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Theories of Viability: a Comparison

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Given the growing complexities in the environments of organizations and societies, the concept of viability has become ever more important as an orientator for those in charge. The Systems Approach has bred powerful theories of viability, which can help actors in the socio-technical domain to cope with complexity. The two main manifestations of the Theory of Viability are Living Systems Theory (LST) by Jim & Jessie Miller on one hand, and the Viable System Model (VSM) by Stafford Beer on the other. In this paper, both are analysed and compared in terms of their relevance and potential with respect to social systems. Also, a brief overview of the state of pertinent applications is given. The paper comes to an unexpected conclusion: LST and VSM are not competitors, but most probably complementary. Copyright © 2006 John Wiley & Sons, Ltd.

Keywords theories of viability; living systems theory; viable system model; organization theory

INTRODUCTION

In the face of increasing complexity and turbulence in the environments of organizations and other social systems, the concept of viability as a superordinate orientator has gained in importance, although the term is mostly used metaphorically. System-oriented Management Theory, however, has always been familiar with the concept of viability, using it in the sense of a system's ability to maintain its independent existence (Beer, 1979). In the course of time, various theories and models have evolved which operate with this concept or others closely related to it. The most comprehensive are James Grier Miller's 'Living Systems Theory' (LST for short) and Stafford Beer's 'Viable System Model' (VSM). In both relatively well-known cases, we are dealing with elaborated and established theories. In either case, too, we may speak of 'a school of thought' recruited from Miller's or Beer's 'disciples'. It is, however, striking that apart from their derivation from common roots there are practically no links between the two theories or schools. No systematic comparison has as yet been made. The following essay is a contribution towards filling this gap.

A systematic comparison of the two theories is to be made. Observations are strictly confined to the viability of *social systems*, i.e. those of organizations and societies. A third candidate, Aubin's (1997) 'Viability Theory', is not dealt with in detail owing to its purely formal and algorithmic character.[1] The two theories—LST and VSM—are first described and subsequently

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[1]Worthy of mention, however, are the three principles which, according to Aubin, underlie living systems: 1. Principle of non-determination, 2. Principle of viability, 3. Inertia Principle. For a detailed account, also of other theories of viability, see Adam, 2000.

compared. We then glance at the applications, in qualitative and quantitative terms, for both cases before summing up.

ON THE CONCEPT OF VIABILITY

Beer uses the term 'viability', Miller 'living systems'. There is a subtle difference between them, to which I recur in the comparison. The common feature of the two theories is that they are both based upon Thermodynamics, Information Theory, Systems Theory and Cybernetics. In both cases, organizations and societies are regarded as organized systems maintaining thermodynamically highly improbable energy states by continuously interacting with their environments. They thereby absorb substances with less entropy and greater information-content than they return to this environment (Miller, 1995: XVI). Social systems cope with complexity by means of adaptation- and learning-processes in which control and communication play a decisive role.

What both theories have in common is that they strive to identify those essential components of a social system that ensure the viability, respectively, survival of an organization. Miller unmistakably bases his argument more strongly upon General Systems Theory, emphasising openness, inputs and outputs. Beer, on the other hand, argues primarily from the Cybernetics point of view, dwelling principally upon the management of complexity by means of control, i.e. (feedforward-based) steering and (feedback-driven) regulation.

MILLER'S LIVING SYSTEMS THEORY

Miller formulates the objective of his gigantic research project as follows:

> 'The purpose is to produce a description of living structure and process in terms of input and output, flows through systems, steady states and feedbacks, which will clarify and unify the facts of life' (Miller, 1978: 42).

His aim is to set up a 'General Living Systems Theory' related to concrete systems existing in space-time. He identifies seven hierarchical levels of systems performing life-processes: 1. Cell, 2. Organ, 3. Organism, 4. Group, 5. Organization, 6. Society, 7. Supranational Systems.

He desires to integrate all social, biological and physical sciences relevant to structures and processes at these levels, namely: Physiology, Biochemistry, Genetics, Pharmacology, Medicine, Economics, Political Sciences, Anthropology, Sociology and Psychology. Apart from these, Physics and Engineering are also considered important. Finally, Logic, Mathematics and Statistics contribute methods, models and simulations. All these disciplines are integrated on the basis of Systems Theory and Cybernetics.

Miller's core-thesis is that systems at all the seven levels listed above are open systems, which are in their turn made up of subsystems processing inputs, throughputs and outputs of various forms of matter, energy and information. Miller identifies 19 critical subsystems, as he calls them. Another, the 'timer', was subsequently added by his wife Jessie. The processes associated with these twenty 'critical subsystems' are, according to the theory, 'essential for life'. He writes:

> 'Together they make up a living system' (Miller, 1978: 1).

A living system must either possess all these critical subsystems or, by uniting with other systems, have access to the corresponding life-processes (Miller, 1978: 32). Since a living system must, however, be capable of forming its own decisions, the 'decider' subsystem is the only one which is non-sharable with other systems. Let us now take a look at the individual subsystems in their contexts.[2] Some of them process matter-energy, others information, and some do both (Figure 1, further to Tracy, 1989).

Critical Subsystems Which Process Information

If we trace the information-process from input to output, we find that the first critical subsystem

[2]On the following, see: Miller, 1972, 1978.

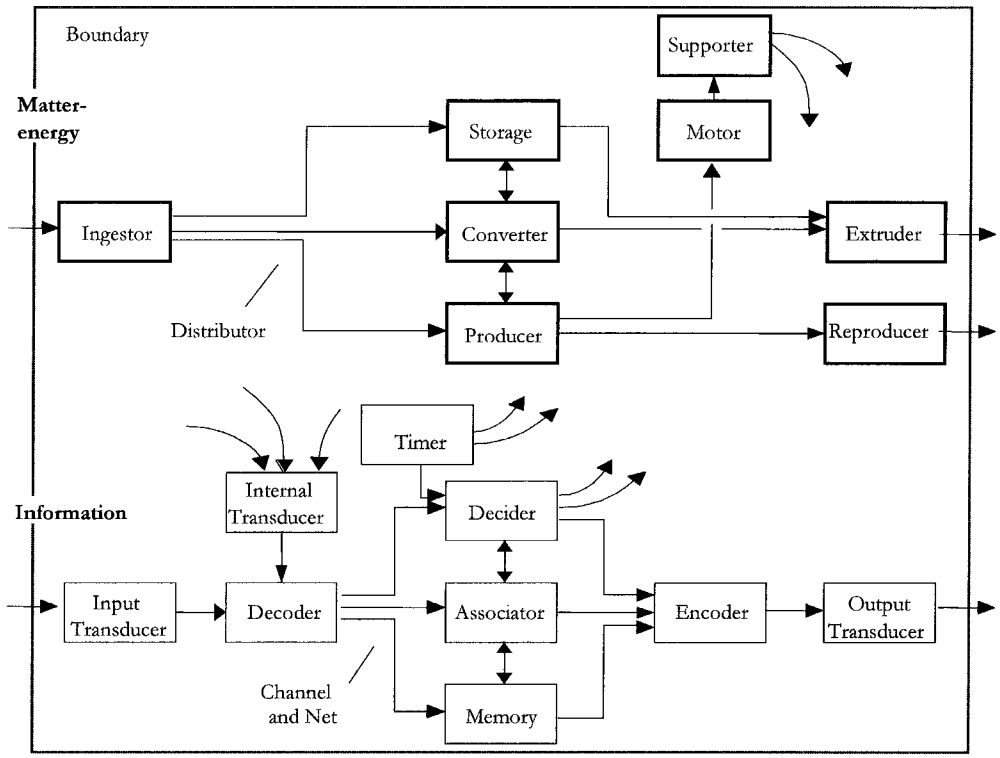

Figure 1. Critical subsystems according to Miller's Living Systems Theory

processing only information is the *input-transducer*. This is the term for the sensory subsystem which supplies the system with so-called 'information markers' that indicate significant changes in the environment. From these it continuously introduces innovative input into the system. Similarly, the *internal transducer* gathers information on current states, feelings, attitudes, ideas or innovations. Both *transducers* transform the 'information markers' in such a way that they can be passed on. Here, one should think of reports, management information systems, or units of quality control, for example. Items of information are transported through the system via a *channel and network subsystem*. This may consist of electronic networks or the bush-telegraph. The *decoding subsystem* converts the code of the information input into a 'private code' which is internally comprehensible and thus usable. In real terms, these are translators, technical interfaces and so on. The *association process* forms lasting links between information-components. This function is performed by training and further education, inter alia. Both *association* and *memorization* are aspects of the learning-process. As embodiments of the *memory* subsystem, Miller mentions the book-keeping department and the archives, whereas we today should refer to data-banks, but also to shared mental models, organizational routines and the like (cf. Kim, 1993).

According to Miller, the *decider*—the decision-making subsystem—is the most important of all the critical subsystems, because it cannot be outsourced, i.e. handed on. It determines objectives, receives information from all the other subsystems, analyses these inputs, and makes decisions that it conveys as information outputs which guide the whole organization. The *timer* transmits information concerning time, and performs functions of sequencing and synchronization. Miller also points out that the *decision-making* subsystem is divided up into different decision-making levels. He emphasizes that it is not entirely free, but subject to restrictions such

as its own intentions, values, resources, procedures and social forces.

The other two information-processing subsystems are the *encoder* and the *output-transducer*. The former transforms the information-code from the private into the public form, so that information is accessible to outsiders. Annual reports and so forth are mentioned in this context. Finally, the *output-transducer* channels information markers into the environment of the organization. Miller gives, for example spokespersons, negotiators, lobbyists, salespeople and the Public Relations Department as examples.

Critical Subsystems Which Process Matter-Energy

Miller distinguishes between two kinds of process in living systems: (1) *Communication*, which transforms information from one state into another, or transfers it from one point to another; (2) *Action*, which he defines as movement of matter-energy in space. This subdivision is theoretical, since matter-energy and information always flow jointly. Since the subsystems which process matter-energy function similarly to the information-processing kind, they need not be described in detail here.

Critical Subsystems Which Process Matter-Energy and Information

These are the subsystem of *reproduction*, and the system's *boundary*. The former is capable of forming new organizations similar to the original. This *reproducer* contains all units, groups or individuals which create such a new unit.

The system's *boundary* holds the components of the whole system together and protects them from environmental stress. At the same time, it prevents or permits the ingress of various kinds of matter, energy and information. Miller mentions that the boundaries 'often have complex shapes... and... do not necessarily have immediate physical continuity'. (1978: 609). He also gives many examples for both matter-energy boundaries (e.g. fences, guards, receptionists, purchasing departments, receiving-docks) and information boundaries (e.g. security officers, mail rooms, credit departments, loan committees). In our day, the electronic 'firewalls' can undoubtedly be subsumed here. Filters such as required standards, but also priorities and other selective 'mechanisms', are also at least indirectly mentioned by Miller.

Miller's Model of Living Systems is dealt with here only with reference to organizations. The chapter on organizations in his book takes up 151 pages. In this voluminous work, however, the various subsystems on all the seven system levels he distinguishes are meticulously described in the greatest detail, totalling 1101 pages. The paperback edition (Miller, 1995) also contains a set of symbols by the use of which system levels, subsystems and flows can be illustrated in diagrams, flow-charts, simulation models and the like.[3]

BEER'S VIABLE SYSTEM MODEL

In search of a universally valid approach to the modelling and design of organizations, Stafford Beer, father of Management Cybernetics, developed a set-theoretical model in which he enumerated and defined the structural prerequisites for the viability of organizations (Beer, 1994). This model was later converted into a topological model which is now known as the Viable Systems Model (VSM for short). The development of the VSM was originally inspired by the structures of neurophysiological control in higher organisms. Beer found an isomorphism in that he identified a set of control 'mechanisms' essential to both human beings and organizations, which he modelled by one and the same formalism. To put it more concretely, he discovered that management systems of a viable organization and the nervous system of viable human organisms exhibit—in a well-defined sense—identical basic structural patterns.

In the VSM, a set of management functions is specified which Beer describes as the necessary

[3]Kjell Samuelson is preparing an article on the development of these symbols.

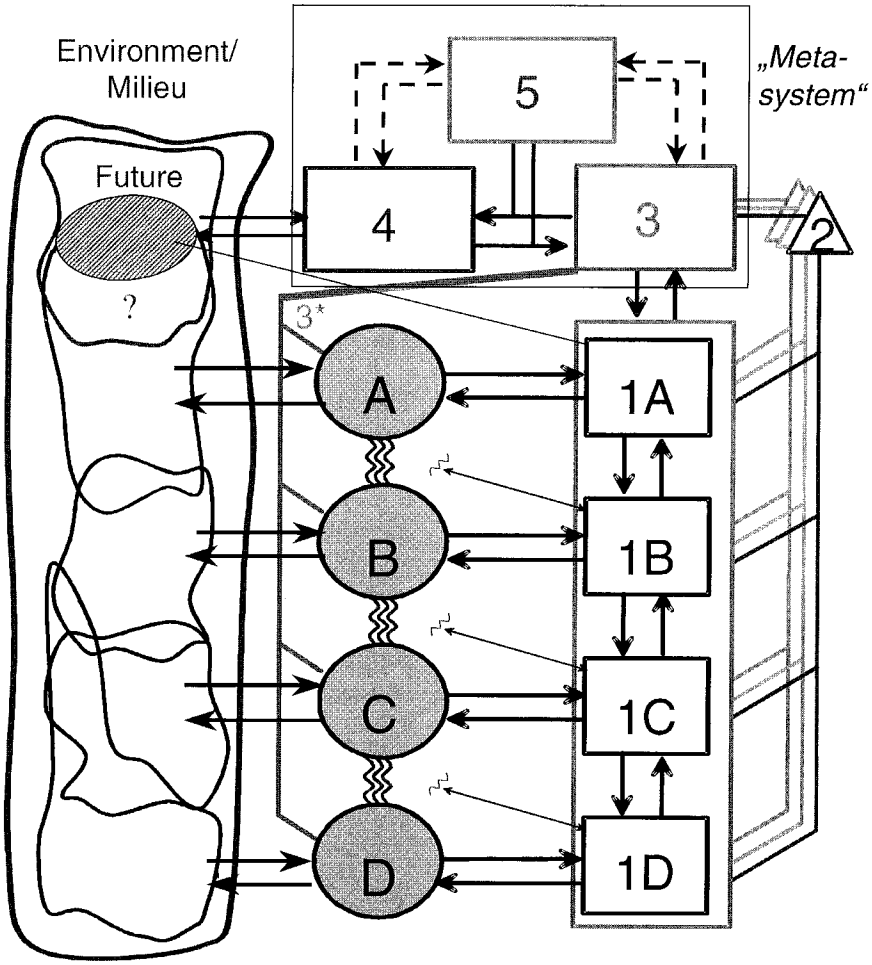

Figure 2. Beer's Viable System Model (VSM). Slightly simplified version (cf. Beer, 1985)

and sufficient conditions for the viability of organizations. These functions and their interrelationships are set out in a comprehensive theory whose propositions I now briefly summarize:[4]

The Principle of Viability

A company is viable if and only if it has a dovetailed structure of management units whose functions and inter-relationships are precisely specified (cf. Figure 2).

- *System 1*: Regulatory capacity of the largely autonomous and mutually adaptive operative basic units (A, B, C, D in the Diagram), optimization of daily business. Basic units with their respective management are called *primary units*. Example: the company's business units.
- *System 2*: Strengthening ('amplification') of the self-regulatory capacity, reducing ('attenuation') of oscillations, and co-ordinating the activities of the primary units by means of information and communication. Examples: the information- and budgeting-systems, co-ordination teams, internal service-units, standards of behaviour, knowledge-bases.

[4]On the following, please see: Beer, 1979, 1981, 1984, 1985.

- *System 3*: Internal guidance, providing synergies, allocation of resources, and striving for an overall performance optimum of the set of primary units. Example: the executive corporate management.
- *System 3**: Investigation and validation of the information flowing through channels 1–3 and 1–2-3, by means of auditing and monitoring activities which imply directly accessing the basic units. Examples: the internal audit, and special investigations into operations.
- *System 4*: Comprehensive external orientation, and long-term orientation to the future, the ability to grasp, diagnose and model both the whole organization and its relevant environment as well as the organization–environment-interaction. Examples: company development/strategic management, research and development, knowledge creation.
- *System 5*: Striking the balance between present and future, keeping internal and external perspectives in proportion, checking interactions between Systems 3 and 4. Determining the identity of the organization, its functions in the larger context, incorporating the supreme values, norms and rules, i.e. the ethos of the system as a whole (Normative Management). Example: The sovereign people (in the case of a democracy), and the will of the sovereign as succinctly expressed in the Constitution (a comparable device used in a firm might be a corporate charter).

To sum up: Systems 1, 2 and 3 (including 3*) represent Operative Management, System 4 (in interaction with System 3) Strategic, and System 5 Normative Management. Together, Systems 3, 4 and 5 constitute the metasystem, i.e. the system which is of a higher logical order than Systems 1 and 2. System 5 has also been called the 'mastermind of the metasystem' (Beer, 1985).

Implications for Organizational Diagnosis

Defects in this structure, such as missing components, insufficient capacity or inadequate coordination of the components, all impair or endanger the organization's viability. Consequently, strong diagnostic points can be discovered by applying the VSM properly. For example, Systems 4 and 2 are often underdeveloped. In the latter case, this may be the cause of overload on management. In the former, the firm-in-focus may still be making a lot of money in its operations, while a VSM-based diagnosis reveals that, from the strategic point of view, the company is already doomed to failure.

The Principle of Recursion

The viability, cohesion and self-organization of an enterprise depend upon these functions being recursively present at all levels of the organization. A recursive structure comprises autonomous units within autonomous units. Moreover, a viable organization is made up of viable units and is itself embedded in more comprehensive viable units. Each unit, inasmuch as it is producing the organization's task, rather than servicing or supporting this production, replicates—in structural terms—the totality in which it is embedded: It has all the functions outlined above, to be able to manage, from start to finish, the processes for the purpose of which it exists. If we take such a viable organization as a 'system-in-focus', depending on the perspective adopted, it 'may have more than one next higher and next lower recursion' (Beer, 1985: 6; for pertinent applications, see Leonard, 1989; Schwaninger, 2000). In other words, these recursive structures may also be multidimensional or even circular (cf. Schwaninger, 1994).

With specific respect to the management functions, the principle of recursion manifests itself as follows: together, Systems 3, 4 and 5 constitute the metasystem of a given level of recursion (for example, a division of a company). At the same time that very metasystem constitutes System 1 of the next higher level of recursion (in this case, the whole company).

The Principle of Autonomy

At this point it should be clear that autonomy is basic to the VSM. From Greek 'autos' (self-) and 'nomos' (law) this term refers to the primary unit

as a whole being 'a law unto itself' (Beer, 1981: 103). The autonomy in question is therefore both a system's freedom and responsibility to regulate itself. This is the pivot of an organization's adaptation and learning, which requires subsystems disposing of high degrees of freedom. The autonomy is not absolute, but limited by the aspect of interdependence: as the logical hierarchy of the management functions outlined above clearly shows, the autonomy of subsystems is moderated through checks and balances in order to maintain the viability of the whole system-in-focus.

The three books on the VSM contain a total of 1,151 pages (Beer, 1979, 1981, 1985). They are valuably complemented by an insightful overview given in Beer (1984).

COMPARISON OF THE TWO THEORIES

It is necessary to make clear beforehand that the following comparison focuses on the specific relevance of LST and the VSM to the realm of social systems. In other words, it does not extend to all the domains to which these two theories, LST in particular,[5] would be applicable.

The two models are found to have some striking *features in common*:

1. *Origin*: As far as the underlying formal theories are concerned, both models sprang. from the same roots: System Theory and Cybernetics. As far as the substantive aspects of their models are concerned, Miller's thinking appears to have been shaped strongly by the traditions of Medicine and Biology, Beer's by antecedents of neurophysiological theory. However, both authors are eminently interdisciplinary in the views on which they construct their theories, both of which are transdisciplinary.
2. *Theory-formation*: Both authors' objective is to identify the structural invariances of social systems. Theory-formation thereby proceeds from the recognition of similarities to the identification of homomorphisms, and thereupon to the presentation of an isomorphic model applicable to a great variety of real-life organizations.
3. *Purpose of research and model*: In both cases, the quest is for a better means of description, explanation and diagnosis.
4. *What the model represents*: Both authors have in mind concrete, realistic systems which exist and evolve in time and space. This differentiates theirs from other theories, for example from Luhmann's sociological theory (Luhmann, 1995), which deal solely with abstract systems of action- or relationships.
5. *Elaboration of theme*: Both models are presented in great detail, and both make use of specific sets of symbols, which makes them easier to apply.

As for *differences*, the following can be found:

1. *Perspectives*: Miller's standpoint is positivist, the biological and particularly the physical viewpoints prevailing. This physicalist approach is, on the one hand, an advantage, since it allows of a high degree of concreteness and wealth of detail. On the other, it proves to be restrictive. Shannon's scientific-technical concept of information is consistently applied. The result is, however, that the syntactic level is overemphasized, whereas the semantic and pragmatic levels are largely neglected. This also applies to human factors, such as implicit knowledge, attitudes, emotions, etc. In some passages we find mention of such concepts as significance, power, meaning, etc., but on the whole such aspects remain curiously understated.

Beer's approach is constructivist. He does not position his model primarily as an image of 'the reality out there' (i.e. representationally), but as an heuristic aid on which discourses about the diagnosis and design of organizations can be firmly based. As regards Beer's concept of 'information', he takes Shannon's Tenth Theorem as his starting-point, but continually points out the need for a significant differentiation. Beer (1979) understands by information 'what changes us', in contrast to data, which are 'statements about facts'. Therefore, information can emerge only in the recipient. In Beer's work,

[5]In addition to social systems, LST also addresses the levels of cell, organ and organism.

human aspects such as ethos, meaning, sense-making and self-reference, are recurrent themes, either as integral parts of the theory or just as aids to its interpretation.

2. *Complexity and coping with complexity*: Miller's concept of complexity is objectivist. In his eyes, complexity increases unbrokenly and drastically up through every level in the system from the cell to the supranational systems. Beer regards the degree of complexity as dependent upon the observer: it is determined by the distinctions he or she makes. Their concepts of complexity management differ correspondingly. Miller's approach is hierarchical, just like his system-concept. Beer, on the other hand, adopts a concept of recursive complexity management. He distinguishes between recursive structures and hierarchical ones, although from a mathematical standpoint recursivity is a special case of hierarchy. This differentiation has powerful implications. Beer proceeds from the assumption that decision-makers at any level possess similar capacities for dealing with complexity. Therefore, according to the logic of variety engineering, at each level of recursion external variety the complexity faced must be curbed and 'eigen'-variety (the variety, i.e. the repertory of behaviours of the respective agent) strengthened. Complexity is therefore coped along with the fronts where it manifests itself.
3. *Concept of system*: Miller considers living systems to be open systems which import, transform and export matter, energy and information. Without denying these processes, Beer regards this open-systems view as largely irrelevant. He once exclaimed to the author (*cum grano salis*): 'There are no open systems!' Beer places in the foreground the concept of the operationally closed system, whereby organizations are understood as wholes which in obedience to their own inner logic perform recurrent operations which make them viable. This is to be understood not only as self-production and -reproduction, but also in the sense of development. I have used the term 'viability beyond survival' in this context (Schwaninger, 1993).
4. *Unit of analysis*: Miller talks of 'living systems' from the cell right up to supranational systems. Prominence is thereby given to the *actuality* of these systems; the descriptive element predominates. Beer investigates 'viable systems' with the focus invariably on organizations and society.[6] He focuses on *capability* and *potentiality* (Beer, 1981), and this is the reason for his further-reaching aspiration to specifying the 'necessary and sufficient conditions' (Beer, 1979) for the viability of any social system—organizations in particular.
5. *Purpose of the system*: In Miller's theory, the purpose of the system is 'life', i.e. survival implicitly associated with the preservation of the openness and integration of the subsystems. Beer's 'viability' is explicitly defined as 'maintenance of identity', or: 'The purpose of the system is what it does.' (Beer, 1985).
6. *Components of the model*: Miller's 20 critical subsystems concern both information and matter-energy. Beer specifies five 'necessary and sufficient' management functions linked by 'feedback-loops' which are orientated exclusively to communication, control and pre-control. VSM and LST thus prove to be not only different, but also complementary in certain respects.
7. *Basis of the model*: Both models are formulated graphically and verbal-descriptively. The theory underlying VSM, following Ashby and Shannon, was developed mathematically, first as a set-theoretical and later as a topological model (see above), based on the structure of the human central nervous system. Miller's system is formulated verbally and graphically.
8. *Principles of organization*: Miller's model does not deal with organizational principles, but all operational processes are essentially orientated to the building-up of negative entropy. Beer names and elaborates upon autonomy, recursion and viability as principles of organization. These are manifoldly connected to the corpus of organizational and management knowledge, but also to the highly abstract

[6]The living organism serves in his theory only as a homomorphic reference system.

Table 1. Summary of comparison between VSM and LST from organization-theoretical viewpoint

Criteria	Miller	Beer
Concision/Stringency	2	2
Strength of theoretical claim and Falsifiability	1	3
Elaborateness and Transparency	2	2
Empirical underpinning	3	1
Diagnostic potency	1	3
Validity	2	2
Reliability	2	2

concepts of entropy and negentropy (cf. Beer, 1981; see also Beer, 1966).

DISCUSSION

The comparison of the theories made above may be compressed into the following assessment (Table 1).

The criteria adopted for this purpose are derived chiefly from Popper, but also from earlier theoreticians, especially William of Occam's principle of parsimony.[7] The relative strength of each theory is assessed and compared with respect to these criteria, on an ordinal scale ranging from one to three. 'One' signifies that the theory in question is inferior to the other, three that it is superior. 'Two' roughly signifies a tie.

Regarding *concision* and *stringency*, the two models are similar, although the core of the VSM is somewhat more stringent in that it is constituted by a more parsimonious set of components. The *strength of theoretical claim* and the *falsifiability* of the Beer model are considerably higher. In their *degree of elaboration* and *transparency*, there is little to choose between them. As to *empirical underpinning*, Beer himself in his writings already supplies us with copious evidence. But more applications of LST have been published.[8] The chief reasons for this are probably that Miller, in contrast to Beer, operated on an institutional basis,[9] and that LST is older.[10] The *diagnostic potency* is partly connected with the strength of the theoretical proposition. LST contains an 'escape clause' according to which living systems do not absolutely need to dispose of all twenty 'critical subsystems' (Miller, 1995: XVIII). This weakens its diagnostic potency. In the VSM, there is no such reservation.

Concerning the criteria of *validity* and *reliability*, the comparison revealed no clear superiority of either model. If one were to understand by 'validity' the quality of 'insightfulness', however, the VSM would score higher. Some of Miller's examples taken from his physical observations are fragmentary and therefore of dubious illustrative value (for example, archives as organizational memory, fences as the boundaries between systems), while considerably more significant aspects—in terms of structural diagnosis and design—slip through the mesh of this mode of screening.

To sum up, this analytical comparison reveals:

- An advantage for LST by one criterion (*empirical underpinning*, measured by the number of empirical studies published)
- An advantage for the VSM by two criteria (*strength of theoretical claim/falsifiability* and *diagnostic potency*)
- Same score by the other four criteria (*concision and stringency*, degree of *elaborateness and*

[7]This principle has been recorded in several versions, one of them being, e.g.: 'What can be done with fewer [assumptions] is done in vain with more' or 'Entities are not to be multiplied beyond necessity' ('Entia non sunt multiplicanda praeter necessitatem.'). After William of Occam (c. 1285-c. 1349).

[8]Example: A query conducted on October 24, 2002 in the EBSCO Host Research database in the sectors 'Business Source Premier' (2 800 journals), and Psychology and Behavioral Sciences Collection resulted in a total of 26 hits for the keyword 'Living Systems Theory', and 13 for 'Viable Systems Model'. For each, 5 of these sources were dated after 1994. An extension to 'All Collections' on this database produced 69 hits for LST and 16 for VSM. On the same day, seven hits were scored by each of the two search-objects on the JSTOR database.

[9]Miller occupied academic posts at the following institutions inter alia: Harvard University, University of Chicago, University of Michigan, Cleveland State University, Washington Office of the Academy for Educational Development, Johns Hopkins University, University of Louisville and University of California. Beer was a Guest Professor at approximately thirty universities, as well as being an internationally active consultant. For details, please see the contributions on Miller (Swanson, 2000) and Beer (Schwaninger, 2001) on the 'Luminaries-Page' of the ISSS—International Society for the Systems Sciences, www.isss.org.

[10]Miller's book is dated 1978, but numerous earlier publications on LST also exist (e.g. Miller, 1965a, 1965b, 1972). Beer's VSM had already been outlined in various books, but appeared in its complete form for the first time in 'Diagnosing the System' (1985).

transparency, validity, reliability), with a reservation in favour of the VSM regarding its 'insightfulness'.

As the public response to LST and VSM indicates, both are obviously attractive and exert great fascination, at least as far as the community of academics and practitioners interested in the Systems Approach is concerned. This is shown by the fact that more and more people and organizations now work with these models. It is noticeable that technicians and scientists tend to favour LST over VSM. Examples of applications in Systems Engineering (Mistree and Allen, 1993), Information Management (Taormina, 1991), Manufacturing Systems (Swenson *et al.*, 1991) are recorded, but not only there: applications of LST to Marketing (Reidenbach and Oliva, 1981), Public Health (Merker, 1987), Army Organization (Ruscoe *et al.*, 1985), etc. have been published.

The VSM is chiefly utilized in general management and consultancy. This applies to both the private and State sectors. Examples are to be found in company-wide organization designs, and diagnoses of the total organization of firms of all kinds and sizes (e.g. Espejo and Harnden, 1989; Schwaninger, 1989; Espejo and Schwaninger, 1993, 1998; Brocklesby and Cummings, 1996; Espejo *et al.*, 1996), as well as public and international authorities (e.g. Hühn, 1996; Espejo *et al.*, 2001; Reyes, 2001; Schwaninger and Körner, 2003). Beer himself contributed an application to Chile as a nation under the title 'How to run a country' (Beer, 1989), and the VSM was also employed to analyse the Swiss political system in a thesis (Willemsen, 1992). Moreover, in the meantime VSM-based theses on themes related to Engineering have been completed at Technical Universities or Institutes in different countries (e.g. Börkqvist, 1996; Thiem, 1999; Moscoso, 1999; Henoch, 2003).

All of these indicators speak for the potential of both models being enormous, but having been exploited only to a small extent. Furthermore, the detailed comparison expounded here leads to the conclusion that the relationship between VSM and LST in respect of content is one of complementarity rather than of competition or substitutability. This idea should be further explored and tested for probable potential synergies.

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REFERENCES

Adam M. 2000. *Lebensfähigkeit sozialer systeme: Stafford Beer's viable system model im vergleich.* Doctoral Dissertation Nr. 2442, University of St. Gallen: Switzerland.

Aubin JP. 1997. *Viability Theory.* Springer: Berlin and New York.

Beer S. 1966. *Decision and Control.* Wiley: Chichester.

Beer S. 1979. *The Heart of Enterprise.* Wiley: Chichester.

Beer S. 1981. *Brain of the Firm,* (2nd edn). Wiley: Chichester (1st Edition: 1972).

Beer S. 1984. The viable system model: its provenance, development, methodology and pathology. *Journal of the Operational Research Society* **35**: 7–25.

Beer S. 1985. *Diagnosing the System for Organizations.* Wiley: Chichester.

Beer S. 1989. National government: disseminated regulation in real time, or 'How to run a country'. In: Espejo R, Harnden R (eds). 1989. *The Viable System Model, Interpretations and Applications of Stafford Beer's VSM.* Wiley: Chichester pp. 333–360.

Beer S. 1994. *Towards the Cybernetic Factory* (originally published in 1962). In: Harnden R, Leonard A. (eds.) 1994. *How Many Grapes Went into the Wine. Stafford Beer on the Art and Science of Holistic Management.* Wiley: Chichester pp. 163–228.

Björkqvist O. 1996. *Perspectives on demand-side energy efficiency.* Doctoral Dissertation, School of Mechanical and Vehicular Engineering, Chalmers University of Technology: Gothenburg, Sweden.

Brocklesby J, Cummings St. 1996. Designing a viable organization structure. *Long Range Planning* **29**(1): 49–57.

Espejo R, Bula G, Zarama R. 2001. Auditing as the dissolution of corruption. *Systemic Practice and Action Research* **14**(2): 139–156.

Espejo R, Harnden R. (eds). 1989. *The Viable System Model, Interpretations and Applications of Stafford Beer's VSM.* Wiley: Chichester.

Espejo R, Schuhmann W, Schwaninger M, Bilello, U. 1996. *Organizational Transformation and Learning: A Cybernetic Approach to Management.* Wiley: Chichester.

Espejo R, Schwaninger M. (eds.) 1993. *Organisational Fitness: Corporate Effectiveness Through Management Cybernetics*. Campus: Frankfurt/New York.

Espejo R, Schwaninger M. (eds.) 1998. *To be and not to be, that is the system. A tribute to Stafford Beer*. CD-ROM Carl Auer-Systeme Verlag: Wiesbaden, Germany. ISBN 3-89670-063-4.

Henoch J. 2003. *Towards adaptive management systems in manufacturing—An agent-supported approach*. Doctoral Dissertation, Eidgenössische Technische Hochschule Zürich, Nr. 14865. Wissenschaftlicher Verlag: Berlin.

Hühn M. 1996. *Organisationsstrukturierende Faktoren in internationalen Behörden unter besonderer Berücksichtigung der International Seabed Authority*. Doctoral Dissertation, Nr. 1818. University of St. Gallen: Switzerland.

Kim D. 1993. The link between individual and organizational learning. *Sloan Management Review* **35**(1): 37–50.

Leonard D. 1989. Application of the VSM to Commercial Broadcasting in the United States. In Espejo R, Harnden R (eds). 1989. *The Viable System Model, Interpretations and Applications of Stafford Beer's VSM*. Wiley: Chichester, pp. 175–209.

Luhmann N. 1995. *Social Systems*. Stanford University Press: Stanford, California.

Merker SL. 1987. A Living systems process analysis of an urban hospital. *Behavioral Science* **32**: 304–315.

Miller JG. 1965a. Living systems: basic concepts. *Behavioral Science* **10**: 193–237.

Miller JG. 1965b. Living systems: structure and process. *Behavioral Science* **10**: 337–379.

Miller JG. 1972. Living systems: the organization. *Behavioral Science* **17**: 1–182.

Miller JG. 1978. *Living Systems*. McGraw-Hill: New York.

Miller JG. 1995. *Living Systems*. Paperback edition. University Press of Colorado: Niwot: CO.

Mistree F, Allen JK. 1993. Designing at a high level of abstraction. *Behavioral Science* **38**(2): 124–138.

Moscoso Ph. 1999. *Managementsysteme für die Shop-Floor-Logistik: Eine modellbasierte Gestaltungsmethodik*. Doctoral Dissertation, Eidgenössische Technische Hochschule Zürich, Nr. 13293, Zürich, Switzerland.

Reidenbach RE, Oliva TA. 1981. General living systems theory and marketing: a framework for analysis. *Journal of Marketing* **45**(Fall): 30–37.

Reyes A. 2001. Second-order auditing practices. *Systemic Practice and Action Research* **14**(2): 157–180.

Ruscoe GC, Fell RL, Hunt KT, Merker SL, Peter LR, Maj. Cary JS, Miller JG, Cpt. Lee BG, Cpt. Reed RW, and Cpt. Sturm MI. 1985. The application of living systems theory to 41 US Army battalions. *Behavioral Science* **30**: 7–50.

Schwaninger M. 1989. *Integrale Unternehmungsplanung*. Campus: Frankfurt/New York.

Schwaninger M. 1993. A Concept of Organizational Fitness. In Espejo R, Schwaninger M. (eds). 1993. *Organisational Fitness: Corporate Effectiveness Through Management Cybernetics*. Campus: Frankfurt/New York, pp. 39–66.

Schwaninger M. 1994. Die intelligente Organisation als lebensfähige Heterarchie. *Diskussionsbeiträge des Instituts für Betriebswirtschaft an der Hochschule St. Gallen*, Nr. 14.

Schwaninger M. 2000. Distributed Control in Social Systems. In Parra-Luna F. (ed.) 2000. *The Performance of Social Systems*. Kluwer Academic/Plenum Publishers: New York, pp. 147–173.

Schwaninger M. 2001. Stafford Beer. In *www.isss.org ← Luminaries Section*. www.isss.org/lumBeer.htm

Schwaninger M, Körner M. 2003. Systemisches Projektmanagement. Ein Instrumentarium für komplexe Veränderungs- und Entwicklungsprojekte. *ZfO-Zeitschrift Führung und Organisation* **72**(2): 75–85

Swanson GA. 2000. James Grier Miller. In *www.isss.org → Luminaries Section*. www.isss.org/lumJGM.htm

Swenson D, Malley J, Balsmeier Ph. 1991. General living systems theory and just-in-time manufacturing: a framework for change. *Industrial Management* **33**(5): 12–14.

Taormina RJ. 1991. Organizational analysis of information processing using living systems theory. *Behavioral Science* **36**(3): 196–223.

Thiem I. 1998. *Ein Strukturmodell des Fertigungsmanagements: Soziotechnische Strukturierung von Fertigungssystemen mit dem "Modell Lebensfähiger Systeme"*. Doctoral Dissertation, Fakultät für Maschinenbau, Ruhr-Universität Bochum, Shaker Verlag: Aachen.

Tracy L. 1989. *The Living Organization. Systems of Behavior*. Praeger: New York.

Willemsen MH. 1992. Ist die Schweiz ein lebensfähiges System? *Kybernetische Diagnose des schweizerischen politischen Systems*. Haupt: Bern, Switzerland.