unfinished. As Homer said, 'The journey is the thing.'