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Complementarities, Coupling and Organizational Adaptability

by

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Abstract

Complementarities arise when increasing environmental turbulence and complexity forces an organization to differentiate its primary orientations and attend to the different orientations simultaneously. The left and right hemispheres of the brain, the social and technical components of sociotechnical systems and the product and function orientations in matrix organizations are examples of complementarities. Each orientation possesses an intrinsic logic of its own, yet different than but complementary to the other. At the juncture of these different orientations a coupling takes place that may be as tight or "hard-wired" as the corpus callosum in the brain or as loose as it is between teaching and research in many parts of academe. At the coupling point, the differences between orientations is taken up. In essence, this is the point where organizational adaptability is or is not successfully implemented. Organizations structured to recognize complementary functioning are a logic of change rather than a logic of control.

COMPLEMENTARITIES, COUPLING AND ORGANIZATIONAL ADAPTABILITY

Harold Benjamin, in a 1949 Inglis lecture "The Cultivation of Idiosyncracy," asked a question "which a democratic society may ignore only at its deadly peril. The question is double-barreled:

1. How much uniformity does this society need for safety?
2. How much deviation does this society require for progress? (p. 9)."

Benjamin's questions are directed to a societal level. Similar questions have been raised at every other level in the domain of research we call organization behavior. At the level of the organization, Parsons (1960) identified pattern maintenance and adaption as two central attributes; March and Simon (1958) pointed to the importance of programmed activity and innovation and, in the same work, to persistence and change; Ashby (1956) was concerned with the variety decreasing and variety seeking properties of organizations. Thompson (1967) referred to the phenomenon as the basic paradox of administration, one that was drawn between certainty and flexibility and which revolved around the time dimension.

"In the short run, administration seeks the reduction or elimination of uncertainty in order to score well on assessments of technical rationality. In the long run, however, we would expect administration to strive for flexibility through freedom from commitment - i.e., slack - for the larger the fund of uncommitted capacities, the greater the organization's assurance of self-control in an uncertain future" (p. 150).

Karl Weick (1969) attempted to straddle the organizational and social psychological levels and saw Benjamin's questions as ones that cast two

orientations in competition with each other. "The reasons for the instability of organizational arrangements, and the reasons they must be continually reaccomplished, is that the requirements for flexibility and stability are mutually exclusive. The attainment of one is at the expense of the other" (p. 39). He advocated the maintenance of a balance between flexibility and stability, a balance we will explore in more detail in our discussion of complementarities and of the coupling between them.

At the social psychological level the issue of conformity and deviation has been a recurrent one (Bass and Berg, 1961; Hollander and Willis, 1967). At the level of the individual, authors have used a variety of terms to refer to the invariant, identity-seeking properties of individuals juxtaposed against the needs to seek variety, to develop, to grow (Erikson, 1960; Gergen, 1971). Meltzer (1972) summarized this concern in his explanation of George Herbert Mead's model of "I" and "Me".

"The "I", being spontaneous and propulsive, offers the potentiality for new, creative activity. The "Me", being regulatory, disposes the individual to both goal-directed activity and conformity. In the operation of these aspects of the self, we have the basis for, on the one hand, social control and, on the other, novelty and innovation" (p. 11).

Benjamin's questions raise the issues of uniformity and deviation, not one or the other. With time as the differentiator, Thompson too seeks the elimination of uncertainty as well as the attainment of flexibility. Weick advocates a balance between the two; not one or the other, but some appropriate balance of both. And Mead is explicit in stating that both "I" and "Me" are needed to make up the self. I will refer to this inclusion of both attributes as the concept of "complementarities," and for now

I will be deliberately vague about the characteristics of these attributes. The word "complementarities" is borrowed from the late Fritz Roethlisberger. In his posthumously published autobiography (1977) he postulated "a principle of complementarity as a way out" and explained it as follows:

> "Thus, I come finally to the conclusion that the two ways of representing social reality as concrete systems and as abstracted systems are complementary ways of looking at it, neither of which can be reduced to the other. This conception of social reality offers the opportunity for the development of knowledge and action in ways that avoid the confusions and inconsistencies that we have fallen into. It makes it possible to keep *separate but related* the concrete and the abstracted, the A-relations and the B-relations, the natural (phenomenological) and the artificial, subjects and objects, the knower and the known, description and prescription, knowledge makers and knowledge users. Our failure to do these things during my lifetime has resulted in the issues and debates that we have been unable to settle and from which have emanated the inconsistencies and confusions that have limited the development of our understanding of the phenomena of human behavior in organizations." (p. 465).

Roethlisberger's comments guides us not only to the use of the term "complementarities" but also to the observation that complementarities are not merely polar opposites in a dichotomous scale. Rather, they are conceptual components that when combined into a complementary arrangement can lead to new understanding, particularly of complex phenomena. I will

take considerable license with Roethlisberger's definition and will not confine the term solely to concepts that are simultaneously concrete and abstract. I will redefine the term so that it refers to complementary organizational units or aspects of organizational arrangements and then study how analysis in complementarity terms can explain organizational adaptability and perhaps even guide it.

This discussion, then, will focus on a specific outcome variable, adaptability, and will explore it through research developments at several organizational levels: the individual, the work group and the organization. However, the concentration in the discussion is with issues of organization design and, in particular, the design of matrix organizations and sociotechnical work groups. In this sense we follow Pinder's and Moore's (1979) request for a multidimensional criterion that reflects the "Characteristic Adaption Style" of the organization. The individual level research is literally intra-individual since it refers to recent medical and neurological developments in the area of left and right brain research. The work group level explores the concept of complementarities through the social and technical components of sociotechnical systems theory. The organizational level discussion deals with the dual arrangements found in matrix organization designs.

The assumptions driving these arguments follow from Emery's and Trist's (1965) contention that the environment of many organizations is becoming increasingly turbulent. Organizations operating in such environments increasingly discover that it is inadequate to be strong along only a single major organizing orientation (function, product, area, culture, technology, short term, long term, etc.), the classic rational approach

of bureaucratic organization. For many such organizations at least two sub-environments are simultaneously critical to survival and to effective functioning (Davis and Lawrence, 1977). Those simultaneous environmental demands must be recognized in the organization's arrangements. Furthermore, the nature of those demands are such that they result in quite different orientations within the organization, orientations that are complementary to each other, although occasionally conflicting. I will elaborate later.

At the organizational level, the recognition of environmental dependence has been relatively recent, but it has been responded to with a variety of different organizational designs (Ansoff and Brandenburg, 1971; Davis and Lawrence, 1977). At the work group level, complementary concepts have been understood for a longer period of time, but application has been slower. Environmental turbulence at this level shows up primarily as variance in the processes of production (Cherns, 1976). Emery and Trist (1960) have identified the social and technical aspects of socio-technical systems as the components of work groups that must be appropriately coordinated if the variance is to be managed effectively, components I will be calling complementarities.

I will commence my case for the consideration of complementarities at the level of the individual and with respect to recent research into left and right hemispheres of the brain. My argument builds from Jaynes' (1976) contention that current conceptualizations of consciousness are a result of recent revolutions in the functioning of the mind. The mind of earlier man did not operate as our minds now do and the complementary relationship of left and right brain hemispheres is a biological-organizational evolution fomented by the breakdown of the earlier bicameral mind.

The case being made here is that we will do better in our understanding when we consider both constructs as complementary components of an effective response on the part of the organism or organization to its environment. Furthermore, the very process of thinking in complementarities will allow us to re-address many situations where we've been too often too prone to categorize the different forces in "either-or" terms, or too quick to adopt contingency perspectives that, depending on the state of a particular variable, force a single choice when a single choice may not be the most appropriate response.

Complementarity Situations

The Complementary Hemispheres of the Brain

One important example of complementary functioning has achieved recent scientific recognition as a result of medical experiments done with patients whose "corpus callosum" has been severed (Ornstein, 1972). The corpus callosum is the set of interconnecting fibers which join the left and right hemispheres of the cerebral cortex of the brain. When the hemispheres are separated the independent action of each becomes observable. The left hemisphere is connected to the right side of the body. It is predominantly involved with analytic, logical thinking in a linear mode. Information appears to be processed sequentially in this left hemisphere. The right hemisphere (connected to the left side of the body) is primarily responsible for our orientation in time and space and for our artistic sense. This hemisphere tends to be more integrative in the way it handles information.

> If the left hemisphere can be termed predominantly analytic and sequential in its operation, then the right hemisphere is more holistic and relational, and more simultaneous in its mode of operation. (Ornstein, 1972, p. 68).

The research into split-brain functioning is fascinating. That two very different modes of operation have been discovered adds a completely new dimension to our understanding of how the mind works. However, there has also been another equally important discovery: namely that these two very different modes of operation work in a kind of complex harmony. In some coordinated mannner, the left and right hemispheres combine to allow each of us to use language and thought analytically while still enabling us to be creative and to solve complex puzzles out of disjointed and often limited information.

The hemispheres of the brain do not achieve this result by functioning as polar opposites in a dichotomous relationship. It is not that more of one means less of the other. Their relationship is different. What the one is capable of doing is quite different from what the other can do. They appear to function as complementary components, as two distinct entities working in tandem and linked together, as a team of sled dogs might be, by some seemingly fragile couplings. It's almost as if their orientations were orthogonal to each other. Yet, they are not independent of each other. They interact with each other, and they do so extensively.

That the hemispheres can't be orthogonal is a consequence of the fact that their interactions lead to occasional conflict. Some situations occur where concentration in one orientation is achieved at a cost to the other (Ornstein, 1972, p. 78). For the most part, however, the relationship is a complementary one. I will refer to this relationship as a complementarity. This complementarity of the hemispheres of the cerebral cortex provides a foretaste of the complementarities to be explored in the domain of organizations.

The argument advanced here is presented at two levels: one illustrates the conceptual value in thinking in complementarity notions for a variety of phenomena that have too often been conceived of as dichotomies. Roethlisberger characterized many of these as "false dichotomies" (Roethlisberger, 1977). The other level focuses on specific organizational designs that are living examples of the complementarity concept. This second level of argument describes particular designs which are explicit recognitions of complementarities in their structures,

in their support systems, and in the detailed processes that make up day-to-day organizational life. I will commence with the latter.

Sociotechnical Systems as Complementarities

While it was some 20 years ago that the initial research was done that coined the term sociotechnical systems (Emery and Trist, 1960), it is only of late that this work has began to be appreciated in the organizational literature and applied in a number of organizational settings. The concept of sociotechnical systems was born of an awareness of the increasing turbulence of the environments in which organizations function (Emery and Trist, 1965). It will become evident that this recognition is an important reason for thinking in terms of complementarities.

The early work in the development of sociotechnical systems concepts came from studies into the changes that technology had created in the coal mines in Britain. Coal getting had been a manual operation performed by a small team of colliers. With the introduction of undercutting equipment to prepare the coal face, of new, more powerful explosives and of conveyor belts to transport the coal, coal getting became a much more technologically sophisticated undertaking (Trist and Bamforth, 1951). In redesigning their organizations to take advantage of the technological improvements, many of the colliery owners moved in the direction of optimizing the technological arrangements and paid very little attention to the sociological or social group requirements. Productivity improvements were well below what they should have been and were accompanied by significant increases in job dissatisfaction (Trist et al, 1963).

However, the researchers also found that not all the colliery owners

implemented the technological improvements in the same manner. In some British coalfields, the optimum technological designs were compromised in favour of more concern for the social structure of the work group. In these "composite" systems, the coalface was redesigned so that the miners worked in semi-autonomous work groups and were paid as a group for the level of production they achieved. What became apparent to the researchers was that different combinationsof social and technical arrangements resulted in different combinations of, on the one hand, productivity and on the other job and social satisfaction. The resulting job and social satisfaction of the miners more than compensated for sub-optimal technological design and the combined sociotechnical system outperformed, on both productivity and satisfaction dimensions, most of the systems that had been designed purely to optimize the technology.

The conclusions of the researchers was that good sociotechnical systems design took into account the interdependence of the social systems and the technological systems. Within this conceptual framework there was also room to account for many of the other variables that could affect a particular situation. For example, variations in the geology of the coal face had a significant impact on output. As a result, the sociotechnical arrangement that suited one coal mine could be quite inappropriate in another. In like manner, the experience of the people in a particular colliery, the state to which the coal mine had advanced in introducing technological improvements, the social system "on top", and a host of other variables could each affect the choice of sociotechnical arrangement for that particular situation. It suggested to the researchers that context was a critical aspect of the design of organization. Hence the

second strong conceptual statement they proposed was that organizations have to be considered as open systems in continuous interaction with their environment.

If we reflect back on the previous discussion about the left and right sides of the brain, it is obvious that context is critical here too. The social setting in which the individual develops, the perceptual stimuli received at the inputs to the brain, the patterns of experience ingrained in any single individual, are all bound to affect the interaction patterns of the left and right brains with respect to a particular situation. As with sociotechnical systems we have to be consciously aware, not only of the complementary aspects of the two orientations but of the context of a wider environment in which the individual operates.

Even more so than the study of the brain does, the study of sociotechnical concepts reinforces the case for arguing that we are dealing not with the polar ends of a spectrum when we examine the tensions built into some organizational forms, but rather that we are dealing with two different orientations that interact with each other. Each orientation has independent characteristics as well as interdependent ones. The interactions between orientations clearly affect the interdependent characteristics, and these, in turn, reflect back to impact the independent ones. The entire interaction is a dynamic one. Seen in the context of a wider "turbulent" environment, the complexity of the design situation begins to unfold.

The Complementary Components of Matrix Organizations

The study of the brain is fascinating but is at its infancy in terms

of our understanding. Our knowledge of sociotechnical systems is older, but our familiarity with successful applications is recent (Emery and Thorsrud, 1976) and not too extensive, at that. The formal study of matrix organizations is even more recent than the study of sociotechnical systems, but the applications of matrix organization forms are many and are growing rapidly (Perham, 1970; Stopford and Wells, 1972; Davis and Lawrence, 1977).

Davis and Lawrence (1977) have proposed several conditions to guide an organization in its decision about whether or not to adopt a matrix design. One such condition occurs when an organization faces at least two different environmental sectors and finds that each is critical to its success and one is not significantly more critical than the others. To respond appropriately the organization must develop and maintain orientations that confront each of these critical sub-environments.

In domestic manufacturing organizations, functional hierarchies and business area or product teams are the usual way to respond to these dual environmental pressures (see figure 1). In multinational corporations the duality tends, for the most part, to be represented by simultaneous product and area orientations. In service settings the two focii tend to be manifested through function and area (or geography) organization forms. While the combinations are different for each sector, the essential similarity is that the two orientations are not polar opposites. Nor are they orthogonal to each other. They are, in the language we have used here, complementary to one another; complementary, that is with respect to the organization's purpose. Within the organization itself, this self-same complementarity creates a tension; but a constructive tension

that maintains the organization responsive to its sub-environments and, as we shall see later, highly adaptable.

Independent Logics: Rationalization and Innovation

The above-mentioned tension in matrix organization forms are a consequence of a fundamental paradox that all organizations must manage. If we remain for now with the domestic manufacturing matrix, where function and product are the two organization forms, this paradox becomes obvious. The functional orientation is designed to allow the organization to benefit from scale economies. It is Weber's classic rational-legal design. Its underlying basis is efficiency or rationality and it makes that basis operational by working down the learning curve, whether that learning is in the selling or manufacturing areas or in the specialist and upper management areas. A functional organization must become good at doing the same kinds of things over and over and over again until it does at least some of them better than others who compete in the same environment. In other words, the functional organization has an intrinsically sound, logical basis for being one of the critical components of the function-product matrix organization.

The product organization has a completely different rationale underlying its design. Its purpose is coordination and, frequently, innovation. It exists to create cohesive responses and bring them to bear against the organization's environment. Building off skill and knowledge differences and not off similarities, as the functional organization does, it attempts to integrate these differences into new ways, new approaches, new ideas, new technologies, and ultimately new products or services.

Like the functional form, the product component has an inherently logical purpose of its own.

The resulting internal tension is between economies of scale or efficient ways of doing similar things and novel or different ways of coordinating dissimilar things; i.e.,between rationalization and innovation. Each has an independent logic of its own, a purpose and a rationality of its own. Yet the two are interdependent and complementary in the manner in which they accomplish the overall organizational objectives. I will explore that interdependency and reinforce the concept of complementarities by examining some of the other conditions for matrix organization.

A second condition for matrix organization is also environmentally determined. If the amount of information that the organization must process is considerable, and an organization that faces out onto two turbulent sub-environments will certainly face high information processing requirements(Galbraith, 1972), then to be effective in its environments the organization must develop capacity to process that large amount of information. In effect, this is the condition that creates the <u>need for interdependent action</u> on the part of the two orientations in the matrix.

The members of the functional organizational units develop proficiency in a variety of skill and knowledge areas. The more rapidly the sub-environments of the different functional units change (e.g., the scientific sub-environment that is faced by the research and development unit, Lawrence and Lorsch, 1967a), and the more diverse they become, the greater the uncertainty and complexity in the skills and knowledge made

available to the organization by the functional members of these differentiated units. The product organizational unit in a turbulent environment faces a similar situation. For example, it may confront variations in its market sector, in its customer base and in the posture and pricing policies of its competitors. Both orientations feed a wide variety of different information to the organization, information that is often uncertain and, in its aggregation, complex. However, each orientation depends on the other to provide it with the requisite diagnostic skills to act appropriately on its own information.

For example, a product manager who wants to respond to a competitor's new product entry may need the functional engineering group's assistance to evaluate the technical implications of a possible response, the sales or marketing area's knowledge to analyse the market share, pricing and publicity problems of an intended change, and the manufacturing department's assessment to forsee the impact on existing inventories and future production.

The first condition for matrix organization, then, sets the logic for simultaneously independent organization units. The second condition establishes the need for interdependent interaction. The third condition forces that interdependence if resources are scarce. It is this last condition that leads to two-boss persons in the matrix.

Product teams need high calibre functional inputs to the decisions they must make. If they haven't the wherewithal to develop and maintain those resources themselves (as a decentralized organization would), they must "borrow" them for appropriate periods from the repositories of those particular skills, the functional organizations. While attuning themselves

to the product goals, the functional representatives must maintain their specialist hats, must remember who and what they are representing. From the organization's perspective, their functional focus complements the product's purpose. As such, they are the vehicle through which the complementarity concept is exercised.

The two-boss person is the "corpus callosum" of the matrix. He or she has been referred to as "an integrator of sensitive processes" (Davis and Lawrence, 1977, p. 209). The two-boss person, in fact, may help us understand some of the corpus callosum functioning. If you sever the corpus callosum you remain with independently functioning left and right brain halves. By themselves, each can process as much information as it could connected to the other, perhaps even more (Ornstein, 1972, p. 74). However, the individual loses the ability to respond with coordinated or complex replies. If you removed the two-boss persons from a matrix design, despite their small numbers, the effect on the organization would be equally debilitating. You would remain with functional units unable to coordinate to accomplish their purpose, and with product units with few or no resources to apply to their respective market sectors. In effect, the organization would be less able to cope with complexity; as in the case of the individual whose corpus callosum had been severed.

The essence of matrix understanding is the comprehension of the complementary way its necessarily independent components interact interdepedently. Matrix organization designs are one set of ways to manage the tension that results from simultaneous needs to cope with, for example, rationalization and innovation.[1] Human brains are similarly organized to manage complementarities; in their case, in so far as our understanding

to-date is concerned, the functions of analytical reasoning and holistic understanding. Sociotechnical systems perspectives are systematic ways to design work situations to integrate the potential benefits of efficient technology with the total set of human and social demands of men-machine combinations. All are easier to comprehend by seeing first their independent perspectives and then their interdependency with and complementarity to each other.

The Concept of Complementarities

Several research directions have hinted at complementarities but few have been conceptualized as such. Social psychologists struggled for years with the evidence of both task and social motives in the behavior of small groups (Bales, 1958) but they rarely saw a way to fuse the two in a single conceptual scheme. Etzioni (1965) advanced an early proposal advocating the simultaneous existence of task and social leaders in small groups but this avenue was quickly abandoned and replaced by leadership theories that centered around dichotomous notions of leadership, i.e., a leader was either task-oriented or socio-emotionally oriented (see House and Baetz, 1978 review). This led inevitably to contingency approaches to the problem (Fiedler, 1967; House, 1971) whereby different conditions dictated when one leadership style rather than the other was appropriate. Leadership theorists never seemed to take the extra step to acknowledge that both might be necessary at the same time (with the exception of some earlier discarded "great man" theories of leadership).

Blake and Mouton (1964) had an enormous impact on management training in countless corporations through their Managerial Grid. They assumed that most managers were either production-oriented or people-oriented,

and while it was also true that some were a little bit of both, very few were enough of both to achieve the desired ideal of being simultaneously high in orientation towards production and people. If we treat the Managerial Grid as a complementarity concept (and I won't defend that here) we can advance our understanding of complementarities from observation of the Grid's application. At the same time, with our developing knowledge of complementarity functioning, we can, in turn, suggest a better way to conceptualize the concept of the Managerial Grid.

How can we learn from the Managerial Grid? The technology of the Grid suggests that a little bit of both a production and a people orientation isn't enough to be the basis for effective management. In other words, there is at least a threshold level of dedication to each of the independent components of a complementary pair that must be made. (I won't pretend to explore the contingencies that might determine the minimum threshold levels). Each orientation, then, must have some legitimate recognition of its role if a complementarity relationship is to exist, and that role must be neither trivial nor a secondary one. There is no statement here that both orientations must be equally represented, only that neither can be subservient to the other and both must be above some threshold level.

We can now turn to the question of how complementarity concepts might improve the Grid. From experience with matrix organizations, it can be suggested that while managers high on both production and people orientations may be effective in their jobs, the high level condition is probably not a necessary one. Rather, the ability to adjust the production-people, balance according to some contingencies (situation, indivi-

duals, task, technology, etc.) is likely a more realistic way to conceptualize effective managerial behavior. There are times when a high production orientation and a medium people orientation makes sense and times when a medium production and a high people orientation is better; but there's almost never a time when all production and no people is an appropriate response or vice-versa; and an orientation that is half production and half people is probably below the threshold level of effectiveness. Complementarities, then, is more a concept of appropriate balance than one of maximization along each independent orientation.

The learning coming out of the discussion of split-brain research, sociotechnical systems and matrix organization designs suggests that each of the component parts of the complementary organism or organization has its own unique logic for its particular sub-environment: rational and analytic for the left hemisphere of the brain, artistic and holistic for the right; technically efficient for one component of the sociotechnical system and socially sensitive and supportive for the other; rational and efficient for the functional side of the matrix design, integrative and responsive for the product side.

Complementarity components, then, each have a logical, rational purpose within themselves. Each is an organized way for the organism or organization to respond to important but different aspects of its environment and the components are necessarily different in order to manage those environmental differences. Over the long-term, neither is subordinated to the other unless the environment becomes placid and selects one orientation. In the short-term one orientation may dominate, but over time, enviromental change will re-dress that imbalance. To be able

to do so,i.e., to be adaptable, both orientations must enjoy equal legitimacy. This, then, is another good reason for there being at least a minimal threshold of each component. With environmental change, each component re-adjusts to the size and relationship appropriate for the external conditions without being heavily hampered by normal organizational resistance to change.

I have identified the relationship of each component in the complementarity set to each other in terms of the relative size of each, the simultaneous need for both, the minimal levels of each, the intrinsic logic in each, and the balance that must be drawn between them. I have not identified the orientation of each to the other in terms of directionality or differences. It was earlier suggested that the relationship was somewhat orthogonal but nevertheless interdependent. The best I can do at this point is turn to Sommerhoff (1969) and use his concept of "directive correlation" to inform us, much as it has informed the earlier-mentioned sociotechnical theorists. Both components must be directed towards a common objective and this probably sets the necessary conditions for interdependence. The inherent logic of each sets each component on its own independent track, but the need for each to be directively correlated towards shared organizational goals forces interactive activity. That, coupled with the need each component has of the knowledge of the other to make decisions that are effective for the organization as a whole prevents each unit from sub-optimizing along its own logical direction. While I can only speculate about this relative orientation, it appears to be intuitively sensible if we examine the examples of the brain, sociotechnical work groups and matrix organizations. Finally,

though the reasoning is somewhat circular, if these complementarity forms are as adaptable as I shall subsequently suggest, that adaptability must result because the independent orientations are driven to interact with each other around some commonality, and that commonality must be one of shared objectives.

Coupling

Specialization or the division of labor is the basis of bureaucratic organization theory. It is also fundamental to the concept of organizational efficiency in the theory of just about every organizational form. However, the coordination of that same specialist activity is equally fundamental if any kind of cohesive organizational response is to result. Rules and regulations, shared superiors in the hierarchy, planning and budgeting systems and direct contact (Fayol's (1951) "bridge") have been identified as the primary mechanisms of coordination in conventional, hierarchical organizations. Contingency theorists (Lawrence and Lorsch, 1967; Galbraith, 1972) have added to the list by including more complex coordinating mechanisms which come into play as the uncertainty and complexity of the organization's environment increases. Hence, in ascending order of complexity, they have added task forces, teams, integrators, integrating departments and matrix organizations to the list of mechanisms to be utilized as the organization becomes increasingly differentiated.

More recently, Glassman (1973) and Weick (1976) have advanced the concept of loose coupling and loosely coupled systems to suggest another way to conceptualize the linking mechanisms between different organizational units. A loosely coupled system is distinguished from a more integrated or "fully joined" (Ashby, 1960) system in that it is: "A system

whose parts are less richly interconnected, one with independence or temporary independence between parts, (and one which) forms local stabilities which ignore limited perturbations elsewhere in the system" (Glassman, 1973, p. 8.)

As environmental uncertainty increases and the information processing requirements of the organization increase commensurately (Galbraith, 1972), a tightly coupled system demands utilization of most of the mechanisms of coordination mentioned above, particularly the more complex ones. A loosely coupled system, in contrast, uses its loose coupling to buffer the system against environmental change. Rather than adapt to the turbulence in the environment, as a fully joined or tightly coupled system might, the loose couplings function as shock absorbers which take up the environmental turbulence and allow the component parts of the system to remain relatively stable.

Weick (1976, p.3) reiterates this in his definition of loose coupling by which he "intends to convey the image that coupled events are responsive, but that each event also preserves its own identity and some evidence of its physical or logical separateness." Defined this way, the concept of coupling seems a particularly appropriate way of conceptualizing coordination in the complementarities we have been discussing. However, the question of whether loose or tight coupling is the more appropriate coordination for complementarities is dependent upon the goal of the discussions here, namely,the understanding of organizational adaptability. Loose coupling tends to connote short-term buffering from environmental uncertainty. In time, however, loosely coupled systems must go beyond buffering and must also adapt or the environment will declare them misfit

and they will not survive. Tight coupling connotes rapid responsiveness, either reactively, which can be done by matching the environment (Burns and Stalker, 1961) or by mapping on to it (Lawrence and Lorsch, 1967), or proactively, by attempting to dominate it (Rhenman, 1973). We can begin this process of understanding adaptability by exploring the concept of coupling in the different situations we discussed earlier.

It was only as a result of cases where the corpus callosum was severed that researchers came to understand the independent functioning of the left and right hemispheres of the brain. When the corpus callosum is intact the hemispheres work in tandem and their independent actions are difficult to discern. However, it is the interdependent responses that are of interest here. Through many millions of nerve fibres in the corpus callosum, the brain is able to assemble a cohesive response that takes into account the orientations of each separate hemisphere. The coupling doesn't appear so extensive that one orientation undermines the other, but there is enough coupling to classify it as critical to the functioning of the organism. Hence we are concerned both with how "fully joined" (loose or tight, i.e., how intensive) coupling between complementarities must be and/or with how extensive the required coupling must be.

A good illustration can be drawn from experiences with matrix organizations. In the case of manufacturing organizations, for example, as few as 5%, and sometimes less, of the people in the matrix organization may be actively involved in the coupling experience, i.e., the two-boss persons. However, they are critical to matrix functioning. Their coupling is intensive. In academic institutions, where almost everyone is "matrixed"(Davis and Lawrence, 1977) with each other on one activity or

another, a much greater percentage are involved in the coupling, occasionally up to 100%. But the criticality of their coupled roles appears to be less (perhaps because the complementary orientations in these organizations are not of equal importance). Here the coupling is extensive, but not too intensive. In professional firms (e.g., construction and architectural consulting) or service sector organizations (e.g., hospitals) the numbers involved in the coupling functions appear somewhere between the above two examples. Hypothesizing is quite conjectural at this stage, however, as the numbers of those involved in the coupling increases the coupling appears to become less formal, less intensive and more fluid or more extensive. Hence the "hard-wired" corpus callosum in the brain and the formally appointed two boss persons in the matrix are replaced in professional and academic situations by teams and task forces with changing membership and by committees whose mandates are often unclear and whose freedoms to choose goal directions are often great.

If we turn to sociotechnical systems, the coupling mechanisms are more difficult to identify. Sociotechnical systems designs tend to be built on self-managing semi-autonomous work groups (Susman, 1976; Herbst, 1968). Some of the required coupling is to be managed within the self-regulating characteristics of the work group (e.g., peer evaluation, group selection of members, group allocation of tasks and administration of planning activities). However, in most of these instances the structural arrangement of the technology has been determined, hopefully jointly with social system considerations, and the self-regulating properties of the work group are more like "vernier" adjustments to compensate for variances in the social system or in the task context (e.g., the geology

of the coal face,if it's a coal mine,or the tree size and terrain if in the woodlands), as opposed to the technology. In other words, the work group is expected to operate within designed-in boundaries. Supervisors are expected to manage outside the boundaries of work groups (Jenkins, 1978) and within the work group are to behave as "coaches" rather than bosses. They, too, have limited control over the system parameters. The degrees of freedom to correctly couple social and technical components into a complementary organization lie essentially with the system designer.

Davis (1977) and Cherns (1976) have specified some of the principles the designer must apply if sociotechnical systems are to be appropriately coupled for effective complementary operation. For the most part, they are general design principles that exhort the designer to be systemic, congruent and conceptually clear of his or her approaches, to design minimally and to give the participants (the supervisors and work group mentioned above) the information, involvement and control to make necessary adjustments, and to be prepared to re-adjust as experience with the new design is gained. Coupling "devices" in sociotechnical systems are not clearly specified, as is a corpus callosum or a two-boss person. As in Lawrence's and Lorsch's (1967a) and Galbraith's (1972) scales of increasing levels of coordination mentioned above, it may be that there is a scale or set of coupling devices that needs to be identified to better understand how social and technical components of a system are linked (for example, a scale of increasingly local levels of variance control: design philosophies, technological and social constraints, design parameters, support functions, supervisory roles, work group roles, variance management, information access, etc.). This inability to clearly identify

coupling devices may be a consequence of the variety in the contexts to which sociotechnical systems approaches are applicable. Nevertheless, it may also be a central reason for the relatively limited success and diffusion of a seemingly powerful conceptual framework (Walton, 1975).

Coupling in complementarities can be both loose or tight, extensive or intensive, and in totality should probably comprise some of each. There's no obvious best arrangement. In sociotechnical systems we see tight coupling in the design parameters for the social and technical components of the system and loose couplings in the autonomy given the work team to adjust to local variances. Recent brain research has suggested that the physical arrangements of male and female brains are quite different (Witelson, 1976) and while the basic left-right hemispheres logic applies to both, the physical or structural differences lead to different strengths and weaknesses in the complementary relations that make up male and female response sets.

In matrix organizations, the inter-mingling between functions and products oftens blurs the clear distinctions that theory draws between the two. Within a larger matrix there is room for both smaller matrices as well as for hierarchically structured units. While much of the coupling takes place through two-boss persons, coupling is also accomplished in a host of other ways (teams, meetings, physical co-location, etc., see Kolodny, 1979).

Organizational Adaptability

In the process of development, children learn more quickly from

differences than they do from similarities (Vygotsky, 1972). There's no reason to believe that this same learning process would not apply to adult development. Complementarities are conducive to learning because they introduce different perspectives at the coupling point. I suggest that because of this they are a logic of change rather than the logic of control that characterizes bureaucratic forms of organization. I also suggest that this learning from differences is one of the central conceptual underpinnings that differentiates complementary logic from bureaucratic logic.

In a matrix organization, a change in either of the two orientations (again let us use the example of a product and function form) sets up an unstable state within the triad that forms the basic unit of analysis (see figure 2). For example, a new technological innovation may result in an engineering manager asking the design engineers (in their roles as two-boss persons) to revise the way they utilize that technology on some products. This could lead to re-negotiation of the role set or psychological contract or task boundaries between the design engineers and their respective product managers. The two-boss person can almost always buffer small perturbations. However, larger changes will force a re-negotiation of the three-way relationship. If the larger environment is truly turbulent, then so are the sub-environments, and the matrix triads can never be stable for very long. They must be continuously adapting. If all the triads in the matrix are doing so, then it appears appropriate to characterize the matrix design as a logic for change rather than a logic of stability.

This characteristic of complementarities is their greatest strength.

More so than any other reason, it explains why matrix organization designs have recently flourished, sociotechnical system designs have come into prominence (Emery and Thorsrud, 1976), and perhaps even why, if we follow Jaynes' (1976) argument, the brain has evolved from its earlier bicameral form of functioning. Adaptability is the basis of organism or organizational survival. This is true whether one takes an ecological perspective (Hannan and Freeman, 1977) and sees the environment selecting those organizations which are most adaptable, or whether one takes the perspective of the unit in question and views survival in terms of adaptive responses, e.g., organization designs that are contingent upon the uncertainty in their environments (Lawrence and Lorsch, 1967a).

Organizations based upon complementarity concepts come into being precisely to adapt to simultaneous but different environmental demands or conditions. In forcing a common coupling agent to coordinate the complementary logics, an integral part of the organization is forced to learn to constantly adjust to changes within each complementary component. Multiplied through many coupling points, this is one powerful explanation for the concept of "organizational learning" (Argyris and Schon, 1978). A tension is created at each focal point, at each coupling point; a tension that, properly channelled, can lead to adaptive behavior for the organization. The resultant set of behaviors is a complex set that I won't describe here but could include power balancing, dual systems, multiple bosses, etc. (see Kolodny, 1979).

Organizations are morphogenic (Buckley, 1967). They can adapt to the above described tensions by restructuring or, if coupling is loose, they can take up short-term perturbations within whatever flexibility the

coupling agents possess. If the coupling agents are two-boss persons, they can either exhibit the consequences of the tension negatively, e.g., stress, dysfunctional behavior and mental breakdown, or positively by improving interpersonal skills or using openness and trust to enhance communications in the triads (Kolodny, 1979).

If the brain is our complementarity situation and the corpus callosum is our coupling agent, we can only share Jaynes' (1976) speculations about how long-term evolutionary adaptability has made man more fit to cope with complexity. Short-run reactions would be the province of psychoanalytic theory with a wide range of unconscious and maladaptive behaviors that parallel the stress and overt dysfunctional behavior of two-boss persons who experience tension negatively. The positive correlate of short-run tension at the coupling point, the corpus callosum, must be related to how individuals learn.

It is more difficult to explain the functioning of adaptive coupling in sociotechnical systems. We know that supervisors are expected to buffer the boundaries, and we know that workers must be allowed to readjust their own work arrangements and work roles to compensate for the variances due to the reflections of changes in the social and technical environments. However, if the changes are large, for example, in the basic technology, we know that the system designers must redesign since the design is an integral part of the coupling process. More so than with matrix designs, sociotechnical systems demand that the design skills be kept adjacent to the system.

Turning to the matrix form, again, as an example, we can see other consequences of the complementary design that suggest its adaptive character.

With two orientations recognized as simultaneously important, a greater number of people become boundary spanners, i.e., people who face out onto the organization's environment and interpret for it. With more transactions with the environment, the matrix design increasingly approaches the open systems characteristics (Bertalanffy, 1968) considered conducive to environmental sensitivity, an information gathering stage that is a prerequisite to adaptive behavior.

An open systems perspective has always been one of the basic building blocks of sociotechnical systems theory (Emery and Trist, 1960). Variances in the context of the task, technology and social systems are managed by the work team. This self-regulation builds some adaptability within the work team. Pushing the supervisor out to manage the boundary is, however, more of an action to reduce uncertainty in the work team's immediate, and usually organizational, environment. Hence we see the effective sociotechnical work team simultaneously adapting itself to external variances while attempting to buffer itself from environmental variability. It explains short-term adaptability of sociotechnical systems but leaves puzzles about long-term adaptability.

Conclusion

Using matrix organizations as illustrations, I have discussed rationalization and innovation as a pervasive complementarity. Referring to the sociotechnical systems examples, I have pointed to another equally pervasive complementarity: task or technological or production orientations on the one hand and social or humanistic or considerate orientations on the other. There are other complementarities I can identify that are

occasionally operationalized in different organizational forms. Long-term or strategic planning in concert with short-term or operational effectiveness is one that appears repeatedly in organizational arrangements (Vancil, 1974). Organizational efficiency and individual autonomy is another (Argyris, 1964). Still another is that of profitability on the one hand and social responsibility on the other, a complementarity that is a current preoccupation of many business institutions.

Using matrix organizations again as our guide, we can point to multinational matrix structures designed around product and area orientations and service sector matrix designs based on area and function. These two sectors introduce geography or area as a third component to be examined in concert with rationalization and innovation to make up two more pairs of complementary relationships.

What constitutes a complementarity as opposed to a polarity or duality or dichotomous relationship? The question is difficult to answer, but some of the characteristics identified earlier might begin to differentiate between "true" complementarities and "false dichotomies" (Roethlisberger, 1977). We know that every firm deals with rationalization and innovation. We know that every firm deals with task and technology and social dimensions. We know that most organizations are concerned with both the long-term and the short-term, with organizational efficiency and individual autonomy, with profitability and social responsibility. What makes these a complementarity is the fact that the orientations are handled simultaneously and not sequentially.

Functional organizations handle the complementary relationships sequentially. The function arrangements are set and almost as an after

thought horizontal coordination is added to guarantee attention to the secondary orientation. Or tasks are designed to be efficient and rational (and assembly lines and scientific management come to mind here) and the social dimensions are introduced afterwards, often as a result of labor strife and expressed dissatisfaction. Many organizations are structured to handle their short-term operational problems and pay attention to the longer term only once a year, at an annual budgeting/planning meeting. In a similar vein, these firms organize for efficiency, while the problem of individual autonomy is dealt with through the personal and psychological space that individuals manage to negotiate for themselves. Social responsibility is low on the list of priorities for most organizations. It's only the pressure of environmental advocates and regulatory bodies that forces many to mitigate the profitability orientation in favor of a more social one.

Nevertheless, there are repeated examples of institutions who have chosen to deal with the problems of complementarities simultaneously. These organizations have, for the most part, been at the state of the art in their domain of activity, and have demonstrated that complementarity organization can be both feasible and profitable (Johnson and Ouchi, 1974). The matrix and sociotechnical systems designs have been adopted by many to handle at least the complementarities of rationalization and innovation and of technical and social orientations, respectively. Many of the successful and progressive firms have also incorporated long-term and short-term, organizational efficiency and individual autonomy, profitability and social responsibility complementarities into the structure of what they do on an everyday basis. When the conditions warrant it, their

actions suggest that complementarity organization may be an extremely desirable way to go.

We can point to other dualities and ask or wonder if they too merit consideration as complementarities and if organizations should be designed to reflect them. Should new work designs simultaneously incorporate hygiene factors and motivators (Herzberg, 1966) or is their implementation a sequential rather than a simultaneous one, in keeping with the Maslovian hierarchy of needs from which Herzberg derived the concepts? Is the concept of cognitive and behavioral approaches the best way to conceptualize some of the difficult behavioral problems we have been unable to explain in the social sciences? We know that people want to be fulfilled and achieve satisfaction from the work itself; yet the influence of pay and other reward systems has been undeniable and continues to be one of the best predictors of behavior and of performance. Has the problem been our unwillingness to accept both simultaneously our unwillingness to base our explanations on cognitive as well as behavioral precepts? For example, would our decision-making improve if we were cognizant of both the acceptance characteristics of group decisions as well as the quality aspects (Maier, 1973). Is the best leadership style one that is based on both quality and acceptance criteria and not contingent on one or the other (Vroom and Yetton, 1973)? Is this the message that Japanese management has willed us, and that "Theory Z" companies in North America appear to have acquired (Johnson and Ouchi, 1974).

There are unclear complementarities, and there are probably many of them. There are also clear ones, and we pointed to some of the more pervasive ones. The concept of complementarities may allow us to enter a

new domain of organizational understanding. It may explain why we have tried so long, so unsuccessfully to relate satisfaction to productivity and found no significant relationship. Perhaps the two are complementarities. They are independent of each other, but interdependent with each other. When we consider both simultaneously, we will construct more adaptable organizations.

Footnotes

1. Matrix organization designs cope with rationalization and innovation in an integrated fashion. One could also deal with the simultaneity of these logics by handling them in parallel. Ansoff and Brandenburg (1971) identify such a form and refer to it by the title "innovative form".

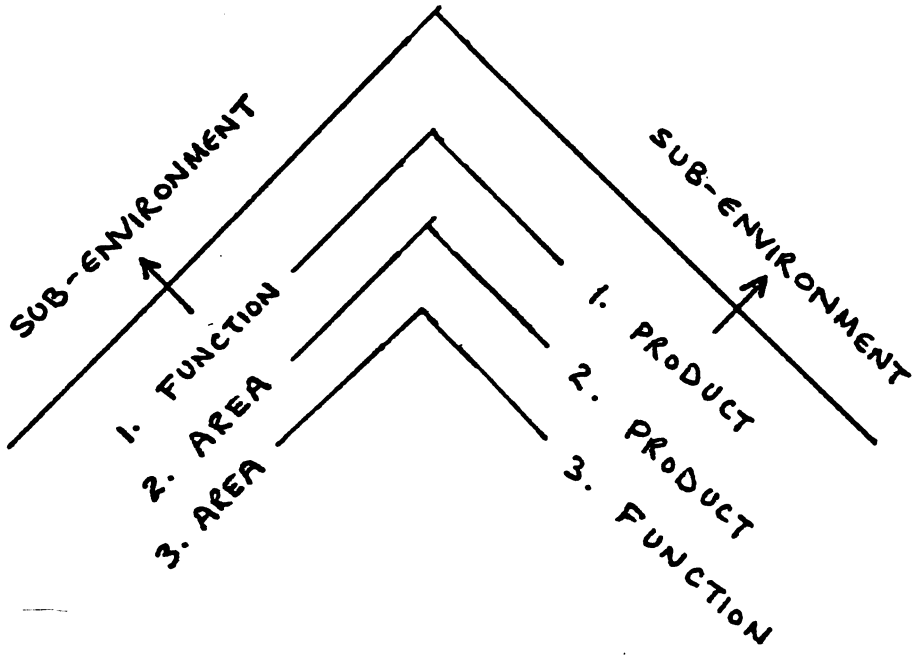

Figure 1

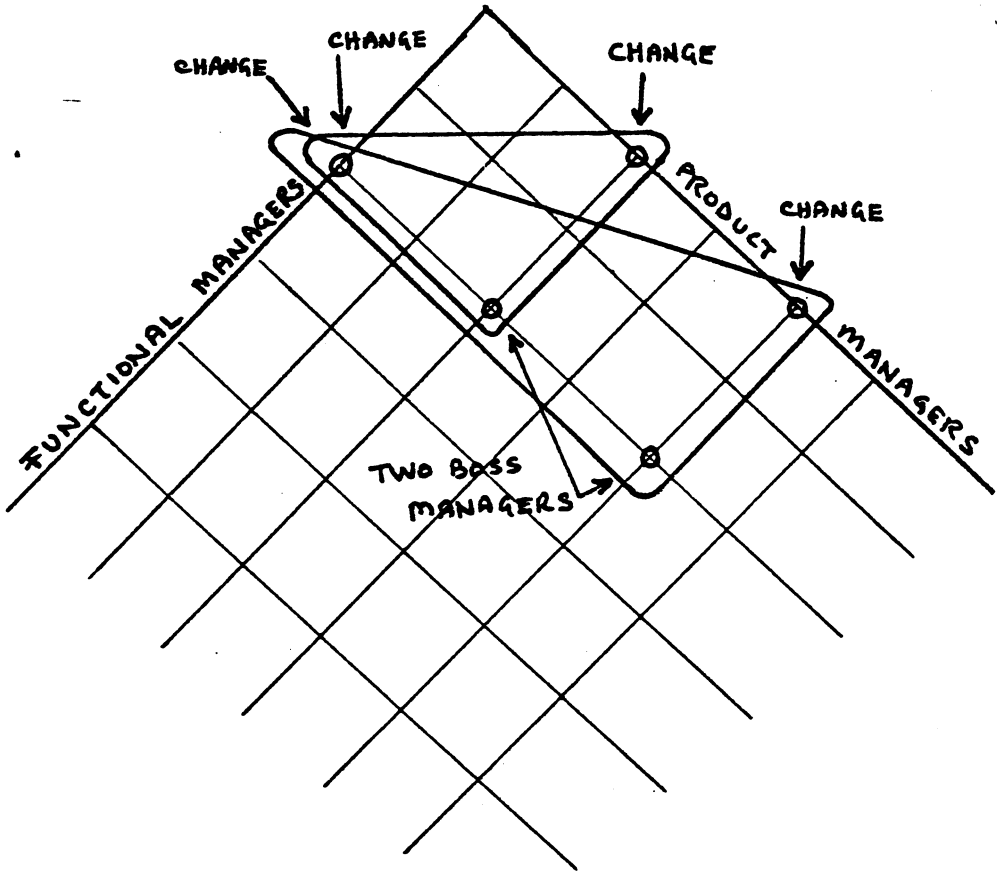

Figure 2

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