

# Ecological and complexity principles applied to socio-economic systems

Masters in Economics for Transition, Schumacher College

## 1. Worldviews and economics and economic worldviews

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## Focus of this week

- To explore complexity economics
- To understand where complexity economics fits against the dominant economic paradigms and worldviews
- To reflect on real situations through a complexity lens
- To link complexity economics with Buddhist, evolutionary, political economics

## Focus of today

- To explore worldviews and define the complexity worldview
- To consider what *is* economics
- To link worldviews with economic paradigms
- To define complexity economics



Think back to when you were sixteen.....



At sixteen, where did you expect that life would take you?

What did you think you would do with your life?

# Has your life gone to plan?



**What gets in the way?**

# What gets in the way of plans working?

Good luck



Limited information

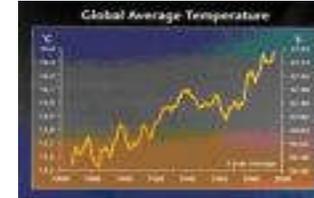


Catastrophe



Bad luck

All these things are normal!



Unintended consequences

You don't know where choices will lead you

Interconnections and unexpected influences

Things change

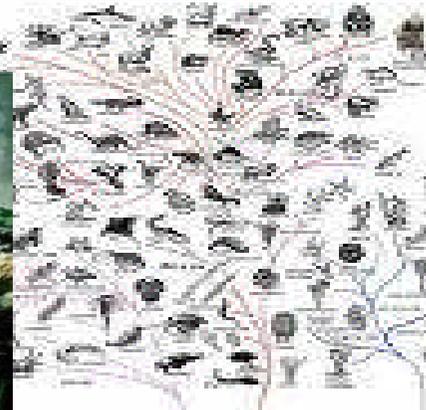
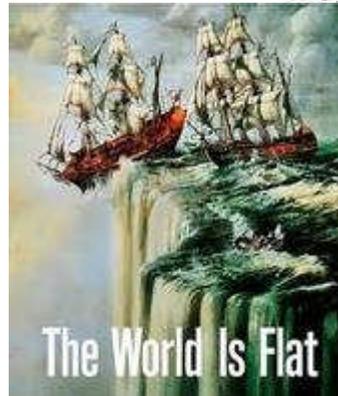


## Our phenomenological worldview, from our experience

- 'Things' go to plan for a while and then something **unexpected** happens; **unintended consequences**
- The world sometimes seems to change rapidly and radically and new eras **emerge** which have completely different features
- Small events, seemingly insignificant, can have large unexpected effects; **tipping points**
- Sometimes we try to change things and things stay the same whatever we do; **lock in**
- We learn and who we are depends on context; **not 'rational Man'**
- No one/ no situation is the same and people/communities have different experiences of life and reality; **contingency**
- Everything that is there plays its part – history, culture, context, emotions, unconscious as well as conscious thoughts and intentional action; **systemic**

What is a worldview?

## Worldviews



Ways we think about 'the way the world works'

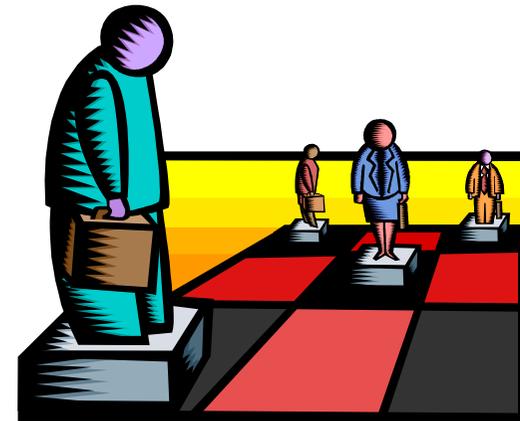


Ways we conceive 'reality'

## Organisational methods and implicit worldviews



- Think of some traditional methods used to manage organisations, schools, hospitals -----
- What worldview is implied by these methods?



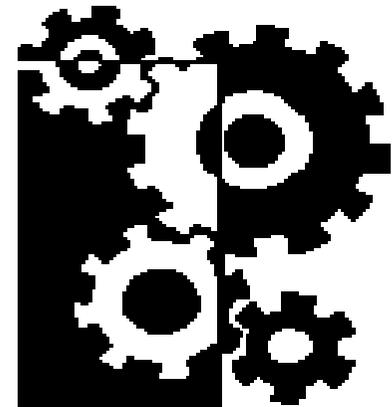
## The worldview that is assumed in most methods of management

the future is predictable and follows smoothly from the past

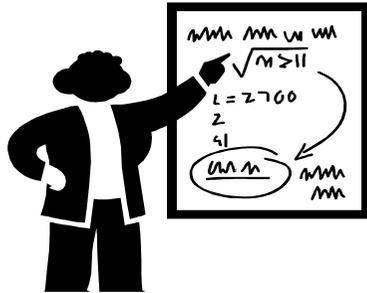
people behave rationally and predictably

measurement identifies clear outcomes and clarifies what to do next

we can separate factors from each other and control things



# Traditional mechanical science as a worldview



## Determinism

Life goes to plan and can be  
controlled and measured



## Reductionism

You can carve most things into bite-  
size chunks and deal with them  
separately



## Reason

We can use reason to solve everything



Descartes

Why did/does this mechanical worldview dominate our culture?

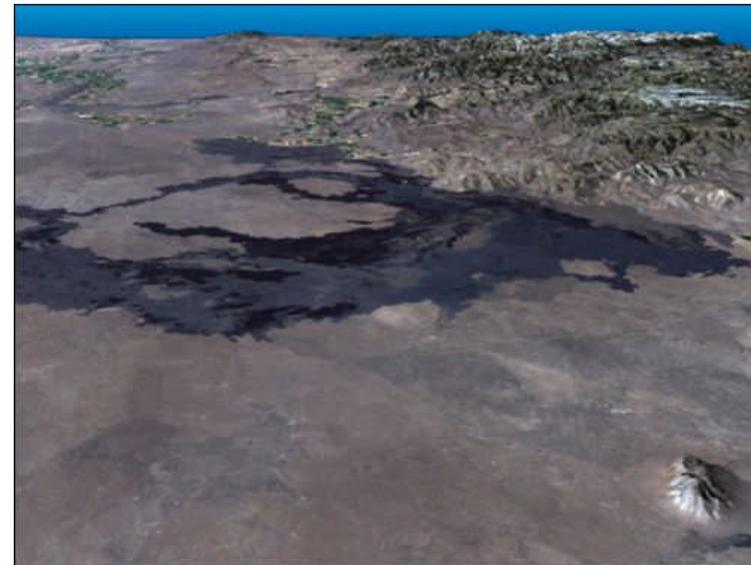
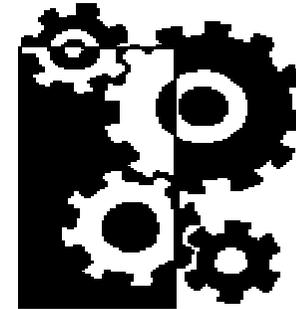
Why did/does this mechanical worldview dominate our culture?

Defines what is professional and scientific

Power!

# Traditional physical science and its impact on worldviews

- Traditional science had two 'stories'
  - **Newtonian**, mechanical science, applicable to closed, linear, mechanical systems, deterministic.
  - Equilibrium thermodynamics, **entropy**, which tells us that everything tends to equilibrium. What that means, for the universe, is that in the end everything dies and turns to dust – also applies to closed systems and also deterministic



## The equilibrium worldview

- Most situations are near equilibrium
- Near equilibrium we can predict what will happen next as things tend to move back into balance
- Harmony and balance is part of 'natural law'
- There is a destination (equilibrium)

# What about worldviews from ancient cosmologies?



*Upon those that step into the same rivers different and different waters flow...They scatter and ...gather...come together...and flow away...approach and depart*  
*Heraclitus*

*These rivers flow....they arise from the sea and flow into the sea....these rivers, while they are in the sea, do not know 'I am this river' or 'I am that river'.*  
*Chandogya Upanishads*

*'there is no self-defining discrete reality to cause or effect. Forms or feelings are devoid of inherent existence; it is only on the basis of aggregation of subtle elements that forms exist; form can only be understood in relational terms to their constitutive elements.'*  
*Dalai Lama explaining Milarepa Buddhist text, April 2008*

*Integrity is this sense of becoming whole in one's relations with other things is a co-creative process in which one shapes and is shaped by one's envioning circumstances...*  
*Ames and Hall – commentary on Dao de Jing*

How would you summarise the focus of these ancient worldviews?

How would you summarise the focus of these worldviews?

flow  
becoming not being  
form but not fixed  
co-creation  
Contingency/path dependency

So, we've explored a phenomenological worldview,  
a mechanical worldview, an equilibrium  
worldview and worldviews from ancient cosmologies...

What about the development of the  
complexity/evolutionary worldview

# The impact of Darwin's theory of evolution

## Darwin 1859

- variation followed by selection;
- emergence of new form within an ecological/systemic context
- the future emerges, cannot be know in advance

The theory of evolution had a huge impact  
on every sort of science and philosophy

Veblen, 1896

Why *isn't* economics an evolutionary science?

Pragmatism/indeterminism  
Charles Peirce, William James

*holism*

## And then there was the theory of evolution

### Darwin 1859

variation followed by selection;  
emergence of new form within an ecological/systemic context

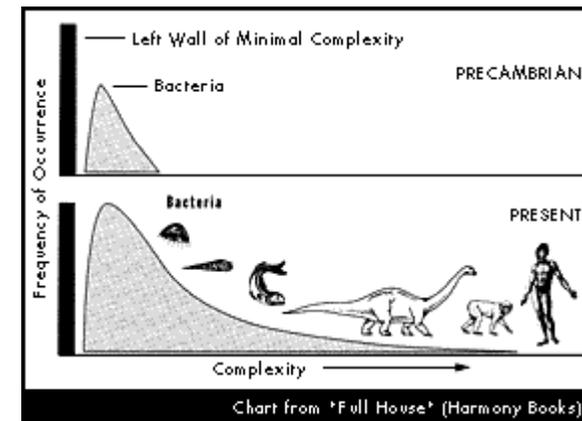
Why, if physics,  
in the form of the second law of  
thermodynamics,  
proposes that matter and form  
degrade into structureless dust,  
does life '*mount the incline that  
matter descends*' (Bergson 1907)  
.....in other words, why does physics  
not connect with biology

Prigogine gave an answer to Bergson's question in 1947.  
He pointed out that for open systems, entropy  
can decrease and order/patterns emerge

## Complexity, a 'new science' of evolution, a 'new' worldview

Ilya Prigogine, a physicist, (1947) started to form a theory of how evolution occurred and connected it with physics

He got the Nobel prize (1976) for this



*He realised that most systems were **open** to the environment; and that fluctuations were key to explaining emergence and change;*

*it was these insights that led to complexity science*

## The complexity worldview

It provides a view of the world as:

- systemic
- contingent
- emergent
- the future cannot be predicted nor controlled - but is not random
- sometimes self-regulatory (locked-in) and sometimes tips into new eras with new characteristics

How does this relate to other worldviews?

*Complexity as a worldview accords with the pre-modern philosophies from around the world and with evolution and with our own experience of living.*

*It supports the idea that we are in relationship with the earth, that what we do matters and yet we must act with humility as we cannot be sure of outcomes.*

*It shows us that we cannot always turn back, that change can be irreversible and change can sometimes be fast and furious*

*If more people thought this way, we would be more likely to live in a way that benefits the earth and our grandchildren*

So how does all this link to economics?

# What is economics?

What is the focus of economics?  
With what is economics concerned?

How do you 'do' economics?  
What are some of the features/mechanisms of economic thinking?

With what is economics concerned?

markets goods wealth consumption stability  
production supply  
demand

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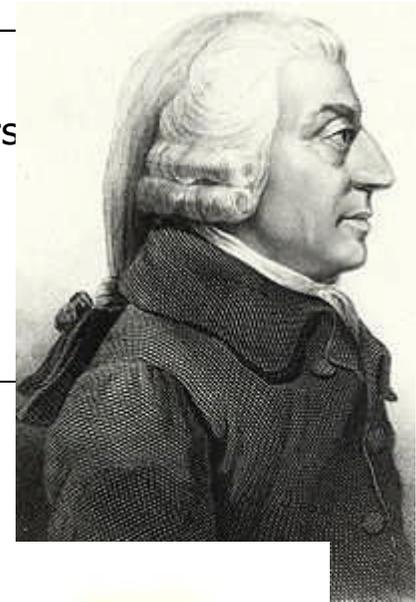
What are some of the features of economic thinking?

surplus scarcity equilibrium choice 'Economic Man' control competition

# Key traditions

## The Moral Invisible Hand (Smith 1776)

If people act in their own self-interest AND respect the well-being of others goods and wealth will be produced that benefit all of society. Governments should not restrict or interfere in markets because they can regulate themselves and, thereby, produce wealth at maximum efficiency.



## The Amoral Invisible Hand (Walras 1874)

### General Equilibrium Theory

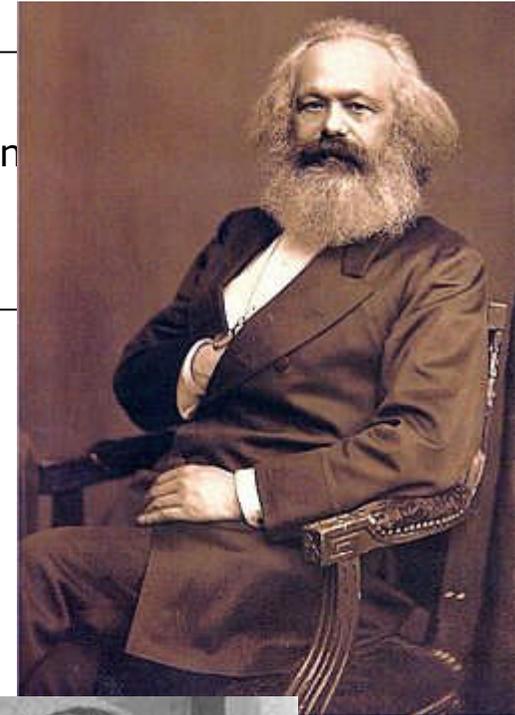
The market ensures a systematic tendency toward equilibrium with perfect equality between supply and demand



# Key Traditions

## Marxist Economics

The rich will get richer and more powerful so the means of production should be owned by the workers



## Keynsian Economics

Governments can act to promote stability (equilibrium) through use of taxes and public spending



## **Differing approaches to economics depend on:**

- Worldview; what do we assume about the way the world works
- Values/purpose; what is economics for and for whom?

How do the 'mainstream' economic traditions fit with the worldviews we have explored?

Is anything missing in traditional economic perspectives

## Is there anything missing in traditional economic perspectives?

**Systemic thinking** – economic decision and actions are not separate from social, political and environmental decisions

**Non-linearity** – there is no reason to expect we are near equilibrium or that changes are linear and incremental

**More than one future** - at tipping points, things could go in more than one direction

**Contingency** - situations are not replicable, depend on the detail (cumulative causation).

**Lock-in** - the powerful get more powerful and are hard to shift (Marx said this)

**Instability** - why should we be near equilibrium

And...

It is really just people making decisions;  
any patterning – such as markets or supply/demand  
are dynamically-held and temporary;  
there is no endogenous and exogenous.

# Ecological and complexity principles applied to socio-economic systems

## 2. Complexity economics; implications and examples

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## Focus of today

- Review the implications of a complexity worldview for economics
- Consider examples

## The complexity worldview

It provides a view of the world as:

- systemic
- contingent (path dependent)
- emergent
- the future cannot be predicted nor controlled but is not random  
(patterning of relationships are stable for a time but can change)
- sometimes self-regulatory, 'locked-in' and sometimes tips

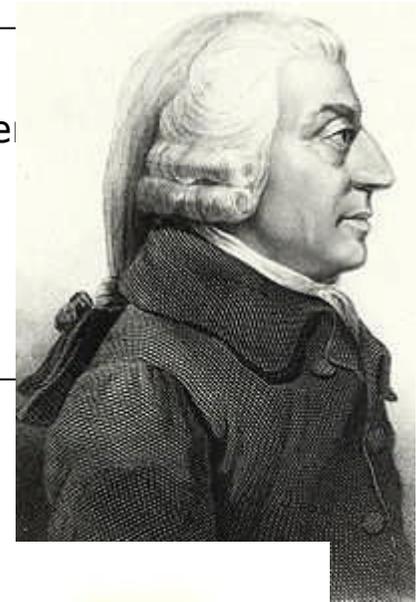
# Key terms

- **Self-organisation**
  - The patterns of relationships that emerge are influenced by history, context, choice and chance and imposed interventions – but what emerges cannot be controlled although it can be influenced by behaviour, values – and how you intervene
- **Emergence**
  - New features emerge which cannot be known in advance and which may be different even in supposedly similar circumstances
- **Co-evolution**
  - The way an innovation shapes the environment and the environment shapes the innovation eg the relationship between the development of the mobile phone and the way it impacts society and society impacts its development
- **Tipping points**
  - The point at which things start to change irreversibly into new patterns with new features emerging

# Key traditions

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If people act in their own self-interest AND respect the well-being of others, goods and wealth will be produced that benefit all of society. Governments should not restrict or interfere in markets because they can regulate themselves and, thereby, produce wealth at maximum efficiency.



## The Amoral Invisible Hand (Walras 1874)

### General Equilibrium Theory

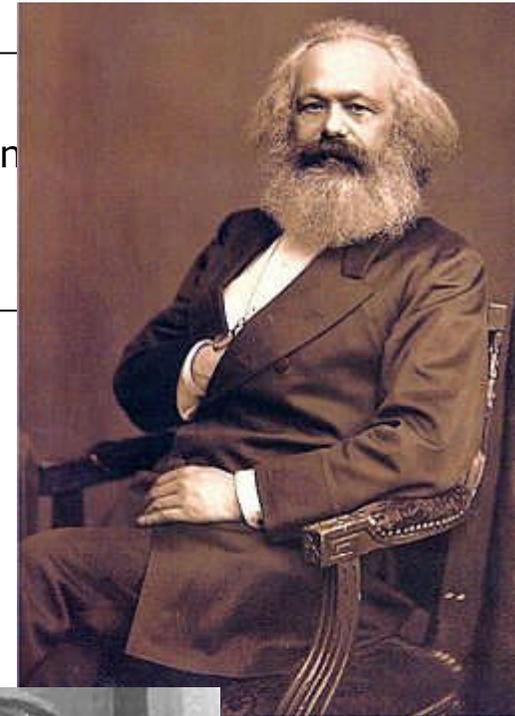
The market ensures a systematic tendency toward equilibrium with perfect equality between supply and demand



# Key Traditions

## Marxist Economics

The rich will get richer and more powerful so the means of production should be owned by the workers



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Is there anything missing in traditional economic perspectives – anything that does not reflect the nature of a complex world?

# Complexity economics

**Systemic:** does not separate economic, political, environmental and social – from either a consideration of goals and purpose (macro) or a consideration of individual behaviour (micro)

**There is more than one possible future:**

*Non-equilibrium:* does not assume the economy is near equilibrium, nor that there is only one possible equilibrium

*Emergent:* today's patterns will not last forever and the new characteristics that emerge in the future can be known

**The detail matters:**

*Evolutionary and path dependent:* takes account of the detailed paths (shaped by history, context, choice and chance)

– each situation is unique and affected by the particularity of the detail

*Emphasises values and intentions:* with cumulative causation/path dependency, 'the ingredients you put in the mix' shapes the future

**The door is not always open:**

*Tipping:* sometimes we are near the conditions for tipping into new regimes

*Self-regulation:* sometimes there is a harmonic dynamic balance, at least for a while

*Lock-in:* 'increasing returns' can lead to the big getting bigger, the powerful more powerful

# Implications: the systemic nature of the world

# Thinking systemically – or not

The decision to modernise a major Transport Hub.

First there is the **economic** argument; we can show, from historical data, that new hubs do create economic value in the surrounding area, as well as directly to users of transport services.

Then there is a **social** argument: we have to take into account that there may be people who will lose their homes and/or their livelihood as a result. Historical data suggest that, in the long term, this is acceptable to the public, *provided* the numbers are not too great.

Then there are issues of **noise and air pollution**.

There are also wider arguments centred on whether we should be facilitating more travel given the reality of **climate change**.

What can happen in policy circles is that the economic, environmental and social issues are considered separately, the debate becomes polarized and the public and others feel they have to choose between opposing priorities.

However, if we can look at the situation *holistically* - while still making the many and often conflicting views and objectives explicit - a clearer, more balanced, perspective can emerge.

If we don't have the hub here, it may happen elsewhere in Europe anyway. Studies show the public place a very high premium on travel. If it is not here, we lose the economic advantage and also the potential opportunity to place more influence on pollution, traffic control, 'greener' aircraft design.

*Based on Collins (2010)*

# Unintended consequences

- *'last week millions of jellyfish in a swarm 26 sq km in area and 10 m deep drifted into a salmon farm in the Irish Sea and killed all 100,000 fish' New Scientist 1 December 2007*

- Warmer water is allowing them to move north
- Carbon dioxide has made the sea more acidic which harms creatures which compete with jellyfish
- Plus over-fishing is removing vertebrates that eat jellyfish
- Plus jellyfish eat baby fish so fish stocks are inhibited from recovering
- So we need more fish farms (as natural fish stocks not recovering) – but jellyfish (who are increasing) can wipe out fish farms....
- AND to feed the fish in the farms we need to harvest small plankton-eating fish to make fish meal to feed them...
- BUT these small fish are those which compete directly with jellyfish so if they too are being over-fished.....the jellyfish will have fewer competitors



# Development of the Senegal river basin

Dam built on mouth of river to turn salt water into fresh water and grow rice funded by a development loan from a European-based charity.

Previously millet had been grown in the region to fit with seasonal floods. Floods now stopped by second dam higher up river. This in part was to secure stability for rice growing and was also to produce electricity for Smelting iron ore. In the event ore was not of high enough grade so electricity sent to Dakar thousands of miles away (needing infrastructure to do so)

Mauritanian herdsman had used area for cattle – they declared war on Senegal.

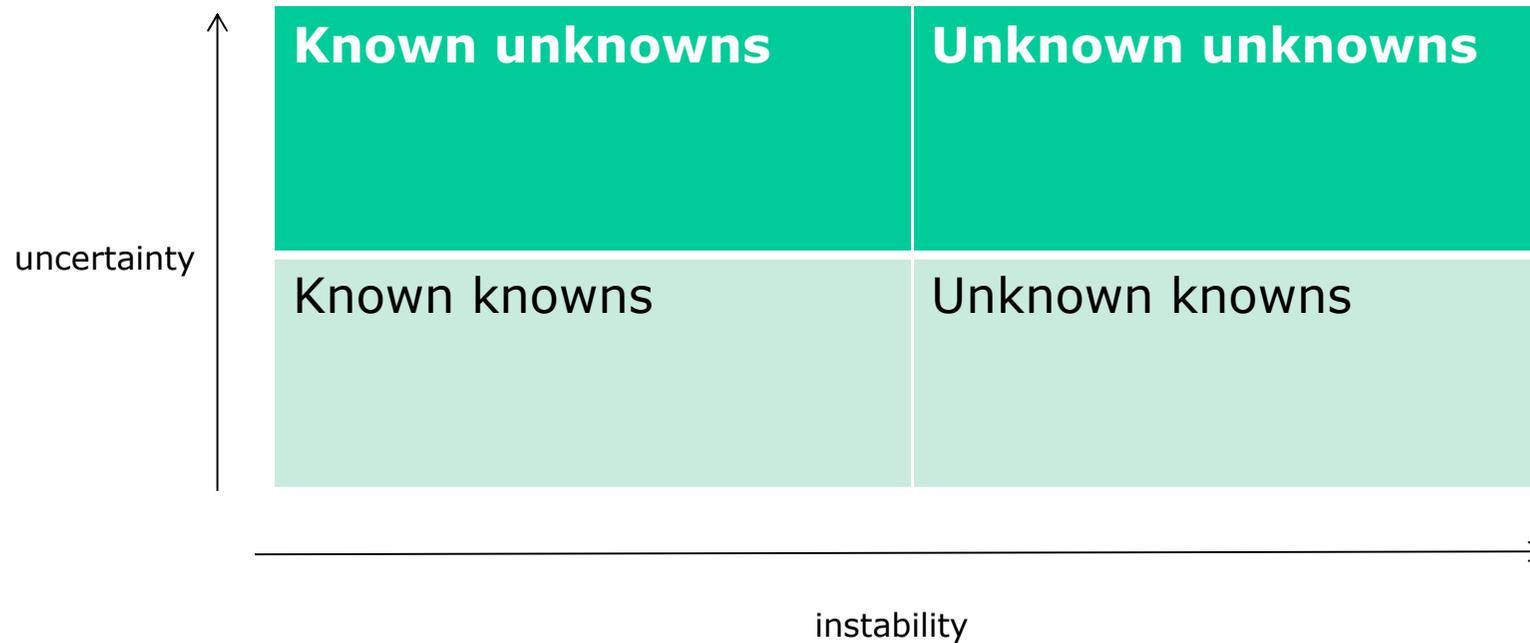
Cow dung had made soil fertile so used fertilisers (bought from Europe) which travelled into river basin and affected fishing

People working in paddy fields got River Blindness – treatment drugs cost more than rice crop.

To pay for development costs of the dams the fish that were caught had to be exported.

Implications – there is more than one possible future;  
uncertainty

# The issue of uncertainty; a contingent approach



Judgement, foresight, experiment, portfolio,  
regular review, multiple perspectives,

# An example of an unknown known

Risk management and catastrophes

Tim Jackson – prosperity without growth

## Implications: lock-in

- *Conventional economic theory is built on the assumption of diminishing returns'* (Arthur 1994:1) e.g. minerals; as demand goes up, mineral deposits harder to reach must be mined, so price goes up and controls demand.
- But lots of products become cheaper as volumes increase (due to initial vast outlay in cost of production or in marketing); 'increasing returns', i.e. positive feedback loops ' *make for many possible equilibrium points'*.
- At which equilibrium point we end up can be a matter of chance and/or a result of corporate manoeuvring. E.g VHS/Betamax, petrol/electric cars
- So free choice is not so free and the best product does not necessarily win

# Lock-in of attitudes; freedom is not so free after all

- Climate change denial
- Consumerism and attitudes to beauty, femininity, happiness, growth, obesity
- Viral marketing
- Advertising
  - Bottled water – (concern about tap water, fitness, weight)

# Implications: regulation

## 1. Is the 'free market' really free?

Hidden regulation – subsidy, trade agreements, link with aid, limited liability, shareholder value.

The issue of advertising

## 2. How to combat 'lock-in' (positive feedback loops)

Need for anti-monopoly regulation?

## 3. The issue of values, goals and timescales

Does the market take care of the longer-term, the weak

## 4. The need for a political economics

Complexity economics supports the need for some regulation not just laissez-faire

- but regulation that responds to what happens, is not fixed from on high once and for all. 'Living', responsive, debated regulation.

# Deregulation: the banking crisis

## **The banking crisis**

How did this come about? One can perhaps trace its origins to the deregulation of the London Stock Exchange on October 27 1986, 'Big Bang Day'. As a fervent supporter of free market thinking, the then Prime Minister Margaret Thatcher's main concern seems to have been to abolish the closed shop. At the same time as this sweeping away of restrictive practices for the stock exchange, currency exchange regulations were scrapped which caused massive amounts of foreign exchange to flow through London; these two factors, together with the advent of powerful small computers, meant that volumes of business and numbers of stockbrokers mushroomed, with little regulation either formally or through established custom and practice. Following this, in 1997, Gordon Brown passed the Treasury's power to set interest rates to the Bank of England and its regulation of the banking sector to the Financial Services Authority. This move reduced, once again, levels of regulation and meant that financial stability was nowhere held as a goal. This deregulation has created a climate where financial institutions have, in some cases, acted according to what was allowed as opposed to what was prudent, with the consequent creation and burst of the credit bubble.

## Examples re deregulation

Financial deregulation, 1989

Wage differentiation

Inadequate infrastructure

The UK is the least regulated European country and is amongst the worst re teenage pregnancies, literacy and numeracy, happiness, unemployment, obesity, numbers in prison, – almost every measure of social wellbeing

How do we get from where we are – and do we agree where we are?

# Implications – social movements

End of slavery

Co-operatives

## Local versus global?

Schumacher did not say small is beautiful,  
he said appropriate scale.

What is best decided locally, what nationally,  
what globally and how do you do that?

## The UK riots what happened; how do we frame what happened. How should policy-makers/the police/the judiciary intervene?

- Worse riots for 3 decades. Started in Tottenham, N London after the fatal shooting of Mark Duggan by police; spread to 22 boroughs, to West Midlands and North-West; facilitated by information spread via social networking sites
- Aug 7 BBC *Started 6 August continued into early hours – Torching, looting; started when 200 gathered outside police station to protest about man shot by police on 4 August*
- Aug 7 BBC *8 injured police taken to hospital, people pushing away shopping trolleys full of looted goods, double-decker bus set on fire*
- Aug 12 BBC *'destructive nihilistic gangster culture says David Starkey, historian*
- Aug 13 BBC *Police in Manchester inundated with calls to 'shop a looter' scheme*
- Aug 14 BBC *peace rally B'ham for 3 men run over and killed*

## UK riots continued

- Aug 22 Guardian *riots don't have one cause, a reformation of society is needed, is there a spiritual response to the riots?*
- Aug 24 BBC *Neet youths (not in employment education or training) risen to 18.4% of 18-24 year olds; nearly 1 million are neet.*
- Aug 25 BBC *Govt will look at limiting access to social networks during any future disorder. BUT also helped people to stay in contact, organise clean ups. A number of people jailed for four years for 'online incitement'*
- 7 Sept Independent *Judge giving out longer prison sentences for rioters than they would have if offences had been committed in isolation*
- 7 Sept Independent *Looting leaves taxpayers with £140m bill for extra policing; 'one 17 year old was found with his pockets bulging with stolen cigarettes and jewellery'*
- 15 Sept BBC *1 in 4 people charged over riots had committed more than 10 past offences. 'dysfunctional communities fertile ground for drug dealers, gang recruiters, violent money lenders'; more than half of 1715 in courts under 20; 45% no previous convictions; of 315 sentenced so far, half given custodial sentences*

# Principles of acting in a complex world (e.g. to develop policy)

- Create a 'steering group' of differing stakeholders and in particular including those affected by any policies; shared ownership
- Gather information widely – others' experience, situations from the past, similar situations in different contexts
- Imagine the future – what might happen that might change thinking today. What are the social, political, economic and environmental implications, what else could happen in the future? What might be the implications of unlikely but catastrophic events
- Craft/weave a tentative approach – clarify and weave intentions and shape approach – what needs clarity, what can be left to later, to the 'users'
- Pilot if possible and review outcomes – unintended consequences, unexpected successes or barriers; refine approach
- Implement policy and communicate intentions, processes, how to report problems
- Review progress by 'steering group' and modify if need be
- Continue reviewing progress, and also 'blue-skying' – is something new coming onto the horizon; are the needs the same