OPEN OR CLOSED SYSTEMS? BRIDGING THE GAP

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It is an honour to deliver the Ashby Lecture, a memorial to a great man with a great mind. He also appears to have been a straight talker with a wicked sense of humour – I found this on the net: "An Intelligence Test measures the degree to which Tester and Subject think alike" (cybsoc). I would have liked this man!

Open Systems Theory (OST) is a conceptual framework that includes Ashby's work amongst its foundations. However despite its solid foundations, OST seems to have become almost invisible since Fred Emery returned to Australia in 1969. Up until that time, it was well known in the Northern hemisphere. Certainly Emery & Trist's 1965 citation classic was much cited although not used, as was also that subsection of OST concerned with the development of jointly optimized sociotechnical systems.

The reasons for this period of relative invisibility don't matter but as OST has made some significant progress since 1969, it seems a shame that such solidly based and reliably successful developments are not widely known to today's international systems community. I hope to start building a bridge across that current knowledge gap.

History, Purpose and State of the Art

OST has been under continuous development in Australia since 1969. OST, otherwise known as the socioecological approach, is an alternative to a closed systems social science. Any social science question can be approached from either a closed system or open system perspective. The overall goal of OST is to develop a social science that actually works in practice – reliably.

To do that, we have had to go beyond von Bertalanffy's conceptualization of an open system to that presented by Emery & Trist (1965). Therefore, this paper has three purposes:

1. to explain why it was necessary to deviate from Bertalanffy based approaches hereafter called GST
2. to give a brief idea of our progress since 1969
3. to show that although it appears that systems thinkers must choose between open and closed systems approaches, there is a bridge over that gap that benefits all parties.

To put the Australian work in context let us remind ourselves of the major landmarks of OST that already existed by the end of 1969. Those landmarks in turn take their place against the 'thin red line', the name Fred Emery and Eric Trist gave to the development of a realist, science, one based in material universals, from time immemorial.

History – the *Thin Red Line*

Historically, we can discern two major streams of accumulating knowledge based on two views of the nature of reality (see Table I). The streams are sometimes called Platonic and Aristotelian (Emery M, 2000a). They embody 'realism' and 'idealism' (Mead, 1932).

Idealism runs through philosophers such as Kant to the physicist Newton, to social scientists such as Thorndike, Freud, Hull and Lewin sometimes (Trist, 1985; Emery M, 2000b). Realism runs through the philosopher Leibnitz to the physicists Maxwell, Faraday and Wigner who explored electrical *fields*, and then to the polymath philosopher Charles S

Peirce. In the modern era of social science there are many such as Asch, Ashby, Chein, Gibson, Jordan, Pepper and Tomkins whose realist contributions provide some of the foundations of OST. The chronology brings us up to the flowering of OST at the Tavistock Institute in London in the period 1951-1969 (Trist & Murray, 1990; 1993; Trist et al, 1997).

Table I. Material and Abstract Universals		
	Material Universals - ***Thin Red Line***	*Abstract Universals*
The question is:	'What does it do?'	'What is it?'
Identification:	What in a particular context has effects on the focal thing or event and what changes in that thing make what changes in the context - grasped in the grasping of the particular	The 'thing in itself', its essence, context free - what is true about a thing or event under any circumstances
Language based on:	Serial genetic constructs	Generic things, nouns
Proceeds by:	Structural corroboration - corroboration of 'facts' by its relation to other 'facts'	Multiplicative corroboration - confirmation of the same 'facts' by replication
Assumption - sufficient conditions of behaviour are:	In system-in -environment	Within the organism or social unit
Units:	*Transact*	*Self act* or *interact*
Novelty or emergence:	Recognized as novelty or emergence from *transaction* or *coevolution*	Handled by reductionism or postulation of other entities
Area of research:	Social science	Disciplines, specializations
Emphasis:	Synthesis	Analysis
People:	Open systems with permeable, dynamic boundaries	Imprisoned within impermeable, static boundaries
	Can purposefully change their environments	Subject to 'drives' and forces
	Can consciously *extract* knowledge from environments	*Tabulae rasae*, must be taught

"As Table I shows, each of the streams provides a constellation of internally consistent dimensions. "One of these views accepts as real, physical bodies and their activities; the other nontangible formal qualities and logical and mathematical truths" (Chein, 1972, p146). Human knowledge develops from the identification and classification of particulars and these competing views of reality identify entirely different types of taxonomies. Cassirer and Lewin define them as the "class concept and the series concept" which are also described as phenotypical (superficial appearances or similarities) and genotypical or 'genetic' (Lewin, 1931, p10-11).

These classes or laws are called 'universals' and there appear to be only two basic forms of universal, known as *material* and *abstract*. *Material universals* describe a material or real world (Feibleman, 1946, p451) and derive from particular dynamic instances or events. They identify the limits of reality within which a claim to 'truth' is made so that the search for material universals inclines more to 'verities' than to an abstract 'truth' (Chein, 1972, p19-336). Despite the recent sorties of physics into a 'theory of everything' (Wertheim, 1995), science generally proceeds by structural corroboration (Pepper, 1942, p39-70) or the identification of invariants (Gibson, 1966). Science uses a language based on *serial genetic constructs* or functional entities that have testable relations with other entities, including context (Cassirer, 1923). This language is very different from the everyday usage of nouns to express the *generic* nature of things…Identifying things as nouns out of context involves us in circular arguments as properties such as extroverted behaviours define an 'extrovert' and

the 'fact' that a person is an 'extrovert' explains the extroverted behaviours" (Emery M, 2000a).

The two streams have far reaching consequences, particularly for social science which must deal with the fact that people create. The schools of thinking flowing from abstract universals are based on *self action* and *interaction.* They assume that "the sufficient conditions of behaviour are within the 'organism' or, in social determinism, in the (so called) 'social organism'. With self action and interactionism the emphasis is on analysis: with transactionalism the emphasis is on synthesis. This is not the synthesis of metaphysics - it is (the synthesis of) systems" (Emery F, undated). We explore below what these choices mean for theory and practice.

History – 1939-1969

In the period 1939-69, we can distinguish some solid foundations for a building program.

- 1938-9. The group 'climate' experiments - three structures only - autocratic, democratic and laissez faire (Lippit & White).
- 1950. Incomplete open system – (von Bertalanffy).
- 1951. First natural experiment leading to emergence of open sociotechnical systems (Trist & Bamforth)
- 1959. 'The characteristics of sociotechnical systems' (Emery F)
- 1959. First Search Conference, report 1960 (Trist & Emery)
- 1965. Completion of conceptualization of open system - 'The causal texture of organizational environments' (Emery & Trist)
- 1966. 'The rationalization of conflict' (Emery F)
- 1962-7. Norwegian Industrial Democracy Project using the method now called STS in Europe and USA (Emery & Thorsrud, 1969, 1976)
- 1967. Experimental phase finished, diffusion phase begins. Discovery and publication of the genotypical, organizational design principles (Emery F). STS stagnates in Scandinavia, goes to USA and remains unchanged, minor variations only.

This was a particularly formative period in which the two most basic concepts of the open system and the genotypical design principles were discovered and there was an early glimpse of active adaptive possibilities in the first Search Conference followed by exploration of the rationalization of conflict during the Search meetings of the parties to the Malaysian, Singapore and Indonesian confrontation.

Brief Australian chronology

An Australian group formed around Fred Emery when he returned home in 1969 and quickly engaged in building on the above foundations. There were two urgent, interrelated priorities; the first was to design a quick and easy method for organizational democratization, to replace STS. It had to be one designed for diffusion in a Type IV social field with its characteristic relevant uncertainty. The second was to rapidly develop the Search Conference for active adaptation in that social field. One of the immediate tasks was to try to restore the totally fractured national industrial relations (IR) system. Another was to put local planning on a cooperative, future oriented footing.

In pursuing these priorities, we stuck to material universals, the tried and the true. In so doing, we deviated from both Trist and Ackoff. For example, we stuck with the time-based Search Conference where probabilities of various scenarios change over time while Ackoff went with time-free 'idealized design' (Ackoff, 1974, p30). Neither Ackoff nor Trist ever used the design principles which underpinned all our work (Trist, 1986). The Australian group stayed with Angyal's system principle, the unique relation between L_{22} and L_{11}, and the

organizational design principles that determine the shape of the L_{11}, (see Figure 5) while Trist worked on referent organizations and domain theory (Trist, 1983). The coherence that had developed around the Thin Red Line had disappeared (Emery M, 2000a).

The following list conveys only a flavour of the major developments and the spirit of the times in which it was conducted.

- 1971. First Participative Design Workshop (for organizational democratization)
- 1972. First Search Conference in Australia
- 1973. First Industrial Relations Search Conference
- 1973. Democratization begins in a university (Williams)
- 1974. 'Participative design in work and community life' (Emery & Emery)
- 1974. Designed the Community Reference System so that communities could select their own unbiased set of participants.
- 1974. Worked out DP2 in governance systems, the alternative to representative democracy - 'Adaptive systems for our future governance' (Emery F)
- 1976. Spelt out communications in DP1 and DP2 systems, etc - 'A Choice of Futures' (Emery & Emery). Also contained first exploration of neurophysiological effects of television.
- 1976. First write up of development of the SC - 'Searching' (Emery M, Ed)
- 1976. Systemic alternative to factor analysis - 'Causal path analysis' (Emery F)
- 1977. Second Industrial Relations Search
- 1977. Reasons for emergence of Type IV environment (cultural revolution) - 'Youth - vanguard, victims or the new vandals?' (Emery F)
- 1976-77. Final conceptualization of ideals, active adaptive planning, etc- 'Futures we are in' (Emery F)
- 1979. Self management in conference and course design (Davies A)
- 1979. Measured ideals and maladaptions in a nation (Emery & Emery)
- 1980. Ecological learning vs learning of abstract knowledge- 'Educational paradigms' (Emery F)
- 1980. Developed OST test of personality as observable behavioural preferences (Emery & Emery)
- 1982. Relation of design principles to economic systems - 'Sociotechnical foundations for a new social order' (Emery F)
- 1982. Dynamic and behavioural implications of organizational design principles, SC, mixed mode, multisearch, etc. 'Searching' (Emery M)
- 1983. First Accord signed between government and Australian Council of Trade Unions- 'Award Restructuring'. Result of 10 years of work by many parties that started with first IR Search (1973). Achieved amongst many things the repeal of the Master-Servant Act and freed up conditions for registering legal DP2 structures through Enterprise Bargaining Agreements.
- 1986. Role of the affect system in diffusion - 'Towards a heuristic theory of diffusion' (Emery M)
- 1987. Democratization of university at system level (Treyvaud & Davies)
- 1989. 'Participative design for participative democracy' (Emery M, Ed)
- 1989. Retroduction as alternative to deduction and induction- 'A logic of hypotheses' (Emery F) – published 1997.
- 1991. Concept of active adaptation completed in theory and practice - the 2 stage model (Emery M)
- 1993. 'Participative design for participative democracy' (Emery M, Ed)
- 1994. Policy making in open systems (Emery F)

- 1994. Replaying Rio - a blueprint for grass roots sustainable development (Emery M)
- 1999. Searching: the theory and practice of making cultural change (Emery M)
- 2003. First publication of evidence that design principles are fundamental throughout all realms of nature (Emery M)
- 2006. Blueprint for (re)designing schools as adaptive systems for learning (Emery M)
- 2006. Developed organizational health and innovation survey with full formula for design principles (Emery & Aughton)
- 2007. First publication of Unique Designs (Emery & deGuerre)
- 2007-8. Confirmed Trist & Bamforth that design principles are a major determinant of mental health in the workplace (de Guerre et al).
- 2008. Confirmed that design principles are a major determinant of creativity and innovation in the workplace (Emery M)
- 2010. Confirmed that the human relations school cannot solve the growing problems of turnover and absenteeism; only change of design principle can do that (Emery M).

Most of the major areas of social science have been investigated. The repetition of titles indicates quantum leaps in our understanding.

Today - the state of the art in OST

The basis of OST is of course, the open system in environment and at the heart of open social systems are purposeful people. Our open systems social science has a clear purpose and some well established means towards it. The big picture rests on some solid building blocks.

This section starts with the building blocks of OST, overviews the system of concepts, its long term purpose and the translation of these into the three major methods, the Search Conference (SC), the Participative Design Workshop (PDW) and Unique Designs (UDs).

Building Blocks

System. Angyal (1941b, p38) has given us the clearest exposition of an open system - "The logical formulation of a given system states the construction principle or the system principle of the whole. Every system has one and only one construction principle." As every open system has some balance of autonomy and heteronomy, governing from within or without, the system principle, therefore, expresses the unique relationship between the system and the environment. All systems have permeable boundaries. Organizations may or may not be systems.

People are taken to be *open, purposeful systems* who "can produce (1) the same functional type of outcome in different structural ways in the same structural environment and (2) can produce functionally different outcomes in the same and different structural environments." They display *will* (Ackoff & Emery 1972, p31). By constantly acting as active, responsible agents, not simply helpless, powerless reagents (Chein 1972, p6), they change the environment. The current environment is a result of the will and power of the people (Emery F, 1977). You will note that this definition of people is a serial genetic one: it bears no relation to any of the infinitude of definitions of 'human nature'.

While people as one arm of the basic directive correlation display will and act on their environment, they are also acted upon by that environment. They are part of the whole whether they like it or not. Mental health is "the capacity both for *autonomous expansion AND* for *homonomous integration*". (Angyal 1965, p254) No person is an island! 'Autonomous' means governed from inside. It is a concept of purposeful activity, a general systemic direction towards expansion through coherence. But "life is an autonomous dynamic event which takes place ***between*** the organism and the environment" (Angyal, 1965, p48, my emphasis). Autonomy without corresponding homonomy actually restricts and inhibits

personal growth. Focusing simultaneously on the environment and system creates the potential for an adaptive balance in any environment.

People are not limited to being purposeful, however. They have the *potential for ideal seeking.* As purposeful systems they can be confronted by choice between purposes and they may choose outcomes which are endlessly approachable but unattainable in themselves (Emery F, 1977, p69). They spring from our capacity for potential directive correlation (Sommerhoff 1969), to *imagine and expect***.** In certain conditions, in DP2 structures (below), these outcomes are the ideals.

The ideals are *homonomy***,** a sense of belongingness and interdependence; *nurturance,* cultivating and using those means which contribute to the health and beauty of the whole and all its parts; *humanity***,** expressing what is fitting and effective for us as people; regarding people as superordinate to institutions and materialism; *beauty***,** that which is aesthetically ordered and intrinsically attractive (Emery F, 1977).

The necessity of a shift from von Bertalanffy to Emery. There is one other property of human beings and that property creates the need for a genuinely open systems social science: it is the demonstrable fact of consciousness defined as "awareness of awareness" (Chein, 1972, p95; Emery M, 1999, pp70-80). von Bertalanffy's (1950) formulation of an open system was a brilliant step forward and probably still covers the great mass of animate creatures on Earth. He is rightly called the *Father of Open Systems* but his conceptualization deals only with people as bodies. There can be little doubt that we are physically adapted to our planet but when we contemplate consciousness, it becomes obvious that we must go beyond von Bertalanffy.

Why do people change their minds? How do we explain this phenomenon? When we see people arguing about the meaning of what happened yesterday or when we document social change over time, there can be little doubt that we also stand in some state of adaptation to a world of our own making; a world of ideas, ideals and values. We know the physical world not only directly but also through our ideas about it and how we value it. And all aspects of this world of ideas, ideals and values change over time. Without a conceptualization of that world, there is no answer to the question of what people are adapted to. For the human being, von Bertalanffy's conceptualization is effectively closed.

We need a social science that accurately describes and explains the *human reality.* To achieve such a social science, the conceptualization of the social environment must be added to Bertalanffy's concept of the open system.

The open system (Figure 1A) shows that system and environment and their interrelations are mutually determining and governed by laws (L) which are able to be known. When the system (designated '1') acts upon the environment (designated '2') we say the system is planning (L_{12}). Environment acts upon the system and is known to us through ecological learning (L_{21}). L_{11} and L_{22}, express the intrinsic natures of the system and environment respectively. The laws that govern them are implicitly learnt about in the Search Conference.

The environment, the L_{22}, is defined as the extended social field of directive correlations with a causal texture (Emery & Trist 1965; Emery F, 1977) where the nature of the extended social field affects the behaviour of all systems within it. This conceptualization provides both a conceptual, historical and practical framework for cultural change and its fluctuating adaptivity.

The social field is a directly observable, objective entity in its own right. As a field, not a system, its laws are very different from the laws governing systems. The inclusion of a discrete social environment is the major defining difference between an open and closed systems social science. What Emery & Trist achieved in 1965 was the completion of the conceptualization of the open system that von Bertalanffy so admirably started.

Directive correlation expresses the mutual shaping of a system's behaviour and its environment towards a goal. In the directive correlation mode1 (Figure 1B), it is a necessary condition for the subsequent occurrence of a certain event or goal that two or more variables, environment and system, should at a given time be in exact correspondence to be in an adaptive relationship. The environment and system are directively correlated with respect to the goal and the starting conditions (Sommerhoff, 1969), that is, system and environment are correlated in terms of direction. They are acting to bring about the same state of affairs from the same starting point.

From the original condition at t_0 which consists of the system and its environment, both system and environment are making changes at t_1. These result in a new set of conditions consisting of a changed system and a changed environment at t_2. In the case of Figure 1B the changes are directively correlated and, therefore, adaptive. There are of course, an infinite number of cases in which system and environment are not directively correlated and, therefore, stand in a maladaptive relationship.

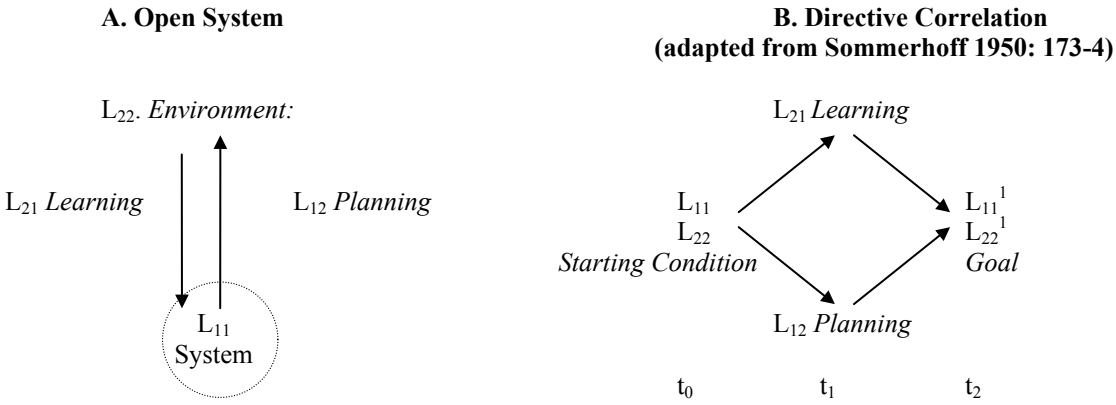


Figure 1. The Basic Models of Open System and Directive Correlation

There is only one concept, the mutual determination of system and environment, but the models have two critical differences:

1. the open system is a picture of a point *in time* with change expressed through learning and planning while the directive correlation is a picture *over time*, and
2. the open system includes adaptive and maladaptive relations while the directive correlation expresses precisely when adaptation is or is not occurring.

The two models are tools that allow us to perform a wide range of tasks both synthetic and analytic.

With the conceptualization of the L_{22} and documentation of its changing causal texture over time, OST escapes the many dilemmas involved in closed systems based on GST. Not the least of these is that many closed systems theories are attempting to deal with problems which are a product of social change and whose solution will involve further change. But closed systems are by definition static, incapable of conceptualizing change (Pepper, 1942). So without a concept of a social environment, these problems and their solutions can never be adequately addressed.

The two genotypical organizational design principles. The first design principle, DP1, (Figure 2) is called 'redundancy of parts' because there are more parts (people) than are required to perform a task at any one given time. Individuals have fragmented tasks and goals. The critical feature of DP1 is that responsibility for coordination and control is located

at least one level above where the work, learning or planning is being done. A DP1 system is one governed by asymmetrical dependence. Therefore, the DP1 organization is autocratic or bureaucratic: it is the master-servant relation in action. In other words, in DP1, those above have the right and responsibility to tell those below what to do and how to do it. It is a structure of personal dominance, a dominant hierarchy. Controls might be sloppy or tight but the principle is the same. DP1 enshrines inequality.

Control (vertical) and co-ordination (horizontal) are the two dimensions of organization and responsibility for both is vested in the supervisor. S/he controls subordinates by specifying what the individuals will do, vis-a-vis the jobs allotted to them. S/he achieves coordination across the section by manipulating the work loads of individuals to take care of the interdependence between individual jobs.

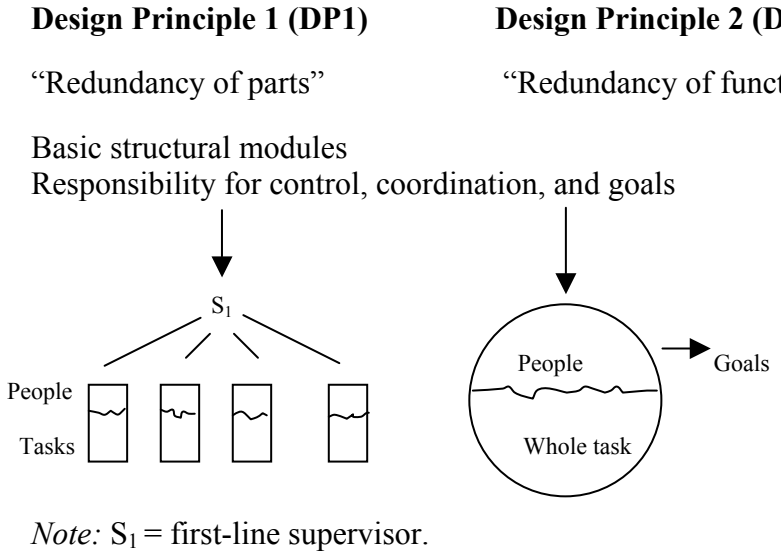


Figure 2. Genotypical Organizational Design Principles

When we analyse this structure, we see immediately that it produces competition. At the most trivial level, there is only one supervisory position and individuals are in competition for it. As soon as people are forced to compete, they have to look after their own interests and so self interest comes to dominate life in a DP1 structure. All the team building in the world cannot change this dynamic.

The second principle (DP2) is called 'redundancy of functions' because more skills and functions are built into a person than that person can use at any one given point in time. In DP2, responsibility for coordination and control is located with the people performing the task. The self managing group works to a comprehensive set of agreed and measurable goals. Large DP2 structures are non-dominant hierarchies of function where all change is negotiated between peers. A DP2 system is one governed by symmetrical interdependence.

DP2 has markedly different potentials to DP1. The first and obvious feature is that there are no individual jobs or positions. People in a designated group are now jointly responsible for all the tasks and all the inter-dependencies and interactions they involve. They are also responsible for monitoring and controlling the contributions of members, organizing themselves to cope with individual and task variations and meeting their agreed group goals.

Because in DP2, people are working together to achieve agreed goals for which they are collectively responsible, it engenders cooperation.

In a DP2 systems, change can be initiated anywhere and all change is negotiated between *equals*.

Laissez-faire (Lippit, 1940), not shown in Figure 5, completes the set. It is defined as the absence of a design principle and, therefore, the absence of structure and the absence of responsibility for coordination and control. In its pure form, it is just a collection of unrelated individuals each doing 'their own thing'. Laissez-faire today commonly takes the form of an organization where the structure on paper is DP1 but the controls have been loosened to the point that there is widespread confusion about where responsibility for control and coordination are located. These forms of organization are increasing in North America and now elsewhere: they are attempts to accommodate the increased call for participation. Most involve the change of name of the first line supervisor to Team Leader or Coach (TLC) and have mistakenly been designated as empowered workplaces (deGuerre & Emery, 2008).

We recently worked with one of these organizations and it was an extraordinarily troubled workplace with very high levels of fight/flight, dependency and negative affect, much higher than you would expect in your run-of-the-mill DP1 structure, confirming the original conclusion by Lippitt & White (1943) that laissez-faire produces as much if not more distress than DP1 and similarly produces low productivity.

These design principles have been discovered independently by Riane Eisler (1995, p105) who also recognizes they are extremely powerful and affect most aspects of life. Over time DP1 actively deskills and demotivates, DP2 skills and motivates (Emery & Emery, 1974). Many common organizational phenomena such as communication problems and personality conflicts flow from the nature of the design principle (Emery & Emery, 1976; Emery, M, 2004). So too do Bion's group assumptions or organizational dynamics of dependency, fight/flight, pairing and the creative working mode (Emery, M 1999). These genotypical organizational design principles also appear to operate across the animal, biological, cellular and mechanical realms (Emery, M, 2003).

The genotypical organizational design principles are correlated with the psychological requirements for productive work, called the '6 criteria' for short (Emery & Thorsrud, 1969). It is difficult to get good scores on the 6 criteria from DP1 structures even when management has gone out of its way to attend to all hygiene factors (Hertzberg, 1987) and such efforts are appreciated. The 6 criteria are the *intrinsic motivators* and are independent of the hygiene factors, or external motivators. The nature of the relationship between design principles and six criteria has held in every country and culture studied so far. They are very good examples of species or human laws. If an organization genuinely wants high levels of intrinsic motivation or engagement, it appears to have no choice but to change the design principle that underlies the structure.

The six criteria are:

1. Elbow Room, optimal autonomy in decision making
2. Continual Learning for which there must be
   (a) some room to set goals
   (b) receipt of accurate and timely feedback
3. Variety
4. Mutual Support and Respect, helping out and being helped out by others without request, respect for contribution rather than IQ for example
5. Meaningfulness which consists of
   (a) doing something with social value

(b) seeing the whole product or service to which the individual contributes

6. A desirable Future, not having a dead end job.

The first three pertain to the individual who can have too little or too much and are measured from -5 to +5 where 0 is optimal. The second three pertain to the climate of the organization and of these you can never have too much. They are measured from 1-10. They have been routinely measured in countless surveys and Participative Design Workshops (PDWs) since 1971 (Emery, M., 1993). They provide a highly reliable measure of intrinsic motivation and work equally well regardless of the purpose or nature of the organization, including universities (Emery, M., 2000b).

This version of DP2 above is appropriate when multiskilling is possible. When multiskilling is not possible because of legal demarcations or specializations, the basic module must be modified as illustrated by a group at the strategic, policy level.

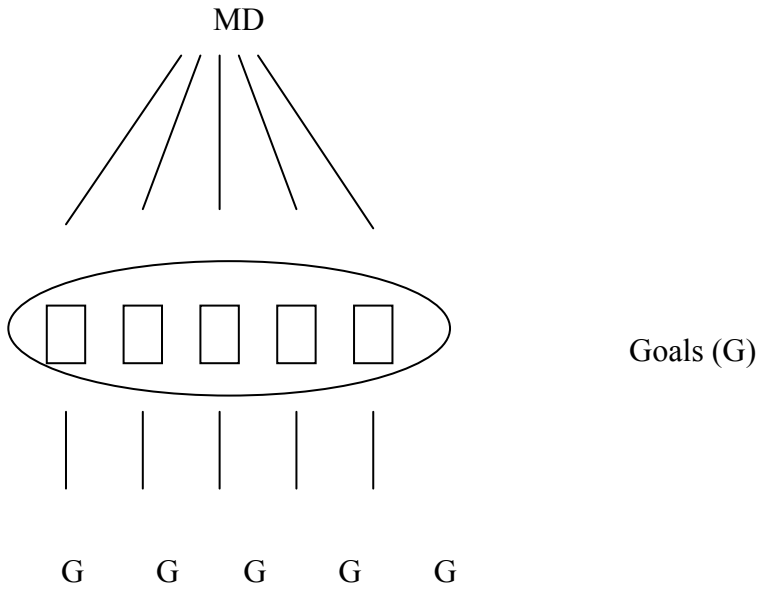


Figure 3. DP2 without multiskilling

In this variation of DP2, control and coordination are split with control remaining with the individual while there is still shared responsibility for coordination and goals.

Within DP1 structures, errors amplify (Beer, 1972; Emery F, 1977). People are not able to set their own goals and challenges and the structure also militates against them getting accurate and timely feedback on performance. These organizations cannot, therefore, be environments for learning. DP2 structures, however, provide for all basic psychological needs including being able to learn and go on learning. They attenuate error over time and, therefore, only DP2 produces a *'learning organization'*, "structured in such a way that its members can learn and continue to learn within it" (Emery M, 1993, p2). There is no implication here that organizations can learn.

The design principles operate at all levels and sectors of society. They underlie the nature of political or governance systems in the same way as they underlie structure of single organizations of all types. Representative political systems derive from DP1. DP2 alternatives have existed and currently exist.

Ecological learning comes from our inbuilt adaptation to our world and our ability to immediately and directly extract meaningful knowledge of it (Emery F, 1980). This perceptually based learning applies to human behaviour as well as the physical environment. When placed in DP1 structures which inhibit their potential, people directly perceive this and make and act upon 'group assumptions' (Bion 1952, 1961) about what must be done to ameliorate the effects. These further paralyze communication and learning. In DP2 structures which maximize opportunities for development, people adopt the *'creative working mode'***,** become cooperative and task oriented which promotes communication and learning towards shared purposes (Emery, 1999; Emery & Aughton, 2006; Emery M, 2008).

We accept the *joint responsibilities* of social science - to help improve the human condition as well as adding to social science knowledge. In our action research, we use the *collaborative mode* (DP2) based on the $^{A}_{X}{}^{B}$ model (Newcomb, 1953), not the academic or consultative modes (Emery F, 1977) which are based on DP1. We regard it as unethical to treat people as anything but purposeful systems, the same as ourselves.

Overview and Purpose

As part of their ground breaking insight of the reality of a social field or environment, Emery & Trist (1965) conceptualized and documented the changing nature of that social field over the span of human history, in terms of its causal texture. The three types of field of most relevant here are the Types II, III and IV.

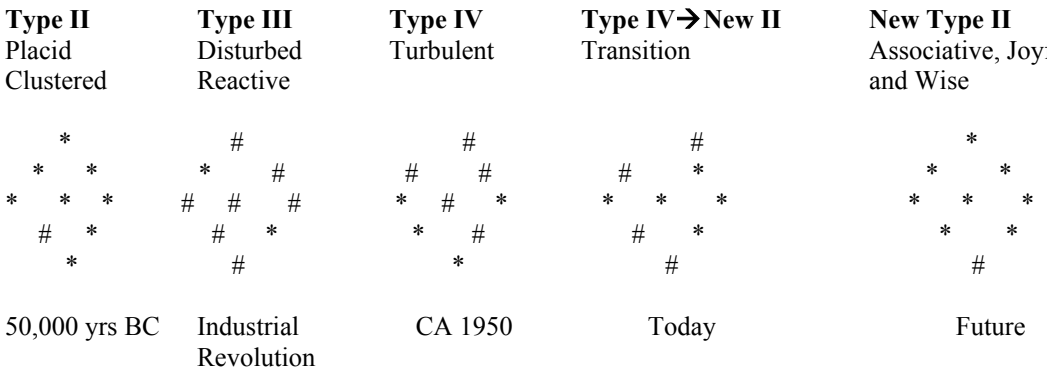
The Type II lasted from the dawn of human history to roughly 1793, the birth of the industrial revolution. It is by far the most adaptive environment people have as yet created. It was characterized by cooperation because people commonly employed the form of organization based on DP2. The ancient cultures, remnants of which still exist on most continents as our Aboriginal and First Nation peoples, have been extensively studied by archaeologists and anthropologists. Their work leaves little doubt that these cultures were socially sophisticated, peaceful, intimately tied to the land and highly knowledgeable about how the biosphere works (Emery M, 1982). In these *Tribes without Rulers* (Middleton & Tail, 1958), both learning and planning were integrated as normal, everyday parts of life. In the Type II, meaningful learning is to understand the intrinsic nature of human and environmental systems and what the environment affords. To retain the nature of the environment, people and all other resources are nurtured as there is a sense of belonging to the whole (Knudtson & Suzuki, 1992).

The Type II was destroyed. The Type III came into being at the beginning of the industrial revolution because as the factory system was built, labour was recruited from the nearby towns and farms. These people worked in groups and lived in rhythms dominated by the sun and the seasons. Whether in the fields or in cottage industries, these people worked in DP2 structures. They proved unreliable when required to abide by mechanistic factory time and rules. To ensure reliable behaviour, the owners introduced supervisors and when the supervisors proved unreliable…For the first time in the West, we had the widespread application of DP1 with its inherent competition. As these DP1 organizations grew so we had large bureaucratic organizations competing for the world's finite resources.

But the Type III had a very short life expectancy. It conflicted with predispositions to the earlier Type II. People hate living and working in DP1 structures and the delicate balance of physical ecosystems rapidly became disturbed. Symptoms of the distress of both people and ecosystems began to show up with decreased levels of motivation displayed as increased rates of absenteeism and turnover on the human side and crashes for example, in whale populations on the ecological side.

The Type III came to a slow demise at the end of World War II. Since 1945-53 we have been living in a new environment, the Type IV, an unintended consequence of adopting the world hypothesis of mechanism (Pepper, 1942; Emery M, 1999, pxx). People finally reacted to the Type III environment, rejecting its assumptions and structures and increasingly taking things into their own hands (Emery F, 1978). They are still in the process of sorting out what they really value and the Type IV environment is known as 'turbulent' because it is characterized by rapid value shifts and discontinuities. It is an intrinsically dynamic environment which induces *relevant uncertainty* (Emery & Trist, 1965). This makes it unpleasant and unhealthy. There has been a growth of maladaptions, particularly dissociation and superficiality (Emery F, 1977; Emery & Emery, 1979), illustrating reluctance to engage at a meaningful level. At the same time, people are reasserting their individual and community uniquenesses through their capacity for ideal seeking (Emery M, 1999, p35; Emery M, in press).

The overall purpose of OST has been, and is, to cut through the confusion in the field, reduce the relevant uncertainty and make adaptive cultural change so that we return to a modern form of the Type II. In terms of cultural history, therefore, our work is framed against the sequence shown in Figure 3.



Where # means DP1 and teaching abstract knowledge, * means DP2 and ecological learning

Figure 3. Environmental Texture and Cultural Change Over Historical Time

To shift this environment requires the creation and maintenance of an *active adaptive culture* which I describe as 'associative, joyful and wise' (Emery M, 1999). Within this culture, people are creative and motivated to diffuse their culture. To do this, they require conscious, conceptual knowledge. We are aiming for an end state, *participative democracy*[1], where **all** entire systems are and want to be purposeful and responsible, continuously learning and practicing active adaptation within this more stable environment.

Making it happen

Socioecological means 'people in environment' and active adaptation is being in a constant state of purposeful change appropriate to both our ideals and a continuously changing environment. Learning and dynamism are inherent to open systems.

[1] The convention we have adopted is that PD stands for participative democracy and PDW stands for the Participative Design Workshop.

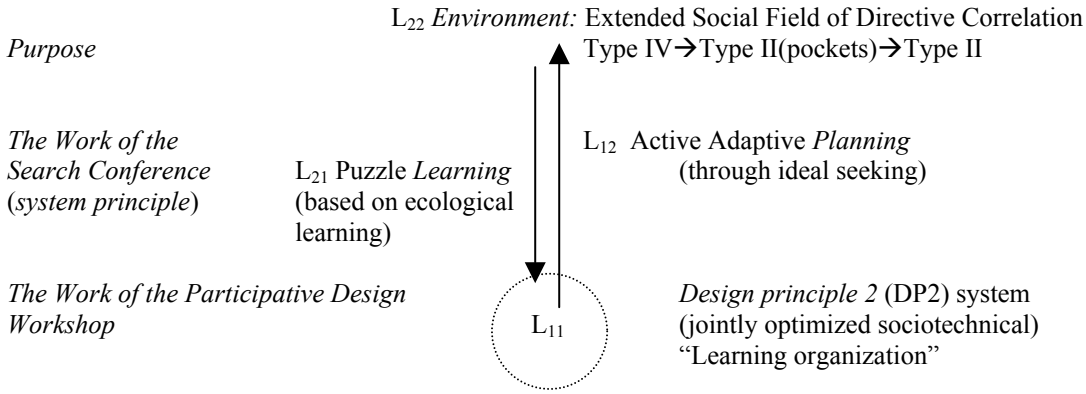


Figure 4. The 2 Stage Model for Active Socioecological Adaptation

Figure 4 illustrates the concept of active adaptation. The 2 stage model has been designed to establish active adaptation in practice (Emery M, 1999). There are two parts to active adaptation, establishing an adaptive system principle between system and environment (L_{11} and L_{22}) and adaptive relationships within the system (L_{11}). There is a reliable, carefully designed method for each part.

Major Methods

If OST is to fulfil its purposes it must in every way treat people as defined above. Our methods, therefore, encourage people to act purposefully to create and take responsibility for their own futures, express ideals through all their systems which they must be able to design as learning planning communities, functioning as and providing an experience of, and learning for participative democracy.

The Search Conference (SC) establishes an active adaptive relationship between the system and the environment through the creation of a new system principle. The system principle is contained within the new set of strategic goals, the Most Desirable Future of the system. The Search uses our inbuilt capacity to directly extract meaning from the environment and creatively combine that meaning with our ideals. It answers the question 'where and what do we want to be in year X?'

The Participative Design Workshop (PDW) produces an active adaptive (DP2) system, one in which all people are responsible and motivated to achieve shared goals, and who know how and why to maintain it. Unless the system affords the learning and support for learning that is required for implementation of the system principle, the work of the SC will ultimately be wasted. The PDW, therefore, answers the question 'how do we organize ourselves to ensure that we reach our Most Desirable Future?'

While the methods are complementary, they are totally different in their design and management. Both require preparation and planning and detailed attention to their introduction and design in any particular organization, community or system more generally: the better the preparation, the better the outcome. These are not trendy recipes but flexible methods designed to make lasting change based on tested concepts and principles. Every aspect of their design and management has been researched in order to make them highly reliable. OST practitioners must understand the theory.

The Search Conference. A Search is a carefully designed integration of external and internal structure and process which function to provide for the practice of ecological

learning. Each of the major theoretical frameworks are translated into practice and integrated to form an internally consistent whole.

The external structure (design) of the SC is a translation of the open system into practice (Figure 5). The content consists of learning about (and also learning how to use) the environment (L_{22}) and system (L_{11}), and integrating them for active adaptation between changing system and the changing environment. The process consists of integrated learning (L_{21}) and planning (L_{12}).

Searching for a better world via mutual adaptation of environment and system can only be valid when the environment is consciously perceived and known. The Search Conference is the method which specifically features the L_{22} as a critical component of making adaptive change through strategic planning and related activities. Without this major feature or even with a token inclusion of it, an event or method isn't a SC. Above all else, it was the inclusion of the L_{22} which originally marked the SC as unique and still distinguishes it from many other methods of planning. Phase 1 of the SC collects data about the L_{22}, analyses and synthesizes it into Most Desirable and Most Probable Futures. Phase 2 deals with the L_{11} through a history session, an analysis of the system today and building on that, a creation of the Most Desirable System. Phase 3 integrates the learning from phases 1 and 2.

The Search uses *puzzle learning* which is the appropriate form of learning for a Type IV environment where ends cannot be assumed. The analogy is the jigsaw puzzle where the next piece is determined by the shape already on the board. By contrast, problem solving assumes an end point.

For learning (L_{21}) people use their perceptual abilities of *figure ground* relations and their *reversals* (Koffka, 1935). We can recognize an object as a figure on a background and a background as an object, and make reversals in this figure ground perception. This is a critical concept for learning about and planning in relation to the extended social field (L_{22}). This ground is brought into focus as figure. The most effective method for enhancing this ability to see the environment as figure is to focus on the *embryos of social change* (Emery F, 1967). These are the emerging systems which may indicate value shifts and develop into major social movements. Identifying these embryos and keeping an eye on them is a powerful form of preparation for change and adaptive responses.

Through these two practical concepts, the L_{22} becomes the figure of creative learning. Then the intrinsic character of the system becomes the figure. Through this process of figural reversals, the learning/planning process produces powerful learning about system-in-field transformation.

The external structure shown in Figure 5 is that of the 2 stage model. That structure is schematic allowing for great flexibility. Each SC is custom designed, from the above irreducible minimum. For example, there may need to be a ‘task environment’ which lies between the L_{22} and the L_{11} (Williams 1982), sometimes a Most Probable Future of the system needs to be included. The design is a plan, not a linear program. As its purpose is to build a *community*, as much work as possible takes place in the large, community, group. Small group work is used only to speed work up, put in detail and validate conclusions. The SC is a wholistic method for whole people. Diffusion is powered by the affect system, particularly the affects of excitement and joy (Tomkins, 1963; Emery M, 1986; 1999). The 2 stage model provides the best possible conditions to generate diffusion.

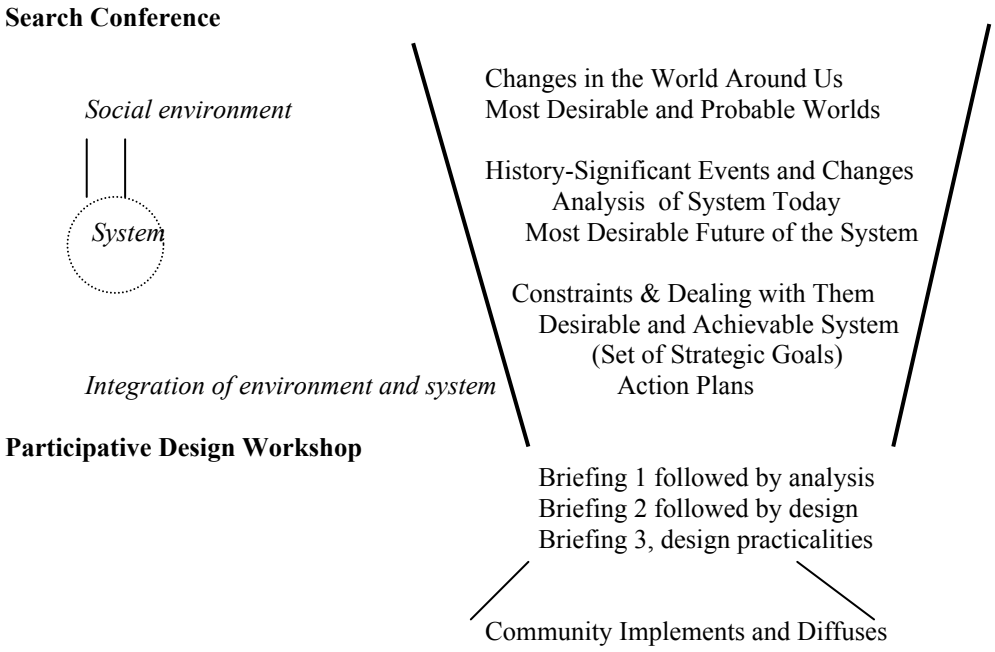


Figure 5. Minimum schematic Design of 2 Stage Model

Similarly, strategic planning in a Type IV environment must be done by the people who have to live with the consequences of the plan. When people plan and take responsibility for their own future which embodies their deepest selves, they often make radical change. This gives the lie to the saying that people fear and are resistant to change. They are fearful and resistant only to change which is imposed upon them. In the SC, both participants and process managers are organized on DP2. This yields a strict division of labour where participants take responsibility for all the work, the outcomes and the implementation – managers must stay out of the content. Their work is to provide the very best conditions for participants to do their work. This prevents outbreaks of the *basic group assumptions* (Bion 1952; 1961; Emery M, 1999).

Every aspect of the SC as a generator of creative work and learning has been subjected to testing. Because of relevant uncertainty, planning must use the *strategy of the indirect approach* (Sun Tzu; Hart 1943; 1946). This, the oldest strategy in the world, entails manoeuvring, constant monitoring of the environment and constant active adaptation. The SC incorporates management of *the conditions for influential communication* (Asch 1952; Emery 1999). It also uses the *rationalization of conflict* (Emery F, 1966) to maximize task orientation and community building.

The PDW at the end of the SC is a version modified for design rather than redesign. It provides the conscious conceptual knowledge which prevents the risk of participants lapsing back into DP1 during implementation. Setting up committees and other forms of DP1 organization guarantees drops in energy, motivation and action.

The **outcomes** of the SC are:

1. an adaptive system principle
2. people who:

- want to make the changes they have planned,
- understand how to monitor the environment and deal with its changes and

- can adjust their strategic goals, priorities and action plans as necessary, and
- have the excitement, energy and knowledge to involve others in spreading the process

There are variations on the SC such as a series of SCs with an 'integration event' and a multisearch (Emery M, 1999).

If an organization already enjoys the outcomes a SC produces, it can go straight into the internal redesign of the system.

The Participative Design Workshop (Emery & Emery, 1974; Emery & Hall-Jones, 2011). The PDW is a workshop with the single purpose of changing the genotypical organizational structure from the first design principle (DP1) to the second (DP2), designing back in the human dimension of work which is summarized by the six psychological requirements of productive activity.

Structural redesign is not about 'doing teams'. We are talking about a series of workshops which yields an elegant *system* with a flat *non dominant hierarchy of functions* with people at every level being responsible for an agreed comprehensive set of measurable goals. Change can be initiated from any point in the structure and is negotiated between peers.

We are talking about changing the *formal legal structure* within Enterprise Bargaining Agreements which are signed off by the appropriate authority so that the design principle cannot be changed by a change of ownership or the whim of management. These arrangements came into being with the First Accord in 1983 which amongst other things repealed the master-servant act which used to be the default option for our organizations.

The comprehensive set of goals includes social, environmental and other goals as relevant, as well as production goals. 'Measurable' means they all have numbers on them, e.g. x cans of peas per unit time with y quality specifications. These are all negotiated and agreed so that collectively, they move the system towards its strategic goals.

As with the SC, there is preparation, planning and design work to be done prior to initiating the workshops.

The *basic design of the PDW for redesign* is as follows:

Phase 1. Analysis

Briefing 1 - Design Principle 1 and its effects

Groups complete matrix for 6 psychological requirements of productive activity.

Groups complete matrix of skills available.

Reports and diagnostics.

Phase 2. Change

Briefing 2 - Design Principle 2 and its effects

Groups draw up work flow for information and learning.

Groups draw up organizational structure and redesign it.

Reports.

Phase 3. Practicalities

Briefing 3 - What Is Required to Make the Redesign Work

Groups spell out :

- a comprehensive set of measurable goals.
- essential training requirements for start up (from skills matrix).
- other requirements, e.g. mechanisms for coordination, changes in layout or technology, etc
- first draft of career paths based on pay for skills and knowledge.

- how the redesign improves scores on the 6 criteria.

The first phase is an analysis of what currently exists, phase two makes the change and phase three covers all of the practical matters which accompany the systematic change and ensure its effectiveness in practice.

In phase 1, the PDW manager does a briefing on the 6 criteria, DP1 and its consequences. The participants then analyse the effects of the existing structure in terms of human motivation and current distribution of skills.

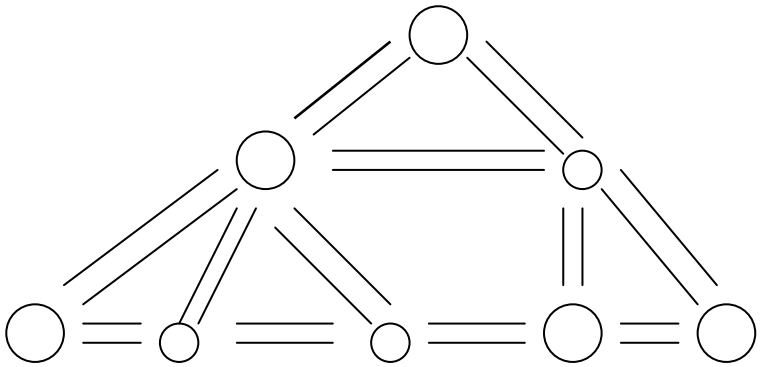
In phase 2, the manager covers DP2 and its consequences and the DP2 structures appropriate for multiskilled, specialist (Figure 2) and unstable work (Figure 6). Participants briefly draw up the workflow through their section of the organization to ensure that everyone knows what happens in the section as a whole and where critical decisions about control and coordination are made. They then draw up the formal legal structure of their section and redesign that structure. When they have the best possible DP2 structure, they move on to phase 3.

In phase 3 they do a first draft of the goals which will control the work of that section or the groups within it, work out their detailed training requirements and anything else required to make the new structure work in practice. They also do a first draft of a new career path based on skills as it would apply to them in their work. These drafts are later negotiated and a final career path based on payment for skills will be designed by a professional career path designer.

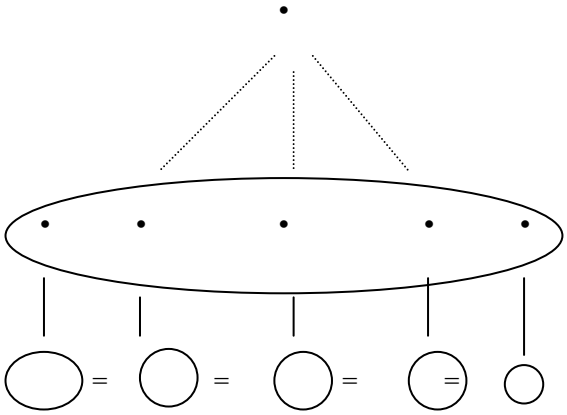
The final system design will be individual to the organization and its people. It will be a variation on some mixture of basic models (Figure 6).

The application of the PDW is very flexible. The basic rule is that there must be *no imposition* of a design. Everybody in the organization fills in the matrices for the 6 criteria and skills, and is involved in the final design.

Apart from this rule, PDWs can be done in parts separated over time, workshops can be composed of single sections, deep slice teams from a section, multiple teams designing different sections or multiple teams designing the same section with integration. There is also the option of using a workshop using mirror groups which adds to organizational learning. These choices will depend on the nature of each individual workplace (Emery M, 1993).



Large organisation with non specialized people at strategic level



Small to medium-sized organization with specialized people at strategic level

One Level organization

Whole organization is decision making
Body composed of temporary overlapping project teams

Small so called 'knowledge work' organization

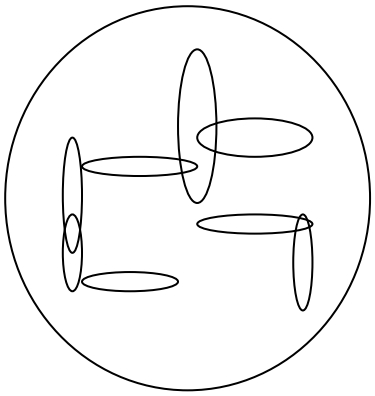


Figure 6. Variations in DP2 Systems

Unique Designs (Emery & deGuerre, 2007). As their name implies, these designs are done to cover the range of purposes other than strategic planning and organizational (re)design. They can be used to solve a problem or design a 2 hour meeting. UDs are designed backwards. Step 1 - spell out the precise outcome to be achieved. Step 2 – decide what pieces of work will help achieve the outcome. Is an L_{22} or task environment scan required? Would a history of the problem help? Step 3 – arrange the necessary elements into a logical flow of work that delivers the outcome.

Open systems thinkers now have available to them a vast array of conceptual and practical tools. With these they can design an infinite variety of events and processes for an infinite variety of systems which encompass DP2 and active adaptation more generally.

Elaborating the Model to Cultural Change

The directive correlation model can be extended infinitely to address adaptation at the cultural level over much longer time spans. Culture is defined as a system of behaviours in context. Cultural change is produced by an integrated sequence of activities in which there is an individual goal for each, and at the same time an ultimate goal to the whole sequence. Sommerhoff's integration theorem states: "If G_A is the goal event of a directive correlation A and if the occurrence of G_A is a necessary condition for the occurrence of the goal, event G_B of a directive correlation B, then G_B is also a goal-event of A." (Sommerhoff, 1969, pp187-8). As L_{22} and L_{11} are coimplicative, mutually determining through a process of coevolution, sequences of directive correlations will then look as in Figure 7. $L_{11}(L_{22})$ means the system as it is defined by reference to the environment in which it exists and vice versa for $L_{22}(L_{11})$ (Emery F, 1993).

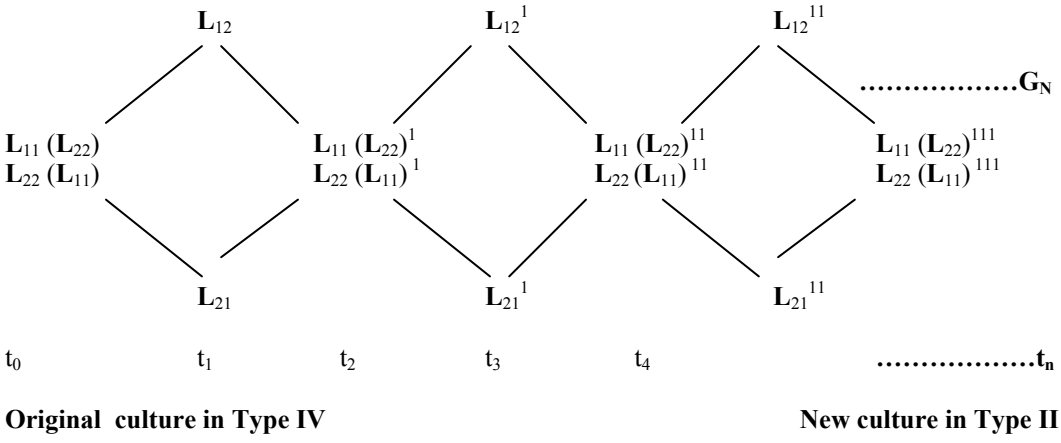


Figure 7. Codetermination of Cultural Change over Time

At each point in time, the environment is defined in terms of the changing systems which form it. Similarly the systems within it are defined by the nature of the environment they form. Any one system has only a limited effect on the field but as systems influence each other and coordinate their directions relative to the field, they can have a significant and visible effect. After both system (L_{11} (L_{22})) and environment and (L_{22} (L_{11})) have responded to the starting condition, they have changed each other at t_2. This continues to happen. If such a sequence is adaptive over time, it will result in a more coordinated movement of L_{22} and L_{11}. At t_n there is a distinctly different culture which when sufficiently widespread, becomes a new environment. The open systems model is inherently and continuously dynamic.

When we translate Figure 7 into the 2 stage model, $L_{11}(L_{22})$ is an organization or community which has Searched and created its set of strategic goals incorporating the ideals, G_N. As it implements its plan, the environment $L_{22}(L_{11})$ is itself changing. By the time $L_{11}(L_{22})$ arrives at G_A, the first level of subgoal in the nested temporal hierarchy of strategic

goals (G_N includes G_B which includes G_A), the organization must, as it assesses its progress, continue puzzle learning, re-evaluating changes in L_{22}, and its position in relation to them. Where there have been discontinuities in the field or even moderate shifts in areas of relevance for the process of L_{11}, priorities will need to be revisited and probably reordered. Monitoring the L_{22} becomes a way of life.

If L_{11} has democratized itself (its first goal, G_A) for learning, it will be able to not only respond adaptively in terms of modifying its G_B, but the creativity of its people released by the change to DP2 will also have resulted in innovations which themselves require redefinition of G_B. As the strategic goals embody the ideals, then the process of mutual adaptation of L_{22} and L_{11} can continue towards G_N. Because G_N is ideal based, it can only be approximated over time. Therefore, adaptation is a continuing process in which the subgoals G_A onwards, become milestones and deliberate pauses for reassessment of both L_{22} and L_{11} and adjustment of further goals towards G_N. But of course, as more systems Search and follow the process approximating G_N so L_{22} itself evolves through Type IV towards a new Type II. This is exactly the thinking behind some current forms of strategic alliance and other dedicated relationships.

As systems become adaptive, they establish protected sanctuaries of ideal based structures and processes which function as Type II environments. Over time, as more systems become adaptive, these pockets of Type II cohere into larger, more encompassing systems, finally evolving into a new, modern form of clustered, placid environment, the new Type II.

Bridging the open-closed gap

For the social scientist, the choice of world hypothesis, material or abstract universals, open or closed, *should be* an easy one as people deliberately create novelty. As Pepper (1942, Chapter X) has convincingly argued, only the world hypothesis of contextualism can deal with change and novelty, indeed he states that change and novelty are the ineradicable categories of contextualism (p235). For contextualism, order must not "deny the possibility of disorder or another order in nature also…this is denied by all other world theories" (p234).

Similarly, we see every day that people transact, they influence each other, and they co-evolve with their social environment. The social field has changed dramatically over the last 40 years (Emery & Emery, 1979; Emery, in press).

Similarly again, all the people I know sometimes cooperate, sometimes argue or yell and scream, depending on which econiche they find themselves in; they choose something and then change their minds, depending on which econiche they find themselves in; and in all ways behave just like me, and probably you.

However as I have argued before, many social science papers including those by systems scientists, involve or describe people who seem remarkably impoverished compared to the people I know. These researchers have chosen the closed system approach and so we end up with two quite irreconcilable human portraits (Emery M, 2000a).

As we saw in Table 1, the choice between material and abstract universals is fundamental and results in coherent sets of characteristics; open systems, transactionalism and synthesis on the one hand, closed systems, self action and interactionalism, and analysis on the other.

The choice is stark when we work with people in organizations and communities: it affects our practice and it affects our results. It has long been shown by the work on sociotechnical systems that if you treat people as dumb, unreliable and irresponsible, they will eventually

behave that way. If you treat them as purposeful, conscious and responsible learners, they will behave that way.

From this, it appears that we are faced with a very basic choice – to use an open or closed systems framework. However, I am going to argue that this is not the case. There are some gaps that cannot be bridged but for the vast majority of systems work, there is a solution that benefits all involved.

The bridge in practice

So what does closed systems, self action and interactionalism, and analysis look like in practice?

An example: a colleague and I were invited to work with a multinational firm in the process of introducing an ERP/SAP system. The project had run into innumerable problems and was already running 18 months late. The plant had only mediocre and dropping levels of engagement as measured by an external consulting firm. Within the complex hierarchical structure set up to introduce the system were several different systems experts. One had designed a communications strategy. It was immediately obvious that the strategy was designed for a mythical creature, one who could be relied upon to fall in love with the new technology as soon as they had full information about it. In discussing this strategy with the communication systems expert, I asked why she thought there was so much resistance to the project after all that 'communication'. Her answer was that they needed more information. Here we see people as mechanical information receivers and receptacles who function on the basis of information only.

Because the project was going badly, a team of change management experts was set up to design new ways of doing things, ways that might better address the multiple problems with morale, resistance, absenteeism, turnover etc. Here we see people as passive, reactive creatures, Chein's (1972) powerless reagents, who will respond positively when we find the right button to press. In this project, there was not a purposeful system in sight. Financial problems caused the project to be cancelled shortly after.

Let us take another very different example. A group of colleagues had been working with an organization determined to increase its productivity and quality. They had been asked to train the troops in a variety of methods such as TQM and some systems dynamics and did so. Nothing changed and productivity continued to decline. In desperation, the management decided to democratize, to legally change its design principle. About three weeks after start up day, a group of operators approached my colleagues to ask if they knew of anything that could improve the efficiency of their operation as they knew it could be better. It was obvious that all the previous training had gone in one ear and out the other.

Some of my colleagues sat down with the operators and went back through all the same material and collectively they worked out some new processes which worked brilliantly. Productivity went through the roof.

Another example: a small community on the coast was horrified to learn that a developer was intending to build another 300 homes on a ridge overlooking the town at a time when they were becoming extremely concerned about climate change and their sustainability. They had a Search Conference and when they were doing their action plans they realized they did not have the expertise to evaluate the options available for improving their sustainability. So it was over to the modelling girls and boys.

In these latter two cases we see that starting with open systems and synthesis does not preclude analysis and the use of other forms of systems work. In fact it enhances the value of that work as it is welcomed and used to maximum advantage.

So how could it have been different in the ERP/SAP case? All the huge waste of time and money, to say nothing about the angst, was, of course, unnecessary. What would OST practitioners have done? They would have sat down with the management, unions and relevant documentation to get an overview of the organization and its needs. They would have mapped out a comprehensive but flexible plan and a set of designs for events within the plan that would yield a high probability that all needs would be addressed systemically and with positive outcomes.

Rather than start with a series of parts that required analysis with separate strategies for each part, we would have started with a Search Conference looking at the future of the whole within the context of the L_{22}. As part of the preparation for this, there would have been a series of carefully designed workshops, UDs, carved out by the normal breakpoints within the structure. In these workshops, the employees would collectively consider their responses to questions such as what would improve their section of the workplace, what would improve productivity and what they needed to know about possible new technologies and how they would affect their way of working.

That data would then be presented to a meeting of the participants of the Search Conference for their consideration, probably the top two or so levels of management and perhaps some highly specialized people from different parts of the organization, and some external systems experts. This is a normal part of the preparation for such an event along with the compilation and presentation of other basic data about the organization and its performance.

The Search would then be held, the L_{22} examined, and an up-to-date strategic plan produced which encompassed an adaptive system principle for the organization. This would be expressed as a short number of strategic goals complete with action plans for the top strategic levels. These may or may not include plans for installing an ERP/SAP system but probably the realization of some goals would involve technological change.

The goals would then be taken back to the original workshop groups who would be asked to work out how to implement the goals in their areas and levels of the organization and report back. With this sort of joint collaborative process, which is much quicker and cheaper, there would be no need for a communications systems expert at all.

Similarly, the external systems experts would be asked to report back on the best approaches to the technological changes required. Their responses would be made in the context of the whole plan in which they have been involved. They would be evaluated in a similarly collaborative fashion after considering the responses from the various departmental workshops as well. The final strategic decision on technology would be appropriate to the future adaptive organization and it would invite no resistance. People do not resist their own plans.

One final point, if any of the strategic goals include statements such as ‘a highly motivated workforce’, ‘a reduced error rate’, or ‘higher productivity’, and they just about always do, the technological decision should be postponed until a series of Participative Design Workshops had been held and designs implemented. This is necessary because once the organization is working as a DP2 structure, the needs of employees will change as will support systems. Therefore, the technological needs will change as well.

These contrasting approaches to the introduction of new technology illustrate all of the differences between open/closed, purposeful/not purposeful, transaction/interaction and their internally consistent relations with synthesis and analysis. As we have seen above, the Search Conference sets the scene wherein this unitary system transacts with a humanly created social

field in a whole to whole relation of mutual influence. Once the system principle is glimpsed and elaborated into a set of adaptive strategic goals, all future decisions are guided by it and by the future of the whole. The process is inherently transactive with open purposeful systems constantly influencing each other through cooperative, thoughtful work. Throughout the whole process there are periods of analysis merging with periods of synthesis within the logic of the whole and its future.

The OST approach to this work illustrates Angyal's conclusion that "It is, however, a misconception that the holistic type of study excludes analysis. Analysis consists in a concrete or abstractive division of an object into smaller units" (Angyal, 1941a, p12). The example above is an example of his fourth way of division where the lines of division are prescribed by the structure of the whole; they follow the structural articulation of the whole and the analysis of such parts does not destroy the whole.

This approach illustrates what is meant by *"the synthesis of systems".* "In a system the members are, from the holistic viewpoint, not significantly connected with each other except with reference to the whole" (Angyal, 1941a, p250). And the whole is governed by a system principle. Add in the change from DP1 to DP2 and you have adaptation at both levels, *between* system and environment and *within* the system.

But also as we have seen in the real failed ERP/SAP experience, if an organization starts with closed systems, it is stuck with analysis and the truly awful task of attempting to weld disparate, often conflicting, parts back into a whole when the whole has not been identified or even acknowledged. The trick for success is that you must start with open.

Fortunately, that is easy to do and in the process of starting with open systems, bridges are automatically built between open and closed systems. In the ERP/SAP example, the technology systems specialists would have understood their brief much more clearly than is usually the norm and would have enjoyed working conditions superior to those engaged in the real project which was governed by Murphy's Law, producing high levels of frustration.

All the examples demonstrate that the formulations of open and closed systems are intrinsically asymmetrical as an open systems approach does not prohibit analysis or work on the system as entity or closed system, or on any natural part within it. In practice o*pen encompasses closed*. In Figure 1A, this is the equivalent of starting with the L_{22} and later working on the L_{11}. In the Search conference, that is exactly what happens (Figure 5).

The bridge at the level of world hypotheses?

At a level above conceptual frameworks are world hypotheses which are "modes of cognition" (Pepper, 1942, p105). They inform us about the structure of the world and how best to approach knowledge of the world (p74). Each is a system of assumptions which flows from a root metaphor. The adequacy of a world hypothesis depends on its potentialities for description and explanation. At the moment four world hypotheses are considered relatively adequate which means that "they are capable of presenting credible interpretations of any facts whatever in terms of their several sets of categories" (p99). Inadequacies arise mainly from internal inconsistencies so that the minimum requirement today for a world hypothesis is unlimited scope.

OST's development is explicitly based in the *world hypothesis of 'contextualism'*. Its root metaphor is the historic event and its basic working hypothesis is, therefore, that there is a whole changing over time and that we know it through a series of historic events within the changing context of the whole. The other three adequate hypotheses assume a closed and static system. Most relevant here are 'mechanism'; its root metaphor is the machine and it assumes that everything is and works like a machine, and 'organicism' which is based on

constant integration of data into wholes. The other adequate world hypothesis is 'formism' whose root metaphor is similarity, perhaps best seen in the original Aristotelianism (Pepper, 1942).

Mechanism, still endemic in the industrialized West, springs from the assumption of a closed, static mechanical universe and consequently views people as goal seeking within closed systems generally (Wertheim, 1995). Pepper has traced the intellectual origins of mechanism back to Leucippus and Democritus (p95). Within mechanism, there is a place for everything with everything in its place. Mechanism precludes active adaptation. So too does 'organicism' which periodically manifests itself in mystical theories such as self organizing universes.

The relevance of organicism lies in the surging popularity of 'systems', particularly whole systems and 'holism' more generally. The process of integration is towards an absolute or ideal whole and according to the organicist, "facts are not organized from without; they organize themselves" (Pepper, 1942, p291). The absolute is implicit in all of its fragments or parts (p307). In organicism as in mechanism, unpredictability is inherently inconsistent and must be explained away whenever it happens to emerge. If all else fails, the unpredictable is declared predictable (p145), the disorder or chaos is found to contain order.

Pepper concluded that formism and mechanism are analytic theories while organicism and contextualism are synthetic theories. The analytic theories acknowledge synthesis but the basic facts are mainly elements and factors and synthesis becomes a derivative, not a basic fact. The same holds with the synthetic theories where the basic facts are complexes or contexts and analysis becomes derivative.

Formism and contextualism are dispersive theories while mechanism and organicism are integrative theories. The dispersive theories see the world as "multitudes of facts" which do not necessarily determine each other. Unpredictability is consistent with these theories while for the integrative theories it is anathema. For the integrative theories, the world is a totally determined place right down to the most minute detail (pp142-43).

So while organicism and contextualism have much in common, they diverge around matters of time and change and these relate to the core difference, context. Like the other three adequate world hypotheses, organicism admits of no context while it is of course an essential component of contextualism. In other words, by adding context to organicism, we can turn it into contextualism. Experience shows that once people have gotten used to seeing wholes in the context of the L_{22}, they start to think contextually and begin to accept uncertainty and unpredictability.

What of the relation of contextualism and mechanism? Here the addition of a context won't do the trick as mechanism does not deal with wholes but only parts, elements. But the real stumbling block is the root metaphor of the machine. The gap between the inanimate machine and the animate, conscious human being cannot be bridged. However, in sociotechnical organizations, and even sociopsychological systems such as hospitals use sophisticated technological systems, joint optimization can ensure that mechanism can live happily within the technological system of the organization while the contextualists look after the whole and the relation between the social and technological. This seems right and proper. I want a mechanist very carefully analysing every sound and electromagnetic measurement of the MRI machine to prevent it becoming unpredictable when my head is inside it. Mechanism in the service of machines is entirely appropriate. In organizations, contextualism and mechanism can cohabit although they cannot mate.

While contextualism and formism share the characteristic of dispersion, they appear in all other ways, incompatible. The root metaphor of similarity is incompatible with the most basic feature of material universals which is its use of serial genetic constructs – the questions of

'what does it do?' and 'in what context does it change?' Similarity indisputably works on the basis of generic things and nouns which is why its classificatory systems have such a poor track record, e.g. one of the essences of 'swanness' is 'whiteness' – well, not where I come from. And the Koala was called a 'bear' when it is actually a marsupial. Formists often overcome some of their taxonomic problems by reductionism which again is incompatible with an emphasis on synthesis. Similarity describes a static world while for the contextualist, the world is inherently dynamic.

Contextualism, therefore, can encompass or absorb organicism over time, can include mechanism within clearly defined boundaries but must remain incompatible with formism.

So within limits, open includes closed. But closed does not encompass open. When the framework is one of closed systems, the system remains closed. One only has to read Ashby's *Design for a Brain*, chapter 1, to understand the insuperable problems that confront a conceptualization that seeks to build up a picture of such a system from a representation of all the parts and all their interrelations. Ashby rejected all such approaches and adopted the system-environment approach. He specifically acknowledges the simultaneous thinking of himself and Summerhoff (Ashby, 1952, section 5/13) on his quest for the answer to adaptation.

Despite the best efforts of later systems theorists such as Ackoff to start from closed and escape into open without acknowledging an external social field, they are always fail.

Ackoff made several attempts to define a system without recourse to a social field. The 1974 version was "a system is a set of two or more interrelated elements of any kind" (Ackoff, 1974, p13). In 1999, he elaborated this definition and followed it with "a system, therefore, is a whole that cannot be divided into independent parts" (p16). He then explains that "the essential properties of a system taken as a whole derive from the interactions of its parts, not their actions taken separately" (p16).

Ackoff's method for determining whether an entity is or is not a system requires finding a larger system in which to embed the smaller system. Using the example of a school, his method requires finding the function of the larger education system within which the school is embedded. It breaks down at the point where there is no larger system in which to embed the smaller system. When the people of the world come together as a system, where does one go to find the larger social system within they are embedded?

He states (1999, p16) that "a system is a whole that cannot be understood by analysis", but ultimately, his definition and method require just that. It is not until one has analyzed the relations between the parts and the relation of the parts to the whole entity that one can decide whether or not that entity is a whole or a system. His conceptualization is ultimately one of analysis. While he writes of wholes, he cannot achieve synthesis.

Ackoff was defeated by an inescapable logic – it is simply impossible to arrive at an open system from the starting point of a closed one. Any attempt to define a system by reference only to its parts or to a larger whole, and not to an environment, inevitably remains within a closed system framework and analysis only - synthesis evades it. As we saw with the two closest world hypotheses, context or environment must be *added* to organicism in order for it to become contextualism. Without the addition of an environment to any whole system, that system remains closed.

My *conclusion* is that with a minor exception (minor because formism is a very frail world hypothesis), and the confinement of mechanism to the world of technical systems, *there is a bridge between open and closed – but it is a* ***one-way*** *bridge.*

Implications

Given that it is a one-way bridge, my solution is this: any variety of systems work, with the exception of those that rely wholly on formism, should consider the system on which they are working to be an open one. For those of you who work purely on technical or technological systems, remember that there is no such thing as what you might call a 'disembodied' technical system, it is inevitably joined to a social system. It cannot be changed without consequences for the social system which is always an open system. And every change in a social system has repercussions, not only for the individuals involved but also via transfer effects to their families and friends (Emery & Phillips, 1976), and ultimately to the L_{22} (Emery, in press). There is overwhelming evidence for this.

The implication of this is that all systems theorists and practitioners need either to learn to use OST or become part of groups who can collectively work with organizations and communities to educate and re-orient these entities towards more desirable futures. You don't always win – but given what we confront, both environmentally and socially, it is vitally important that we start addressing the reality of our current circumstances.

All systems scientists start with a great advantage, they acknowledge that our world consists of, and functions as, systems. If we can all more precisely acknowledge reality by conceptualizing our work within *open* social systems, it can renew the vital spark within the citizenry. We need more people asserting their capacity for ideal-seeking to restore the Type II associative, joyful and wise culture. This we need above all else – or else we march, or drift, into a future which is simply too horrible to contemplate. I ask you all to consider making the shift. Thank you.

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