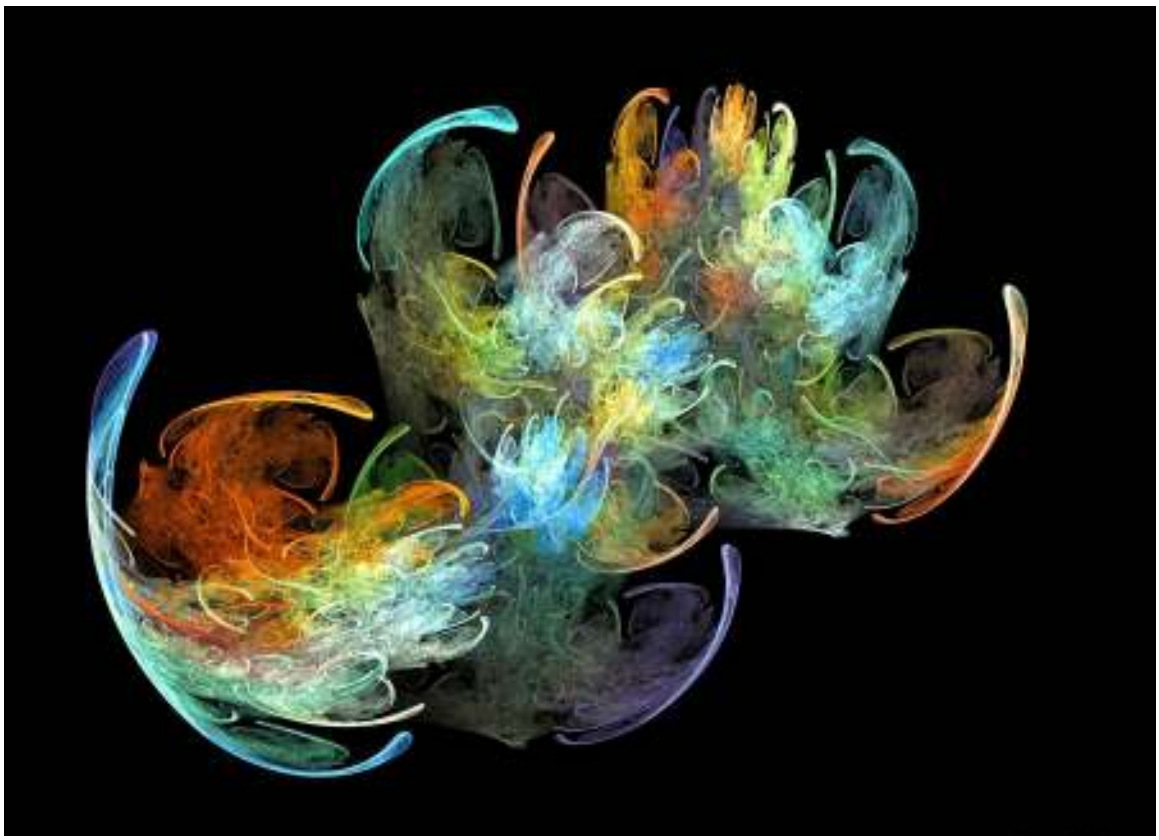
COLLAPSE

'For the first time in history, we face the risk of a global decline. But we also are the first to enjoy the opportunity of learning quickly from developments in societies anywhere else in the world today, and from what has unfolded in societies at any time in the past.'

Jared Diamond, 'Collapse: How Societies Choose to Fail or Survive'



Learning Portfolio
UGRD 3001
Unravelling Complexity
Themed 'Collapse' in 2009

Melanie Bannister-Tyrrell

Trust me, this will take time but there is order here, very faint, very human. Meander if you want to get to town.

Michael Ondaatje, 'In the Skin of a Lion'

The image on the front cover is a fractal: a self-similar object of infinite complexity and a model for all knowledge. You can position yourself at any depth and be staggered by boundless complexity: this is how biologists cherish a lifetime of work investigating a single protein and poets never fail to seek inspiration in the human condition. But be wary of finding yourself lost in two dimensions. Look up, down and around; an interdependent universe beckons. It is by moving between these ephemeral boundaries that we can meaningfully share our knowledge of our many worlds.

Contents

Introduction

This course poses several important questions

- How do we come to understand the unknown?
- Can we define complexity?
- How should we deal with complex issues?
- Can we predict the outcome of complex events?

There are many valuable directions that this learning portfolio could take, including an analysis of vulnerability and resilience, a thorough examination of recurring features of complex systems, application of strategic thinking to each case study, or a myriad of other possibilities.

I believe the most important question to address is how we come to understand the unknown. We cannot expect solutions to complex problems without careful development of transdisciplinary thought, frameworks and values. The focus of my learning portfolio is on building a framework for a philosophy of knowledge that aims to marry critical enquiry with the imagination.

Road map

This Learning Portfolio is required to show evidence of preparation and reflection on many topics and processes. To best elucidate the course themes and address my focus question, I have restricted the main body of the text to a thematic reflection on the panels and tutorials, organised by week. For marking purposes I have distinguished where possible between material that has come from panel presentations, readings or tutorial discussions. Material from other sources, including media sources, has been incorporated where relevant.

The Tutorial Preparation section in Appendix 1 includes responses to specific questions set by the tutors each week. For the most part, compulsory and suggested readings have been considered in the Panels and Tutorials section. Unless specifically referenced, these notes are not intended to enhance the flow of ideas in the portfolio and have been submitted to fulfil the requirement of ‘evidence of tutorial participation’.

Reflections on tutorial presentations and the policy brief exercise, including group work processes, are included in Appendix 2 and 3 respectively.

I have attempted to tie many aspects of the course together in a final essay on Building a New Philosophy of Knowledge through the Transdisciplinary Imagination and simultaneously address the question of ‘how we come to know the unknown.’

Panels and tutorials

Course introduction

"Universities serve to make students think: to resolve problems by argument supported by evidence, not to be dismayed by complexity, but bold in unravelling it".

– Lucas and Bolton

Lawrence introduced the course by calling us to question the Lucas and Bolton statement:

- Should we 'unravel' complexity? 'Unravelling' implies a reductionist approach; in reducing a problem we assume that we can understand something by understanding its constituent parts. Much of science adopts a reductionist approach, and this has proved to be a highly successful methodology for understanding the entities and processes that create and shape our world. However, reductionist approaches miss emergent properties; Tchaikovsky's transcendental compositions cannot be understood by analysing each bar.

- Should we support our arguments by evidence only? What about the role of our emotions, rhetoric and politics in solving arguments? Evidence does not always matter, and the lack of evidence should not preclude us from framing an argument or making a decision. We may need to change the way we think in order to find the evidence to support an argument.

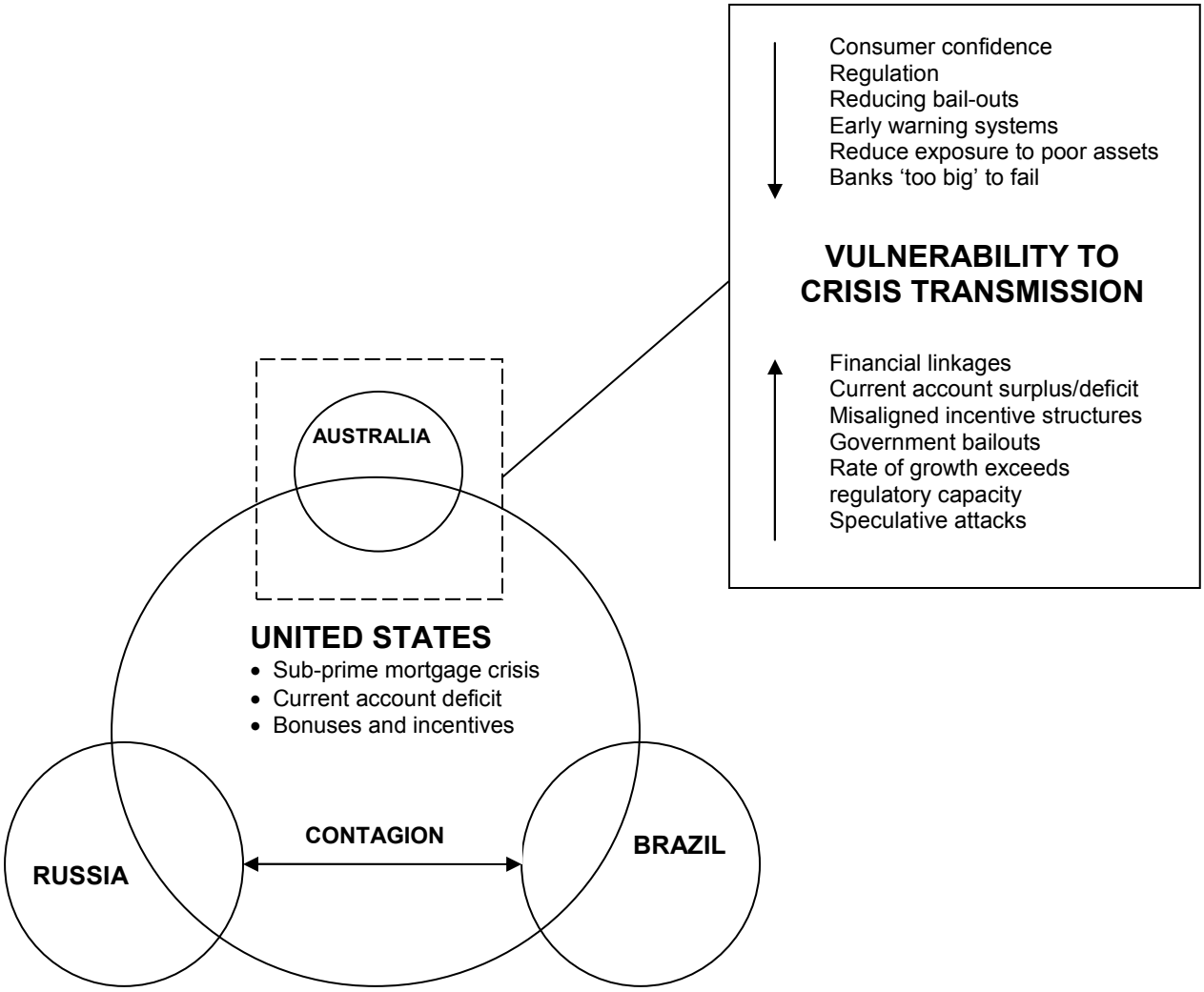
- Should we focus on solving problems? The education literature from the past fifty years emphasises that problem solving is amongst the highest and most cognitive activities that humans engage in. However, there is a deep criticism of the 'problem-solving' mentality, which is that it is purely reactive, and thus takes the contemporary context for granted and produces solutions that often come far too late for problem resolution. This criticism can be described as the 'futility of learning', which is that if we learn how to solve problems, yet solutions come about too late, then it is futile to learn.

Lawrence leaves us with the challenge to discern where new knowledge comes from. This challenge has been preliminarily addressed in my tutorial preparation notes, but a full exploration requires deep contemplation of the nature of knowledge and how we come to understand and represent complex ideas. Please see my response in a short Essay on Building a Philosophy of Knowledge through the Transdisciplinary Imagination

Global Financial Crises

Global Imbalances and Dynamic Linkages

Figure 1: Diagram of Linkages and Vulnerabilities in Global Financial Crisis



- Financial crises transmit along direct and indirect linkages. Centre markets transmit crises between disparate markets, for example Russia and Brazil are linked via the United States
- Misaligned incentive structures: few downsides to losing money, especially with government bailout packages, but huge benefits to making money.
- Rate of economic growth exceeds regulatory capacity
- Current account surpluses and deficits between developed and developing countries
- Transmission of shocks from one market to another not warranted by economic health or linkages of affected countries – "dynamic linkages"

- Erratic 'emotional' behaviours including speculative attacks, expectation and mimicry increase vulnerability to crisis

Tutorial exercise – Deposit Guarantee in Australia

Deposit insurance aims to increase banking system stability but actually increases the likelihood of banking crises, the more so where bank interest rates are deregulated and the institutional environment is weak. Adverse impacts are stronger the more extensive the coverage offered to depositors.

Deposit insurance poses a 'moral hazard'. Ability to attract deposits no longer reflects the risk of asset portfolio; therefore banks are encouraged to finance high-risk, high-return projects.

Higher GDP per capita reduces probability of banking crisis but increases likelihood of deposit insurance → *risk elements that make banking systems more fragile have little to do with the decision to adopt deposit insurance.* But, deposit insurance weakens market discipline.

Deposit guarantee was introduced in Australia to 'restore confidence'. However there should have been no need to restore confidence: Australia has a strong economy with a very different banking system to the United States and minimal exposure to poor assets.

Deposit guarantee schemes introduce imbalances into the financial system by reducing downsides to losing money. *The greater the imbalance, the greater the capacity for erratic behaviour to destabilise the system*. Introduction of the deposit guarantee nearly tipped the Australian economy into crisis; arguably it was the strong regulatory models in place that allowed the Government to halt 'bank-runs' on deposits held in institutions not covered by the guarantee.

Policy considerations

In a domestic economy, monetary policy changes (interest rates) are very effective. However in a global economy, fiscal policy changes (taxation, government spending) are more effective. Globally, monetary policy is limited by differences in interest rate fluctuations. One question I have is whether the Federal Government was actually aiming to strengthen its position in the global economy through the stimulus packages rather than shoring up the domestic economy, as was implied by politicians and the media.

Question: How can mimicry of financial instruments in distinct economic environments function to strengthen the financial system?
Relevance: One of the major motivations for the Australian government to introduce a deposit guarantee is that many other OECD countries have a deposit guarantee scheme in place. Instances of both isomorphism and diversity are observed to reduce vulnerability in complex natural systems but we lack the tools to predict whether mimicry or diversity will hold offer the greatest evolutionary benefits in the future. The same uncertainties seem to apply to the global financial system.

Helpful and unhelpful thinking about complexity and uncertainty

Definitions and typologies of complexity

First we need to distinguish between complicated systems and complex systems

- Complicated: Many components, but understandable and predictable processes and rules.
- Complex: Boundaries are difficult to determine (ecosystems) with shaky equilibriums (if present at all). Processes of memory are inherent (past states affect present), nested (systems within systems), not just simple causes and effects, feedback loops, adaptation (learning behaviour)

Comments on Table 2, Typology of Problems in the reading on *Wicked Problems: The Implications for Public Management* (Head, Alford).

Table 2: Typology of problems

Diversity → / Complexity ↓	Single party	Multiple parties, each having only some of the relevant knowledge	Multiple parties, conflicting in values/interests
Both problem and solutions known (Heifetz Type 1)	Tame problem 1	2	3
Problem known, solution not known (relationship between cause and effect unclear) (Heifetz Type 2)	4	5	Wicked problem 6
Neither problem nor solution known (Heifetz Type 3)	7	Wicked problem 8	Very wicked problem 9

In the tutorial I found the use of this chart to be an exercise in persuasion in determining who had the most 'wicked' problem. Believing that your problem is 'very wicked' rather than 'wicked' is not particularly enlightening and does not offer any approaches. The table falls into the 'problem-solving' discourse that Lawrence Cram questions in his critique of Lucas and Bolton's statement.

Using this table reminds me of a scene in the film Dead Poets Society *where John Keating instructs his class of boys to rip out the entire introduction of their poetry text, with its prescribed methodology for graphically analysing the quality of poetry.*

"Now I want you to rip out that page. Go on, rip out the entire page. You heard me, rip it out. Rip it out!

http://www.youtube.com/watch?v=tpeLSMKNFO4

Planning for surprise

Steve Cork argues that the prevailing tendency towards optimal control means that we do not bother with strategic plans for non-optimum states. He argues that we have a tendency to turn possibility into certainty, with the example of the Y2K bug, but also that we ignore planning for surprise.

So what, then, was the Y2K bug? Who did it benefit to develop plans for managing the possibility (certainty?) of a clearly non-optimum state? It seems to me that we meaningfully plan for many situations that, if they eventuated, would result in a catastrophic loss of the optimum state, e.g. Y2K bug, WMDs in Iraq, Cold War nuclear proliferation.

Yet from time to time we suffer catastrophic 'failures of imagination', best evidenced by the September 11 attacks.

Strategic thinking should include envisioning multiple futures, including one in which your organisation does not exist. Contrast to strategic planning, which is a short term plan of lower cognitive activity with multiple embedded assumptions (including assuming the future existence of the organisation) producing one interpretation of reality.

Tutorial reflections

Nassim Nicholas Taleb's 10 points for a 'Black Swan Proof World' aim to reduce the vulnerability of financial systems to surprise. His comments on the global financial crisis offer a new perspective on material from the previous week.

Point 1: *What is fragile should break early while it is still small*.
This contradicts the point from the previous panel that banks that are 'too big to fail' resist crisis transmission

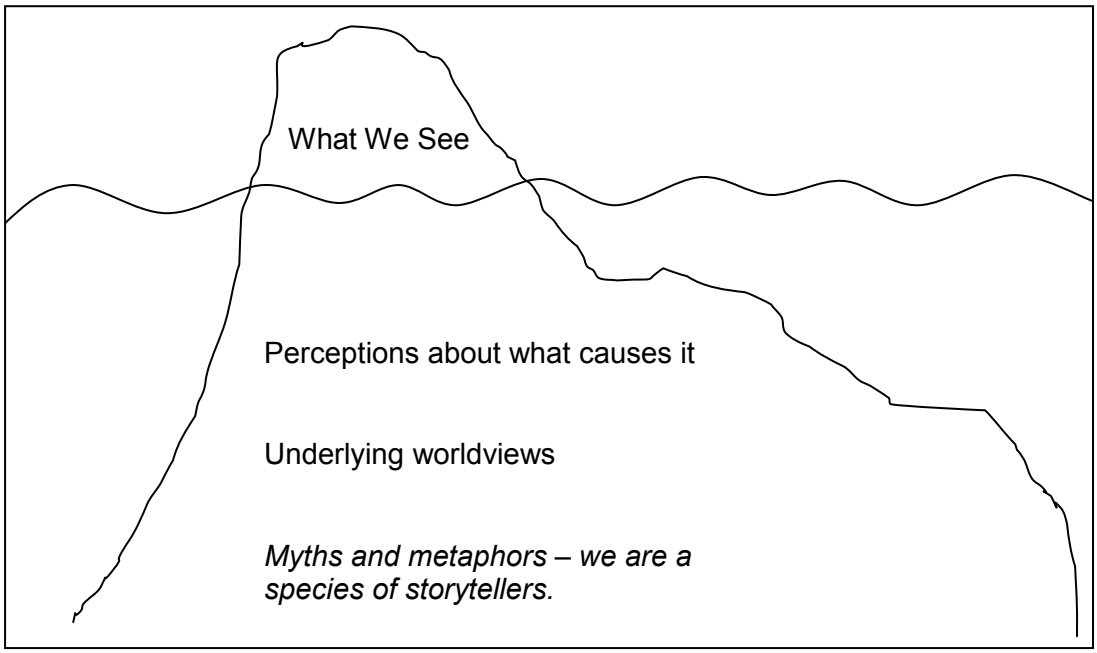
Point 2: *No socialisation of losses and privatisation of gains*. *Whatever may need to be bailed out should be nationalised; whatever does not need a bail-out should be free, small and risk bearing.*
This calls for a socialist revision of the financial world to reintroduce nationalisation of companies. This is the opposite to what has happened in Australia over the past decade, e.g. the privatisation of Telstra and Qantas.

Point 5: *Complexity from globalisation and highly networked economic life needs to be countered by simplicity in financial products.*
The sub-prime mortgage crisis should never have been allowed to happen; consumers should not be offered mortgages based on high-risk bank portfolios that they are not told about and do not understand.

Point 7: *Only Ponzi schemes should depend on confidence. Governments should never need to restore confidence.*
The Government's attempt to 'restore confidence' by establishing a deposit guarantee nearly tipped the economy into crisis. However Government stimulus packages seem to have prevented Australia from slipping into recession. Australia seems to have fared the best of all OECD countries in this crisis.

Myths and storytelling

Figure 2: Sohail Inayatullah's Causal Layered Analysis



Further to this notion of storytelling is the identification of Royal Dutch Shell's strategy in the 1960s to plan for an unprecedented oil crisis, by using vivid stories both to focus management on planning for alternate futures, and as critical tests of the logic of scenario planning. This point is explored further in the Essay on Building a Philosophy of Knowledge.

Storytelling emotionally prepares people for change.

Questions: What are our loved stories of complexity? How long do ideas and visions take to become 'stories'?
Relevance: Steve Cork said that Obama is the Cinderella story of contemporary American politics. This question is important if we want to understand how and when 'radical' ideas such as strategic thinking will permeate the levels of influence in Sohail Inayatullah's causal layered analysis.

Collapse of Empires

Through the looking glass

'A society may be able to hold off its enemies as long as it is strong, only to succumb when it becomes weakened for any reason, including environmental damage. The proximate cause of the collapse will then be military conquest, but the ultimate cause – the factor whose change led to the collapse – will have been the factor that caused the weakening. Hence, collapses for ecological or other reasons often masquerade as military defeats.'

- Jared Diamond, *Collapse*

Jared Diamond investigates this perspective with respect to the collapse of the Western Roman Empire, which some historians have claimed to have been caused by repeated barbarian invasions. However, Rome had held off such invasions for 1000 years. What then, brought Rome down?

Here we are probing questions about the nature of history. The diversity in reasons given for Rome's collapse can be understood in terms of Sohail Inayatullah's Causal Layered Analysis, especially in understanding our underlying world views. For example, the Kennedy thesis posits that economic wealth underpins military power in societies, and that if too great a proportion of resources are diverted to wealth creation, the benefits of expansion may be critically undermined by the inflation in expenses. In this sense, Rome 'was too big to *not* fail' (similar to Nicholas Taleb – nothing should be too big to fail). Criticism of the Kennedy thesis includes that it is an exclusively materialist explanation anchored in economics, money and guns; causation is more complex and includes the role of ideology (including religion) and individuals. Another example, the so-called 'Climate Change' explanation, which posits that pervasive environmental degradation, including deforestation, salinisation, overcultivation of marginal lands and coastal road construction, contributed to the collapse of the West Roman Empire. Broadly this explanation can be examined in the context of 'presentism', in which we apply a lens to our reading of the past according to the preoccupations of the present.

Probing further, we can examine the underlying myths and metaphors that shape how we think about international affairs, which is formalised as International Relations (IR) theory. Two historically important narratives include 'power politics realism', which emphasises military strength and ruthless leadership, and 'liberal internationalism', which takes Western liberal democracy and corporate capitalism to be the model for perpetual peace (please see my diagram in the tutorial preparation for this topic). In contemporary IR we are examining the collapse of these dominant narratives in a quest to deal with modern questions of ethnicity, multiplicity, religion and environment. Governments are addressing the need for complexity and nuance in all policy arenas, recognising that these modern questions cannot be answered by free-market, individualist regimes nor increased aggression. Uncertainty, contingency and complexity are unavoidable.

This is an important point in the course where we can see how valuing rather than unravelling complexity is the preferable approach. It is precisely the 'messiness' of complexity that demands we let go of dominant narratives as they present a single viewpoint of history. This point will become increasingly relevant in considerations of identity and mapping in the Pacific islands and in considering the 'Closing the Gap' approach to indigenous affairs.

In the tutorial we argued that we must move away from foundationalist theories that are *non-adaptable* and *unchallengeable*. We need frameworks that supply working definitions; we can't eliminate systemic biases but awareness of these biases limits their persuasiveness.

Asking the right questions

Should we be asking not why the Roman Empire collapsed but why it lasted so long? Why did the Roman Empire outlive the Ancient Greek Empire? We can argue that societal collapse is ultimately inevitable. Understanding the longevity of societies may better help us to understand the characteristics that make societies *resilient* to collapse. We can't foresee the reasons for the eventual collapse of the modern Western world, but we could aim to build our resilience.

A good strategy is to utilise scenario planning, which does not require us to understand the complexity of collapse; it involves reducing vulnerability to collapse.

In the tutorial we examined resilience to collapse and identified the importance of thresholds, which combine our vulnerabilities, adaptabilities and capabilities. We drew on examples of corporate failure (Enron) and corporate success (Microsoft) with the assumption that modern corporations display similar trends or qualities to societies. This idea of modelling big systems with smaller systems is explored in terms of fractal geometry in the panel on Dynamics and Geometry of Complexity.

Questions that remain to be asked include, 'what is our capacity to anticipate change in the international system?' It seems that international systems are extremely sensitive and rapidly responsive, for example the globally perceived moral collapse of the US is being overturned under the Obama administration. How can we distinguish between minor 'noise' fluctuations and real signs of impending collapse?

Complexity in Our Sea of Islands – failing States or failed analyses?

'The other level is that of ordinary people…who, because of the poor flow of benefits from the top, scepticism about stated policies and the like, tend to plan and make decisions about their lives independently, sometimes with surprising and dramatic results that go unnoticed or ignored at the top. Moreover, academic and consultancy experts tend to overlook or misinterpret grassroots activities because they do not fit with prevailing views about the nature of society and its development'

- Epeli Hau'ofa, *Our Sea of Islands*

Through the writings of Epeli Hau'ofa and the commentaries provided by the panellists, we can see a strong juxtaposition between identity maps and colonial cartography. In colonial times, the Pacific has been framed as a collection of states – 'powerful, strong, meaningful lines' that arbitrarily divide the vast Pacific Ocean.

Ancestral identities and failing stories

The three panellists presented us with vivid stories of their identities and experiences; complex textures of place, ancestry, movement and symphony. Epeli Hau'ofa shares his own perspective on the ancestral identity of Pacific people. He overcomes the notion of smallness and isolation of 'Pacific islands' by inviting us to consider the 'myths, legends and oral traditions, and the cosmologies of the peoples of Oceania', which offer an expansionary and boundless view of the Pacific in which people, ideas, resources and art are shared across the 'sea of islands'.

In colonial times, this vast movement of people was halted by the imposition of imaginary lines in the ocean; to cross these lines may now require visas, work permits and identity papers – all of which state that you belong to a tiny land mass, isolated from others.

Epeli Hau'ofa considers that globalisation has had liberating effects on the people of Oceania, who have been able to once again travel across vast distances and establish new homes throughout the Pacific; in Australia, Fiji, New Zealand, the United States and Canada, and further afield in Europe. In moving away from the normative approaches of international relations and development theories, we can see a broader picture of a complex, nuanced reality *as it is experienced.*

The key question then, is how do the stories we tell limit our capacity to see and appreciate complexity? What are the stories we tell ourselves compared to the stories we tell each other, how does our ancestral identity frame these stories, and how do they impact on our view of the Pacific?

For example, we can frame Scott McWilliam's discourse on racism and racial development in Fiji within the framework of storytelling.

- *What stories is the indigenous Fijian government drawing on*? Race and racism are natural and permanently divisive, but can be tamed through a modernist approach, with an emphasis on 'racial harmony' and 'national unity'. Striving for racial harmony demands the maintenance of race as a divisive element. Racial development becomes the instrument for 'taming' racial divisions.
- *What stories is the government telling the population?* During the 2001 election campaign, Laisenia Qarase pledged to save the Fijian race from extinction. The response is affirmative action for equality.
- *What stories are they telling themselves?* Advance of indigenous capital as communal capitalism based on a customary system of distribution among chiefs. Race dissolves into ethnic respectability and economic nationalism along ethnic lines. Striving towards multicultural rather than non-racial objective.

I am also interested in the development of the myth of 'indigenous', which is a dominant discourse in Fijian politics. In the tutorial we identified that ancestral heritages are not confined to 'indigenous' people and that 'non-indigenous' groups such as Indian-Fijians are woven into the fabric of Fijian identity. To take an example outside the Pacific, Inuit Greenlanders assert indigenous status in their efforts to seek independence from Denmark, which was a 19th century colonial power. However Inuit people were at least the fourth group of distinct settlers from the North American continent, and arrived after the medieval Vikings. Indigenous status is a response to neo-colonial economic and development agendas but does not offer solutions; most of Greenland's GDP is supplied by Danish aid. I think that the idea of an indigenous state denies the reality of an intercultural existence, and I think this may be relevant for the Pacific, Greenland and Australia.

The tutorial exercise on reductionism reveals the stories we have learned to believe, with our identities seemingly strongly shaped by our academic experiences. When asked what 'human security' means, I was surprised to hear many responses describing human intelligence operations such as ASIO. I immediately thought of health, which is consistent with my world view of seeing poor health as a barrier to education, development and economic growth. Others suggested happiness to be the measure of human security, which immediately realigned my perspective to consider whether health is necessary for community cohesion, for hope, for pleasure, or for capacity to believe in and effect change.

Simples states

The State can be conceived as an agent of simplification. States establish weights and measures, currency, time, legal equality, registration of land ownership, imposition of national languages, and codification of customary law. The concept of the nation-state coincided with the rise of nationalism in the 20th century; the creation of a nation-state implies the existence of 'other' nation-states. In the tutorial we examined the creation of states and interpreted that national boundaries are reactive and not always inclusionary. The nation-state concept asks people to be united against the other, and this manifests in neo-colonialist and possibly indigenous discourses as discussed. An alternative view is to introduce a temporal identity to the concept of nation-state, so the question

becomes not “is there a nation” but “when is there a nation”. Katerina Teaiwa used the elegant example of Rugby 7s tournaments in Pacific to explore this stochastic model of the nation-state emerging and dispersing within more constant yet fluid ideas of community and identity.

The paradox of states is that perceptions of difference provide the motivation for creating states, yet all states look more or less the same. State isomorphism arises through several pressures, including:

- Coercive: Military defeat, colonial rule
- Mimetic: Irrational copying of admired ideals e.g. US, USSR
- Normative: Professionalisation of work and training programs. Hospitals and schools are the same everywhere.

When states look the same, the relative differences between them become much easier to quantify. Consider how GDP is used to divide the world into the G8, G20, OECD, ‘tiger economies’ and ‘developing nations’. With these asymmetries so salient, power relationships conform to the same asymmetries. Powerful nations have the power to set regional and global agendas and to say what is important. It is on this point that I think the indigenous discourse becomes most useful because it strongly identifies a group who may sit on the wrong side of the asymmetry, which can mobilise a call to action for shifts in power structures. Again, a question of effectiveness is raised; I think Epeli Hau’ofa’s discourse could do much more for the people of Oceania than continued divisions into indigenous and non-indigenous people.

Failed Analyses

Is the Pacific failing? We can identify failure as defined by Western economics in the sense of market failure, which extends to a failure to meet the ideal ‘nation-state’ model (see discussion of neoliberal discourse in panel on Collapse of the Roman Empire)

Consider an alternative view: The nation-state is a failing model. Progress and growth are deeply linear ideals. Adam Smith’s market-based definition of sovereignty: “defence, police and construction of public works that would be unprofitable for the private sector but of benefit to society.” However, rule by states also introduce distinctions that create and perpetuate disadvantage, for example Pacific women living in nation states were relegated to a new private sphere while men took on opportunities in the public world of politics and government.

In the tutorial we considered a failed state as a state that is not providing the needs of the people, particularly with respect to the economy, health and education. However, there are other ways to provide these things. Consider this quote from Epeli Hau’ofa: “Much of the welfare of ordinary people of Oceania depends on an informal movement along ancient routes drawn in bloodlines invisible to the enforcers of the laws of confinement and regulated mobility.”

Tools for unity are drawn from spiritual, emotional and intellectual centres; an arbitrary nation-state has little influence on these spheres.

Question: How is success measured as opposed to collapse in a ‘sea of islands’? To measure success we must change scales and focus on links between places. What kinds of links would be most pertinent?

Closing the Gap

What is the gap we are trying to close? Statistical gaps are evident in measures such as life-expectancy, health status, housing status and literacy rates. These gaps may be understood as manifestations of deeper gaps, including structural, location, discursive and cultural gaps between indigenous Australians and other Australians.

Discourses on closing the gap are not unique to Australia; even the World Health Organisation has programs on 'closing the gap' within the framework of addressing the social determinants of health.

The most difficult gap to discern is the supposed 'well-being' gap. Altman claims that Eurocentric measures of wellbeing are used to conclude that Indigenous Australians experience lower well-being than other Australians. Altman argues that indigenous Australians living in remote outstations still achieve well-being by their own standards, despite poorer health and higher mortality rates.

"Closing the Gap" implies sameness; a national program runs the risk of looking for simple, universal solutions to wicked problems.

Collapse of due process

We can ask whether the Northern Territory Intervention was a good response to a collapsing society, but first we need to address whether the intervention represents a collapse of due process as part of an ongoing invasion of indigenous lands and societies in Australia.

Characteristics of the Northern Territory Intervention indicative of collapse of due process may include:

- Experts and indigenous communities were not consulted
- Military and police deployed
- Suspension of Racial Discrimination Act
- Compulsory land acquisition
- Compulsory health checks
- No pornography or alcohol permitted in government-defined areas
- Appointed, not elected, government bodies establishing authority
- Income-linked school attendance

There is no doubt that I have applied a lens to this list of characteristics; it is very difficult not to. Indigenous affairs are an extremely sensitive issue in Australia, and most discourses are forced into a generic anti-Government left-liberal position or a pro-intervention neoliberal 'we know best' position. I think that the first step in addressing these questions is to consider how our own experiences and those of our families and friends have shaped perceptions on indigenous issues and made it difficult to subscribe to an alternative viewpoint. The introductory exercise in the tutorial was designed to invite people to share experiences, biases, concerns and fears about indigenous issues that may have shaped their perceptions and opinions.

Francesca Merlan's presentation also explored the importance of personal experience in life history in her examination of two authors who have written about the decline and collapse of indigenous communities over the past several decades. In her presentation and writings, Merlan commences by explaining the background of the authors she is writing about, for example identifying Noel Pearson's experience of growing up on an ex-Lutheran mission in Queensland. Merlan then frames her discussion of Pearson's analysis of social decline by asking Pearson to consider that the processes he grew up with on a Lutheran mission were actually socially transformative. Merlan draws on her own experiences of socio-cultural differences that 'open' indigenous communities to the distortions of substance abuse, violence and dysfunction, and that would make it difficult for Pearson to achieve his bicultural reformist agenda.

It seems that the question is not whether due process has collapsed, or whether indigenous communities are declining or collapsing; it is the nature of these collapses that has attracted the most attention and requires nuanced understanding. Noel Pearson has levelled stiff criticisms at left-liberal discourses; John Altman has done the same to the right. Alternative approaches must be imaginable. What is missing are not individual indigenous perspectives but a choir of distinctive, harmonious voices to overcome the quagmire of current policy approaches and facilitate meaningful and shared engagement and responsibility for improving indigenous social conditions.

Understanding vastness – insights from the Pacific

Has the rhetoric of community failure been the most devastating outcome of the Northern Territory intervention? The 'indigenous issue' in Australia seems intractable. We are overwhelmed by stories in the media of sexual abuse, domestic violence, drug and alcohol abuse, crumbling infrastructure and massive resource shortages. In launching the 'Closing the Gap' program the Government implicitly adopts the position that it holds responsibility for 'fixing' these problems. Indigenous communities are painted as remote, helpless and suffering such severe social dysfunction that they cannot assume responsibility for change.

Such dire representations conjure Epeli Hau'ofa's analysis of his own communities. He describes,

"MIRAB societies – pitiful microstates condemned forever to depend on migration, remittances, aid, and bureaucracy, and not on any real economic productivity. Even the better resource-endowed Melanesian countries were mired in dependency, indebtedness and seemingly endless social fragmentation and political instability. What hope was there for us?"

It is not difficult to see the parallels with indigenous Australia.

Successive governments have defined indigenous communities by special provisions, laws and discourses which 'traps' indigenous communities and denies the reality of an intercultural existence - 29% of indigenous Australians live in NSW, many in urban centres.

My **question** is then, how can we overcome bleakness? I think that Hau'ofa's narrative of a 'sea of islands' is readily adaptable to indigenous Australians. The movement of people across vast areas is a common theme, with Merlan describing the transient population of outstations, and that the role of housing is to facilitate the movement of people, especially relatives, between towns and outstations. Similarly, issues of remoteness, smallness and isolation are evident; overall Australians do not value the vast desert lands that make up most of our country, and instead focus our social and economic activities on the temperate and coastal fringes. A possible response to overcome this bleak remoteness is Sean Kerrins' discussion of the increasing recognition of the value of biodiversity on indigenous lands, and how this resource can support the community across many sectors. 20% of Australia's total landmass is now under indigenous ownership, with indigenous land management programs restoring ancient connections and livelihoods and offering real alternatives to the mainstream economy.

Enormous challenges remain. Indigenous land ownership is a positive step but land has been returned without compensation for introduction of feral animals, invasive weed species, changed fire management and wildlife use. However I think that reshaping the consensus and understanding of the importance and connectedness of indigenous land is a positive step towards building engaged and valued diverse Australian communities.

Policy problems in environment and sustainability

Sustainability is a higher order social goal; a "complex, contestable challenge spanning generations"

There are three elements of sustainability

1) economic and human development that protects opportunities for future generations to use natural resources, live in a healthy environment, and continue to develop
2) Recognition of goals including importance of biodiversity and adopting an integrated approach to development and environmental conservation
3) Principles for policy and decision making, including consideration of short and long term implications, and integrating environmental, social and economic concerns – a triple bottom line.

I have noticed the discourse of 'beyond' to be salient, for example here Dovers refers to 'Beyond end-of-pipe' in the previous panel Altman references his paper titled 'Beyond Closing the Gap'.
What is common in these calls to go 'beyond', and will this be concretised in the next wave of social and philosophical discourse, as in the transition from modernist to postmodernist thinking in the early 1960s?

The language of effective policy formulation on climate change must be able to consider the following points:

- Mitigation – a diabolical problem but amenable to system policy interventions such as ETS
- Adaptation – a very messy problem in that adaptations required will vary enormously, demanding diverse policy interventions
- Vulnerability – challenges relate to a lack of precise information; need to act anyway
- Resilience – ultimately a question of people management, not environmental management, as highlighted in the tutorial
- Uncertainty – a major research and policy challenge. See below.

Despite good political awareness (despite inaction) of the complexity of climate change, policy responses aimed at mitigation focus on system-wide approaches that do not interact with all spheres of the problem. We addressed the establishment of Emissions Trading Schemes (ETS) in the tutorial. Emission trading schemes imagine carbon debt as a global jigsaw, but can we just pick up and swap the pieces? Is it a level playing field? How does this make sense in the context of carbon cycles in ecosystems? Imagine what carbon debt would look like in a financial crisis – would emission trading schemes be stable? Which markets would they be most sensitive to? What linkages would emerge in a crisis that affected the capacity of a country to sell its debts? How would this affect industry? Effectively, I think an Emissions Trading Scheme is a blunt policy instrument and would fall short of carbon reduction targets because of these considerations.

Uncertainty in Research and Policy

Uncertainty is embedded in every level of research and policy for sustainability, and its impact is compounded by fragmentation of responsibilities across portfolios and agencies.

- Nature of human and natural systems – biota, climate variability, stream flow patterns, nutrient and energy fluxes
- Nature and importance of interactions
- Future changes in human and natural systems
- Changing political agendas and social values
- Efficiency of approaches to informing decisions in the absence of sufficient technology
- Impact of past, current and proposed policy

Uncertainty can also be conceived as 'unknowns'. In the opening week we were asked consider how we come to learn new things. Answering this question as a society will have important implications for our actions and response to climate change.

Steve Dovers provides the following table in his paper titled *Uncertainty, Complexity and Environment*

Table 1: Types of Unknowns

Risk	Uncertainty	Ignorance
Believable probability distributions can be assigned to possible outcomes	Direction of change is believed to be known but precision in prediction is not possible; believable probability distributions cannot be assigned	Not even the broad directions of change are known, and thresholds and surprise are understood as likely

This description of ignorance flounders in that it does not recognise the capacity to plan for surprise and to investigate the implications of multiple alternative thresholds, surprises and outcomes. It leaves the reader slightly overwhelmed by the apparent incapacity to gain a glimpse into the 'broad direction of change'. Steve Cork's research on scenario planning, and the classic example of Royal Dutch Shell's capacity to *plan for* and *rapidly respond* to surprise undermines the implied hopelessness of ignorance in Dovers' representation.

I think that Dovers' most relevant insight on uncertainty is that "uncertainty will change and probably increase following policy or technological commitments based on imperfect knowledge".

Mike Smithson's typology of ignorance, quoted by Dovers et al, draws on non-scientific elements such as taboo, distortion and irrelevance, which have relevance to debates on sustainability. I examine this typology in the section on Integration Sciences.

Questions

Knowledge and uncertainty are close friends. Dovers' panel also touched briefly on ideas of participatory knowledge. What types of knowledge come about by essentially individual introspection, compared to participatory, collective knowledge, and how can we best utilise different types of knowledge

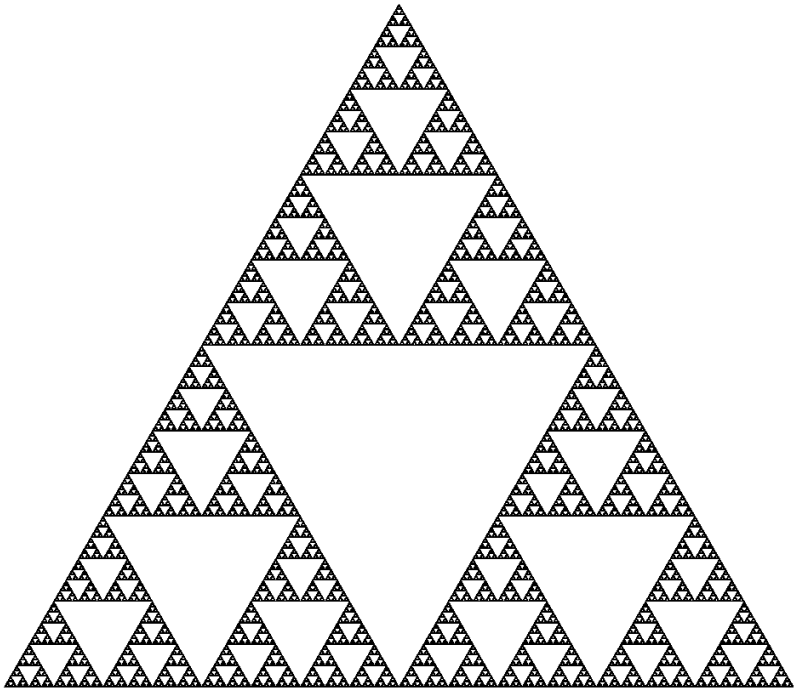
Can knowledge exist if it is not possessed? To understand knowledge, we must understand the capacity of the knower. Who is the 'knower' in participatory, collective knowledge? Where and when does this entity of the 'knower' exist?

Dynamics and Geometry of Complexity

Visualising Complexity

This panel offers the first approaches to building a structural and visual model of complexity.

Figure 3: Sierpinski Triangle



The Sierpinski triangle reveals higher order geometries of chaotic systems. This triangle is defined by a simple rule: take three points, and from one point, move to a position half-way to another point. Repeat.

Key insights into the structural nature of complex systems are summarised below

- Simple systems may exhibit complex behaviour. Simple systems can be very sensitive to initial conditions. Complex behaviour may generate very simple fractal patterns. Homeomorphic systems may look very different.

- Sensitive dependence – there are simple deterministic systems whose behaviour cannot be predicted. In representing such systems there has been a shift from numerical to pictorial representation, which reveals stunning higher order structures and regularities as seen in the Sierpinski triangle.

- Interactive control is essential to achieve goals. What are the implications for the standard policy framework of implementation and maintenance? Is maintenance a steady-state or dynamic process?

- Little things can look like big things. Fractal equations can store photographs. Steve Dovers used the example of gravel run-off in Queanbeyan to illustrate the complexity of environmental issues. What can we understand about gravel run-off in Queanbeyan that helps us understand how ocean currents respond to melting ice caps?

- A complex object may be a familiar one in disguise. We are subjective beings; we cannot know each others' inner subjective worlds, but we can say that they are homeomorphic. Our basic rules are the same and are structured by the basic constraints of our brains.

- 'Collapses' of orderly systems into chaotic behaviour is multifactorial but one or two factors push a system to the threshold of collapse.

Can chaos theory predict societal collapse?

Chaos theory says we can't. There is an interesting convergence of disciplines here; in the panel on Collapse of the Roman Empire historians denied that you can take lessons from history as each set of historical conditions are unique. Another way of saying this is that minor changes in initial conditions lead to vastly different outcomes. However, we can still generate and observe broad patterns. We see patterns in history much like we see patterns in fractal geometry, which could suggest that historical patterns are emergent properties. Taking further lessons from fractal geometry, we can't predict the outcome of a single event but we can predict the overall structure that a large number of events will produce. This perspective could be used to legitimise attempts by authors such as Jared Diamond to identify broad trends in history, and perhaps his five-point framework for societal collapse is like the vertices of a Sierpinski triangle.

Questions

If we can't predict specific outcomes but we do have structures and geometries that allow us to imagine and negotiate complexity, where does this leave us?

How does this affect policy? How do half-percentage point rate increases set by the Reserve Bank of Australia this month affect the future state of the Australian economy? How do policy makers manage this?

A debate on mathematical modelling

The tutorial for this panel was run as an analysis of mathematical modelling of complex systems.

The first issue with this approach is that the panel was not about mathematical modelling; the panel was about a branch of mathematics that has the property of both producing and absorbing complexity. This is very different to 'mathematical modelling', which can draw on the entire field of mathematics for problem-solving strategies. The difference between modelling based on Newtonian calculus, and modelling based on

chaos theory, is immense. Mathematics is as much a methodological tool for understanding complexity as is anthropology or any other discourse. The challenge is to understand the difference between different methodological approaches.

To illustrate, consider standard analyses of economic or population growth, which use measures such as maximum yield in formulating the mathematics of growth. Employing indicators such as maximum yield assumes that economies or populations grow at an equilibrium rate. In contrast, modelling economies and populations as chaotic systems leads to a very different understanding of the nature of the system; systems with more subtlety, more responsive to interactive control, more sensitive to small changes in conditions, and deeply unpredictable; the best we can do is manage the system as it emerges and further research the triggers that indicate ripples of chaotic change.

The discussions in the tutorial were invariably negative towards the role of mathematical modelling in understanding the world, with the main criticisms levelled at the assumptions inherent in such models. Whilst this is true for many modelled systems, as evident in discussions of the causes of the global financial crisis, this approach seems to be unaware of the deeper but unjustified assumption that human systems are *irreducibly complex*, rather than simply complex but with embedded or emergent structures. The intelligent design argument for observed biological diversity assumes irreducible complexity in the design of organs such as the eye. The power of Darwinian evolution lies in its capacity to explain stunning complexity with a simple nonlinear progression – a simple rule.

Non-specific criticisms of mathematical modelling belie lack of recognition of the ability of mathematics to describe processes that extend beyond the reference frames of human lifetimes and contemporary experience. Mathematical insights into the nature of human systems can offer structural frameworks that improve our capacity to manage complexity.

Collapse in systems and networks

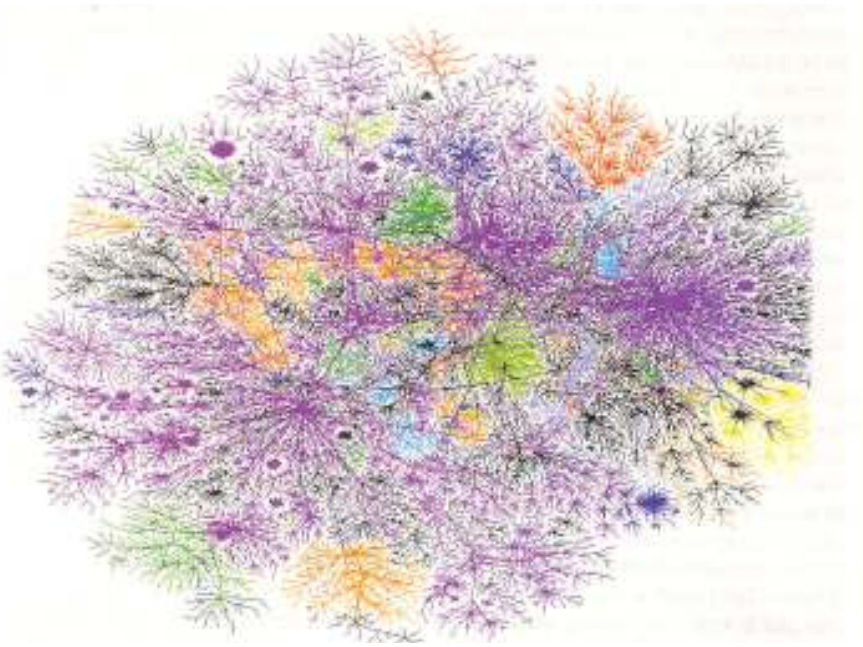
Complex geometries

With last week's panel on chaos theory and fractal geometry, I am starting to build a geometrical methodology for managing complexity.

David Hill's presentation on network theory seems to be arriving at the same kinds of structural models for complexity that are achieved by chaos theory and fractal geometry. Network theory provides the following insights into complexity, which agree and expand on the characteristics elucidated by chaos theory:

- Complex networks have emergent properties – e.g. consciousness as an emergent identity of neural networks in the brain
- Systems are defined by organisational and functional hierarchies; a basic example of biological hierarchy is outlined for the structure of the heart, which controls blood flow:
  molecule – protein – cardiac cell – cardiac muscle – heart – pulmonary system – human
- Synchronisation can emerge, e.g. synchronisation of cardiac pace-maker cells produces a 'heart beat'
- Network collapse transmit along linkages – e.g. metastatic cancers spread through lymph nodes
- Networks are homeomorphic (see figure 4 below)

Figure 4: Complex Networks are Homeomorphic



I have taken Figure 4 from David Hill's presentation and removed the captions to illustrate network homeomorphism. What does figure look like to people in different disciplines?

I see a biological tree of life, a human nervous system, the transmission of a virus, the spread of social 'memes', or the growth pattern of moss.

What do you see?

Figure 4 is actually a graph of internet connections across the globe, with colours representing different countries. The US is purple.

Engineering meta-disciplines

There is a major difference between mathematics and engineering. Pure mathematics operates from first principles; nothing can be assumed. Many of the greatest successes in mathematics, such as the field equations for Einstein's general relativity, were discovered by challenging the fundamentals of the discipline.

However, pure mathematics does not solve everyday problems. It can afford to take 200 years to find a solution. Disciplines that apply mathematics, such as economics and engineering, do not have this luxury and therefore make strategic assumptions about the world.

Engineering deals with many of the same problems as mathematics, but the assumptions of engineering mark a radical distinction:

- A problem can be isolated and solving it is good
- A problem is first decomposed to identify the constituent parts and required specialisations
- A problem can be solved by developing and maintaining a specific system, for which the 'system requirements' already exist

In adhering to these assumptions, traditional engineering systems are limited to:

- Reacting to a known problem, not predicting future problems
- Isolating and fragmenting concerns that span specialisations
- Developing systems with poor understanding of their potential impacts or adaptive capacity

The discipline of engineering is responding to wider social calls for environmental and social accountability, social justice and responsiveness to climate change. A meta-discipline of sustainability science and engineering is emerging, which integrates industrial, social and environmental processes in a global context. The skills required in this meta-discipline are very different from traditional engineering capabilities, and include an ability to combine information and insights across multiple disciplines and perspectives to achieve higher-order economic, social and environmental goals. Engineering can make considerable contributions to climate change debates and solutions, not just by engineering 'green' technology but by investigating the global energy carrying capacity and raising public awareness of technological innovation.

This integrative approach was the theme of this week's tutorial, in which decisions about the installation of energy systems required discussion and consensus from diverse groups. The prime considerations for this group eventuated as environmental impact, regional security issues, a preference for renewable technologies, and a desire to be seen as innovative or an international leader. Traditional engineering concerns, such as cost of design and installation, on-going maintenance costs, functional limitations and overall cost-effectiveness were given little consideration.

Question: Biological systems are readily described by complex network models; however network theory is only applied to the nervous system in standard thinking. The immune system seems like an ideal candidate for a network approach, and could lead to the prediction of novel therapies. What new predictions could arise using a network theory for the immune system that the standard approaches may miss?

Complex emergencies, refugees, disasters, health and development

Responding to thresholds

Previous discussions of 'thresholds' have elucidated the idea that complex systems have multiple theoretical thresholds, but that exceeding just one or two thresholds is sufficient to trigger transition to chaos or collapse. In this panel I am interested in our ability to respond to thresholds that we know exist, and for which we have concrete evidence.

Case studies of H1N1 'swine flu' impact

- Indigenous population in US: eight times the average number of hospitalisations – probably related to housing status
- Prison flu study – ACT's first human rights compliant prison – swine flu did not spread, which was related to living conditions not control measures.
- Local containment is extremely difficult; the USA was in 'contain' phase for just three days before H1N1 established in the population
- Contain phases overwhelmed health systems in Australia and USA, especially the laboratory system. Flu clinics in emergency departments remained viable for only several days.

The US has one of the most well-resourced health systems in the world, coupled with good infrastructure, yet was unable to contain the H1N1 outbreak. This suggests that the H1N1 virus has a very low threshold to establish epidemic infection. Infectious agents are products of evolution; most have a very high capacity to infect and spread amongst human populations. Taking these two points into account, we are unlikely to be able to influence the threshold of containment.

Therefore, a sufficiently infectious disease is likely to cause an epidemic. In this case, preserving the health of the population becomes the most important issue.

Projected impacts of H5N2 'bird flu'

- In developed nations, measures likely to have the most impact on population health during an epidemic include hygiene, quarantine, vaccination and medical care
- In developing nations, due to severe resource shortages and sanitation difficulties, antiviral medications are likely to have the greatest impact on population health during an epidemic
- Greater than 95% of deaths are likely to be in developing countries, which have less than 1% of the global antiviral stock

We should at this point confront Lucas and Bolton's statement; *that universities serve to make students think: to resolve problems by argument supported by evidence.* Here is perhaps the first instance so far in this course of having clear evidence that supports a clear argument – developing countries need a majority share of the global antiviral stock – but this argument has been utterly ineffective in resolving the problem.

The effect of simple rules

TRIPS (Trade-Related aspects of International Property Rights) describes a package of agreements that regulate and establish patent law. Patents provide a legal monopoly on a discovered product or process for up to 25 years. TRIPS hands the power of medical innovation to pharmaceutical companies with large patent portfolios, who achieve a global monopoly on vital pharmaceutical products such as Tamiflu and Kaletra (second line antiretroviral treatment for AIDS).

In discussions of chaos theory and networks we saw that a simple rule could produce stunning complexity that modelled real-world processes, stored photographs and offered visual insights into the nature of complex systems. Here is another simple rule:

'Patents shall be available for any invention (product or process) in all fields of innovation'.

This rule grants a legal monopoly to pharmaceutical companies who develop drugs for some of the deadliest diseases that afflict humanity. In this case we have a simple rule that has massive global implications. The sheer simplicity of this rule makes it inflexible and uncompromising, and changes to this rule, however warranted, require major international negotiations.

Within this patent-depended system of global drug distribution, the preferences and needs of developing nations are not detected. For example between 1975 and 1992 only 1.3% of patents were relevant to tropical disease. Under the influence of global monopolies more powerful than many governments, the role of democracy is 'hopelessly compromised' according to Peter Drahos.

An obvious question is why did countries like India and Brazil sign on to TRIPS, given their manufacturing capacity to service low-income countries with important pharmaceutical products? To understand how this rule was established we need to consider the power of fear over calm reasoning. In the 1970s the US pharmaceutical giants framed pharmaceutical industries in India and Brazil as pirates who were 'stealing from the mind' and stealing intellectual wealth from US scientists. These power plays explain why we have created global risk zones for pandemic disease by not supplying affordable pharmaceutical products to developing countries. Given the evidence that disease containment is unlikely, this is the worst possible scenario for the West. I think this indicates a serious failure of democracy and international trade; it is surreal that the world's biggest economy and democracy is subservient to the interests of the pharmaceutical industry.

Strategies to mitigate the effect of this simple rule must be clear and directed; offering hazy guidelines and detailed exceptions to a simple rule is only likely to stall change.

- Transparency is vital in managing complexity. The pharmaceutical industry lacks a genuinely independent organisation like the IPCCC.
- Leadership really matters, including remarkable individual leaders. Could Obama-like personalities take on the US pharmaceutical industry? What lessons can we learn from government interactions with the US tobacco industry?

- Alternatives include the establishment of a multi-billion dollar prize fund to replace the patent system in its purported role of supporting research and development. Prize funds harness individual interests by maximising profits but reduce the impact on international health.

Question: Are there publicly-funded alternatives to the pharmaceutical industry? A publicly-funded consortium unravelled the human genome before a competing private group. Could publicly-funded researchers discover and develop important pharmaceutical products, competing against pharmaceutical companies? Can the UN or another international body submit a patent application?

Uncertainty in the law

Law can be described as a linear process:

- Determination of rules →
- Determination of facts →
- Application of rules to facts

However, facts-based prediction lacks complex feedback based on imagination and experience. This topic looks at the capacity of domestic and international law to perceive and respond to complex issues.

If this linear process describes what law 'is', then we also need to consider its goal. In their paper on *'Making International Refugee Law Relevant Again',* Hathaway and Neve argue that international law is a mechanism to 'manage complexity, contain conflict, promote decency, or avoid catastrophe'. It is difficult to see how the linear description could encompass this approach.

Scale matters

International Law

Domestic law generally adopts a positivist approach to defining the law. Law is discovered by a rule of recognition, for example
Legislative bills in the Australian legal context become law when passed by both Houses of Parliament and signed by governor general. Law comes into existence with the recognition of judicial rulings.

The processes of domestic law, which are structurally similar across many nations, have not been scaled up to create international law. International law does not have a rule of recognition, nor legislative bodies, no compulsory jurisdiction, no enforcement. International law is non-representative and its direction can be influenced by academic writings. In effect, international 'law' is actually 'custom'; for example the principle of *non-refoulement* of refugees is enforceable only by international embarrassment.

These inconsistent approaches create major impediments to change in international law. However, alternative legal discourses with relevance to domestic law may offer insights. Consider the following approaches that offer a different 'rule of recognition' and introduce more scope for nuance and complexity into domestic law. These approaches may 'scale-up' better to international law than the current framework.

- Separability thesis – There is a difference between the law and moral behaviour
- Radbruch's thesis – A law can be so unjust that it is no longer a law
- Law as a prediction of the judgement one will face in court
- Civil disobedience, conscientious objection and conscientious non-compliance represent the calibration of legal norms against ethical and human rights norms.

Nanotechnology

Nanotechnology provides a novel challenge to the legal system. Nanotechnology products offer innovative and cost-effective engineering solutions to a diverse group of problems, from water microfiltration to cosmetic sunscreens. Australian law treats nano-products as scaled down versions of familiar macro products because they have the same constituents. For example, building materials made with carbon nanotubes are legally considered to be the same as materials made with carbonised steel.

Scientifically, nano-products are very different to their macro 'equivalents'; for example gold is used for jewellery because it is essentially inert at the macro level (and thus will not erode) but at the nano level, gold is highly reactive and used as a catalyst. Nano-products also have different biological properties; carbon nanotubes possibly pose the same risk as asbestos.

In the absence of firm evidence of detrimental health effects, should the precautionary principle be applied by regulating or banning products that promise major engineering advances?

It is difficult to answer this question in isolation. One approach drawn from the panel on pandemic disease is to consider the vulnerability and adaptability of health systems to addressing health problems if they arise. We can consider the health resources available in countries such as India and China, where the large manufacturing sectors mean that many people could be exposed to nano-products in poorly ventilated factory conditions. Is nanotechnology a domestic or international issue, or both? A scenario planning exercise could offer the most useful framework for preparing for multiple eventualities, ranging from fulfilment of Millennium Development Goals on access to clean water, through to protracted legal claims for compensation for workers suffering from an asbestos-like illness.

Limitations of the law in dealing with complex issues

International refugee law

'Interest convergence' in international refugee movements has ended – there is no longer a need for ideological or labour driven welcoming of refugees, as was the case when the Charter on Refugees was drawn up in the immediate post-war era. Furthermore, developing nations host by far the greatest number of refugees. It is difficult to demand developing nations to commit to international legal treaties that require them to share scarce resources with a burgeoning refugee population, especially higher level services such as rationing systems, education and public relief.

The Hathaway/Neve approach advocates creating new convergent interest groups by giving something to the 'north' such as temporary protection with processing in partnered developing countries. In the Australian context, Howard's Pacific Solution and Rudd's recent Indonesia solution are examples of attempts at this framework. In the tutorial we discussed the issue of intercepting refugees before they reach physical land. What role does the ocean play in determining asylum status? Why can the Oceanic Viking transfer asylum seekers to Indonesia just because they were intercepted in water, rather than at Christmas Island or the Australian mainland? This discussion is reminiscent of the

creation of arbitrary national boundaries in the Pacific. Imaginary lines in the ocean, designated as 'international waters', serve the purposes of the wealthier nations who draw these lines by extending their effective exclusion zones. As I write this, Sri-Lankan asylum seekers have been onboard the Oceanic Viking in Indonesian waters for three weeks, with no political or legal solution readily available. This indicates a major vulnerability of the international legal system.

Right to life determinations

In the tutorial we formulated a statement for the right to life, to be included in a Bill of Rights as an amendment to the Constitution of Australia.

"All people have the right to life, with this right embodying a reasonable expectation of longevity with respect to the average Australian life expectancy; thus the nation must promote this right for all people within its realm of influence. Individuals maintain control over their own life; thus it is a right, not a requirement"

In formulating this definition we attempted to be as inclusive as possible, providing flexibility for self-determined termination of life and emphasising that there is a minimum standard implicit in the right to life, which at its minimum is a right to anticipate an average longevity, with the right to reasonable health implicitly embedded.

The questions here are 'what is a life'; whether life is simply the physical state of existing or whether a right to life implies the right to expect a healthy and long life, the right to engage with others' lives (social inclusion) or perhaps the right to a certain standard of life, which encompasses health, education, livelihood or other aspects. The further we progressed with this exercise the more I questioned what value there is in ascertaining a right to life for legal purposes, given that any final definition would likely be sufficiently vague that it could be used to justify any application. I was also saddened to realise that my group's formulation of the right to life could be interpreted to justify taking indigenous children from their families to improve their life expectancy.

The law seems to be a very limited instrument in comparison with the role of education, discussion and social memes (such as tolerance) in determining the right to life.

Question: A problem with international refugee law is that it specifies categories of experience. In comparison, patent law has pervasive effects because it does not offer such specifications. Would international refugee law benefit from the development of a 'simple rule' for making a claim to asylum? What a simple rule be more able to manage the complexity and diversity of refugee experiences?

Integration Sciences

Collaborating across disciplines to enhance research

"Significant policy attention has been paid to funding…interdisciplinary and transdisciplinary collaborations…such as Australian Cooperative Research Centres."

- Gabrielle Bammer – *Enhancing Research Collaborations*

An example of such a collaboration that focuses on national priorities is the National Adaptation Research Network for Human Health, which brings together researchers interested in changes to the range and persistence of vector and food borne diseases due to climate change.

Integrated sciences have in large part emerged from the desire to work on broad, expensive, far-reaching projects with the capacity to affect millions or billions of people. Examples include the Human Genome Project, the World Commission on Dams, the World Health Organisation Commission on the Social Determinants of Health, and the Manhattan project to develop the atomic bomb. Clearly, integrative sciences do not always emerge for the greater *good* of humanity.

How do these broad goals of integration sciences sit compared to disciplinary sciences, with their increasingly esoteric but precise specialisations? Bammer identifies the need for a common methodology;

"There is no agreed systematic approach to the synthesis of understandings developed in different disciplinary and practice contexts"

I think the lack of a prescribed approach demands flexibility and innovation amongst leaders and participants. Imposing ineffective frameworks could place added burdens on sharing difficult ideas between people of diverse backgrounds.

Bammer identifies several key methodological challenges, including the need to effectively harness difference, understanding contexts, considering for what and for whom the integration is occurring, setting defensible boundaries, problem framing and establishing new standards for success.

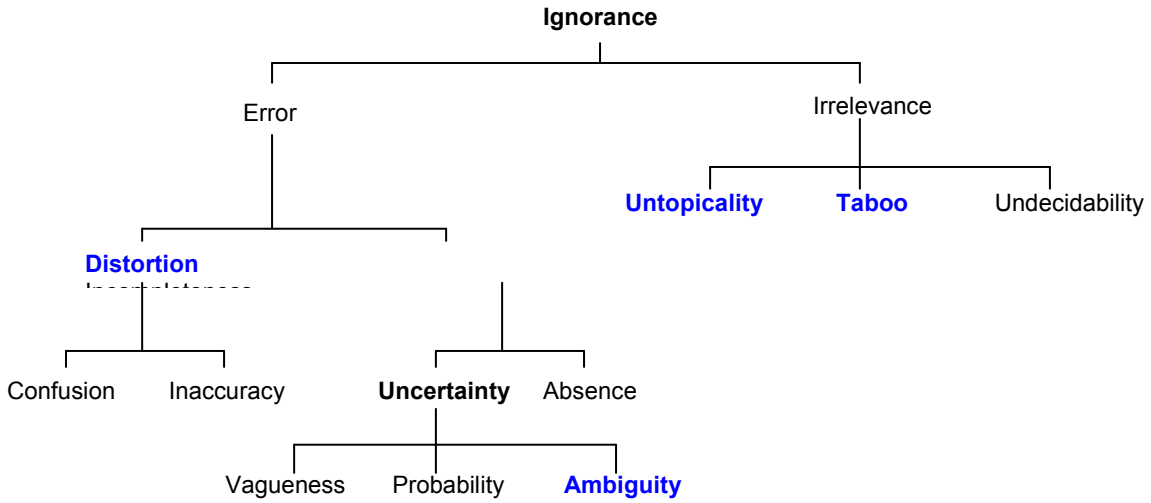
I agree with these points, but think that the success of integration sciences is essentially about two issues: effective leadership and effective communication. An excellent example of effective leadership is Itay Talgam's TED talk, "Lead Like the Great Conductors"

http://www.ted.com/talks/itay_talgam_lead_like_the_great_conductors.html

The nature of uncertainty

Ignorance and uncertainty are valuable because they are the source of intellectual enquiry.

Mike Smithson's typology of ignorance goes a long way to addressing the shortcoming of the model presented by Dovers in the panel on environmental policy, because the typology suggests that there are different approaches for different types of ignorance.



- Untopicality was identified as an issue in Complex Emergencies in that privately-owned pharmaceutical companies do not invest in research into tropical disease, because the market of developing countries cannot offer high profit returns, and there is insufficient Western public concern to mobilise a call to action.
- Taboo is pervasive in many cultures. The extreme sensitivities surrounding discussion of indigenous affairs in Australia is akin to taboo. In the tutorial I co-facilitated, we aimed to address this unknown by asking our peers to share a story or experience that may make it difficult to discuss indigenous affairs openly and rigorously.
- Ambiguity is particularly salient in the climate change debate. We are required to make policy in a climate of change. Ambiguity can be addressed by application of the precautionary principle, as for nanotechnology regulation (see panel on Law)
- Distortion has been a pervasive theme in this course, including the distortion of authority voices. For example, Noel Pearson was often taken by the Howard government to be a representative for, and sometimes representative of, indigenous Australians, and thus his (conditional) support for the Northern Territory intervention held considerable political authority.

Question: How could a prescribed methodology of integration sciences foster the development of a shared discourse, which explains the *perception* of interest amongst the participants, rather than simply combining multiple interest groups?

Seminar: Review of 'Tackling Wicked Problems'

This section is included to meet the requirement of summarising 'how one seminar outside this course at ANU given this semester relates to the course'

Human Ecology Forum, 02/10/2009, Discussions were lead by the authors of the book, *Tackling Wicked Problems*, which will be published early in 2011. The forum was chaired by Valerie Brown.

Disciplinary knowledge

Across all cultures, the sheer volume of required knowledge necessitates the specialisation of knowledge – in the crudest sense separation into women's knowledge, men's knowledge, hunter's knowledge, gatherer's knowledge.

The precise, ubiquitous division of knowledge into tight compartments is a very Western system. The problem arises of how to translate Western knowledge across other knowledge systems without being inadvertently 'neocolonialist' or normative about knowledge structures.

The pertinent question is how is this specialised knowledge legitimised?

In the global academy there appear to be nodes of transdisciplinarity but is there a community, a network of groups and individuals?

Gaps in complexity

Complexity eludes complete representation because of innate gaps in our systems of knowledge, namely:

- Perceptual (observation)
- Conceptual (faculties of reason)
- Cultural (a series of 'lenses')
- Temporal (the world is dynamic and evolving)

If these gaps exist at the level of *knowledge creation,* if they are entirely embedded in the system, then perhaps these 'gaps' should not be explicitly perceived at all (after their initial recognition); rather these 'gaps' are essential threads in the fabric of knowledge.

Regardless, the explication of 'gaps' in knowledge leads to the just recognition of the 'partiality, plurality and provisionality of knowing'. I think this framework goes some way to legitimising knowledge outside of the disciplinary system, including the processes of 'participatory knowledge' that Steve Dovers is exploring in relation to participatory governance.

Uncertainty is an important knowledge gap. Corresponding to the 'partiality, plurality and provisionality of knowing' is recognising 'epistemological, ontological and ethical uncertainty'.

Communities of practice fostering effecting collaborations

In attempting to understand how knowledge systems are legitimised, we need to distinguish between research as enquiry and research as *processes* of enquiry; processes of enquiry are open to critical scrutiny.

Most processes of enquiry are discourse driven. An alternative process is described by a 'discourse coalition', which refers to a group of actors that, in the context of an identifiable set of practices, share the usage of a particular set of story lines over a particular period of time. Discourse coalitions offer a useful framework for understanding the role of storytelling and myth in shaping knowledge, as discussed throughout this portfolio.

The starting point of a discourse coalition is an 'empirically observable shared discourse'.

In acknowledging processes of enquiry and the concept of a shared discourse, we come to a new framework for rational thinking. The authors introduced the concept of 'critical rationality'; "the understanding that knowledge about the physical (instrumental rationality) and social (practical rationality) worlds can only be legitimised through intersubjective, critical reflection that enables the enquirer to become aware of the ways in which their purposes, agendas, values and so on have influenced the enquiry process, outcomes and consequences."

This culminates in the idea of a 'community of practice' rather than disciplines, which demands that we engage in dialogue and present our multiple identities at the decision-making table.

However, communities of practice that emerge to tackle wicked problems are not likely to work (though this approximates the structure of international summits such as Copenhagen COP 2009). Instead, you have to bring people together to develop shared knowledge and values, and processes of seeking and using knowledge.

Decision making

Decisions are made with respect to (at least) five different realities, which roughly manifest as *belief systems*, *identities, specialisations* (disciplinary knowledge), *membership* (of an organisation, nation-state, tribe) and *holistic* realities. In the Western model, disciplinary knowledge is practically (if not philosophically) treated as the *whole* of knowledge; transdisciplinary knowledge realigns the spectrum to explore other holistic realities.

At its point of inception, transdisciplinary knowledge systems place the highest value on the ethos of building sustainable and just societies, which presents a radical departure from traditional disciplinary knowledge, in which ethics is frequently sidelined as a distraction and burden.

Conclusions

Throughout this portfolio I have explored the nature of complex systems, including characteristics that cause collapse – which can be variously described as a failure, decline, deregulation, or an inherent property of complex systems.

We should not aim to 'unravel' complexity; failures in law, development, economics, science and politics derive from a failure to appreciate complexity.

Steve Cork argues that 'unravelling complexity' is about better decision-making, not better prediction or understanding. Much of this course has dealt with policy challenges posed by complex problems. In attempting to 'solve problems' we always reduce complexity; however we need to understand *how* and *how much*.

I would argue that fragmentation of knowledge, failure of imagination and imposition of ineffective international systems increase our vulnerability to collapse. It is very difficult to change these underlying structures, and we cannot know precisely how alternative systems would cope with managing complexity.

In contrast, we can improve our resilience and adaptability to change, through relatively concrete measures.

Acknowledging uncertainty is the first step in developing flexible, pluralist and innovative approaches to negotiating complexity. Uncertainty is not always a problem; it is an inherent component of many natural and built systems, and the source of enquiry.

Instruments that manage rather than simplify complexity include scenario planning, storytelling, scoping the problem and setting clear boundaries, network approaches, applied chaos theory and engaging multiple interest groups. I would further recommend fostering 'communities of practice' and open-access publishing to encourage the sharing of ideas, and to treat knowledge as a gift, rather than a right or a monopoly.

The next section is a reflective essay to address the focus question of my portfolio, 'how do we come to know the unknown?' and further conclude on the material in the course.

Essay: Building a new philosophy of knowledge through the transdisciplinary imagination

'Never again will a single story be told as though it were the only one'

- John Berger

This reflective essay has been written in response to the question, 'how we do come to know the unknown', in the context of transdisciplinary knowledge systems and their capacity to deal with complexity. This is a personal response and the content reflects my experiences and interests. My interpretations of prodigious works of philosophy do not represented a considered thesis, but are ideas that I have found to be thought provoking and would like to share with the reader.

Transdisciplinary knowledge

'*A new philosophy of knowledge that aims to marry critical enquiry with imagination'*

- from *Tackling Wicked Problems* (forthcoming)

Building a framework for transdisciplinary knowledge is a very different endeavour to promoting and describing transdisciplinary collaborations.

Transdisciplinary collaborations bring together multiple interest groups to share ideas and harness their differences to develop innovative approaches to complex issues. There is great value in elucidating methodologies and benchmarks to promote the success of such collaborations. However there remains a shared but unremarked discourse that underpins collaborative endeavours, which relates to how knowledge is legitimised, what forms it takes and how it is communicated. Transdisciplinary endeavours invariably take the form of a 'commission', 'taskforce', 'research centre' or 'network', with the success of their outputs measured in academic or professional journals, government publications or interagency reports. The goal is institutional change.

In contrast, a framework of transdisciplinary knowledge aims to examine the institution of knowledge, to understand how knowledge is legitimised, and to understand what constitutes knowledge. The processes born of such a framework could look very different to current collaborations.

Knowledge as experience

To answer the question, 'how do we come to know the unknown', we first need to ask, 'what is knowledge'. Implicit is the need to understand how and when knowledge is possible, and the consequences this has for our approaches to complexity.

Philosophical approaches to knowledge can be broadly divided into empirical positions and rational positions. An empiricist argues that all knowledge is grounded in sense experience, whereas a rationalist posits that there are ways of gaining knowledge independently of sense experience.

David Hume was an eighteenth-century British empiricist whose particularly sceptical position equates all knowledge to human experience. There is no outside observer, nor any independent faculty of reason, to determine what knowledge is. If we have no non-experiential way to know about the world, then inference about future events is irrational.

I first encountered Hume in a course on the philosophy of science. Hume's empiricism is particularly relevant to knowledge claims made in science. Normatively, science is methodologically empirical in emphasising the importance of scientific evidence, especially evidence obtained through experimentation.

What this means in terms of discovering unknowns is that we have no independent faculty by which to 'discover' new ideas; all new ideas or 'unknowns' are ultimately realised through sensory experience, which is composed of the dynamic relations between all of the elements of our consciousness. Imagination is a manifestation of these interactions and is therefore is integral to Hume's philosophy.

In equating knowledge to human experience, Hume rejects that there is such a thing as objective reasoning, or rationality, which is instead a moment of 'calm passion'.[1]

The major criticism of Hume's approach is that it does not offer any further insights into the origin of perception, or 'how we come to know the unknown'.

Attempts to address this gap in perception include Immanuel Kant's claim that *a priori* knowledge of the world exists; that knowledge can be gained independently of experience. Kant also argues that experience without reason is purely subjective. Kant's position is that knowledge does not derive *from* experience but that we have innate concepts that *enable* experience. In experiencing the discovery of unknowns we are drawing on these innate faculties of reason.

I have deep intuitive difficulties with the Kantian idea that there exists in our consciousness a fundamental and unchangeable mechanism that determines how we process our sensory experiences of the world. I don't doubt that the functional limitations of our eyes and ears restrict what we can directly *access* of the world, but I don't think it is necessary to conceive of a universal prescription, or formula, for how we can *process* experience to shape our knowledge of the world. I believe that Kant is claiming that we have a *homeomorphic* faculty for reasoning (see panel on chaos theory). As a biologist, I am inclined to reject any explanation that resembles the fallacy of 'nature versus

[1] Hume, David, *An Enquiry Concerning Human Understanding*, Clarendon Press, Oxford 1978 p121

nurture'; biological processes are adaptive, integrative and emergent and to speak of a subconscious 'structure' that determines the function of our consciousness is absurd.

So for now, I will accept Hume's premise that all knowledge can be equated to human experience, and explore how we can come to learn new things on this basis.

One approach to addressing the 'gap' in perception is to understand experiential knowledge as a network system, with ideas about the 'unknown' characterised as an emergent property of a network of human experience. In this view we have an emergent faculty of consciousness that is distinct from our sensory experiences, but born of and part of the experiential network, and thus consistent with Hume's claims.

In the introduction to this course we were encouraged to consider the role of emotion and reason in shaping our responses to complex problems. However in accepting Hume's premise, I am rejecting the existence of reason as an independent cognitive capacity. If our faculty of reason draws on our experience, then it first needs to be recognised that all epistemological claims are imbibed with values that concern what knowledge is and what should be. If knowledge is value-driven, then it immediately opens up the possibility for alternative methods of legitimising knowledge of different forms, which I believe has significant relevance to this course and the ideas of transdisciplinary knowledge.

'Scenarios or other tests of logic'

The strategic thinking diagram presented by Steve Cork in the second week offers a remarkable insight: strategic thinking can be assessed by 'scenarios or other tests of logic'. This is point of departure from scientific and philosophical discourses, and suggests that the ideas of the imagination, not reason or evidence, are amongst the highest tests of logic.

Imagine a rewording of the Lucas and Bolton statement; that 'universities serve to make students think; to imagine multiple possible futures and tell stories to support their ideas'.

In practice I think we often use stories to support an argument, only under the auspices of 'evidence'. Justifications for interventions in the Northern Territory and the Pacific invariably draw on 'facts' and statistics, but the processes that seek to identify and use these facts and statistics are part of a deeper story about how we should think about other people. This is consistent with Sohail Inayatullah's claim that 'what we see' is deeply informed by underlying myths and stories.

Whilst these underlying stories are justified by evidence, and while we continue to conceive of evidence as 'rational', then we will not begin to use stories as tests of logic.

However, I believe that we can build storytelling into our systems of knowledge by a closer examination of Hume's premise. If all knowledge is equivalent to experience and 'rationality' is non-objective, then we open the door to a myriad of alternative knowledge structures that represent our collective experiences. Here is a role for storytelling; that storytelling represents knowledge just as much as evidence does, because there is no criterion of rationality to distinguish them. The advantage of telling stories rather than providing evidence is that we grow up with many, many stories.

Multiplicity

"Trust me, this will take time but there is order here, very faint, very human.
Meander if you want to get to town."

- Michael Ondaatje, *In the Skin of a Lion*

The language of transdisciplinarity is that of sharing ideas and discourses, making this field a natural candidate for exploring the role of storytelling in experiential knowledge systems.

When stories are told simply as stories, it seems there are no rules or institutions that govern who can tell them and who can hear them.

By emphasising that our stories and other knowledge derive from non-objective collective experiences, we ask ourselves to systematically describe 'what we see' in terms of the world views and myths that shape our perceptions. In moving away from the normative approaches, especially those of international relations and development theories, we can see a broader picture of reality *as it is experienced* by diverse groups of people. We can also better describe the concept of participatory knowledge that Steve Dovers explored as the sum of perception, ideas and imagination of a group. These group processes produce an emergent identity; we cannot understand the knowledge of the group by modelling the grouped knowledge of individuals.

Building knowledge communities

"The University of the South Pacific, with its highly mobile staff and student bodies…
increasingly the older movers and shakers of the islands are being replaced by younger ones; and when they meet each other in Suva, Honiara, Apia, Vila or any other capital city of the Pacific, they meet as friends, as people who have gone to the same place of learning, who have worked and played and prayed together."

- Epeli Hau'ofa, *Our Sea of Islands*

A pluralist, experiential knowledge system requires acknowledgement that in trandisciplinary endeavours, academia is not the only relevant worldview. Governments, stakeholders, business owners, NGOs, communities and individuals can make important knowledge contributions. Equality of perspective should be a methodological tool for transdisciplinary initiatives. Through this approach we also need to reconcile disciplinary and non-disciplinary perspectives. If we conceive of different belief systems as irreconcilable then we are asking these systems to converge to a point. Alternative geometries are possible. Ideas can exist in parallel and move in the same direction. Fractal geometries allow us to conceive of diving, floating and resting in and through belief systems. I believe that these elastic, abstract textures, if threaded in to ideas about collaboration, could improve our responsiveness and adaptability to change.

Metaphor as knowledge

'The cornet and saxophone and drum chased each other across solos and then fell together and rose within a chorus. He saw himself gazing at so many stories, knowing he could now add music by simply providing the thread of a hum'

Michael Ondaatje, *In the Skin of a Lion*

In the introduction to this essay I identified the somewhat limited scope of knowledge systems and processes with which transdisciplinary endeavours engage.

I would like to conclude this essay with a brief reflection on the role of art in offering particularly valuable insights on the nature of knowledge.

Throughout this course and in academia more generally, I am surprised that we do not turn to art to help and inspire us to negotiate and embrace complexity. In this portfolio I have included references to Michael Ondaatje's novel because I think that the best art, in Ondaatje's words, 'can realign chaos and suggest both the chaos and order it will become'.

If our knowledge system is grounded in experience, and art is the imaginative interpretation of experience, then we should look to art as a form of knowledge. We can look for metaphors in the art world to shape our understanding of knowledge, but more than that I claim that metaphor *is* knowledge. Artistic forms have had conversations relevant to understanding complexity, often many decades before the papers we read in this course were written. Cubism, for example, broke with the tradition of creating three-dimensional pictorial space based on linear, single point perspectives. Cubism perceived the object as seen from multiple points of view.

The 'transdisciplinary imagination' offers a rich, inclusive framework for understanding how we come to know the unknown. Our imagination plays with our diverse experiences that extend well beyond the bounds of a discipline base. In equating knowledge with experience, we can see creativity as an emergent identity that moulds, interacts and adapts with our experiences, and brings us to new ideas.

Appendix

1. Tutorial Preparation

1.1. Course introduction

Where does our knowledge come from?

Hume – knowledge derives from empirical experience, inference is non-rational
Kant – *a priori* synthetic statements to establish the validity of causal relations
Russel - knowledge is a 'belief' that is in 'agreement' with the 'facts'. 'Belief' may be shown by behaviour without corresponding mental occurrence – assumptions about the existence of things that we don't explicitly consider. If belief is causally important, it must be defined as a characteristic of human behaviour.

Summarising these philosophical perspectives, knowledge can be considered to be a combination of immediate and partly derivative knowledge, with the role of inference questionable.

Useful lessons from philosophy of science
Popper – knowledge by failure of falsification
Kuhn – knowledge within a paradigm
Quine – verification of the whole field and not single statements. All scientific statements are interconnected, and no statements are immune to revision.

Positivism
Reduction
Instrumentalism: The viability of knowledge

Another approach: Does new knowledge *derive* from new values, and if so, are these values expansionary or reactive?
One idea: One must be in the right position to see certain things. Redefining one's position may be of an expansive character.

Lucas and Bolton paper

"Seek…resolution of a problem. Identify problems and resolve them by rational argument supported by evidence"
"Learn to seek the true meaning of things…to distinguish between the true and there merely seemingly true".
Responses: Why do the authors prioritise truth? What assumptions underlie their representation of truth?

"Contract/service provider attitude subverts the open-ended, often transformative relationship between academics and their students that disturbs complacency and fits graduates to confront and deal with the challenges of complexity and change"

"Censorship over what is *difficult* or *innovative*… watering down… condescends towards those judged, a priori, to be incapable of better things."

1.2. Global Financial Crises

• Describe why policy makers might opt for a deposit guarantee.
- Mimicry – other OECD countries have deposit guarantees
- Restore confidence of individuals and families with small savings
- Appear to be responding to the crisis

• Describe the motivation for the introduction of the deposit guarantee in Australia.
As above
• In designing a deposit guarantee, what features for inclusion would you debate with your co-policy makers?
$100 000 savings cap or other figure – deposit guarantees are designed to protect individuals and families, not corporations. Do not want to introduce moral hazard into an already precarious economic environment.
Consider co-funding by banks to reduce moral hazard
Prudent regulation
• Describe what you think the economic implications for a deposit guarantee may be.
Deposit guarantees increase the likelihood of banking crises, especially when interest rates are deregulated and the institutional environment is weak.
Adverse impacts are the stronger the more extensive the coverage
• Describe what impact these changes may have on the global economy.
Introduces moral hazard – ability to attract deposits no longer reflects the risk of the bank's asset portfolio, therefore banks are encouraged to finance high-risk, high-return projects. Through this mechanism, deposit insurance may lead to systemic banking crises

1.3. Helpful and Unhelpful Thinking about Complexity

Use the data base the class set up via the introductory survey to consider some example of complex (possibly wicked) problems.

The potential for male circumcision to prevent female-to-male HIV transmission is a problem I have followed since 2007, when the World Health Organisation approved the introduction of widespread male circumcision trials in Africa. The complex issue is not whether male circumcision can prevent female-to-male HIV transmission; there are three original studies with such positive and consistent results that no one has seriously doubted the efficacy of the method. The complex issue is, of course, one of policy: should adult male circumcision be widely introduced in sub-Saharan Africa to help combat the spread of HIV?

- The initial results from the first three clinical trials were extremely positive, with a ~60% reduction in female-to-male transmission rates. If we produced a vaccine with similar efficacy, policy makers would surely not hesitate to introduce the vaccine across the continent. However, in the non-ideal real world, there is the risk that males who undergo the circumcision procedure will not abstain from sexual intercourse during the 6-week healing period. During this period, rates of HIV infection actually increase, as the virus enters the bloodstream much more easily through broken skin. In the clinical trials, men and their partners received extensive follow-up and counselling support, including abstinence counselling and health education. The authors of the papers acknowledge the integral role

this support played in the low dropout rate, the maintenance of abstinence and the general success of the studies.

- Male circumcision offers no direct protection to women, who bear the burden of the heterosexual HIV epidemic in sub-Saharan Africa. Women will benefit indirectly if male circumcision programs reduce the overall incidence of HIV in communities. Similarly, male circumcision does not directly affect the mother-to-child transmission route, which constitutes a major fraction of newly infected cases. These studies did not examine the effect for men who have sex with men. Furthermore, as this strategy is preventative, it is not effective for HIV-infected men. There is a real risk of stigmatisation if HIV-positive men are not offered circumcision, but also the risk that some HIV-positive men will not adhere to the 6-week post-procedure abstinence period, which may pose a greater risk to their sexual partners.
- For circumcision programs to be as effective as the trials, adequate counselling and medical follow-ups should be provided for circumcised men and their partners in the 6-week post-procedure period. However in countries with tightly restricted health budgets, this would inevitably result in the stripping of funding from other aspects of HIV programs, such as provision of antiretroviral drugs, education of pregnant women about strategies to prevent mother-to-child transmission, and financial and social support offered to carers of ill HIV-positive individuals in their family or community. With this in mind, it is much cheaper to circumcise boys or infants well before the onset of puberty and sexual activity. Healing times are significantly reduced, and the abstinence-related complications of the post-procedural period are removed. However, circumcision constitutes invasive surgery, with the risk of infection, pain and even death. The issue of consent is difficult to resolve, particularly for a procedure like circumcision, a practice that is largely divided along religious/cultural lines. Adult men who were circumcised during childhood may not be satisfied cosmetically or sexually.

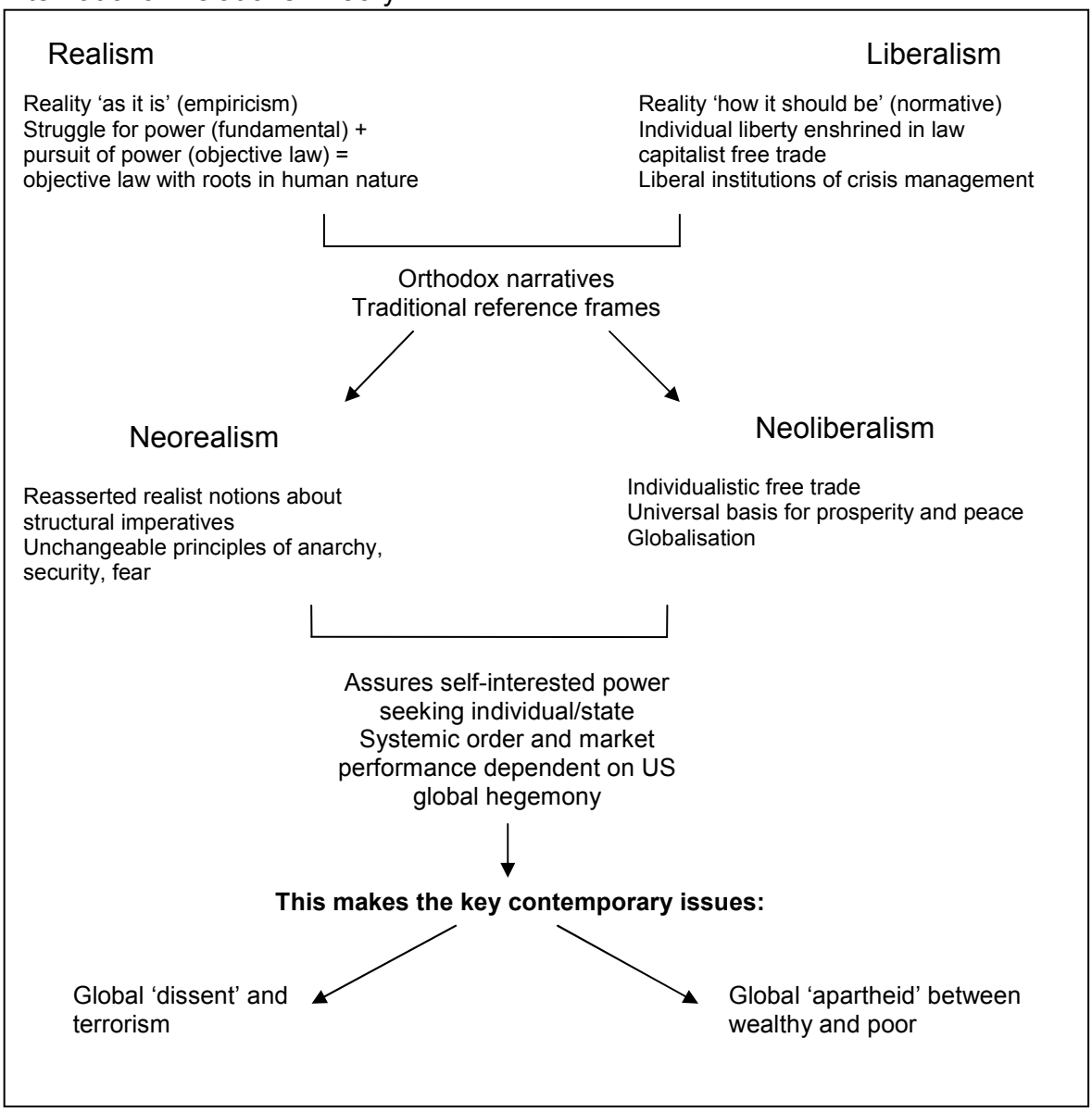
1.4. Collapse of Empires

An example of a collapsed society: Norse Greenland
Background: Norwegians occupied the southwest of Greenland between 984 A.D. and the 1400s and built a European civilisation thousands of kilometres from Norway. During this period, Inuit people arrived from North America
Jared Diamond defines collapse as a drastic decrease in human population size and/or political/economic/social complexity, over a considerable area, for an extended time.
Reasons given for Norse Greenland's collapse

- Environmental damage: Nordic Greenlanders inflicted environmental damage in three main ways
- Destruction of natural vegetation to make way for introduced pasture species for livestock grazing
- Soil erosion and deforestation, initially to source timber for construction and firewood. Native forests could not regenerate at the rate of depletion, in part due to livestock trampling and more generally due to overexploitation of the fragile forest ecosystem. The flow-on effect of the timber scarcity was a severe iron shortage, as timber was needed in fires to generate the heat required to extract and smelt iron. Iron scarcity reduced the military advantage of the Norse over the Inuit

- Climate change: The Little Ice Age between 1400 and 1800 A.D. is implicated in the demise of the Nordic Greenlanders.
- Hostile neighbours – Arrival of the Inuit
- Weakening of friendly trade partners – Economic problems in Norway and the decline in European trade of walrus ivory are implicated by Diamond in the collapse of Norse Greenland

International Relations Theory



1.5. Complexity in Our Sea of Islands – failing States or failed analyses?

Bainimarama 2009: "How can an election, on its own, make a difference when it is based on divisive and race-based communal electoral arrangements? How can an election, on its own, solve the deep differences that our constitution has perpetuated between the different races in our country?"

My response: What constitutes a free and fair election?

In Fiji – government as a tripod. 3 legs – military, church, chiefs. When the military launched the 2000 coup d'état, they were already one leg of the stool, making it easy to topple the government.
States really do look the same: www.fiji.gov.fj
Ministry of Health, Ministry of Women, Social Welfare and Poverty Alleviation (why does Fiji need a Ministry of Women?), Prime Ministers Office
Ministry of Provincial Development, Indigenous and Multiethnic affairs → "attaining greater well-being and good government of the indigenous Fijians"
Imposition of 'capital cities' in Port Moresby, Honiara, Port Vial Suva, that were partially funded with grants from the capital cities of colonial powers including Canberra.

"The Pacific is our backyard and we are the country that has the prime responsibility for looking after the security exigencies as they arise." John Howard, May 2005
Australia looking at the Pacific as real estate. Discourses of power – how do Pacific states influence the agenda when this is the position of the most economically powerful nation in the region?
Australia's neo-colonialist tendencies in attempting to influence regime change in Fiji, the Solomon's, imposing the Pacific Solution for asylum seekers on Nauru, Indonesia.

Max Weber's idea of the state: separate from society, governed by its own official ethos, and gathering to itself the monopoly of the legitimate use of violence.

1.6. Closing the Gap

As I co-facilitated this tutorial, I would like to use this space to reflect on the introductory panel on facilitating a good tutorial, in addition to commenting on the discussions that emerged. Based on the panel led by Geoff Mortimore, Amy and I developed the following objectives and ideas to guide us in facilitating a tutorial.

Objectives

- expand and deepen everyone's understanding
- challenge their thinking
- learn and understand others opinions
- links to different fields
- clarify concepts
- come to a conclusion
- have people leave questioning their beliefs

Ideas

- have those who understand the topic explain it to others
- get into subject groups and provide their subject's spin on the topic using white boards
- ask all stretch etc to relax if people are uncomfortable
- allow people to pass
- have people say what they learned/ thought at the end

1.7. Environment Policy Issues

Classic Problem Solving Methods in Biology

Biology aims to understand the order, nature and processes that define living things. A biological problem is typically described by a gap in specific knowledge systems (specialisations), and the proposed solution involves conducting research to reduce the knowledge gap. The ideal solution is the precise identification of interconnected steps or stages that produce a known outcome. The processes are typically reductionist; however there is an implicit 'baseline' in the reductionist approach to understanding the level of detail of a process. In biology, this baseline falls somewhere in the discipline of biochemistry; once processes can be succinctly defined at the molecular level, the discipline of chemistry takes over in describing interactions and behaviour of entities such as atoms and molecules that contribute to biological structures and functions.

Applicability of Problem Solving Methods in Biology to Climate Change

Policy debates on climate change are first and foremost informed by a growing scientific evidence base. Biological research strongly informs the climate change debate and is a flourishing academic area, as evidenced by the creation of peer-reviewed journals such as Global Change Biology. Topics in climate change such as land-use change, ocean warming, atmospheric pollution, carbon sequestration and global food security are key issues for biologists.

However, the capacity for a reductionist approach to solving climate change is limited. Firstly, the formulation of climate change as a 'problem', for which a 'solution' can be sought through research, has limited relevance. Certainly, the development of biotechnologies such as microbiological carbon sequestering and genetically engineering resilience in vital agricultural crops will be important in both mitigating and adapting to climate change. However, climate change cannot be solved in a holistic sense because change falls outside the conceptual framework of problem solving. The measure of success – or perhaps the burden of proof – in climate change is not the development of a solution – a solution would involve restoring the world to some arbitrary condition – there is no way to select such a condition because the world is not static, and all conditions are beneficial for some organisms whilst detrimental to others. Restorative approaches fail to consider evolutionary processes.

Better – use evolutionary biology to understand climate change. Evolutionary biology asks questions about how an organism has adapted to change over time and identifies specific vulnerabilities and resilience to change. This framework is more relevant and more useful to debates on climate change policy.

There are alternate lines of thought to the classic reductionist approach to biology that I have defined above. An instrumental view of science pragmatically takes all theory as a useful lens to define problems and achieve meaningful, tangible results.

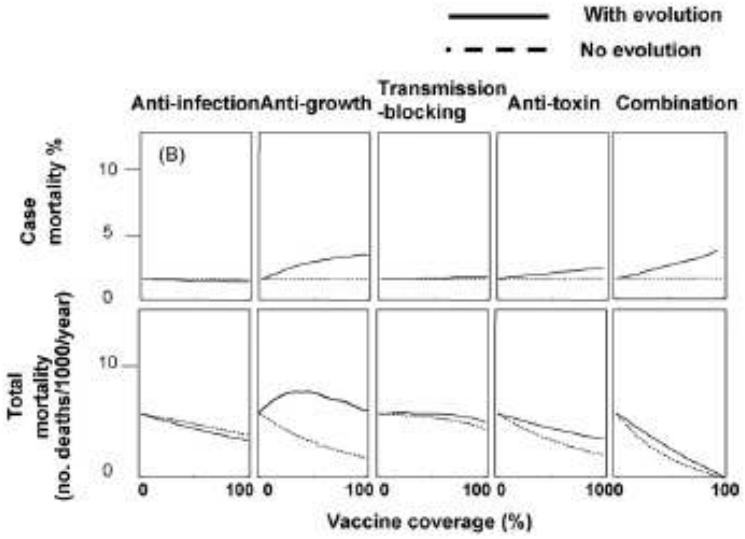
1.8. Dynamics and Geometry of Complexity

An example of mathematical modelling: Virulence evolution in malaria

Assumptions underpinning model

- Evolutionary trade-off between virulence (which you experience as sickness) and risk of host death
- Pathogen fitness is optimised at intermediate levels of virulence
- Virulence is a dynamic characteristic that can adapt to changes in selective pressures

Model investigates the possible evolutionary consequences of widespread vaccination for malaria. The model postulates that certain types of vaccines, especially anti-growth vaccines, could promote the evolution of higher virulence (people get sicker) to the point of eroding all benefits of vaccination.



Note: These considerations have only been applied to malaria so far and are a consequence of the malaria parasite's unique biological characteristics and relationships with humans and mosquitoes.

No action has been taken on this issue because we do not have a malaria vaccine. Vaccines currently in clinical trials are mainly anti-infection type vaccines, which are not predicted to influence virulence evolution.

This model demands that we anticipate and respond to any possible signs of virulence evolution in malaria vaccination campaigns, including careful selection of vaccine type, to avert a potential public health disaster.

1.9. Collapse in Systems and Networks

This tutorial required very little preparation; as a science student I had sufficient background information on all of the listed energy technologies. In preparing for this tutorial I considered what system or network might be relevant to the tutorial. I think that the tutorial is essentially aiming to encourage us to think about policy options in a situation where the collapse of energy systems is probable, and therefore we must take policy measures to reduce this risk. The given scenario implies that energy security is a major concern for *Ayunesia* with *Collapistan* on the verge of economic and political collapse. On the basis of this information alone, as a policy maker I would advise against reliance on imported energy sources including coal, diesel and nuclear. I would recommend a combination of renewable technologies. I have noted that hydropower and solar PV have opposite seasonal shortages, and thus a combined system could work well for Ayunesia. Similarly I think solar PV technology could be supplemented by wind turbines to provide a reliable energy source. Depending on whether solar panels are to be installed on domestic roof-tops or centrally coordinated, I think it would be important to introduce load shedding and other safety measures to prevent the failure of one solar panel from transmitting across the electricity grid and causing a network blackout.

1.10 Complex Emergencies, Refugees, Disasters, Health and Development

Negotiation – Wikipedia

“Negotiation is a dialogue intended to resolve disputes, to produce an agreement upon courses of action, to bargain for individual or collective advantage, or to craft outcomes to satisfy various interests”

Creativity is an important skill in negotiation. Consider Japan’s ‘economic miracle’; the economic success of Japan defies its lack of natural resources and geographical isolation. It is also important to understand the outcome towards which you are aiming, and establish minimum outcomes. There are two approaches – win/lose or mutual gain bargaining, with preference for either depending on economic factors, cultural positions, ethical and moral positions and global hegemonic status.

Summary of recommendations for achieving your outcomes through negotiation (Wikipedia)

1. Accept only creative outcomes
2. Understand cultures, especially your own
3. Exploit cultural difference
4. Gather intelligence
5. Design information flow
6. Invest in personal relationships
7. Persuade with questions
8. Make no concessions until the end
9. Use techniques of creativity
10. Continue creatively after negotiations

In practice, I can relate to how points 2, 4, 5, 7 and 10 could successfully contribute to achieving outcomes. Points 3, 6 and 8 seem to be techniques of bullying or manipulation. Overall I think that this list describes a win/lose approach and assumes that the parties involved can commence negotiations from an equal position. With reference to the lecture, I do not see how developing countries could utilise these techniques to gain cheap access to stocks of Tamiflu. How is Uganda, for example, able to be in the position of gathering intelligence or making no concessions until the end in negotiations with US-based pharmaceutical giants? In this example, point 2 for Uganda probably amounts to recognising vast asymmetries in global power structures but understanding this difference provides no tool for negotiation.

1.11 Uncertainty in the Law

1. *Are there laws governing aspects of your disciplines?*

Certainly – intellectual property law and ethics have a particular role to play in regulating controversial research such as embryonic stem cell research, and research practices such as the use of animals to model human diseases. Furthermore, federal research funding, especially through the National Health & Medical Research Council, is highly regulated by legislation.

2. *Is the law used to address complex problems within your discipline?*

Yes, with salient complex research issues including stem cell research and animal research as described above.

3. *How can the law be used to solve multi-disciplinary complex problems?*

This question would be better framed as 'what is the role of the law in solving multi-disciplinary complex problems' as there is a logical contradiction evident in asking the role of a single discipline in solving stated ;multi-disciplinary' problems. Certainly, law and regulation can be part of an effective solution, with an obvious example being the contribution of statutory regulation of the tobacco industry, which when combined with comprehensive public health programs and education campaigns, has seen a dramatic reduction in smoking levels and seen cigarette smoke virtually removed from public spaces.

4. *Examples of complex problems where legal means have been suggested as a possible solution*

- Asbestos compensation provides funding for acute medical needs in individuals who have developed lung disease as a consequence of industrial exposure to asbestos.
- The MABO judgement of 1992 demonstrates how stunningly effective and simple the law can be in effecting dramatic change. Effectively, the judgement made the colonial declaration of *terra nullius* invalid, in a sweeping decision that legitimised claims to native title.
- National legislation and international treaties relevant to issues of climate change are similarly broad in their impact; affecting public and private sectors at all levels of governance.

5. *Are there examples of where the law has been successfully used to solve complex problems?*

- One perspective is that the law is to some extent successful in keeping only a few years behind social progress, which is often better than governments can achieve, particularly in the conservative Australian political climate. We must remember that law is purely reactive, and this limits its capacity to effect social change. Judges can only comment on what comes before the courts; anything

that comes to court is perceived as a problem. Things that are perceived as non-events or non-issues are not presented in court and therefore the law cannot act upon them. Inherent in this idea is that it can take a critical mass for an issue to crystallise as being a specific *social issue,* with interested parties having the necessary resources to bring a case to the higher courts. An example is the 1999 High Court of Australia decision that 'British citizens are citizens of a foreign power' and thus dual nationals are ineligible to be elected to parliament; a decision which was seen to finally confirm Australian independence from Britain, established by the *Australia Act 1986.* This determination of Australian independence is in some ways well ahead of the anticipation of a positive referendum result in the future to formally establish a republic of Australia.

- Criminal law can also be seen as a possible success, with strong provisions of rights for victims and rights for the accused. Military tribunals for crimes of terror have been shut down around the world at the vehement behest of legal practitioners who aim to uphold the human rights basis of modern criminal law.
- The division of power in the Australian constitution into the legislature, executive and judiciary provides numerous opportunities for revisions to the law, including constitutional amendments, and introduces transparent checks and balances. The fact that the law in Australia is open to democratic processes through court proceedings, referendums and electoral mandates makes Australian legal processes much more successful than in many other areas of the world.

6. *Are there examples of where the law has been unsuccessful in solving complex problems?*

- International dispute resolution has proved to be very difficult under non-binding treaties and conventions. International determinations on acts of genocide and crimes against humanity do not seem to act as deterrents and have very limited capacity to bring perpetrators to court. The International Criminal Court can issue arrest warrants but they are readily ignored, as exemplified by Omar Al-Bashir, President of Sudan.
- Dealing with Somali piracy in the Gulf of Aden is extremely complex given that Somalia does not have a functioning government capable of effecting legal action.
- Music and video piracy is also very difficult to deal with legislatively due to the rapid, private and transnational nature of data flow on the Internet.

2. Student Tutorial Presentations

Often in this course discussions about competing values and discourses have been interpreted as defining characteristics of complex problems. I have previously rejected the table on Typology of Wicked Problems on the grounds that it provided self-fulfilling definitions, but this criticism extends to the failure of the typology to distinguish between complex properties and identification of a zero-sum game. Zero-sum games are certainly a source of considerable tension and require careful, patient consideration, but this is not necessarily *complex*. Other properties of complexity that have been identified in this course include emergent properties (especially in network theory), inherent memory, feedback loops and adaptation. I think it is the case that many problems can be argued to satisfy all of these criteria, but I don't know how valuable it is to label every problem as being complex, especially if we are to develop a methodological framework for managing complexity.

Criteria for complexity

- Emergent properties (sum greater than its parts)
- Chaotic feedback loops
- Sensitivity to initial conditions
- Processes of memory
- Dynamic linkages
- Uncertainty, contingency*

* Uncertainty is not necessarily a criterion. Uncertainty can be built into models of extremely complicated processes such as stream flow rates, resulting in much more reliable mathematical models. This work is being developed by mathematical modellers at ANU.

Depending on the extent of negotiation required in zero-sum games, it is possible to conceive of problems being *wicked* in the social and political sense but not methodologically or structurally *complex.*

This spectrum is only my interpretation, and has been developed as a response to the Typology of Wicked Problems. Nonetheless I have attempted to categorise four problems as presented.

Very complicated	***Wicked but not necessarily complex***	***Complex***	***Wickedly complex***
Malaria eradication *	**Whaling in Japan**	**Cultural diversity and group rights**	**Thermohaline circulation**
• Lack of investment in malaria research • Lack of private sector investment	• Media coverage of whaling in Japan is minimal • Romanticisation of whales in Australia • Importance of multiple perspectives	• Liberalism equivalent to individual choice • Liberalism fails to accommodate cultural diversity • Need for group rights	• Affects planetary ecosystem • Feedback effects • Failure to anticipate • Failure to be watching • Failure to respond

Malaria eradication: My personal perspective is that malaria eradication is exceedingly complex because of the ancient evolutionary relationship between humans and the malaria parasite. Please see my tutorial preparation for Dynamics and Geometry of Complexity for more information. In other cases, disease eradication is feasible and sufficiently predictable given adequate resources, for example the eradication of smallpox. Smallpox was a virus that lived only in humans and a vaccine was available, making it amendable to eradication efforts. It is the biological nature of the disease, rather than socio-political processes, that render the issue of disease eradication either complicated or truly complex.

Whaling in Japan: This problem typifies my distinction between problems that are socially 'wicked' but structurally or methodologically complicated. This is not a question of the nature of whale ecosystems; it is about societal reactions to the management of a natural resource. The positions of different interest groups are clear; the tension lies in resolving these perspectives to a workable solution – a zero-sum game.

Cultural diversity and group rights: Group rights satisfy the criterion of 'emergent properties' as there is no meaningful way to describe group rights based on a collection of individual rights or behaviours.

Thermohaline circulation: This problem is wickedly complex because it is boundless, has multiple simultaneous states, produces and responds to chaotic feedback loops and from a human perspective, is wickedly uncertain. With the enormous time frames and vast ecosystems this could affect, we have minimal capacity to anticipate, watch for or respond to signs of change before it is too late to intervene.

3. Policy Briefing Exercise

3.1. Delivering Policy Briefs

This section has been removed.

3.2. Effective group work

- We set an agenda and scheduled additional meetings when we didn't get through enough.
- We were committed - turning up on public holidays and at 8am on the day of the workshop.
- We workshopped our sub-group presentations and briefs with other sub-groups to look for holes and inconsistencies.
- We were fortunate to be in a group where everyone had enthusiasm for the course
- Using a common template for the briefs and presentation was an effective way of encouraging everyone to attend meetings and contribute. The 5% overall tutorial mark probably had a similar effect.
- I observed a 'natural' delegation of tasks according to strength e.g. Chris taking responsibility for IT stuff, Rhea's organisational skills being useful in booking the engineering room and preparing the overall presentation. In my group, I took on the role of editor because this is basically what I do everyday at work. Being the editor made it obvious that I should present the brief. We took policy topics according to our interests e.g. Bec took the climate change aspects. I also noticed that Amy was able to bring her experience in Japan to the discussions of the ageing population - a topic which may have otherwise not interested her.
- The policy brief exercise drew on the collaborations and friendships developed during the tutorials - we had a high attendance rate, everyone contributed to discussions regularly. This shows the importance of building group dynamics before handing the group a wicked problem. This is not what we see in the real world - e.g. consider Copenhagen COP this December - world leaders will be brought together from distinct backgrounds and experiences and expected to work together in a very short time frame. Pre-Copenhagen events e.g. the conference in Barcelona goes some way to addressing this shortcoming, but more could be done.

3.3. Reflections on policy workshop presentations

The first point to note is that all the other groups had very good ideas about important, pervasive issues. As a tutorial group we tried to simplify our recommendations into four areas, in an effort to express our ethos for policy change. However even with this approach, the other issues presented were critically important and operated on the same time scales. I think this reduced my opinion of the value of policy briefs as an instrument of change; as Jamila said, your problem really is only a small part of their day.

In general I thought the PowerPoint presentations, including our own, did not work very well. However I don’t believe that most groups anticipated that they would be seated across from the ‘Minister’ and ‘Secretary’, with the projector screen behind them. If we

had been explicitly provided with the layout then I imagine that all the groups would have composed their presentations differently. For brevity I have summarised my reflections on the other groups' briefs in the following table:

Group	Notable Strengths	Suggestions for Improvement
Australia-China relationship	• Division into sub-groups that approximately correlated with Departments (e.g. Foreign Trade and Investment, Environment) • Setting specific policy goals e.g. 75% Chinese literacy in Aust. Schools by 2020 • Highlighting international examples of Chinese literacy such as the Jet program in Japan	• Provide short term options as well as long term options, e.g. recommend small grant to bring Chinese teachers to Australia at the start of next year • Attempts to dictate China's aid and investment (curtail check-book diplomacy) implies unprecedented interference in China's affairs
Junk food advertising	• Combining humour with use of common symbols in traffic light example was effective in maintaining attention • Use of concrete examples such as McDonalds sponsoring school sport to explain the need for change at a grassroots level	• No direct evidence offered that tax or subsidy programs work • No budget estimation offered (though this would have been difficult) • Mainly looked at changes in individual and business behaviours, not underlying social causes of obesity and ill health
Refugee policy in Australia	• Provided workable solutions e.g. 5 year visas rather than purely idealistic goals • Identified need to streamline government services across federal and state levels to reduce costs • Offering incentives for first-year employment of humanitarian entrants	• Recommendations should not have been last item on 25 min agenda • References to 'normal Australians' seriously undermined their case • Policy recommendations such as 'establish a narrative' are insubstantial and vague, and very difficult to act on politically.

The feedback for the class was very useful, especially in encouraging us to consider small, short term projects that could be feasibly initiated within a three-week timeframe, as well as budget considerations (though this was difficult without access to budget information). I found it very interesting to hear that the aim of a policy brief is to convince the Minster that it is their idea you are presenting to them. This reminds me of the tutorial role play for Complex Emergencies where the key to success was convincing other interest groups that what you suggest is what they wanted in the first place.

The junk food advertising group touched on the role of industry self-regulation and establishing codes of conduct. Given the observed difficulty in communicating the importance of an issue in a political briefing, I think self-regulation and private sector solutions should be investigated much more thoroughly when tackling a wicked problem. Technological and industrial innovations in response to climate change have exceeded the rate of action by governments around the world; it seems that innovation does not really belong in the public sector. I therefore think the best approach to achieving rapid policy change in government would be to develop small but important, concrete policies and simply request government funding.