Metaphors and System Interventions:

Open & Closed Systems
Part 1

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UWS Hawkesbury, 1996

CONTENTS

Outline

This paper is the first of two. I begin with an overview of systems thinking and its development. This is followed by a consideration of contrasting frameworks (metaphors) for studying and describing a system. A conclusion is drawn that is adequate for the writing of the 'open' and 'closed' system paper. The second paper (yet to be written) will applies the theory and thinking from the first paper into my work practice. It will contain a description of a selected system, from which I will draw implications about its behaviour and a reflection on my learning and any implications for action as a systems thinker and sociodramatist.

The Challenge of Systems

The appeal of using a systems approach for inquiry and problem solving is essentially that, no matter the subject or level of study, the systems approach implicitly refers to higher-order principles (insights) about what determines behaviour (outcomes). A systems approach goes beyond an analysis of a problem in terms of its presenting issues and includes an examination of how that issue is influenced by surrounding factors (its environment) and their inter-relationships. Where there is the possibility of insight into a situation, then there is hope that resolution or understanding will follow.

This is entrancing because higher order thinking offers the prospect of using a powerful organising principle to bring us to a deeper understanding of the world. As learners we all know the thrill of the "aha!", the exhilarating experience where we 'get it'. Better still, we (or others) apply our insights and actually solve the problem or improve the situation. Higher order thinking can bring a number of disparate elements into alignment, perhaps as a model or theory, and let us get a qualitatively different grasp on the presenting situation. If we can develop the understanding to intervene effectively in the problems that face us, then we will have more control over the increasingly complex situations we work and live in.

Organising Principles and Metaphors

Of course organising principles have been around as long as the human race. As a species we have always had to face problems in how we feed ourselves, how to protect ourselves, what to do when someone dies, and particularly, how to make sense of the world. Organising principles tell us how to behave, and explain behaviour. Creator beings, myths, beliefs about who we are all examples of organising principles. Any study of language will find the organising concepts of that culture as expressed in story, metaphor, image and analogy. In Northern New South Wales the traditional story of the creator being in the shape of a possum sank into the earth and became the Nightcap Range provides the essential geography for a Bunjalung elder to know that for example, a ridge they are travelling on is the third claw of the hind leg of that possum. One example from Africa is the use of the image of buffalo horns as the organising principle in the traditional deployment of the armies of Shaka Zulu (as shown in the film *Zulu*). Similar analogies appear in the classic Chinese text *The Art of War* by Sun Tsu, now in revival among business circles as a metaphor for doing business.

In Australia, there are many examples of traditional organising principles being in conflict with modern European concepts. Indigenous kinship or 'skin' systems are set down in story and define social and sacred obligations so that all the community, including strangers, as well as the land is cared for. The European translation of traditional religious belief in the metaphor "dreaming" barely conveys the organising principle from which customary law, ceremonial stewardship and land ownership are derived. In the process of national reconciliation with Aboriginal and Torres Strait Islander peoples a new overarching organising principle is necessary to integrate and transform the apparent contradictions between our cultures.

Systemic ways of thinking seek to develop holistic organising principles such as are found in the enduring metaphors of traditional cultures and religious legend. Metaphors essentially describe something as being like something else - a famous example from Shakespeare is "All the world's a stage". It is a tool of language and communication. The role of metaphor itself is significant because it

> "*implies a way of thinking and a way of seeing that pervade how we understand our world. Research in a wide variety of fields has demonstrated that metaphor exerts a formative influence on science, on our language and how we think as well as on how we express ourselves on a day-to-day basis.*" (Morgan 1986 p12).

Metaphors are very useful because they allow us to understand both different ways of seeing the world and how it works (ontology) and different views on what can be known about the world (epistemology). The scientific method, starting with the classification of the world by Aristotle, gives metaphor a major role in the production of knowledge (Morgan 1986 p346).

However, it is only recently that the fundamental role of metaphor has been taken seriously.
> *"it is not until the work of Cassirer (1946), Wittgenstein (1958) and others emphasising language and other modes of symbolism in reality construction that these ideas [about metaphor as a formative influence] acquire any prominence"*   (Morgan ibid)

A systems approach is a way of making sense of the world. In using systems thinking, as with any kind of thinking, we must recognise that <u>how we represent and describe the world in terms of systems</u> will critically influence both <u>what we see</u>, and equally importantly, <u>the kind of interventions we make</u> in the world.

The systems approach formalises the idea of a holistic organising concept, often seen in the images of metaphor. Rich metaphors and analogies, whether holistic or not, are universally found as the traditional way humans have described the world.

The power and usefulness of such imagery in explaining the world was not seriously challenged until the rise of empiricism in Europe with the work of Locke, Hume and Mill. Their work addressed the fundamental question "What can we really know about the world?" It is not my purpose to document the rise of empirical science (itself a methodology for discerning organising principles) here, except to say that the principle of holism developed because analytic reductionism proved inadequate as a way of investigating all phenomena. The holistic notion that complex objects or systems are best approached as wholes with interacting parts rather than through an analysis of the constituent parts is the basis of the systems approach.

The Development of Systems Thinking

A number of threads are apparent in the development of a systems approach. In this section I draw mainly from Polkinghorne (1983) and Flood & Jackson (1991). Except when referring to publications, dates are intended as a guide only.

Holistic metaphors based on anatomy and biology can be traced back to early Greek and Roman literature where society is compared with a living body (c500 BC). It is only in the last two hundred years that scientific method provided the basis for the conceptualisation of systems beyong analogy and metaphor and the development of a method for the study of systems. The following list of events traces mileposts in the history of systems thinking:

- The emphasis on an organic analogy for society (Herder , Rousseau) in the Romantic movement (1770s - 1840s), was itself a reaction in part against mechanism and scientific rationalism.
- Hegel transformed the analogy of society as a living body into a logical principle in *Philosophy of Mind* (1817). This was further developed in his *Philosophy of History*, published after his death in 1831. His contribution strengthened the concept of holism. He developed the use of dialectical thinking, which recognised the new forms of wholeness and understood that it consists of more than the sum of the parts which make it up (for example the concept 'team'). By way of contrast, the logic of deduction is unable to account for emergent properties, such as the creation of liquid by combining Hydrogen and Oxygen atoms.
- Holism itself was first advocated by the "organicists" (from 1870s) as the proper approach for the study of living systems, because linear explanations could not explain living systems, for example, the theory of evolution, or account for the life force that an organism

possessed but could not be found in any of its parts. Among others, the brothers Haldane challenged the notion of cause and effect (1883).

> *In living organisms, it is not a matter of a prior event producing another event; instead the parts reciprocally determine each other. Each part of an organic system is determined by its interaction with other parts of the whole.*
>
> (Polkinghorne 1983 p137)

- The notion that social systems were holistic was developed by Durkheim (1895) who argued that groups have characteristics that individuals do not. A family is more than the sum of the characteristics of the individuals and has a unity that is not definable in terms of individual behaviour. Holism is contrasted with individualism (or agency) and held that the group controlled the behaviour of its part by defining roles, much as an organism its cells.
- Systems thinking, per se, is traditionally thought to have emerged in the 1940's, again as a response to the failure of mechanistic thinking to explain biological phenomena. The best known was the biologist, von Bertalannfy (1949, 1968) who sought to define the properties that hold for systems in general.

In its simplest terms, a systems approach gives its attention to the organisation or structure of a system and to the modes of information exchange that occur within the system and/ or take place between it and its environment.

While the earlier conceptions of systems were biologically driven, they soon became influenced by and refined to suit applications in many other disciplines. Today, systems concepts developed far beyond their biological roots. An investigation of even a small part of the literature on systems shows that:

- many areas of science and humanities have been influenced by the application of systems concepts and the philosophy of holism. For example, family system therapy in psychology, the study of aesthetics in design and architecture, relationships of space and human movement in ergonomics. See the next section on the diversity of systems approaches for further examples.
- there is no generally accepted definition of a system, or of a unified systems theory and the meaning of systems theory differs from region to region and in translation
- different systems theories are covered by the same name (general systems theory, living systems theory etc); or are included in other theories and known under other names (synergetics, cybernetics, information theory, resource physics etc)
- different theories describe social system behaviour in different terms and propose different methodologies for the study of systems

An Overview of Major Systems Theories

The overview by Chang-Gen Bahg (1990) is very helpful in getting a sense of the diversity of systems approaches. He divides major systems theories according to the disciplines from which they are drawn, as before, the dates given are a guide only.

Biology and/or Psychology: The earliest was *General Systems Theory* (von Bertalanffy 1949 in biology); *General Living Systems Theory* (Miller 1978 in psychology); *Structural Determinism* (Varela and Maturana 1980 in biology)

Physics: *Dissipative Structures* (Prigogine 1969 in chemistry)

Mathematics: Among others, *Chaos Theory* (Hofstadter 1981 in maths)

Cybernetics and/or Information Theory: A number of contributors in applied mathematics, engineering, *Modern Control Theory* (Kalman 1977), *System Dynamics* (Forrester 1961 in computer modelling used to manage complex systems). Recently adapted to Management Science (Senge 1990)

Social Sciences:

Economic Management: *Operational Research* (1940s)*, Input-output Analysis* (Leontief 1966)*, Economic Cybernetics* (Lange 1970); Economic Research (Rutherford 1920s, Boulding 1968, Goergescu-Roegen 1971)

Sociology: *Structural Functionalism School* (Parsons 1937*); Adaptive System Model* (Buckley 1967)

Philosophy: *Systems Philosophy* (von Bertalanffy 1949, Laszlo 1972, Bunge 1979, various Marxist and Hegelian philosophers from 1960s)

This overview cannot do justice to the more recent developments which have applied systems theories across traditional academic boundaries. Contemporary applications include family systems therapy, living systems analysis of organisations (Miller & Miller 1991), a theory of total systems interventions (Flood & Jackson 1991), the use of whole systems approach - future search & open space technology (Emery & Emery 1993, Weisbord), and of course systems thinking in management and organisational learning (Argyris 1976, 1978, Senge 1990b, 1993, Wheatley 1992). Alongside these is a burgeoning industry in research methodology and inquiry systems (Checkland 1990, Zuber-Skerrit 1990, Reason 1986, 1991, Guba & Lincoln 1989, Dalmau & Dick 1985, 1987, 1994b).

How Shall We Organise?

In this paper, I want to look at the application of system theories in organisations and management 'science' (including its various guises - organisational development, industrial relations, change management etc) A number of management authors draw heavily on cross-disciplinary research and use metaphors and analogies from biology, quantum physics, neurochemistry and eastern philosophy s to help describe organisational behavior. In fact there seems to be a coming together of disparate fields in the search for a way to manage in an increasingly complex world and where living and working is characterised by flux and change.

The need to manage our world better (at all levels) has become inescapable and urgent. This has been driven by undeniable changes in the global nature of business, the dominance of US culture, the speed of technological change, the information society and so on. These profoundly affect social infrastructures (unemployment, levels of government services, education, health etc) and economic survival. Holistic awareness of the world as a system is rising. We have come to recognise the reality of interdependence between social, economic, environmental and political levels.

How we as humans organise ourselves and how we solve the problems we face has always been the defining characteristic of any society. As such this question and how we answer it is symbolic of who we are and what we hope for in the future.

It makes sense to me that all these diverse influences converge under the umbrella of systems thinking or a systems approach - because the question "how will we organise?" is fundamentally a systems question. It is my belief that the confusion of terminology and the lack of a definition of what a system is or what comprises systems theory stems from the multiplicity of attempts to understand the way the world works in all its inter-relatedness and complexity. Each field of study holds pieces of the jigsaw of human knowing to date and the appeal is that if we can constitute even a part of the whole then we can make a difference to the problems that we face. Making sense of larger parts of the whole is the task of any organising principle and this what systems have to offer.

What Is a System?

Several authors have attempted to distill the essence of systems concepts so as to present a general concept of systems. Chang-Gen Bahg (1991) proposes 'systemology' as the science of systems. There is substantial agreement in a generalised and basic terminology. This is not true in the next step of applying systems concepts to the real world, where we return to the multiplicity of approaches seen above in the overview of major systems theories.

Following Flood and Jackson (1991), systems can be described at the most generalised level as follows:

A system consists of a number of **elements** and the **relationships** between the elements

A richly interactive group of elements can be separated from those in which few or weak interactions occur by drawing a **boundary** around the highly interactive group.

The system identified by a boundary will have **inputs and outputs** (whether physical or abstract).

The system does the work of **transforming** inputs into outputs.

The processes in the system are characterised by **feedback** (directly or indirectly) to influence the element that initiated the behaviour.

We give **attributes** to elements and relationships according to how we measure them (for example: elements by colour, weight, number; relationships by intensity, flow, strength).

Such a system is separated by its designated boundary from its **environment**.

It is termed an **open system** if the boundary is permeable and allows inputs from and outputs to the environment. A **closed system** allows no inputs or outputs and therefore initial conditions determine system behaviour - for example, gas in a sealed bottle. (There are no closed systems in nature.)

A system is able to sustain an identity by maintaining itself in a dynamic steady state (**homeostasis**) in the face of and using its changeable environment.

A system that maintains an identity and stable transformation processes over time, in changing circumstances, is said to be exhibiting some form of **control**; that system is stabilized by its control mechanisms.

Central to this is the **communication** of information between elements.

A system can be said to be purposive if it is carrying out a transformation, and is termed purposeful if its **purpose** is internally generated.

Properties relating to the whole system but not necessarily present in any of the parts are **emergent**. Synergy refers to the increased value of parts working together as a whole

Systems are generally understood to occur in **hierarchies** so that a system may be considered as a sub-system of a wider system. Sub-systems may also be considered as systems in their own right.

When applied to specific problem situations the description of systems is more difficult. There are a number of systems approaches that describe the presenting issues quite differently. Consequently the recommendations for action depend on the particular systems perspective taken.

Choosing a Systems Perspective

The choice of systems perspective is of course a subjective one that is linked to the reason for describing the system in the first place. A helpful starting point is the placing of systems descriptions in the context of thinking about change.

> *"When I try to describe a situation as a system, I am trying to find a way of thinking about it that will help me to see how it could achieve something for somebody"*
> (Carter, Martin, Mayblin and Munday 1993, p 8).

In other words the system is described with a purpose in mind. It is a way of modelling a situation so that some kind of change can be effected. I see the notion of social or organisational change as being the context for the application of systems thinking. However there is always a subjective element in any such descriptions because we each see the world differently.

Despite this subjectivity Carter et al (1993, p 9) suggest there are general types of systems depending on the viewpoint you take. These are: **natural** (ecosystems), **abstract** (computerised models), **designed** (hardware, manufactured products), systems of **human activities** (cooking, organisations, sports etc). They also make a distinction between hard (well defined and predictable, usually mechanical) and soft (subjective and ambiguous, usually people-oriented) systems.

In this paper I am looking at systems of human activities that occur in organisations and intervening in them in order to improve outcomes, or at least manage them well. Consider this list of organisational problems:

♦ Optimising the number and arrangement of customs surveillance activities and checkpoints to minimise passenger waiting time at airports and to reduce the importation of prohibited substances
♦ Designing a way to reduce the incidence of bullying at schools
♦ Making decisions on the allocation of resources to indigenous health issues
♦ Building a healthy workplace culture to integrate recruitment of Aboriginal staff in Telecom
♦ Reaching an equitable decision on noise and other social issues around the Third Runway in Sydney
♦ Control over the traffic congestion in the inner city

It is obvious that there are no simple common sense solutions to such situations. It is the diversity and complexity of these situations that stand out. Secondly there is not likely to be one kind of systems analysis that can help us deal with them productively. There are many methodologies that fall under systems approaches. The following list by Flood & Jackson (1991) includes some I have never heard of, and omits others such as Whole Systems Approach (Open Space Technology & Future Search), Forcefield Analysis and SWOT Analysis (Strengths, Weaknesses, Opportunities & Threats) although these in turn may be included under other methods.

- Operational Research (OR)
- Systems Analysis (SA)
- Systems Engineering (SE)
- System Dynamics (SD)
- Viable Systems Diagnosis (VSD)
- General System Theory (GST)
- Sociotechnical Systems Thinking (Socio-Tech)
- Contingency Theory
- Social Systems Design (SSD)
- Strategic Assumption Surfacing and Testing (SAST)
- Interactive Planning (IP)
- Soft Systems Methodology (SSM)
- Critical Systems Heuristics (CSH)

Flood & Jackson (1991 p. xi) propose that our capacity to manage organisations well will be enhanced if:

– we admit to the diversity of the 'messes' confronting managers,
– we continue to develop a rich variety of methodologies, and
– we constantly ask "What kind of problem situation can be managed with which sort of methodology?"

In answering this question Flood & Jackson develop a system of systems methodologies that allows us to make sense of the overwhelming spread of systems approaches. Recognising that systems

views are essentially ways of describing the world they identify five main metaphors that seem to capture at a general level the insights of almost all management and organisation theories. These are

Metaphor	with a focus on
Machine or "closed system"	– tasks, regulation
Organic or "open system"	– self regulation to balance internal needs and external demands
Neurocybernetic - **Brain** or "viable system"	– learning and control
Cultural metaphor	– social reality, identity and purpose
Political metaphor - with three sub-metaphors: **team**, **coalition**, **prison**	– interests, conflict and power

Each of these metaphors has strengths and weaknesses in terms of how it describes the problem, what it ignores and the kind of interventions it offers to the manager or organisational developer. These are summarised in Appendix I.

Secondly they group the problem contexts on two criteria.
a) according to the relative complexity of the system(s) that make up the problem, using a continuum between simple and complex
b) according to the relationships between participants who would be affected by a systems intervention. Using industrial relations terminology, these relationships can be described as

unitary   the participants have commonly held objectives, for example a well integrated team

pluralist   divergent group interests with the organisation as a mutual focus point, for example a loose coalition. Conflict may be inherent but can have beneficial effects.

coercive   participants have opposing and mutually conflicting interests, for example in a prison. Conflict is inevitable, power is unequal, domination and punishment is the norm.

This in turn can be drawn up as a grid on which to chart the problem situation. The next step is to analyse the systems methodologies according to the assumptions they make about problem contexts and plot them on the grid.

	UNITARY	PLURALIST	COERCIVE
SIMPLE	• OR • SA • SE • SD	• SSD • SAST • Whole Systems Approach	• CSH
COMPLEX	• VSD • GST • Socio-Tech • Contingency Theory	• IP • SSM	?

We can see that most of the systems methodologies are designed for problem situations with unitary cultures. This makes sense because managers are the ones who work most closely with organisational goals and often assume that these are shared by employees. Managers are held accountable for resolving problems, they predominantly operate in top-down hierarchies, and consequently theirs is the opinion that counts. Most organisations like to project a coherent and

united image, or even a happy family. Managers maintain this line and tend to seek out methodologies based on the assumption of a unitary culture.

Fewer methodologies take account of the participative structures necessary to accommodate pluralist cultures. It is difficult to get adequate participative processes for a joint union-management approach to workplace issues (for example in Telstra). Future Search conferences play their part but when it comes down to day-to-day implementation there are logistic difficulties in getting the plurality of views adequately heard. Organisational politics usually gets in the way and resolutions bear the stamp of vested interests. An example is parliamentary democracy in Australia. In coercive systems power is of such over-riding concern that the call for systems interventions would appear unusual.

Organisational politics is inevitable and a necessary part of system life, yet one that managers and change agents would rather did not exist. This is in itself an intriguing issue. While it is not my purpose to examine it in detail, a brief consideration of the characteristics of organisation politics shows the following:
- it is resilient and unmanageable in that it is a form of system life that cannot be contained by structure and procedures (informal networks and systems of influence);
- it is unpredictable. The struggle for power and position create tension and stress that draw on human ingenuity, spontaneity and risk-taking;
- it is linked to human needs for identity, belonging, importance and hence there are often large personal stakes;
- because of the previous characteristics, systems concepts do not yet offer reliable tools for harnessing it to support desired processes and outcomes.

It will be interesting to see what conclusions emerge from this aspect of the system described in Part II of this paper.

Metaphor as a Lens

Similarly the five dominant metaphors can be charted according to the kind of system and the relations between affected participants (actually seven metaphors in total as the political metaphor comprises the three sub-metaphors - team, coalition and prison).

While some organisations (schools, universities) arguably have characteristics of all of the metaphors, it can be said that some organisations have a dominant flavour. From this viewpoint:
- machine-like organisations tend to be simple and unitary (courthouses, Hungry Jack's),
- organism-like organisations tend to be unitary but more complex (taxi firms, football teams)
- brain-like organisations complex and unitary (advertising agencies, software development firms, TV networks & newspapers)
- culture-like organisation would tend to be pluralist and complex (the United Nations, peak welfare bodies)
- prison-like organisations would be coercive (some cults, gangs, refugee detention centres, the child protection arm of the Department of Community Services).

	Unitary	Pluralist	Coercive
Simple	*Machine*		
	T		
	e	*Coalition*	
	a *Organism*		*Prison*
	m *Culture*		
Complex	*Brain*		

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The purpose of this framework (named "Total Systems Intervention") is not to provide any instant answers to system problems. Instead, the idea is to inform the practitioner of the choices available, enrich analysis by using a variety of metaphors and avoid the drawing of narrow or premature conclusions about the issues being faced.

Reflection

The use of metaphors to investigate how organisations work as systems I find very exciting. Firstly it uses metaphor as an organising principle to group the diversity of systems concepts into more manageable categories. This is a relief as it reduces confusion at the overwhelming diversity and complexity of the field. Secondly it reinforces the view that it is the perspective used that is crucial and, more importantly, that we have a choice about which metaphor we use - we can use one, several, or even, all of them. The dominant flavour of an organisation also depends on viewer. Reality depends on who is looking, the point from which they look and why they are looking. It therefore becomes possible to critique a systems description in terms of the point of view taken. Thirdly, Flood and Jackson argue that the five basic metaphors capture the essence of the major organisation theories used by managers and consultants. An analysis using these metaphors shows a way of distinguishing the various kinds of interventions and the elements that get highlighted or overlooked. By being more aware of the metaphor we typically operate under, we can see the nature of our normal work practice and the limits of our interventions.

The first three metaphors fit within an objectivist view of reality, while the last two are more subjectivist.

Machine interventions focus upon strict, itemised programs and policies, standardisation of procedures and full monitoring and control. It is typically management by objectives.

Organic interventions focus on collecting data about the environment, setting of strategy to fit the external environment, alignment of sections so that they are consistent with the overall purpose of the organisation. Rethinking of transformative processes as long as outputs are maintained.

Brain interventions focus on information processing capacities. Structures are designed to make decision-making process manageable in the face of uncertainty. Autonomous subsystems are set up with the capacity to learn, reflect on practice and challenge norms - to self renew within certain boundaries.

Cultural interventions focus on attempts to bring about a shared reality. It takes the view that the perceptions of the employees have to be managed. These interventions often accompany changes in structure, technology or policy.

Political interventions are a constant factor of organisational life. Compromise, opportunism, appeasement of interest groups, maintenance of the status quo, power grabs are commonly reported in the press. System methodologies are not usually applied to problem situations until political interventions are known to have failed.

Much of the work with metaphors as a lens with which to examine organisations was done by Morgan. Apart from the five major metaphors cited above he also looked at organisations as:

Psychic Prisons	– places where we are trapped by groupthink and conformity. Where we use the organisation to protect us from anxiety and change (the negative side of organisational culture).
Flux and Transformation	– where self-image shapes almost all functioning and self-renewal is a learned capacity
	– networks of mutual causality
	– dialectical process of unfolding contradiction (efficiency vs equity, fiscal accountability vs autonomy)
Domination	– places of privilege and exploitation, where associated health, environmental and social costs are ignored.

Each time I read of organisational life through another metaphor the truth of the description is self-evident. I pick up on one aspect of the 'flux' metaphor below as it seems to me to be the most actively developing of organisational theory. There is also substantial overlap with some of the other metaphors (eg culture and psychic prison; machine and domination) and the same events can be seen in a number of ways. I can see that in any given situation I and the organisation and its participants would each have a bias to using certain kinds of metaphor. I will examine these biases in context of making a systems description in Part II of this paper.

Further Extensions of Systems Concepts

In the course of researching systems methodologies I became aware of two further extensions of systems thinking.

In the development of soft systems methodology Peter Checkland observed two fundamental paradigms in systems thinking. In the hard paradigm:

> *"the real world is assumed to be systemic and the methodologies are used to investigate that reality are systematic."*   (Flood & Jackson 1991 p170)

The systems are assumed to actually exist out there in the real world. In contrast however, the soft paradigm is based on the view that:

> *"the real world is problematical but the process of inquiring into it, the methodologies may be systemic. The notion of systemicity is transferred from the world to the process of inquiry into the world"*   (ibid)

The existence of a system is held within the mental constructs used to model and interpret reality. Hence it lies within a constructivist epistemology.

This is taken a step further by the work of Ulrich in critical systems heuristics. He believes that the logic behind the use of systems needs to be open to question. He developed a system of inquiry to reveal 'boundary judgements' made by planners about what is and is not relevant to the design task and the scope of responsibility accepted, and ask to what the boundaries should be.

> *"In systems science ... which is dominated by limiting mechanistic and organismic analogies, the systems idea is used in the context of 'instrumental reason' to help us to decide <u>how to do things</u> ... [rather than using] 'practical reason' to decide what we <u>ought to do</u>. ... And procedures can be developed which should allow those who have to live with the results of plans to challenge the 'systems rationality' of the planners."*
>   (Flood & Jackson 1991 p 198)

These two extensions of the systems approach make a decisive break towards the constructivist view that we cannot know the world as a reality 'out there'. Needless to say the bulk of systems methodologies still describe systems as if they really exist.

Reflection

So far so good. I turned back to my original questions and see that I haven't yet come to grips with the question of 'open' and 'closed' systems. It seems clear that social systems and organisations are open systems by (hard paradigm) definition. They are all affected by their environments. Nevertheless observation of people at work or in their everyday interactions shows up a lot of behaviour that is intransigent and resistant to information and input. Individuals are systems and much of their behaviour appears 'closed'. This issue is taken up by Maturana and Varela.

Autonomy, Self-Reference & the Capacity for Self-Renewal

The work of two Chilean biologists, Maturana and Varela, into the way living systems are structurally determined has been a major provocation to systems thinking. Much of this section is drawn, again, from the work of Morgan (1986) who discusses their work and its implications for organisations under the metaphor of 'flux and transformation'.

Maturana and Varela see the traditional notion of a system being open to its environment as a description based on the viewpoint of the outside observer. Their work challenges the distinction between a system and its environment and strongly argues for a constructivist epistemology.

Returning to the issue of 'open' and 'closed' systems, in their view:

> *"all living things are organisationally closed, autonomous systems of interaction that make reference only to themselves ... [This generates] the ability to self -renew. ... The aim of such systems is ultimately to produce themselves: their own organisation and identity is their most important product"*   (Morgan 1986 p.236)

Of course systems exist within an environment (surrounding medium) and take in inputs and generate outputs. They are not closed in this sense. They are closed in an organisational sense in a process of self-reference that maintains a stable pattern of relationships. In other words, that maintains their identity.

Maturana's work on the biology of perception led him to the conclusion that relations with the environment are internally defined.

> *"[The] brain creates images of reality as expressions or descriptions of its own organisation and interacts with these images, modifying them in the light of actual experiences"*
>   (op cit p238)

Furthermore,

> *"[a] system's interaction with its environment is really a reflection and part of its own organisation. It interacts with its environment in a way that facilitates its own self-production, and in this sense we can see the environment is really a part of itself."*
>   (ibid)

Individuals and organizations project their identity outwards onto the world and interact with this projection as if it were the world out there. What, then, are the implications of Maturana and Varela's work for organisations? Morgan again,

> *"If systems are geared to maintaining their own identity and if relations with the environment are internally determined, then systems can evolve and change only along with self-generated changes in identity. How does this occur?*
>
> *"When we recognise that identity involves the maintenance of a recurring set of relations, we quickly see that the problem of change hinges on the way systems deal with variations that influence the current mode of operation. ... attention is drawn to system processes that try to maintain identity by ignoring or counteracting threatening fluctuations, and to the way variations can lead to the emergence of new modes of organisation. ... The theory of autopoesis locates the source of change in random variations occurring within the total system. Human ideas and practices seem to ... exert a major transformational effect once they acquire a critical level of support."*
>   (op cit p239)

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Organisation, Identity and Culture

While Maturana and Varela have strong reservations about applying their theory of structural determinism beyond the interpretation of biological events to social phenomena, there are strong correlations to organisational life. Morgan, again:

- *Organisations are always attempting to achieve a form of self-referential closure in relation to their environments, enacting their environments as projections of their own identity and self-image*
- *Many of the problems that organisations encounter in dealing with their environments are intimately connected with the kind of identity that they are trying to maintain.*
- *Explanations of the evolution, change and development of organisations must give primary attention to the factors that shape an organisations self-identity and hence its relations to a wider world.* (op cit p240)

Interestingly this brings us back to the work of management theorists grouped under the metaphor of culture. Identity is a fundamental aspect of culture (individual or group). It is difficult to define what culture is other than to say it is embedded into system life. Culture is a broad concept which includes organisational politics and basic assumptions about what the system is there for: its identity and purpose. Dalmau and Dick (1987 p 12) warn that

"working with organisational culture always involves unpredictability and risk"

Culture is slow to change and it is notoriously hard to make a direct intervention as much of it is held out of awareness (see also Dalmau & Dick 1985, 1991, 1994b). Dalmau and Dick (1994a p6) cite the types of situations where there is evidence that cultural interventions have produced desired change.

- ♦ in small organisations where there is a unitary culture
- ♦ where the change is to a sub-culture within an organisation, and it can be treated as a unitary culture and involve everyone
- ♦ where a counter-culture is established with new people being introduced into the culture or a small group of opinion leaders adopting the change. For example in the agricultural extension model where the counter-culture subsequently displaced the dominant culture.

When considered in the light of the Total Systems Intervention grid used above, this suggests that our management of cultural change processes is somewhat developed only in unitary systems. Pluralist systems are currently beyond us. Coercive systems of course have no regard for cultural change.

Open vs Closed Systems

The contrast between descriptions of systems as 'open' or 'closed' thus has several threads. Firstly it can also be said no living system is actually closed to its environment in terms of taking in inputs, transforming them and generating outputs. This accords with the organismic metaphor although change is seen as adaptation to changes in the environment, hence externally driven.

Secondly, from the work of Maturana and Varela, all living systems can be said to be organisationally closed because their primary focus is the maintenance of an identity projected onto the wider world. It is this kind of closure that lends itself to self-renewal and learning rather than adaptation. Change is internally generated, either randomly or by design. Because of the emphasis on identity this view is more in accord with the cultural metaphor.

Thirdly, some systems can be described metaphorically to be acting as if they were machines, as functionally closed. (There are, of course, actual mechanical systems acting without choice which do support human systems, but these are not considered here.) There are times when people describe their jobs as mechanical and their role as similar to a robot. This highlights the use of

metaphors to bring out the felt experience of individual (component) systems within organisations. As this relates to purpose and identity such comments lend themselves to the notion that living systems are organisationally closed.

What becomes obvious is the key role that identity and purpose have in human system behaviour. For example, the behaviour of an organisation when under threat from external change such as a rival developing new technology, or from internal change, for example a new style of leadership or a research program losing money would depend on the structure and identity of the organisation and how such situations were perceived. We could describe an organisation's structure and identity as defended or expansive, as more open or closed to new influences, as rigid or flexible. An identity open to change would regard conflict and threat as an opportunity to consider and adopt new ideas and rethink its purpose.

A brief consideration of any organisation shows that both things are true at the same time. Schools are largely closed by virtue of the traditional processes of classroom management where the teacher maintains control and punishes variant behaviour. Yet certain individual teachers have opened up classroom dynamics for more self control and learning. In a way the identities of the students involved have become larger, moving from the role of dependent learner to a more independent learner. The integrity of the individual living system is maintained even though they are now behave in alignment with a somewhat larger purpose.

In drawing this conclusion I now propose to examine a single organisation, describe the ways in which its systems are 'open' and 'closed' and analyse how its behaviour is aligned with its identity, purpose and the forces for change both internally and externally.

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