

Organization and Self-Organization

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Abstract. A systemic approach to organizational theory is discussed on the basis of self-organization theory. Organizations are conceived of as nonlinear systems characterized by microscopic complexity, circular causality and openness to their psycho-social environments. Finally, consequences of the self-organizational view for the field of management and organizational theory are discussed. As a synthesis of interventionist and non-interventionist arguments as well a position of indirect evolutionary management is inferred from synergetics and recent trends in the field of industrial organization.

1. Organization and Self-Organization in Industrial Management Theory

The play on the words in the title is intentional: when we speak of larger social systems, that is to say of organizations, it seems natural, as we should like to show, to view them from the standpoint of the theory of self-organization.

To do this we shall first of all turn our attention to publications in the field of industrial management theory. How are industrial organizations defined there?

As regards the concept "organization" a distinction is made in industrial management theory between a sociological concept of organization and one which is business-centered (Hahn, 1990). In the sociological concept a company is seen as a social complex arising from the division of labor in which business is done. The industrial economists express it in this way: "A company *is* an organization"; here organization is used as an umbrella term for the full range of goal-directed social systems (Bühler, 1987, p. 4). In contrast, the business-centered concept speaks of a firm as an organization because it has an organization (structure). "A company *has* an organization" (Hahn, 1990, p. 391 f.)

In the latter definition what is meant by organization is the total of all measures with the help of which the management tries to set up an order, previously conceived by planners, according to which the formal process of on-going business is permanently orientated. "These measures form the concrete content of the firm's organization" (Fries, 1987, p. 61).

Formulations such as these suggest an understanding of systems theory, which is indeed to be found in industrial management theory. Borrmann (1984, p. 338) holds that any enterprise (organization) can be seen as a system "in which the financial, technical and human resources are combined with one another in such a way that its aims are effectively (and as a rule economically) achieved. This process

of combination is controlled by the "central nervous system" of the firm: the management system. Rall & Hagemann (1984, p. 329) view organizational structure as an important instrument of management. What decides the success of a firm, however, is that organization is not applied in isolation, "but as one of the elements, which together form the system of management, the ordering framework for the day's work and which act in combination as in a system of communicating pipes".

In the theory of organization in industrial management studies the systems character is, as a rule, seen in the formal structures. The formal structure is described as the consciously created, rationally formed structure for the fulfilment of the firm's objectives. In contrast, by informal organization we are to understand "the social structures determined by the personal aims, wishes, sympathies and behavior of the employees" (Bühler, 1987, p. 6). These are consistently referred to as sources of "disturbance".

A contrary opinion is held on this point by Ulrich (1985). For him conscious, planned organizing represents at most a necessary complement to or correction of informal structures in a firm. A basic understanding of organization ought rather to be of an informal structure constantly re-forming and adjusting by virtue of its self-organizing abilities. In this light the problem of organization lies in strengthening the human faculty of self-organization through forward-looking outlining of structure that also fosters economically viable action.

Similarly in Malik's view (1986) the basic problem for management is seen in the control of complexity. According to Staehle (1989) one may distinguish a directive-technomorphous theory type from a systemic-evolutionary theory type. The two types are condensed into tabular form in Table 1.

After Staehle systems theory and above all cybernetic approaches have exerted a considerable influence particularly in management research. The author sees here a development in the area of industrial management theory and takes up the distinction between cybernetics of the first and of the second order. Whereas in the first phase of cybernetics management research was mostly concerned with processes maintaining balance with the aim of stability it was, according to cybernetics of the second order, interested in problems of instability, flexibility, change, learning, evolution, autonomy and self-reference. Seen in this light imbalance is no catastrophe but rather the normal case and prerequisite for change.

The development in the theory of industrial economics would be an appropriate paradigm – in our view – for a long-needed revision of the concept of organization in the social sciences. A self-organization viewpoint, which we consider unavoidable, is, however, far from a matter of course as yet. Wiedl and Graf (1991, p. 394), from the field of work and industrial psychology, describe an organization structure "as the total of process relations between members of an organization and the tasks specific to the organization." This perception is systemic in the sense that organizations are seen as complex structures in which many elements stand in relation to one another. The conception, however, does not get beyond the position of cybernetics of the first order outlined above.

Directive-technomorphous theory type	Systemic-evolutionary theory type
Management...	Management...
1. ... is leading people	...is shaping and steering of whole institutions in their environment
2. ... is leadership by the few	... is leadership by many
3. ... is the task of the few	... is the task of many
4. ... is direct influence	... is indirect influence
5. ... is geared to controllability	... is geared to achieving the optimum
6. ... has information on the whole	... never has enough information
7. ... has the aim of maximization of profits	... has the aim of the maximization of the ability to survive

Table 1. Contrasting two types of management

2. Self-Organization in Organizations

We start from the assumption that – in analogy to observable phenomena in other areas of the social sciences – in larger social organizations collective, ordered behavior of components occurs spontaneously in the form of macroscopic patterns. What we postulated for small groups (Tschacher, 1990; Brunner and Tschacher, 1991a; Tschacher et al., 1992) applies also to larger social systems:

In organizations (firms; schools; administrative bodies; etc.) we are concerned with "multi-component" systems as well. It is the communicated cognitions and emotions which represent the elementary components on the micro level. Organizations as self-organizing systems are complex, that is to say the number of their components and/or the connections between them is very large. Macroscopically visible order emerges here too – as in the small groups – from the "chaos" of very many degrees of freedom as a new kind of quality. Self-organized organizations are composed of a great many separate (micro-) components which form the constituents for structures on the phenomena level.

In order to be able to explain the structures and processes on the macro level only a few order parameters ("principle of enslavement") are required. The principle of openness continues to hold: self-organized systems – organizations themselves too after all – exist in a state of permanent exchange with their environment, which

influences them by means of control parameters. And finally the connections between the components of organizations and between systems and control parameters are non-linear, e.g. circular.

On the macro level, i.e. on the level of visible structures, there are many single (social) groups in every organization, out of which the over-all system of the institution in question is constituted. The (formal and informal) small groups are characterized in accordance with self-organization theory on the one hand by external boundary conditions (for instance functional duties); on the other hand through the internal formation of boundaries they give themselves the rules by which

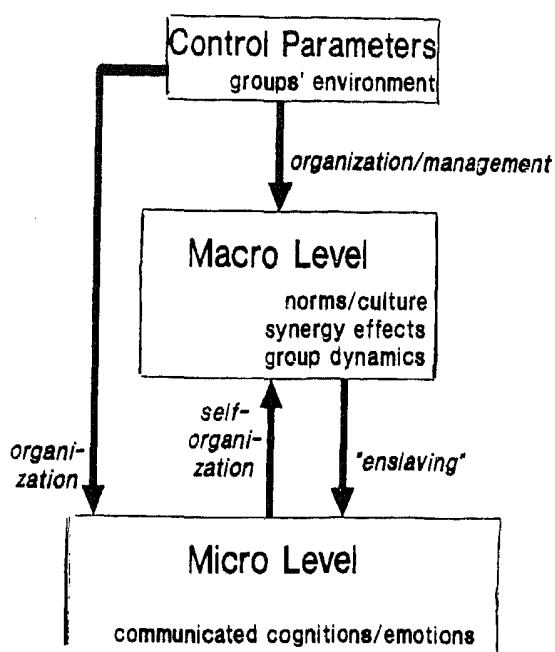


Fig. 1. Schema of organization and self-organization in a complex social system

specific results are obtained.

The degrees of freedom of these "self-organized organizations" are limited in two respects: in the first place these systems exist in an environment, from which they draw energy and/or matter. In the second place organizations are – as indicated above – composed of different kinds of small groups which interact in a multiplicity of ways (Brunner and Tschacher, 1991b). All the groups are connected to one another by virtue of having members in common and/or they have the same social network and are bound together in the hierarchy of the organization in question. Industrial firms can be interpreted for example as miniature societies composed of many interdependent subgroups. Each of these groups will tend to form norms, standards and traditions which are decisive in creating their own particular "work climate".

On the level of the over-all organization too a certain "way of life" will establish itself, creating a company's identity ("corporate identity") which comprises the norms and values characteristic of the organization as a whole, right down to rites and codes of behavior of single persons. In the management of a firm the

improvement or creation of an organization climate that seems appropriate is seen as an important aspect of successful organizations. From the field of industrial organization it is known well that "trust, effective communication, prompt feedback and creativity" are among the prerequisites for positive synergy effects (Sprüngli, 1981).

3. Intervention in Complex Systems

How can systems be managed? – this is an aspect central not only in regard to any theory of industrial organization but also especially to self-organizational processes within an organization. There have been several quite controversial debates on this subject so that it seems close at hand to dichotomize between the advocates of interventionism and of non-interventionism. We concede that this confrontation is incomplete and somewhat exaggerated; therefore we will utilize it only in order to reach a synthesis, which will then be based on the perspective of self-organization.

On the side of *interventionism* the tradition of behavior theory must be mentioned; behaviorists claim that behavior can be shaped almost freely either by the management of contingencies and/or by applying appropriate stimuli. To the present day this optimistic preconception can be sensed in modern developments and applications of behavior theory like in the variants of cognitive behavior therapy or – maybe to a lesser degree – in behavioral medicine.

A corresponding interventionist tendency is found in the established organizational theories of industrial economics (the directive-technomorph type of theory), which is based on models of action theory and decision theory. Leadership is emphasized to be a central function in the organization's hierarchy. Without leadership no effective and reasonable action is possible; problems of control in systems are explained by leadership being implemented in a suboptimal way (Ochsenbauer, 1989).

In sum, interventionist approaches assume that even complex problems may be reduced to simple ones, which are then accessible to fixed strategies of problem solving.

In contrast to this stand arguments for *non-interventionism*. Von Foerster's example of the "nontrivial machine" can be listed here; the machine is a simple system with input, output and some state variable (a kind of S-O-R concept). By combinatorial considerations von Foerster is lead to the conclusion that the machine is de facto unpredictable if its interior state is not known. This argument says that even simple systems may show unpredictable behavior the laws of which may never be extracted from overt behavior.

Another argument pointing to an impossibility of goal-oriented interventions stems from language philosophy and constructivism: the argument of self-reference. From a social systems point of view the manager is herself part of the system she tries to manage. Thus, management is self-management of a system, planning becomes planning plannings (Krohn & Küppers, 1991; cf. Schiepek & Tschacher, 1992); in a cascade of meta-levels the firm ground necessary to control and direct

a system is lost. If a system is closed self-referentially in this way, and there is no demon or transcendence left out, then intervention is merely what the system does anyway, i.e. its eigen-behavior.

From a different strain of research, namely cognitive psychology, we know of findings that also cast doubt on the possibility of successful interventions in complex systems. In this respect Dörner (1989) speaks of a "logic of failure".

All anti-interventionist arguments have a basic statement of this kind in common: complex systems are not reducible and generate complex behavior which can hardly be prognosticated, if at all.

Starting from these preparatory remarks we will try to reach a synthesis by differentiating between different aspects of the problem of management and intervention. It is a well-known fact in synergetics (Haken, 1990; 1991) that complex systems under certain conditions bring forth rather simple behavior: one single mode "enslaves" all the others. From the phenomenology of self-organized systems we may deduce two hypotheses:

- i) A system is sometimes less than the sum of its parts;
- ii) control by management can be broken down into influencing and directing events; there is also need for prognosis; these components must be viewed separately.

Therefore, when considering the question of intervention we have to differentiate depending on what kind of dynamical regime is realized. For elucidation a simple bifurcation diagram showing a system in parameter space may be used (Fig. 2). If the system is located close to a critical symmetry-breaking point

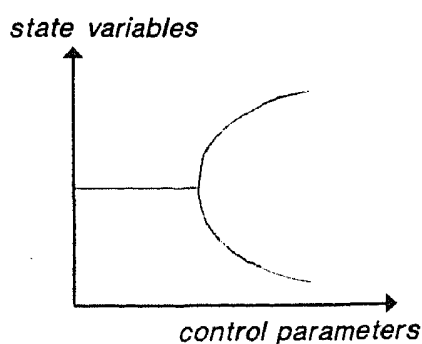


Fig. 2. Bifurcation diagram of group evolution

we can give no deterministic prognosis of the system's further development. The attractor (i.e. the representation of the system's homeostasis) is shallow, so that even small fluctuations at the appropriate time can decide into which attractor the system will settle down in the future. At the same time our chance at influencing the system is obviously great: we could well add the decisive bias ourselves. The situation in other words: prognosis is unreliable, while influence is easy. But there are restrictions to this influence; controlling the system is not possible in just any direction since our choice is limited to the paths offered by the system. Attractors are not modelled by the manager or therapist in any direct way. As a rule, we will

not even know about the new attractor. Thus, this kind of control is more like an influence with eyes closed.

The opposite situation occurs in areas of parameter space well away from critical points. Here prognosis is easy as the system is stable (stability need not mean stationarity, but may also refer to stable, i.e. attracting, oscillations). This is why intervention may meet with the system's "resistance".

Another aspect worth considering in regard to the control of dynamical systems is given by the arrow of time that is linked to dissipation. At least in social and mental systems symmetry breakings are *irreversible*. One may infer intuitively that irreversibility by dissipation (Prigogine, 1980) corresponds to axioms of communication pragmatics (Watzlawick et al., 1967). Communications cannot be taken back nor be inverted, because the system (if sensitive to exterior influence at all) is changed by any event immediately.

How can we manage a chaotic system? In some respect, dealing with deterministic *chaos* resembles the situation close to critical points as we already mentioned: small causes may have great effects. Simultaneously this means that the system is influenced easily but cannot be predicted in the long run. It seems important for the functionality of chaotic attractors that they undergo qualitative changes when parameters of the system's environment vary but slightly; this applies to chaotic dynamics in cognition (Nicolis, 1986) – probably also in economics?

In order to apply our phenomenological descriptions of dynamical systems to the management of groups and organizations we may re-evaluate two points that were already mentioned above in the context of systemic management theory:

1) Management must necessarily be indirect because a self-organized system can be influenced and directed only insofar as attractors are generated by the system. This amounts to a rejection of both interventionism and non-interventionism. According to Malik and other systemic theoreticians of (industrial) organization, management is performed by presenting a framework for self-organization. Management is working on the system's control parameters; management cannot determine the system's equilibrium directly.

2) It is obviously a central point which equilibria systems in economy bring forth when allowed to be more or less self-controlled. In this respect the term "synergy" is used widely, expressing the belief that benefits can be expected to emerge from the interaction of previously independent parts (on the relation of synergy and synergetics cf. Ulrich & Probst, 1984). Doctoroff (1977), for instance, proposed to establish synergy effects by informal gatherings.

4. Trends of Development in Organizational Theory

We will now present some recent developments of organizational psychology and management theory in order to assess these trends from the perspective of synergetics.

During the last decade there has been growing emphasis on issues of *organizational culture* (Schein, 1985). It is accepted increasingly that the "soft" cultural aspects of an industrial company can be at least as essential as the "hard facts" of economy. Culture makes it possible for persons in an organization to identify with

that organization. Organizational culture becomes visible in specific behavior patterns, ways of communicating, rituals, etc. Interestingly, these are emergent phenomena of an informal kind which we introduced as being connected to the self-organization of groups. Thus, emergent aspects seem to move into the focal area of organizational theory.

Theory-Z companies put special emphasis on organizational culture. The distinction of theory-Z and other types of companies was introduced by Ouchi (1981), who was the first of many authors to scrutinize the reasons for the success of Japanese firms. To state some of the topics that have been found to differentiate between western (i.e. mainly US-American) and Japanese attributes: A Theory-Z style of enterprise stresses human resources and the finding of consensual decisions more than the competition of individuals in reaching economical goals; the philosophy of the company is central; job rotation within a firm is common since one-sided specialization of employees is not encouraged.

Computer Integrated Manufacturing (CIM) is jargon for the informationally enmeshed company of the future. In this respect some observations of innovation motivated by computerized integration make clear that these issues are compatible with a systemic understanding of organization: the prototypical case of a computer-based organization is not the infamous "fully automated robot factory", but a flexible production in which work units are delegated to more autonomous groups and individuals. This is a basic claim of the so-called IZ-philosophy proposing an "Ideal Zero" of informational interfaces between stages of production. Production becomes object-oriented rather than organized by functional segmentation.

Participation which substitutes for linear directive leadership is a common denominator to the different trends. From the increased autonomy of teams and from the expansion of work segments flat hierarchy necessarily results. This is also economically efficient, as can be exemplified by the installation of quality circles in many organizations. Quality circles are teams recruited from members of the production sector which serve the function of the traditional department of quality control; division of labor among functional teams is decreased.

To summarize what has been said we may state that for managers it becomes increasingly important to know how group systems – or, more fundamentally, complex dynamical systems – evolve and maintain themselves. This follows mainly from the fact that the single groups and teams may and must act more independently in modern types of organization. Management theories of the systemic-evolutionary type (cf. especially the school of St. Gall; Ulrich, 1984; Ulrich & Probst, 1990) therefore advocate that the psycho-social self-organization of groups in organizations has to be considered with priority. There is growing attention to, and trust in, evolutionary mechanisms rather than directive leadership. The informal level of human interaction is seen as significant and is no longer categorized as dysfunctional only. Holistic work processes will in the long run replace the extreme Tayloristic division of labor. As far as management is concerned, knowledge about how to handle groups and their spontaneous activity is of vital interest. An organization is no longer viewed as waiting to be organized by some external manager but as a self-organized entity.

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