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An Introduction to the Principles of Systems Thinking

Sheffield – 27 January 2011



Systems Thinking 'Defined'

- Interpreting the world around us in terms of wholes and relationships rather than the reductionist approach of examining the parts.
- 'Everything is connected to everything else'
- Boundary
- Aim
- "All models are wrong, some are useful"
- To enjoy learning together.

Standing on the shoulders of giants...

- Aristotle
- Gregor Mendel
- William Blake
- Georges Gurdjieff
- Rudolf Steiner
- Karl Marx
- Florence Nightingale
- Bertrand Russell
- Clarence Irving Lewis
- Alfred North Whitehead
- Henry Ford
- Walter Shewhart

Systems Thinking is not 'new'.

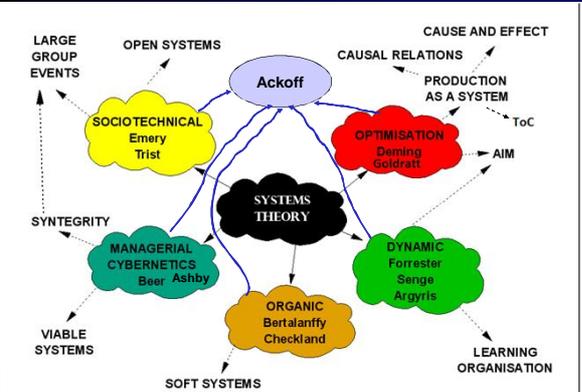
The conscious and explicit study of Systems Theory is a 20<sup>th</sup> Century development.

Some Significant Systems Thinkers...

- |                          |                  |
|--------------------------|------------------|
| • Gregory Bateson        | • James Lovelock |
| • Ludwig von Bertalanffy | • Kurt Lewin     |
| • Warren McCulloch       | • Peter Senge    |
| • Ross Ashby             | • Eric Trist     |
| • Stafford Beer          | • Chris Argyris  |
| • Jay Forrester          | • Eli Goldratt   |
| • Edwards Deming         | • Fritjof Capra  |
| • Russ Ackoff            | • Myron Tribus   |
| • Peter Checkland        | • Dan Jones      |
| • Ernst Schumacher       | • Tom Johnson    |

Add your own...

My principal influences..



Systems Thinking – Systems Practice

The philosophers have only interpreted the world, in various ways; the point, however, is to change it.

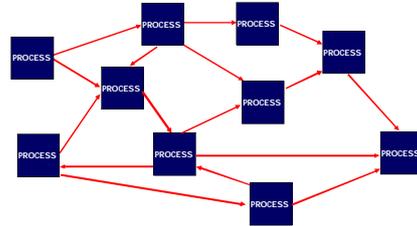
Karl Marx

## 15 Core Principles

- To make a difference we have to be able to communicate systems theory in ways which 'ordinary' thinkers (i.e. linear / reductionist) might understand and begin to apply.
- Over 20+ years of systems practice I have found the following 15 core principles a useful introduction to systems thinking, each having stood the test of time and 'communicability'.
- This selection is, by definition, incomplete and biased.

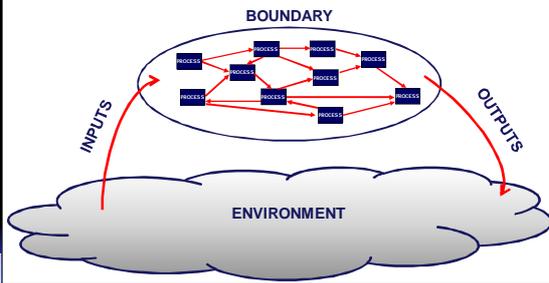
## 1. What is a System?

A system is network of interconnected, interdependent components which work together to achieve a common aim or purpose.



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## Systems - through the eyes of a child

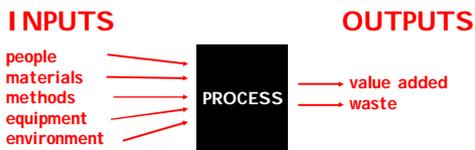
**The Way Water Works**

Amale Candara

Let's begin our own study of the way water works by seeing what you already know about it. Complete the drawing below. Notice there is a water pipe leading into the kitchen sink and a water pipe leaving the kitchen sink. Draw how you think the water goes into the faucet and where the water goes down the drain.

## 2. What is a Process?

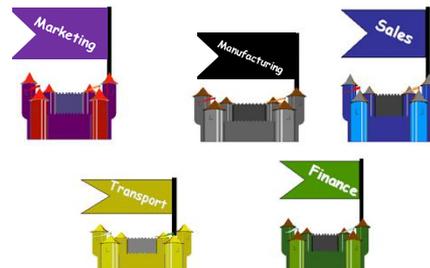
- A process is an added value translation of inputs to outputs.



- Processes are the basic building blocks of systems

## 3. Systems are about relationships

The performance of any system is determined more by the interaction of its component parts than how they function independently.



4. Cooperation is essential

The greater the degree of interdependence in a system, the greater the need for cooperation.



5. Performance is not equal to the sum of the parts

The performance of even the simplest systems cannot be reliably predicted from the capability of the independent parts.



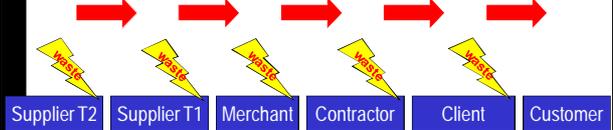
6. Individual Companies don't compete



- Customer Focus
- Supply chain thinking
- Interdependence

7. The Retail Customer Pays for Everything

Example: Construction as a System  
Value Flow (products & services)



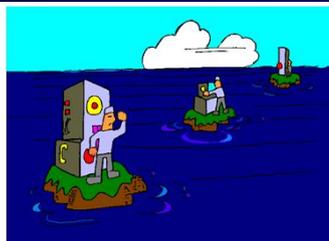
Money Flow



The customer pays for EVERYTHING right back to Mother Earth

8. Effectiveness is a 'whole system' perspective

When we look at processes as isolated islands of production we tend to focus on their *efficiency*.



- To improve *effectiveness* we have to consider how processes work in combination with each other.

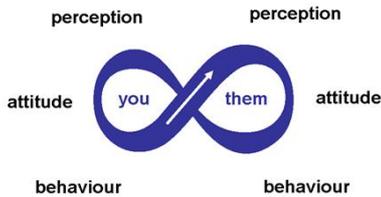
9. Internal competition

- Internal competition 'makes sense' until we understand systems.
- Internal competition motivates localised improvement at the expense of the whole.
- This is called 'sub-optimisation'.
- It destroys trust and cooperation.



10. Optimisation requires trust

- Optimisation of systems cannot be achieved by optimising the parts in isolation.
- Some components may need to be subordinated for the benefit of the whole – this will require trust and cooperation.



11. Aim is an emergent property

- The aim of the system cannot be determined by examining the functions of the parts.
- Aim is an emergent property which is found in the contribution which the whole makes to the bigger system.



No part of an aeroplane can fly.

12. Most systems have multiple aims

What is the aim of a car?



Change the aim and the system changes.

Example - The Penal System

Is a prison a system?  
What is the **AIM** of a prison?



12. Most systems have multiple aims.

13. A system has multiple outputs

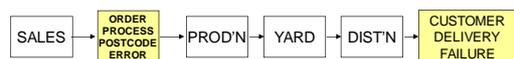
Every system is perfectly designed for the results it achieves.

All of the intended and unintended outputs a system produces (e.g. profit, loss, customer loyalty, waste, pollution, accidents, innovation etc) are the result of the way that system is designed and managed.



14. Cause and effect

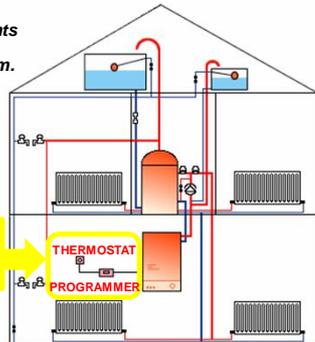
Cause and effect are separate in time and space.



- Cause and effect tend to work in loops rather than straight lines so **COMMUNICATION** is essential
- Action in one part of the system will often manifest itself somewhere else in the system and at a different time so **FEEDBACK** is essential.
- System changes often have unintended consequences so **CONTROL** becomes impossible.

What makes central heating a 'system'?

Interdependent, interconnected components which work together to accomplish a common aim.



- Feedback
- Control
- Communication

15. Behaviour & Blame

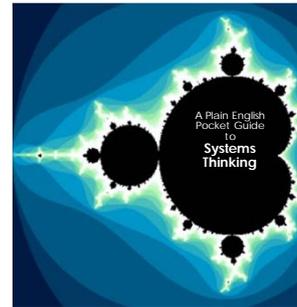
- The behaviour of people is greatly influenced by the structure of the systems they work in and how they think are being judged.
- When there are problems, or performance fails to live up to what is intended, it is easy to find someone or something to blame.
- The assumption that our problems are caused by someone else stems from the external orientation most of us adopt in dealing with problems.
- 90% of the time (or more) it is the system which is at fault, not the person.
- Feedback – Control - Communication

And finally..... Myron Tribus' Perversity Principle

- If you try to improve the performance of a system of people, machines and procedures by setting numerical goals for the improvement of individual parts of the system, the system will defeat your efforts and you will pay a price where you least expect it.

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Feel free to download a pdf copy from my website.



Some books mentioned during discussion

- Beyond Negotiation - John Carlisle & Robert Parker
- The Heart of Enterprise – Stafford Beer
- Systems Thinking Systems Practice – Peter Checkland
- No Contest – Alfie Kohn
- Language in Thought and Action – S I Hayakawa
- The Puritan Gift – Kenneth & William Hopper
- Relevance Regained – H Thomas Johnson
- The Fifth Discipline – Peter Senge

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