

THE FAR REACHING EFFECTS OF THE DESIGN PRINCIPLES

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We are gradually learning just how powerful the design principles are. From the very birth of sociotechnical systems it was noted that moving from non-jointly optimized (DP1) systems to jointly optimized (DP2) ones, caused increases in both productivity and physical and mental health. However, just how systemic sociotechnical systems really were remained to be discovered.

In this paper we review some of the effects from changing the design principle and include an extract from the latest research confirming that design principle is a determinant of mental health.

Productivity

From the very first instance of a DP2 structure in a workplace, there have been increases in productivity and reduced costs. The measures have been many and varied. Here are some recorded outcomes over time. The first selection comes from the four sites in the Norwegian industrial democracy program in the 1960s (Emery & Thorsrud, 1976).

- Christiana Spigerverk - wire drawing. Productivity increased 20%
- NOBO - metal fabrication. Productivity increased 20% in first 10 weeks with a further 10% in next 2 years. Turnover & absenteeism fell below average for the industry.
- Hunsfos - pulp & paper. Quality for averaged week and batch over 2 years ranged from 100% in first 6 months to 145% after that. Costs decreased with improvements from 3.8% to 15.8%.
- Norsk Hydro - fertilizers. Manning levels fell from 94 to 57. Production increase for each of the 3 main lines ranged between 50% & 100%. Down time before was between 10-30%. After was 5-10%.

The next set comes from Australia and Canada from 1970 onwards

- Department of Overseas Trade personnel office: error rates dropped from an average of 40% per pay to 3% (Gorrie, 1975).
- Commonwealth Industrial Gases: the number of gas cylinders produced per man hour increased from 0.6 to 1.7 (Roberts, 1995)
- Karadoc Winery: Productivity increased 7% in first year. Inventories fell from 4 weeks to 10 days for casks and from 2 months to 4-5 weeks for bottles. Improvements in efficiencies and waste reduction were around 28% and 38% respectively, and customer complaints about packaging fell by about 14%. There was a reduction of lost time injuries down from 2,000-3,000 hours per year to 20-30 hours per year over a 10 year period (Aughton et al, 1997).
- Syncrude Canada Ltd used PDWs to secure its future by reducing the cost of a barrel of its light sweet synthetic crude to a cost competitive with the traditional product. During the 1980s, they had tried sociotechnical analysis and design as practised in the United States (STS). Management felt it took too long, was too expensive and too difficult to implement as workers rejected the design and remained negative despite extensive human relations training. An internal action research team of 5 fulltime members and 3 part time associates began work with PDWs in 1992. Between 1989 and 1995, production increased by 37%,

productivity per person increased 76% and revenue increased 50%. At the same time, operating costs dropped 20% and the workforce of originally over 4000 dropped by 22% (Purser & Cabana, 1998, p. 272). There were no major technical changes during this period with only minimal sustaining capital injection. By 1997 productivity and revenue had increased even more while costs and workforce had further reduced convincing owners and new investors to commit over \$2.5 billion in new capital (de Guerre, 2000, p. 657).

- More recently, J Robins & Sons a 100-year old fashion shoe manufacturer, changed its design principle from DP1 to DP2 using PDWs. Over 5 years, total stock has reduced by 50% resulting in increased investment in new technology, lead time has reduced from 15 days to 2 hours, customer returns have reduced by 45%, downtime has reduced by 65% and pairs produced per person has increased by 30%. While they have faced challenges over the 5 years, they are the sole remaining large footwear manufacturer left in Australia. They compete with India and China and have not shifted jobs offshore. Absenteeism has dropped from 4 to 1.5% (Aughton & Butt, 2007).

They are only examples of many organizations that have recorded profound positive changes after moving from DP1 to DP2. However, many of these organizations report their success only informally if at all.

Beware: There is no known case of a *decrease* in productivity after an organization has explicitly changed from DP1 to DP2. However, many claim to be doing sociotechnical systems or introducing self management but in reality are doing no such thing. Unfortunately, many of those practising STS have forgotten what a jointly optimized sociotechnical system actually is and simply use the name and/or old methods that ignore the design principles (see paper on the difference between STS and PD and Part III on *laissez-faire*).

Communication Problems, Group Dynamics, Error Rates and Personality Conflicts

Communication problems are endemic in DP1 structures. They are accompanied by a widespread belief that communication is a primary property of behaviour and therefore, problems indicate something is wrong with the people. Therefore, the most common way of attempting to deal with these problems involves giving people additional communication skills. This belief fuels a huge training industry.

The belief is wrong - communication is not a primary human property but a secondary one. 'It is and has always been a necessary condition for people to act socially. Not, however, a *sufficient* condition. Many situations can be observed where communication channels exist but are not used. In many situations communication can reduce social activity' (Emery & Emery, 1976, 147).

Both quantity and quality of communication are significantly influenced by the organizational structure. An increase in skills does not translate into improved communication unless the person is motivated to use the skills. In DP1 structures people are less likely to enjoy optimal or satisfactory levels of the six criteria and correspondingly, they will be less likely to be motivated to employ the communication skills they hold which are readily displayed in other settings.

We need to consider communication as a purposeful behaviour within the whole organization environment unit where the behaviour reflects the state of that wholistic unit. Because all experiences and behaviour are coloured, if not motivated by emotion or affect (Thatcher & John, 1977, 113; Tomkins, 1962) the quality and quantity of communication are revealing.

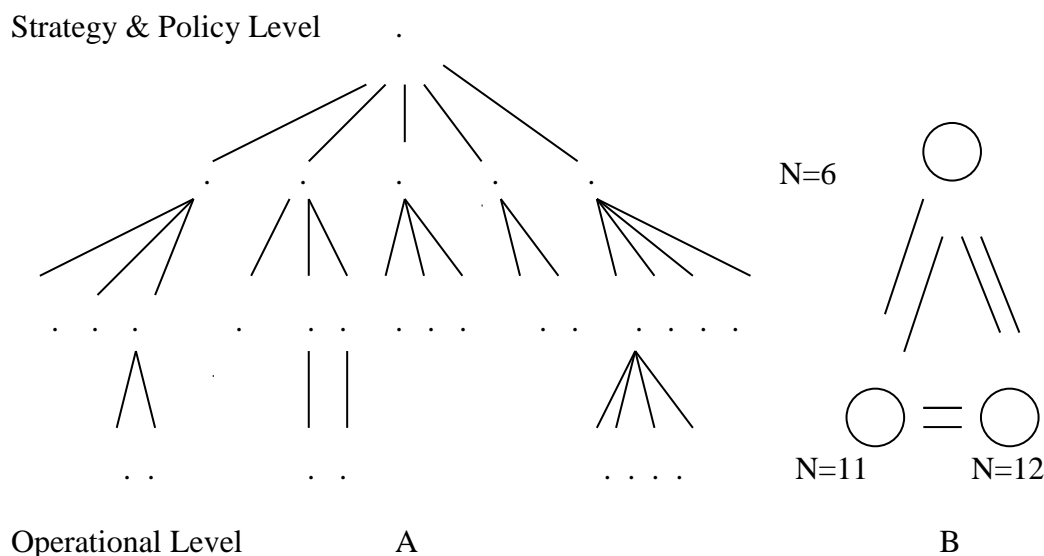


Figure 1. Structures of a Small Organization under the Two Genotypical Design Principles.

Looking first at the influence of design principle on quantity of communication, consider Figure 1 A and B. A and B are charts of the same organization. All that has changed is the genotypical design principle, yielding in A, a typical 4 level DP1 structure. B shows the structure based on self managing groups after the principle has been legally changed from DP1 to DP2. In fact, if this organization were to really redesign itself, it would quickly be found that a group of six people is far too many in such a small self managing organization. There simply wouldn't be enough productive work to keep them occupied and in DP2 structures everybody does productive work and nothing but productive work.

Table 1 documents the differences in quantity of communication in the two structures.

Table 1. Communication Channels and Task Mediated Relations		
<i>Steps removed from policy maker</i>	<i>No in DP1</i>	<i>No. in DP2</i>
1 step	5	2
2 steps	15	0
3 steps	8	0
Total of communication channels	28	2
Task mediated relations between peers, maximum. This is calculated for within groups. We could add 1 under DP2 for between peer groups.	0	136
Paper generating function*	59	2

* These diagrams and table are adapted from Emery & Emery (1976, p166-171) where we stated that this was an estimate of the paper generating function based on previous experience that it increased by the square of the distance from the bottom level. We multiplied number of steps by steps removed from the top.

Even for this small organization, the quantity of communication is vastly different. So too is the quality of communication as all relations are negotiations between peers (indicated by double lines in B), far from the asymmetrical relations between superior and subordinate found in DP1.

Within DP1 structures with their relations of personal dominance, communication has three characteristic features, asymmetry, egocentrism and 'them and us'. Asymmetrical relations lack the reciprocity of sender and receiver that can be observed in a discussion between equals. There can be a total absence of discussion and a predominance of orders or instructions. Orders require reactions or responses, not conversation or negotiation. Asymmetry is a characteristic of the 'communication' between an operator and a machine and that it is reflected in person to person communication should come as no surprise. The principle is 'redundancy of parts'; the world hypothesis from which it derives is mechanism. The replaceable parts often refer to themselves as 'cogs in the machine'.

Egocentrism is expressed in statements such as 'I want this by Friday' and 'It should be done this way'. Use of 'I' versus 'we' was one of the most distinctive language differences between autocratic and democratic organizations (Lippitt & White, 1943). In DP1 structures whole tasks are split into one person pieces with individual responsibility attached. The interests of individuals are, therefore, best served by looking out for themselves. They are not concerned to communicate information that could be of benefit to others, either laterally or up and down. Similarly, unless a received communication is of benefit, there is little concern to attend to it, let alone remember it. When we analyze a DP1 structure we see that it is essentially competitive with all the dynamics that are associated with competition. This is illustrated by the simplest example of promotion which in DP1 structures is usually up the hierarchy. Those below the vacancy must compete for that position. Communication patterns including remembering and forgetting reflect the competitive dynamics.

The competitive nature of the DP1 structure also explains the adversarial nature of communications within it. Each step in the communication chain represents a difference in status and therefore, a difference in the interest of the parties towards the effects of the communication. Superiors want the truth if they know they can do something about it. If not, they would prefer not to know or they may request a report because simply requesting it makes them look good and responsible. Unfortunately, superiors frequently believe they do know what is going on in their organizations but have been suffering from distorted information or a severe lack of information. Failing to inform is a powerful way of waging organizational war vertically as well as horizontally. Inferiors may distort communications to make themselves look good or blameless, and make competitors look bad. *'A status gap between communicants is always a potential barrier to communication. It constitutes an inherently unstable medium: always ready to amplify or attenuate messages in ways that have nothing to do with a truthful correspondence of source events and message'* (Emery & Emery, 1976, 152).

These three characteristics illustrate the dilemmas involved in putting people into a structure which by its nature denies their purposefulness. They get their revenge by exercising their purposefulness in exactly the way the structure, but not the management, demands. As it is inherently competitive, so they compete. But the ends they serve bear no relation to the organization's goals. Because the organization is not adaptive to the nature of the people within it, the communications serve their own

adaptive needs. This may lose them a job in the long term if the organization fails. (This is not a speculative statement. Some of us know organizations that failed because of constant deliberate sabotage.)

These effects also operate at the level of the group. Bion (1952; 1961) discovered that groups can make a set of three basic assumptions (*bas*) about their leadership. The *bas* are a totally different mode of operation from the 'creative working mode' which Bion referred to as W for task oriented work. Calling them dependency, fight/flight and pairing, Bion saw these *bas* as modes which preserve the life of the group. (For a discussion of the bifurcated form of pairing, see Emery M., 1999, 127-132). After nearly thirty years of work with the *bas* we now know that they are structure specific. They appear only when DP1 is operating. As implied by the statement above about the leadership of the group, Bion's patients knew that he was the boss. While Dr. Bion remained in charge, his chances of creating a 'leaderless group' were low. In contrast, when people begin work in a DP2 structure, they immediately go into the creative working mode and stay there. There is no leader to fight or become dependent on.

The *bas* create even more problems for team builders and communication skills developers. They also help explain the frequent lack of transfer effects from the training situation to the organization. Usually the trainers attempting to improve communications or team work find themselves in the same structural position as Bion. Their trainees are vulnerable to the *bas*. Many trainers believe that every group must go through the stages of 'forming, storming, norming, performing' (Tuckman, 1965). Some will deliberately engineer these phenomena to speed up to the performance stage. But for many employees, this is the stuff of everyday life. They are also experts in it and if they don't feel like performing, they won't. Our experience shows that it is possible to go straight into performing (Emery M., 1999, 132-3). The *bas* are far easier to prevent than to cure, by designing methods in which participants plan, work and learn in DP2 structures.

If the trainees adopt either of the most common *bas*, dependency or fight/flight, there will be little learning. 'Least learning occurs in dependency, more in fight/flight and more again in pairing' (Emery M., 1999, 117, 134) but less than in the creative working mode. Add this to the motivational deficit, particularly when it is realized that they are being sent to fix up their problems, and then wonder why they have poor 'listening skills'. '*Poor listening skills*' is yet another mythical deficit promulgated by those who see all behaviour arising from an individual alone, one taken out of context. Exactly the same people show no deficit in listening skills when they are enjoying a spirited discussion at the pub or are working together for their local voluntary organization. Listening is also subject to motivation and refraction.

In a structure which denies purposefulness and reduces motivation, it is not surprising that it also increases *error rates*. DP1 structures are inherently error-amplifying. Error rates are intimately related to communication failures and reflect the same sort of system failure. Errors seep in from the environment and are then subject to the distortion of the three characteristics above. Using Stafford Beer's (1972) formulae for error amplification and attenuation Emery (1977, 91-99) showed how the flow upwards of information from one level to the next dramatically changes between DP1 and DP2 structures.

Table 2. Error Amplification and Attenuation by Design Principle	
DP1, error amplification	DP2, error attenuation
$T = (1-F)^n$	$T = (1-F^n)$

$T = (1.0 - 0.2)^5 = .33$	$T = (1.0 - (0.2)^5) = .9997$
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In both cases in Table 2, a manager has five people reporting to him or her, people who are truthful (T) or make sound judgements eight times out of ten. In the DP1 structure there would be, on average, only one in three occasions that the manager could say that this must be sound advice because they are unanimous. Managers, therefore, seek independent judgements to avoid collusion but the arithmetic shows that the more managers achieve control of subordinates, the deeper they move into error.

In the DP2 structure there would be only about three times in ten thousand that they will unanimously give wrong advice. While the assumed degree of fallibility (F) is the same in both structures, it will vary in nature. The characteristic features of communication found in DP1 structures are not found in DP2 because people have shared responsibility for coordination and control. They are also responsible for their agreed measurable outcomes that they know are aligned with the strategic goals of the organization. The symmetrical dependence of DP2 ensures cooperation rather than competition with the effect that it is in everybody's interests to provide accurate and timely feedback on mistakes. As the whole group has been involved in setting the group goals and individuals negotiate pieces of work to provide personal challenges, both the conditions for continuous learning are in place (Emery & Emery, 1974). Therefore, when errors enter a DP2 structure they become the source of learning rather than defensive posturing.

When error rates are judged unacceptably high in DP1 structures, the diagnosis is frequently inadequate training and the solution is further training. Often this training is provided on a blanket basis. While further training may indeed be required, it will not reliably reduce error rates in the long term. That requires attention to the underlying causes. By contrast, in DP2, an individual who has made a mistake will request advice or training and therefore, the training is targeted and immediately effective.

The class of problem called '*personality conflicts*' arises from exactly the same principles and dynamics as communication problems and error rates. As errors are amplified when they enter a DP1 structure so are personality differences. Asymmetry, egocentrism and the 'them and us' syndrome together with the prevalence of dependency and fight/flight contribute to the hot house atmosphere where even small personality differences are accentuated. Far from being a cool, impersonal task oriented setting, bureaucratic structures are often wracked by waves of intense emotion played out as office politics, clique formation and maintenance, and buck passing. In such settings, any small quirk of personality is quickly amplified and if the predominant basic assumption is fight/flight will fuel a 'personality conflict'. When the same people work together in a DP2 structure, their differences become attenuated and the '*personality conflicts*' mysteriously fade away.

All of these common organization problems are not caused by defective people as is commonly believed. That belief is a product of the schools of thought revolving around the primacy of human self action and interaction and these in turn result from a closed systems approach. Known as the Human Relations School, this ideology has become dominant particularly in North America. Its emphasis on the individual and its neglect of contextual factors such as organizational structure have held back progress and cost enterprises dearly.

Health and Mental Health

The following is extracted from de Guerre et al, 2007.

Mental illness was defined as an epidemic by the UN in 1992 (WHO, 1996) and WHO now (2008) projects that by 2020, depression will reach 2nd place of the ranking of DALYs (disability adjusted life years) calculated for all ages and both sexes. It is already the 2nd cause of DALYs in the age category 15-44 years for both sexes combined and the leading cause of disability as measured by years lived with disability.

The nature of work and workplaces is implicated in this epidemic incidence. Workers today face additional pressures arising from increasingly global markets with increased pressure to do more with less, loss of loyalty between employers and employees with associated job insecurity (Payne, 2000). Work hours and competition between workers have increased while personal control over work has decreased.

Costs are huge. Estimates of billions in both Canada and Australia from absenteeism, 'presenteeism' (at work but with minimal productivity) and lost productivity from other many diverse sources can be found in de Guerre et al, 2007. Additionally in Australia, psychological and illness claims increased 44% from 1993-2003 at a cost of nearly \$80 million per year. This increase has been accompanied by a corresponding growth in the number of people taking their grievances to the courts (CPD News, 2003).

Some employees respond to increased pressures by becoming mentally ill but more frequently, they simply 'turn off', a common defence mechanism in hostile environments. The literature contains a plethora of survey results showing low engagement. Typical figures are engaged (30%), not engaged (54%) and actively disengaged (16%). A high proportion of employees are switched off, leadership has failed and things are getting worse (Lundgaard, 2007).

While many employers remain unconvinced that workplace pressures lead to a variety of physical and mental health problems, despite 80 years of confirmatory research (Borger, 2002), they have been put on notice by new legislation designed to better cover what is now known of the processes that lead to psychological injuries at work (WorkCover Queensland, 2003; Elumina, 2004; Minister for Workcover, 2004; pwclegal.com, 2007).

The Australian Prudential Regulation Authority has also now widened its focus to ensure openness and accountability throughout the organization. Taking a 'whole of business approach', all directors and managers are now "required to take *personal responsibility* that the institution is in compliance" with all relevant legislative and financial obligations (Byres, 2005, emphasis added). Ignoring or not addressing mental health problems in the workplace not only puts employees at risk of psychological injury; managers and directors are also clearly exposed to legal action. Australia has had some highly publicized law suits (Masanauskas, 2007; LaMontagne, 2007b).

Design and Methodology of Current Study

Several years ago, we began work on a comprehensive instrument to measure the effects of the design principles on health and organizational performance. Data from the first two organizations surveyed showed that as we expected, DP2, not DP1, leads through various enabling conditions to motivation, productivity and low number of sick days (Emery & Aughton, 2006). Accelerating worries in the community about mental health and productivity led us to modify the existing instrument to include measurements of mental health and its hypothesized determinants.

This study uses the full sociotechnical model, measures the known effects of the design principles, the 6 criteria and all major dimensions of organizational life. Details can be found in de Guerre et al, 2007. It is a 'before and after' design using the intervention that was specifically designed to create jointly optimized sociotechnical systems by changing the genotypical design principle, the PDW. The *major hypothesis* to be tested, therefore, is that individuals will record better mental health after the intervention than before. As the enterprise bargaining agreement covering the legal DP2 structure and its associated pay for skill system has now been negotiated, it is expected that the follow-up instrument will be administered in February 2008, providing a rigorous statistical test of changes in mental health as well as other organizational behaviours and performance.

Org3, part of a multinational with 68 employees in outback Australia, manufactures mining industry components. Management had tried a variety of methods to improve productivity and lower costs in order to get to the desired cost per unit produced. Extensive effort had been expended on streamlining the technical system and while there were marginal improvements, nothing got the operation close to the unit cost goal.

There had also been experiments with the social system and at the time of the first measurement, there was a mixture of sections with supervisors, with 'team leaders' and one section which consisted of a self managing group, all operating informally within a legal DP1 structure. Employees, particularly those with team leaders, were confused about where responsibility really lay.

The questionnaires were administered to shifts in a group setting. There were no problems with understanding and almost no missing data. We have a total sample of the organization.

The PDWs were single day events for management and operations personnel (production, maintenance and distribution by day, afternoon and night shifts) starting in August, 2006. An integration workshop was held on 19-20 December. The third part of the PDW consisting of agreed and negotiated goals, training requirements and other requirements was finalized on 15-17 January. This workshop also finalized the program for implementation. An implementation manual documenting the process and all decisions was produced in February 2007.

As there were no major training requirements that would necessitate a long delay in start up, self management began almost immediately after completion of the January workshop.

Analysis of Affect and Mental Health

Mental health was measured by self report and by measures of 18 emotions or affects experienced at work. These 18 affects fell into three independent clusters which were converted to three scales, Positive affect, Negative-angry which contains those affects normally associated with a bad day at work such as tired and frustrated and Negative-trapped which contains the more psychiatric indicators. We concluded from an extensive statistical analysis that respondents had overestimated their mental health by roughly a third and the affect scales appear to give a more accurate assessment of mental health or risk of disorder. Until further research can corroborate this finding we use both data sets in the following analyses.

More people had high scores on the negative-angry scale than on the negative-trapped scale and both the numbers and the affects contained in the scales indicate that the negative-trapped scale may be a measure of more serious mental health problems.

Many organizational factors and only one personality factor and one demographic characteristic were found to directly contribute to these scales. This is not to deny their significance of personal factors for some people or the importance of other individual experiences but in the four organizations for which we have relevant data, the organizational variables have proven the most powerful. This is a reassuring message for managers that wish to change their organizations to prevent mental problems in their workforce and concomitantly improve their bottom lines. In particular we found that a productive workplace helps produce healthy people. This echoes the famous saying that ‘the product of work is people’.

Comparing Org3 with estimates of mental illness in the population, we found that Org3 would appear to be in line with more general ratings of mental health in the population.

Systemic Overview of Determinants of Mental Health

At the time of measurement, Org3 was 56.1% of the way towards a perfect DP1 structure, 64.8% of the way towards a perfect DP2 structure and 53.5% of the way towards a perfect Laissez-faire structure. Variable by variable analyses showed there were particular weaknesses in the intrinsic motivators (6 criteria) and in the factors leading to intellectual satisfaction. Mental demand in particular was low.

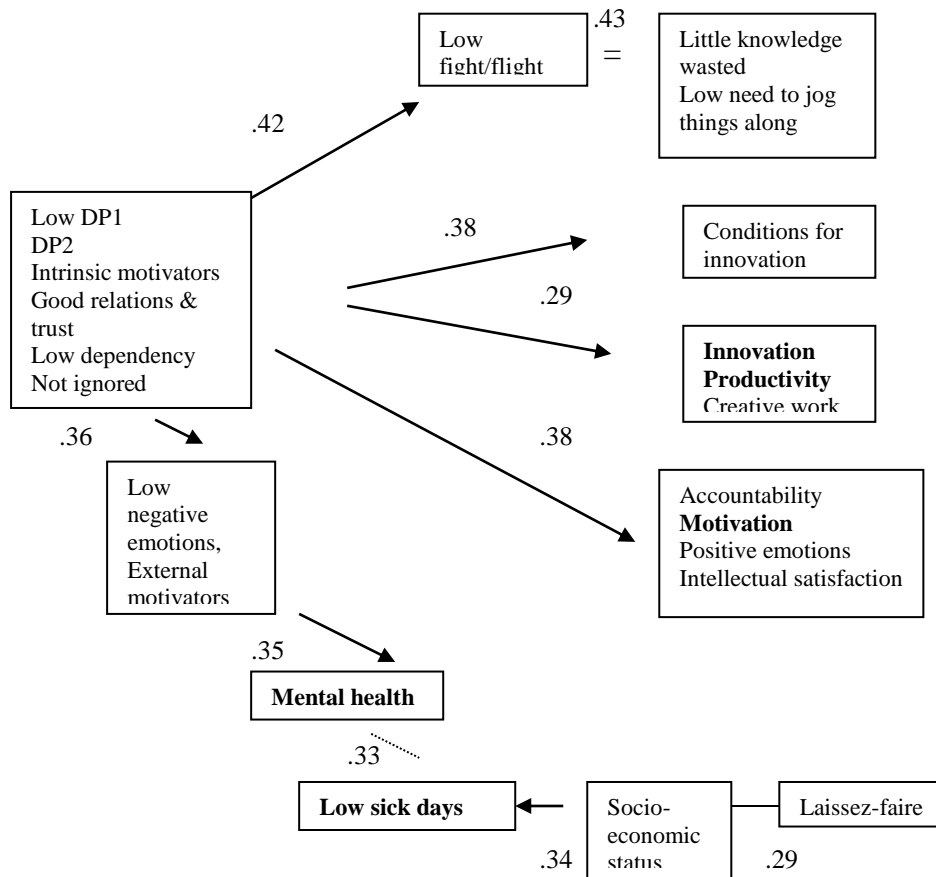
Relationships and trust were generally average, positively influenced on the one hand by management’s openness in discussing how the business was going but suffering from frequent appraisals, the fairness of which was sometimes doubted. There was a reasonable level of tolerance for small mistakes but insufficient opportunities for learning on the job and low reward for innovation.

Figure 2 presents the overall pattern of results from the pre-intervention survey of Org 3. The sample size is 68 and the correlation matrix has been iterated 5 times. In figures 5a and b, only the arrows depict causal relationships. Please note that these graphs are not models, they are the actual patterns of links within the data. Figure 5a shows that DP2, not DP1, along with the 6 criteria (the intrinsic motivators), good relationships and trust, low dependency and people’s bright ideas not being ignored, lead to most of the enabling conditions and then to the outcomes of mental health and low sick days, and lead directly to the outcomes of motivation, innovation and productivity. The breakout of the determining cluster in figure 5b shows that DP2, not DP1, is the primary cause of the intrinsic motivators from which the other factors flow.

Mental health and low sick days have two primary determinants, DP2 as above and also laissez-faire which was evident particularly at the top of the hierarchy (SES). Other data also indicated that the people at risk of mental illness showed a typical profile of ‘lost potential’ (Druss et al., 2000), a higher than average education and family background combined with current low status job or income, i.e. they could not live up to their original potential.

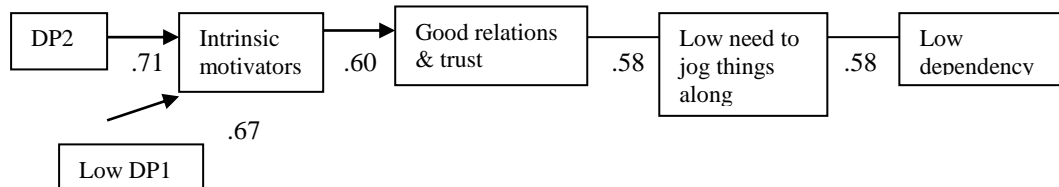
This causal path illustrates sociotechnical theory perfectly. DP2 which locates responsibility for coordination, control and goal attainment (accountability) with those doing the work equalizes relationships, improving their quality and reducing the probability of the destructive dynamics of dependency, fight/flight and pairing (Emery M, 1999). It increases the objective quality of working life as measured by the 6 criteria (intrinsic motivators) listed above and, therefore, motivation or engagement. DP2 is the bedrock on which the positive individual and organizational outcomes are anchored.

As it is not possible for any of the mediating variables to create the design principles, this graph shows clearly that the design principles act directly on the mediating variables to create the enabling conditions for accountability, innovativeness, productivity and mental health.



There are also strong secondary links between the clusters on the right meaning that there are also causal relations between the conditions for innovation and innovation and between motivation and innovation and productivity etc

Figure 2a. Causal Path for Org3
(from M5)



$r = .24 @ p < .05$; $r = .31 @ p < .01$; $r = .39 @ p < .001$;

Figure 2b. Breakout of Determining Cluster
(from M0)

A cascading series of stepwise regressions confirmed the pattern from the causal path analysis so that we may conclude that the sequence of factors for determining mental health runs from DP2 (not DP1) to enabling conditions to mental health. Changing one or more enabling conditions for improved productivity and mental health will not be sustained if the structure is still designed on DP1.

Business Results for First Year of DP2

Productivity measures from 7 different machines on the assembly floor showed a range from 10% to 22% increase since July 2006. An aggregate of all machines showed an overall increase of 11.8%. There has been no change in quality measures which is not surprising as faults were already low relative to number of units produced. There has been no change in Total Recordable Injuries, 2 in 2006, 1 in first 6 months of 2007. Actual sick leave shows a 28% decrease in absenteeism. There has been an 81% increase in employee engagement. These engagement surveys are conducted by an external firm totally independent of the current research reported here.

Conclusion

All the statistical analyses and the business results show a clear sequence of causality:

DP2 → enablers → personal health & org. performance

These results support the theory of sociotechnical systems and confirm previous findings from Trist & Bamforth (1951 and see introduction to the 1989 edition) onwards that the genotypical design principles have far reaching effects on all aspects of organizational life, health and performance.

The discovery of sociotechnical systems was recognized from the beginning as a major advance over previous conceptualizations of organization and its evolution into DP1, DP2 and laissez-faire structures has resulted in further huge advances in our understanding of how structures affect the people who live and work in them. The current study justifies the confidence of the pioneers as we come full circle and confirm the earliest observations that genotypical structure is a major causal factor in mental health.

Destroying Myths

This brief summary of the effects of the design principles destroys several myths that have grown from the results of the practice of STS particularly in North America (see chapter x herein). As this form of STS does not employ the design principles, it shows the same sort of unsustainable results as a whole range of other methods that manipulate only phenotypical factors. When the genotypical principles are changed, the results show the myths for what they are –myths.

Myth 1. Improving Conditions for the People Risks Profits. What this brief overview achieves by its continuous confirmation of results over time is complete destruction of the myth that improving the working conditions for the people is at the cost to business results. This myth arose from organizations that had improved the superficial conditions only to find no difference in the bottom line. No additional amount or beautification of facilities or surroundings can sustain increases in organizational performance simply because those changes do not motivate people to sustain them. A simple change in design principle achieves all this and more.

Myth 2. Improving One or Two Factors Can Change the Whole. The second myth destroyed follows from the first. It is simply that you can not change one, or even a few peripheral or phenotypical factors such as communication skills or computerized feedback schemes to achieve sustainable systemic change. You either change the system or you don't.

Myth 3. It's the People, Stupid. The third myth is the most basic of all. It says that organizational problems arise from the people and, therefore, to solve organizational problems, you must fix up the people. A moment's thought shows that this belief hides an enormous paradox. It is in fact a product of the school of thought that claims to value people above all else. By elevating the individual to the exclusion of all else, this belief actually denigrates them. Valuing individuality as an a-contextual phenomenon inevitably isolates people as the problem because there is nothing else to blame. It is an excellent example of the damage done by closed systems thinking. But this myth goes beyond blaming the victim; it creates them.

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<i>Steps removed from policy maker</i>	<i>No in DP1</i>	<i>No. in DP2</i>
1 step	5	2
2 steps	15	0
3 steps	8	0
Total of communication channels	28	2
Task mediated relations between peers, maximum. This is calculated for within groups. We could add 1 under DP2 for between peer groups.	0	136
Paper generating function*	59	2

* These diagrams and table are adapted from Emery & Emery (1976, p166-171) where we stated that this was an estimate of the paper generating function based on previous experience that it increased by the square of the distance from the bottom level. We multiplied number of steps by steps removed from the top.

DP1, error amplification	DP2, error attenuation
$T = (1-F)^n$	$T = (1-F^n)$
$T = (1.0-0.2)^5 = .33$	$T = (1.0-(0.2)^5) = .9997$

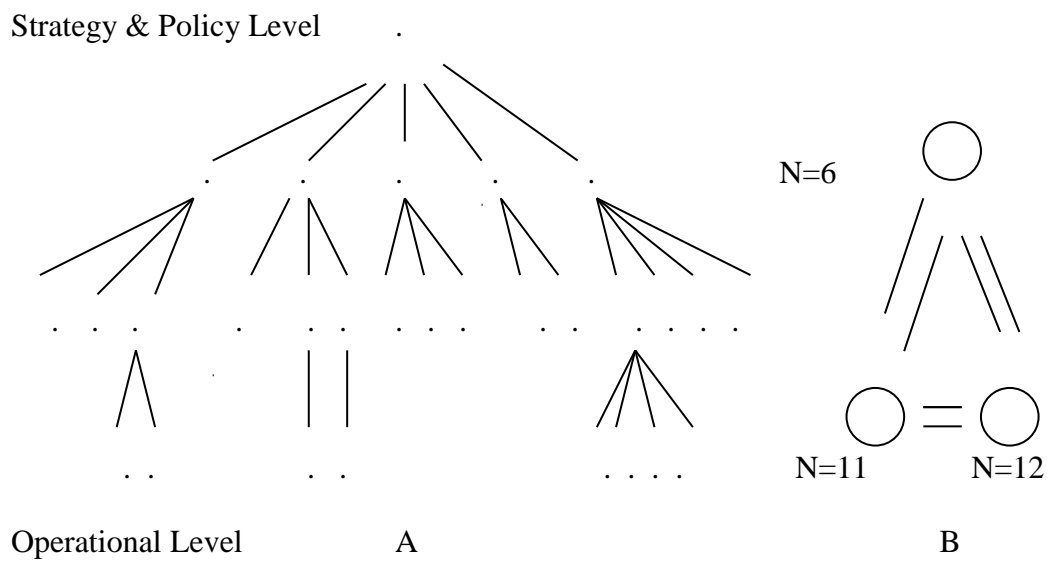
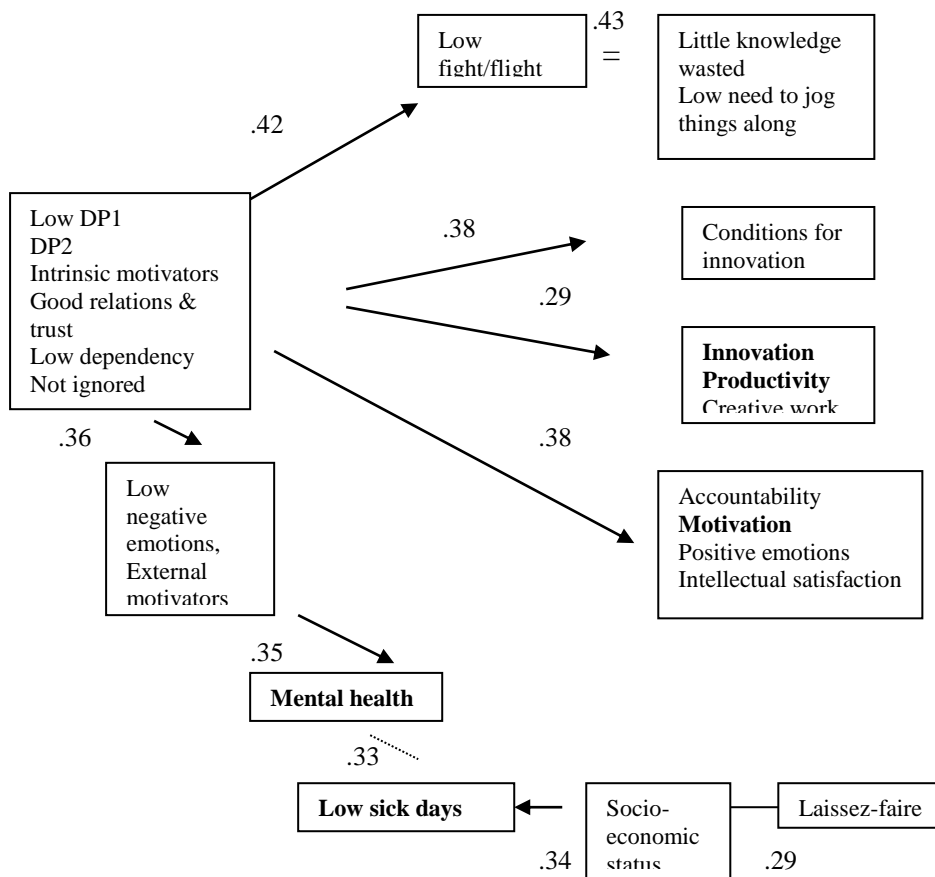
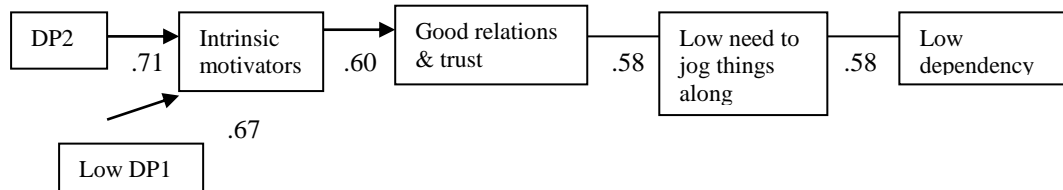


Figure 1. Structures of a Small Organization under the Two Genotypical Design Principles.



There are also strong secondary links between the clusters on the right meaning that there are also causal relations between the conditions for innovation and innovation and between motivation and innovation and productivity etc

Figure 2a. Causal Path for Org3
(from M5)



$r = .24 @ p < .05$; $r = .31 @ p < .01$; $r = .39 @ p < .001$;

Figure 2b. Breakout of Determining Cluster
(from M0)

