

DESIGN FOR A SELF-REGENERATING ORGANIZATION

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ABSTRACT

Ashby's *Design for a Brain* [Ashby 1952] comprises a formal description of the necessary and sufficient conditions for a system to act 'like a brain,' that is, to learn in order to remain viable in a changing environment, and to 'get what it wants'. Remarkably, Ashby gives a complete, formal specification of such a system without any dependency on how the system is implemented. In this presentation the authors will argue how Ashby's formalisms can be applied to human organizations.

All organizations seek to successfully carry out transactions that achieve their goals and assert their identity, whether to educate college students for employment, to govern a territory fairly, or to make money for shareholders. An organization's transactions are predicated on agreements, and agreements in turn are based on conversations in a shared language. Thus human organizations are delimited by their operation in the domain of language, and Ashby's 'essential variables' are the 'shared truths' of an organization—perturbed by the environment, regulated by employees' actions, and carried in its language. We argue the validity of 'social essential variables' as extensions to Ashby into the social realm.

Furthermore, corporations create 'comparators' in the form of people and processes that interpret market fluctuations against monetary and strategic goals (whether qualitative or quantitative). These goals are performed expressed in linguistic distinctions held as internally relevant. Thanks to Ashby we can describe the limits of what is not possible under current constraints of an organization's language, and therefore focus on changes that are required to operate beyond current limits. The authors apply Ashby's framework to generate new desired states and to detail prescriptive action for change, enabling an organization 'to make the impossible obvious.'

In business terms, this provides the ability to initiate specific investments and to track convergence on desired business outcomes. No other methodology for organizational change known to the authors has the formal logic or prescriptive power as this application of Ashby's work. Through such interpretations—as rigorous as the application of *Design for a Brain* to mechanical systems—Ashby's formalism enables the derivation of the necessary and sufficient conditions for a corporation to remain viable in a changing market. The authors claim that the only means for an organization to *change from the inside and by design* is through the creation and protection of processes that recognize the limits of present language and engender the continual introduction of new ones.

The vast literature of 'organizational design' and 'learning organizations' is usually descriptive instead of prescriptive. Some implications of the role of language are not palatable to most modern organizational experts and their executive clients because it is in their self-interest to lionize the importance of individuals as the means to achieve success ('cult of the CEO' and 'leadership awards'). A cybernetic approach to organizational design instead emphasizes the requirements for the social system as a whole to support sub-systems that recognize and reward different types of creativity in the three phases of change: invention, discovery, and efficiency-making.

PREAMBLE

Thank you for the opportunity to be here today in Urbana—a place that was an important 'home to Ashby'—and to be among others who will be talking about 'Ashby in the world.' Our context as co-authors is one of conversation and collaboration of many years. Mike had a long and distinguished career at Du Pont starting in the 1960s, and our collaboration began in the 1980s and continued with Paul's work at Sun Microsystems. We want to bring a pragmatic view of our direct experience in working inside of large organizations from which our questions arise. Please consider this presentation as having the form of a legal brief, where we present our case for your response and criticism.

Our presentation today is part of a broader context in which we ask:

- What is the nature of a good investment?
- How can the social system known as the corporation come to make good investments? and
- How can organizations *survive*?

To handle the problem of recognizing and selecting a good investment, we turn to the language of thermodynamics. Investments can be viewed as creating order out of disorder, which is the definition of work. A good investment is one that can create a surplus; and that surplus can be reinvested in the same business space to produce a greater surplus. In other words, the process is generative.

For a given social system such as a corporation, there are ways to recognize and select appropriate investments, but we will not address that aspect today. We will focus on the ‘conditions of possibility’ that must exist in the social system such that appropriate investment can be recognized, selected, and amplified.

Our work [Dubberly, Esmonde, Geoghegan, Pangaro 2002] has sought to explain what we have all seen: that upon reaching a stage of maturity, a corporation can no longer successfully reinvest in its current activities and market space. Its prevailing strategy can no longer be the basis for creating new jobs, let alone maintaining the current work force. It is forced to shed social assets—its people—in order to remain financially viable. This pattern led us to a set of questions, summarized in these two:

- In specific terms, we ask: What must happen so that the corporation can conserve and expand its social capital?
- More broadly we ask: how can an organization regenerate itself?

This presentation addresses the social aspects of these questions. In the process we must show how social systems can learn and successfully adapt to an evolving environment.

We will outline the basic ideas and explanations, reveal their interconnectedness, and lay bare what *cannot* happen—so that the conditions of possibility for regenerative change become obvious in contrast. To fully explore these topics would take a semester, so here we present an outline and sketch the central arguments.

Our questions

- What is it to learn, to accumulate learning, and to adapt?
- What is the role of ‘bio-cost’ in learning?
- How is *Design for a Brain* isomorphic with *Design for a Social System*?
- What is change, why is it necessary? How does it occur?
- What is the prevailing management theory on change? What are its fundamental errors?
- What is power and truth? Why is it local?
- How can regenerative change occur?
- What processes give rise to regenerative change, and who can bring them about—by design?

ASHBY AND LEARNING

We begin with Ashby, whose work is of fundamental importance in addressing our questions. The usefulness and practicality of his work will become evident during our presentation.

Of paramount importance is the *question* that is asked. The question Ashby posed for himself was: what are the minimum conditions of possibility that must exist such that a system can learn and adapt for the better, that is, to increase its chance of

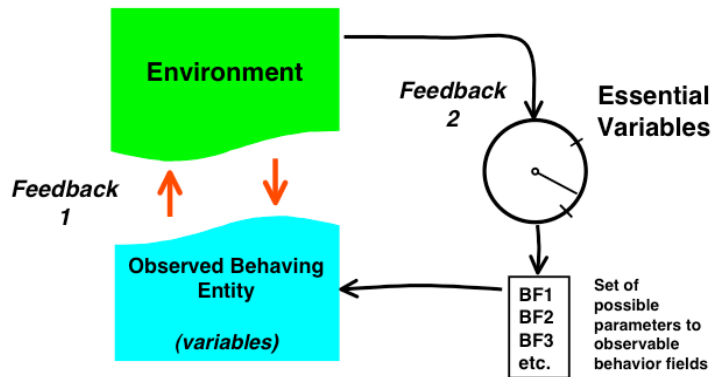
survival? Ashby concludes via rigorous argument that the system must have minimally two feedback loops, or double feedback. The following diagram is quite recognizable to those of you familiar with *Design for a Brain*.

The first feedback loop, shown on the left side and indicated via up/down arrows, ‘plays its part within each reaction/behavior.’ As Ashby describes, this loop is about the sensory and motor channels between the system (labeled ‘Observed Behaving Entity’) and the environment, such as a kitten that adjusts its distance from a fire to maintain warmth but not burn up.

The second feedback loop encompasses both the left and right sides of the diagram, and is indicated via long black arrows. Feedback from the environment is shown coming into an icon for a meter in the form of a round dial, signifying that this feedback is measurable insofar as it impinges on the ‘essential variables.’

Essential variables, as used by Ashby, are those ‘which are closely linked to survival and which are closely linked dynamically such that marked changes in any one leads sooner or later to marked changes in the others.’ [Ashby 1952, p52] For the human species, body temperature, blood pressure, and glucose levels are among its essential variables.

Double Feedback



Requisite variety

After Ashby

The second feedback loop ‘carries information about whether the essential variables are or are not driven outside the normal limits.’ The consequence of this feedback is the selection of a parameter from a set of possible parameters in the lower right box, here labeled BF1, BF2... (though usually labeled ‘S’ in Ashby’s diagrams), which result in the observable behavior. That range of parameters available to the system—seen as behaviors—is the variety and, if sufficient for the system to maintain its essential variables, it is the ‘requisite variety’—a profound concept and contribution to systems analysis and design that we will come back to later.

This second-order loop ‘...determines which reaction/behavior shall occur.’ [Ashby 1952, p84] A change in the parameter causes a change in the behavior (observed) field. This change-in-state-to-change-in-field is a ‘step function’—it causes a potentially discontinuous response to the environment—and is of paramount importance to our discussion. (For more on the topic of parameters, see Ashby 1952, p71.)

To evoke the social arena, we call these parameters ‘behavior fields.’ When learning by trial-and-error, a behavior field is selected at random by the system, actions are taken by the system that result in observable behaviors, and the consequences of these actions in the environment are in turn registered by the second feedback loop.

If the system is approaching the danger zone, and the essential variables begin to go outside their acceptable limits, the step function says, ‘try something else’—repeatedly, if necessary—until the essential variables are stabilized and equilibrium is reached. This new equilibrium is the learned state, the adapted state, and the system locks-in. The rest of Ashby’s formalism is built on this double-loop foundation.

Each step function must be an independent ‘memory’ to be available as accumulated learning when past conditions re-occur.

The step functions also must be distinguished by a gating mechanism such that the system chooses an appropriate step-function from which to obtain the equilibrium-returning behaviors. Otherwise, the system would not know which 'memory in action' to choose upon repeat of environmental conditions, and would in essence 'forget' what it had learned by way of previous actuation of the second-order loop.

The memories are built, area-by-area, as the system develops. Over long periods, as individuals interact with the environment and reproduce (as a species), successful modules can become hard-wired, that is, the learning is embodied in the genes.

There are only two ways to learn: genetic endowment and trial-and-error. It does no good to wait for revelation.

BIO-COST

Now we will look at the 'cost' involved in learning. Trial-and-error learning has a 'bio-cost', our construct for the measurable, biological cost to any system performing an activity in pursuit of 'getting what it wants'. We define the elements of bio-cost to be the resources available to the system: time, energy, and attention. In addition, the demands on resources lead to an additional component, that of stress, which is a complicating factor in systems that include a hormone system cross-tabbed to the nervous system [von Foerster 1973]. There is much more to say about bio-cost, but this brief sketch suffices our purposes today.

Bio-Cost

- The 'cost' to the living system of its daily processes
- Key components
 - Time
 - Attention
 - Energy
- Resource pressures lead to stress
- Consequence of stress = rejection of complexity



Stress

In the context of bio-cost, let's review the complex task that Ashby proposed in 'Design for a Brain' [Ashby1952, p151]—the task of wanting a set of 1,000 spinning wheels to all be stopped in the same position, with the letter 'A' facing up. As in the chart below, there are 3 cases to consider:

- Case 1 construes the task as completely parallel in nature, starting by spinning all the wheels at once. Should all the wheels end up in the correct position—whose likelihood is 2 to the power of the number of wheels, or nothing short of astronomical—then the task is accomplished. Waiting for this probability to pay off is clearly futile.
- Case 2 takes the opposite tack, executing the task completely serially, one wheel at a time until the spin is correct. Each sub-system is taken independently of each other, and each is worked on until correct. The time taken is tractable.
- Case 3 is a mixed approach, where every subsystem is started and failures are re-started until all are correct. Clearly this takes more than 1 spin, but less than Case 2 because many subsystems are working in parallel.

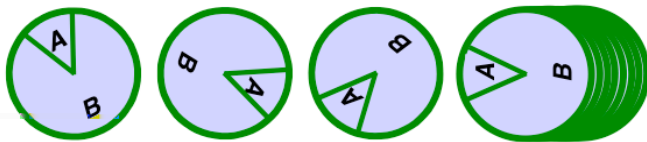
What are the lessons from this simple exemplar of complex tasks? Changing everything at once and hoping that it will all fall into place is futile, as seen in the vast average time taken in Case 1. In our experience, this approach is very common, even though it does not take advantage of intermediate, partial results. A complex task can only be accomplished if broken down into independent subsystems.

We can do that breakdown in a couple of ways. In Case 3, we try everything at once. Many subsystems are in play at the same time and it appears to have low total bio-cost. But there is a huge disturbance internal to the system, with so many subsystems in motion simultaneously. This requires attention distributed across too many different contexts, with high demands for communication across subsystems, leading to confusion and potentially paralysis and death. In Ashby's terms, the

demand on the 'channel capacity' is too high.

Bio-Cost of Complex Tasks

e.g., Spinning 1,000 Wheels



1. Spin all, repeat until all stop in correct position = 2¹⁰⁰⁰ seconds
2. Spin 1 until right, then keep. Spin 2 until right, ... = 500 seconds
3. Spin all, keep all successes. Spin the failures, ... = > 0.5 seconds

After Ashby

Complex environments must be approached part-by-part with little or no communication between the parts until assembly when each subsystem comes together and is integrated into the whole. This is Case 2. Each subsystem can learn on its own, sequentially, and then all the subsystems can be integrated into a whole.

We see from this example that learning to accomplish complex tasks involves high bio-cost. Environmental disturbance, resulting in disturbances to the essential variables, is also costly. To limit disturbances, every system 'simplifies complexity.' The entire construct of the 'scientific laboratory' provides buffers—we don't see and we don't hear a huge range of complexity in order to deal with simplifications so that we can learn about the world in parts, sequentially (otherwise we can't do science). Because of our fragile biology, we build 'stabilizers' that enable us to more easily maintain the essential variables of biological life, such as houses with roofs and insulation and heating systems. In daily life, *habits* are simplifications that shield us from too much complexity, only one of countless examples of cognitive responses to the high bio-cost of living.

Let us summarize, but here we want to keep the context of the social system strongly in mind as we transition to the next section, where we will argue that everything we've said—everything Ashby says—is applicable to social systems.

Systems avoid or dismiss complexity because it is too costly to engage it, and it might even kill you. To survive as the environment changes, systems must learn but learning is costly. A given system has limits as to the environment to which it can adapt. It may not have the requisite variety or the capacity to learn fast enough. As observers we can note the significant, natural resistance to learning to adapt to complex environment—the bio-cost is high, and the benefits are almost certainly unclear to the beneficiaries. It is possible to amplify learning in an existing system—a child can be taught new words, or can be given a dictionary and 'exceed the system's requisite variety' [Ashby 1952]. Systems can successfully expand their variety if they learn part-by-part, serially; maintain clarity in the local subsystem they are engaged in while learning; and avoid over communication between sub-systems.

SOCIAL SYSTEMS

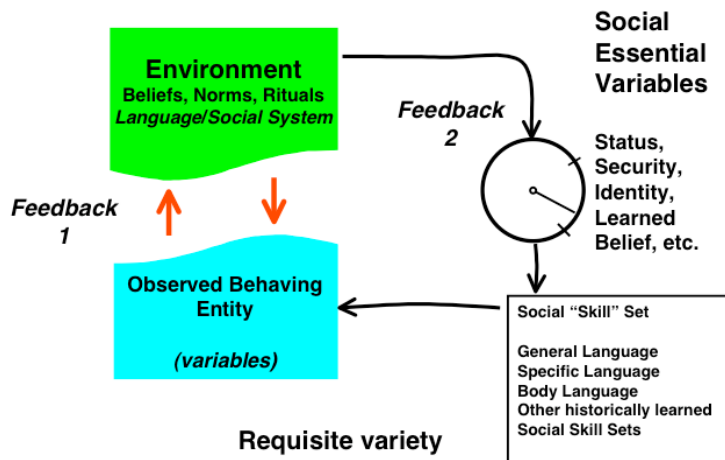
As we hope you can hear, it becomes intuitively obvious that *Design for a Brain* is isomorphic to *Design of a Social System*. Every living system—a living entity in relationship to its environment—evolves in the same way: The previously successful systems that fail to learn and adapt are eliminated. It is not a matter of 'survival of the fittest', but 'survival of the fit', or, more correctly, 'elimination of the unfit.' For humans—*Homo sapiens sapiens*, as Maturana would distinguish us—the ways we formulate our world, behave, and manipulate the environment *in language* are all subject to the law of natural selection. This includes corporations as a dominant class of modern social organization with enormous impact on the global economy and environment, and, inevitably, our everyday lives.

In a social system such as a corporation, the relevant environment is the historically-evolved and agreed-upon system of values, beliefs, social structures, norms, and rituals in its language. This is the relevant environment because *that which is conserved* is what the organization is. It is clear that the medium of behavior in social systems, including corporations, is language rather than the physical world, because language is the medium of the agreements and transactions that constitute the forward motion of a corporation in its own terms (the natural sequence of *discuss, agree, invest*). When measured by its executives or its stockholders in terms of offices and buildings or in any physical space whatsoever, these so-called material assets of the corporation only have meaning in discourse.

As Ashby says, the way for systems to achieve viability is to reach equilibrium with the environment. In social systems, the route to equilibrium for the individual is the process of gaining agreement. An error can only be recognized as such within the context and constraints of the local language. For example, you are not guilty until the judge and jury *say you are guilty*.

What does 'survival' mean for the individual in the social context of the corporation? Further, what constitutes success? Promotion and salary increases are the foundation of recognition, presumably as a sign of contribution to the economic health of the organization (although they *need not* actually reflect that). Increased influence can be a factor for some individuals, in some circumstances. What constitutes failure? Loss of influence, demotion, losing the job entirely by being fired. In sum, for the individual in that social system, the *social essential variables* are those that pertain to social status, identity, the manner of making a living, and, in general, personal social security—that is, 'being OK' as *Homo sapiens sapiens*.

Social System (historical)

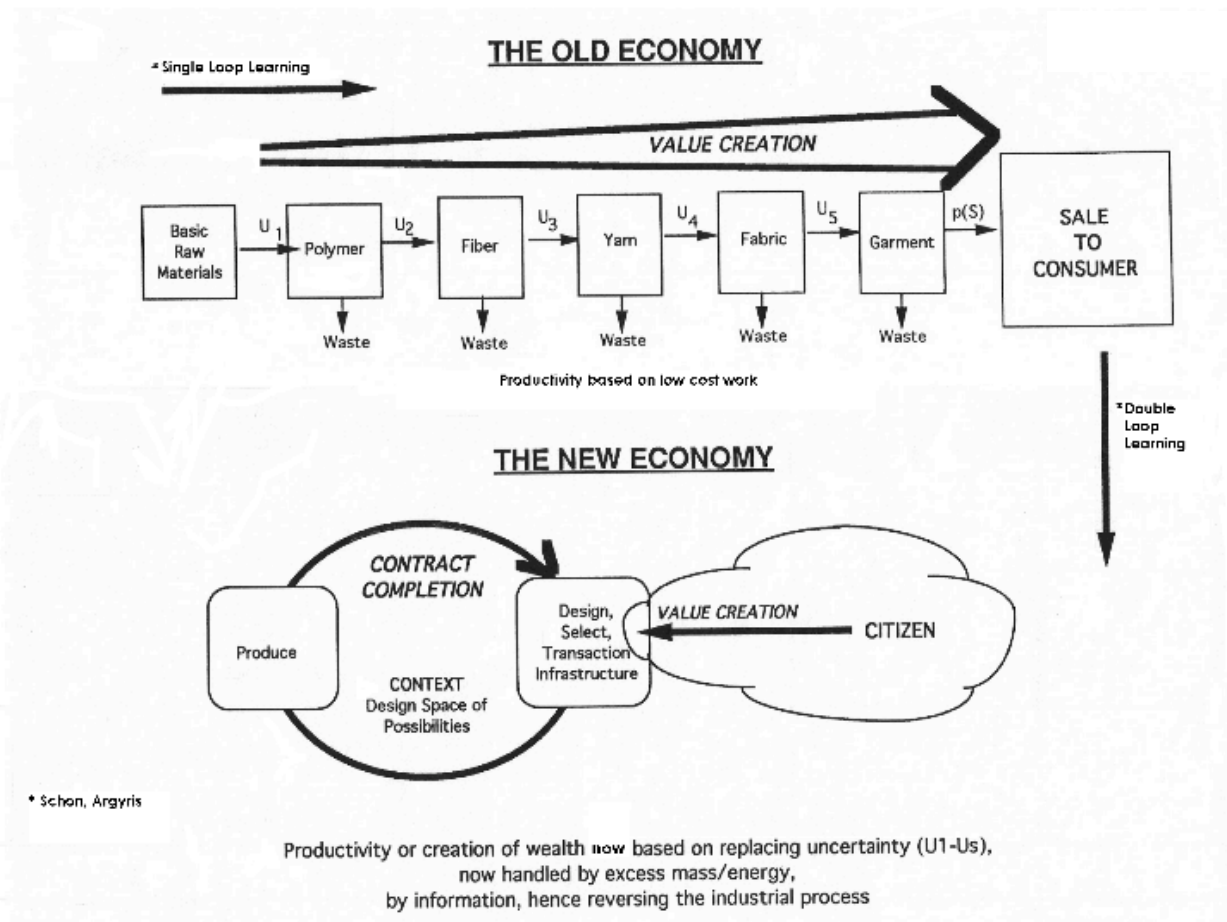


After Ashby

'Detection and correction of errors', to invoke the common first-order cybernetic phrase, is, as usual, the prerequisite to achieving equilibrium. But in the current language of the individual, what can be detected? Errors can be of two types: first-order errors, where adjustments must be made within the current discourse to maintain the (social) essential variables—the kitten adjusting its distance from the fire, or the company adjusting some interaction with customers and partners to improve inventory control. The current language is capable of expressing these errors, and changes to behavior can be made with positive effect.

But what of the second-order errors, where a step-change, a different *class* of behaviors, is required to survive, and the current language is *not capable* of expressing the error? When new errors fall outside the local limitations of language, the social system is at risk. The corporation is doing the wrong things, its version of the truth is faulty, and the individuals inside the corporation 'don't know that they don't know' [von Foerster 1973].

For example where the first-order language cannot express second-order constructs, consider the following characterization of a major shift in the nature of productivity and economic potential that has been widely expressed as 'the networked economy'—although our characterization of the nature of the new era may be unique:



- The mode of productivity of the 'Old Economy', the Industrial Age (up to 1970), was based on *the reduction in the cost of a unit of work*. This is simply an amplification of the muscles.

This was discussable, thinkable, and all the cogent actions of the corporation reflected this truth: the business plan, investments, and market strategies. However, there has been a major shift, noticed but not yet explained by Alan Greenspan and other economists, because:

- The mode of productivity in the 'New Economy' is based on *the reduction in the cost of reducing uncertainty*. This is simply an amplification of the nervous system.

The existence of the confusion over the relationship of productivity and employment in recent times—if productivity is going up, why isn't employment?—can be explained by saying that a new explanation is not discussable in the old language, and so cannot be appropriately reflected in the business plan, investments, and market strategies of most corporations.

We will return to a real-world example of this shift, after a view of the nature of change.

CHANGE

Change, the need for change, is visceral. I, or we, are not getting what we want. 'I don't feel okay about my future security.' For our purposes, we distinguish three embodied classes of change:

Three Classes of Change

1. The Act of Invention
 - Opening a new semantic space
2. Acts of Discovery
 - Specific problem focus
 - Creation of new distinctions, new instructions
—that is, *language*
3. Acts to Increase Efficiency
 - Processes and procedures, e.g. "six sigma"
 - Organizing people, machines, and communications to achieve lower cost per unit of output.

Each of three classes can be construed as the domain of an individual or a group, that is, each class is carried out by a *different type of individual*. This is because the belief system, the values, self-interest, and overt behavior of these three classes are quite different. For example, individuals focused on changes for efficiency *have no 'space'* to consider the issues of invention. It is outside their style and focus, no less outside their language. Lifestyles, 'life meaning', the way in which they achieve satisfaction differs markedly. Once again, the genetic history is one form of learning that has impact on the tendency and capacity for inhabiting a particular class of change; and interaction with the environment (the ontogenesis) does the rest. It seems likely that Einstein, for example, was pre-disposed to Class 1. He would say that himself.

Notice that the flow goes from Class 1 to Class 2 to Class 3. As in evolution and developmental biology, entropy-change goes one way. You cannot go, in same semantic space, from efficiency to discovery, much less invention. You cannot learn what you already know; you cannot invent what has already been invented. You cannot improve the productivity now by what you have done in the past, because of what has changed in the meantime.

Here are some examples of this flow of change from Class 1 to 2 to 3. In the 1960s, Carver Mead asked a key question: what are the limits of Very Large Scale Integration (VLSI)—that is, how many computational elements can you get onto a given area of silicon? What is the theoretical limit of the number of switches that can be packed into a single chip? This is change in the form of Class 1, opening a new semantic space—beforehand, digital switches were implemented out of individual components. This new space in turn gave rise to a whole new set of questions—Class 2—as how to approach the theoretical limit proposed by Mead. These questions constitute the birth of Silicon Valley, because answering these questions provided a roadmap for creating new, viable products. Finally, answering questions in Class 3 led to the progress measured by Moore's Law, a characterization of the pace at which the industry approaches Mead's theoretical calculation of the ultimate limit. One could go into further detail—for example, to show how Mead's original calculation *implies* the answer to questions in Class 2—but here we are limited to these comments.

Another example of these three classes of change starts in the early part of the twentieth century with the creation of means for detecting macromolecules with chemical techniques. This opened up a conceptual space in which it was possible to conceive of natural materials being mimicked by composing synthetic materials out of combinations of long-chain molecules, thereby copying naturally occurring substances but hopefully also improving them—making them more comfortable, durable, malleable, etc. The *invention* of macromolecular chemistry constitutes the opening of a new semantic space that led in turn to, say, thousands of questions as to how to actually manipulate the materials predictably, requiring in turn the *discovery* of many thousands of answers. This gave rise to the creation of nylon, polyester, lycra, etc. Over time, improving the *efficiency* of manufacturing and product-creation processes meant that an existing business could continue to generate wealth for many years—so long as there was ignorance in the system whose removal constituted lower costs and therefore potential profit.

Of course the biologist will recognize that evolutionary and developmental biology comprise components that are isomorphic

to the three classes of change, from *invention* to *discovery* to *increased efficiency*.

When we talk about regenerative change, remember that we are talking about a change in the mode of productivity, where actions or 'programs' will lead to a surplus. This surplus can be invested in the same space to produce further surplus, otherwise you are relatively less and less productive and will be 'selected out.'

EXISTING MANAGEMENT THEORY

Now, let's look at the social system of management theorists and at their disembodied perspective on change, for example, the perspective of Schön and Argyris.

- Single-loop learning: detect and correct errors, *as confined by the existing belief system*, in order to dynamically stay essentially the same. For example, 'productivity depends on lower-cost work, so we must invest in more *efficient* machines.'
- Double-loop learning: detect and correct errors in the belief system itself. The process requires the development of a new set of Social Essential Variables, which means a change in the business theory—a change in 'the truth'—and a change in the interpretation of 'productivity now', for example, to lowering of cost of reducing uncertainty.

Is it any wonder that Schön and Argyris never observed double-loop learning, as they state in [Schön and Argyris 1995]. The inherent resistance to change of belief systems, including the vast bio-cost, means that it is nearly impossible for an existing organization to come to a new belief system on its own, without the intervention of a specific process that is designed to bring it about without destroying the existing system. The individuals—whether deep in the hierarchy or the execs at the top—are too vulnerable, and their need to be secure and know that they can make a living and survive in the social order of the existing organization is too great for all to be comfortable in the face of the necessary change. (They may know intuitively that change is needed, but do not have the requisite variety in language to know how to discuss a secure path forward.) We have witnessed this first-hand.

We can apply this reasoning to management theorists in turn. Though Schön and Argyris referenced Ashby, could they, with their background and focus, have seen the deep implications of Ashby's work? Why did they not follow the reasoning from Ashby into social systems, as we have? Our hypothesis is that, because they were not structurally coupled to a business, it was impossible for these professors, as smart as they were, to see what can only be seen by direct experience of the social system of the corporation. To be a bit harsh about it, talking about double-loop learning is a comfortable way to make a living, but double-loop learning does not happen in the field of action. Our personal experience in large corporations, witnessing the ossification of language and paralysis of the organization, has informed our path. Ashby provided a huge leap in understanding in the form of a new language, a new analysis, with which to explain our experience.

Coming to a new understanding is hard. Consider the bio-cost to a single individual to learn a new language, change an entire belief system, change what is considered the truth, change the manner of making a living—all factors which are conserved [Maturana, Varela 1992].

Now think of such a change at the social level, which is on the order of a 2^n -type problem because the system is relational—each subsystem has to interact with all others, and each subsystem has internal relations of the same order. Consider these circumstances and reflect on the total bio-cost—time, energy, attention, stress—to change what is in place, while staying alive.

THE NATURE OF ORGANIZATIONS

Schön and Argyris ask, what is an organization?

'A government or polis, an agency, a task system, a theory of action, a cognitive enterprise undertaken by individual members, a cognitive artifact made up of individual images and public maps.' [Schön and Argyris 1995].

Their characterization does not include self-interest or history. It is a-biological. Because the systems under scrutiny here, those of humans and organizations and language, are *fundamentally biological*, Schön and Argyris' conclusions, given in the same

limited language as their question, can only be flawed. Such an approach to diagnosing and improving organizations is doomed to fail, as we noted earlier in characterizing some classes of errors as *by their nature* being outside the current language. It is as if a solution is sought in Euclidean space, while the solution lies in a different language, that of Riemannian geometry, which allows an new understanding of space-time curvature, not thinkable in Euclidean space. To solve the problem that Einstein solved means moving outside the limits of current thinking, namely, to realize that time can be construed as local.

In contrast, and in a significant shift of viewpoint from management science, we look at an organization as a set of agreements brought about in the locally limited language, in the self-interest of the agreeors. But further constructs would be needed to explain the force of resistance that is so evident when change is attempted.

TRUTH AND POWER

That which can be discussed—the nature of what is considered true—as well as what is considered an error cannot be separated from power. Power is a subject that most management schools omit. What, indeed, would the MBA-graduate-now-C.E.O. say if such an inquiry made him feel very uncomfortable. There is a mutual self-interest factor at play here.

Power is typically viewed as constraining, oppressive, dealing with the sovereign; it's about wealth, economics, war, and military might. These are not very useful as an explanatory principle.

To understand power in a useful set of explanations, we have turned to the work of Foucault. We're sure you are familiar with his work, and we ask you to resist any generalizations as a consequence of our invoking his work. We need to borrow a few useful concepts and show how it applies to our domain.

Foucault & Regenerative Organizations

- Truth/Power
 - The formation of self interest 'in the now' is governed by the local truth—"this episteme"
 - Carries its own set of rules of discourse
 - *truth is not invariant, it is local*
- Reason
 - The accepted language of efficiency, of today
 - Delimits what, within reasonableness, is an error to be corrected
- Unreason—what today's reason does not accept
 - Being possessed by the limitations of the current reason
 - Creating the language of invention, the new truth

Foucault says,

'The history which bears and determines us has the form of a war rather than that of language; relations of power, not relations of meaning. History has no meaning, though that is not to say that is absurd or incoherent.'

'Each society has its regime of truth, its general politics of truth; that is, the types of discourse which it accepts and makes function as true.' [Foucault 1975]

Foucault sees power as that which exists in relation between people, not a thing in itself. Truth and power coexist. The exercise of power is the production of the local truth. Power determines the rules of discourse, the formation of statements that are considered as acceptable—what is thinkable, what is discussable. Power is 'who talks to whom and about what'. Truth/power is the environment of the Social Essential Variables *now*, locally. Power makes possible the production of things,

the production of new knowledge—really a new class of knower.

We fight daily for the truth, in the production of the truth.

From Foucault's perspective, power has positive aspects in that not only does it induce pleasure but, by pervading all human interactions, it makes possible a coordinated local action and local clarity, thus reducing anxiety. The legitimacy of power can be seen from this biological basis as fundamental to the rewards of learning.

Consider the context of efficiency, minimizing bio-cost, a low level of learning, the *now-domain of reason*. In that context, a major regenerative change, a new truth is relative *unreason*. It is very threatening, and consequently is dismissed.

The desirability of regenerative change is frequently invoked in the political sphere in organizations: 'we must change, we must be a learning organization, the only constant thing is change', etc. In the context of the personal self-interest of the speaker, this all sounds good; but, in practice, talk about change does not make the distinction between old and new language, and does not enter the field of action. One could ask, do the CEO and his like-speaking administration believe that they should be eliminated by natural selection?

In summary up to this point in our frame of social systems, we have outlined the huge bio-cost involved in regenerative change. The social system must change its language, its business model (which is the strategic conversation), and what is locally true. The concept of 'what-we-are-in-the-business-of' must change. We know from experience that learning a new language, a new truth in which to detect and correct error, takes a great deal of time, energy and attention—a high bio-cost.

Einstein: Resistance, Codification, Time

- 1905—Albert Einstein publishes a short paper on Special Relativity
- Renowned scientists of the day interpret the work simply as an improvement on the electrodynamics of Maxwell and Lorenz
 - re-affirming the "truth" of the day
- 1910—Scientific community begins to grasp what Albert had wrought
 - time is not invariant, it is local*
- Regenerative Change has huge social bio-cost
 - To create new language
 - To learn new language

But how can the social system get from here to there? Such a change takes years. And how does it survive in the meantime? The conservative force maintains 'I want to keep my job doing what I know how to do' and it pervades the social system. Ashby says to simplify, take it part-by-part, don't over communicate or tax the system as a whole. Now add the insights of Foucault: Truth is power and the CEO believes he speaks the truth—so real change just doesn't happen. Except, perhaps, with relevant insights and mechanisms, it *could* happen, by *design*. It is our conviction that it can, and that to do so, would ultimately conserve resources, minimize anxiety and personal stress, and lead to the *creative conservation of capital*.

MECHANISMS FOR CHANGE

The forces that maintain the status quo in the social system are huge. Here are three possible ways to bring about regenerative change in the face of them.

I. Machiavelli: We kill the Prince and all those around him that speak the truth as he does. The new Prince brings with him the new truth. This, for example, is what happened at IBM when Lou Gerstner became CEO in the 1990s where he made huge changes at great social cost—the sale of social assets in the form of layoffs for thousands of employees, including those that spoke the old truth.

2. Philosopher Prince: There may exist a 'Prince' who has a dream and owns the truth, and who can move the entire strategic discussion from his existing position. The approach is to allow the old and still to build the new. As unlikely as this sounds, it does happen, as for example famously in the case of Nokia, which began as a totally different company, holding discussions about wood, rubber, manufacturing electrical cables, etc. Based on the CEO's ability to change the truth, there evolved discourses about cell phones and social communication, and thereby a new business was conceived. A new truth, a separate new social system, was created.

3. By Design: We believe that it is possible, based on the understanding outlined in this presentation, working from Ashby through to Foucault and Maturana, that it is possible in principle to bring about regenerative change in an existing organization, including a change in the mode of productivity from mass/energy solutions to information solutions—as we put it earlier, from reduction in the unit-cost of work, to reduction in the unit-cost of reducing uncertainty. We don't know that this has ever been done—and we think we have shown the reasons why it is so unlikely, especially without the insights and prescriptions that arise after years of living in and reflecting on the organizations in question. The normal structure of the corporation excludes a route of internal, transformative change 'by design.' R&D is subject to the existing Prince and is limited by the language of the Prince. The Prince is constrained by his need to portray a bright future right now. He lives in the land of efficiencies and urgency of today, where he defines his self-interest and his history and the history of the organization. If the Prince does not know that he does not know, he therefore thinks he knows.

Methods to achieve change

- Kill the prince and the talkers, change the truth
 - Machiavelli
- Prince brings about the mutation
 - Nokia
- Change by design
 - Create a new language
 - *Ever been done?*

So how can a social system change by design? What are the necessary and sufficient conditions such that regeneration is possible?

ENTER THE CONCEPT OF THE QUEEN

Change by design

- Understand the nature of opening a new space
- Define and solve a focusing problem
 - Only means to create new distinctions = "Queen"
 - Queen not subject to the Prince
 - Prince cannot understand the Queen
- Market example
 - Change in mode of productivity
 - Reduction in cost of unit of work = material change
 - Reduction in cost of lower uncertainty = informational change

Unlike the Prince, the Queen lives in the land of new semantic spaces. She is well aware of the new spaces for discovery that are being opened. She is aware of their potential and can speak new language.

The Queen is able to recognize and select from newly opened spaces those that are most relevant to the regenerative process for her social system—the corporation, with its history and resources. For each selection she can formulate specific, relevant, focusing problems and explain their key aspects, such as the economic potential of these new spaces; how to proceed to ‘take the ignorance out’—out of current understanding, to bring order to disorder, and to create new distinctions in language such that the new truth becomes communicable. This constitutes productive action in the second class of change, discovery, and precedes the logical continuance into the phase of efficiency.

The Queen has full power over the ‘nursery’ in which inventions come about. The Queen is not subject to the Prince. They cannot even communicate in the Paskian sense [Pask 1976]. Perhaps the Prince thinks the Queen ‘speaks in tongues.’

So, ‘regenerative change by design’ is simple biology—conception through the mixing of existing languages to make new language; birth; development. Perhaps Pask has the best formalism to further explore the details of this developmental path, in language, of the social truth in organizations.

The notion of the ‘focusing problem’ is central to moving the organization, and here we outline its necessary features and then offer a real-world example, an attempted implementation.

Requirements for Focusing Problem

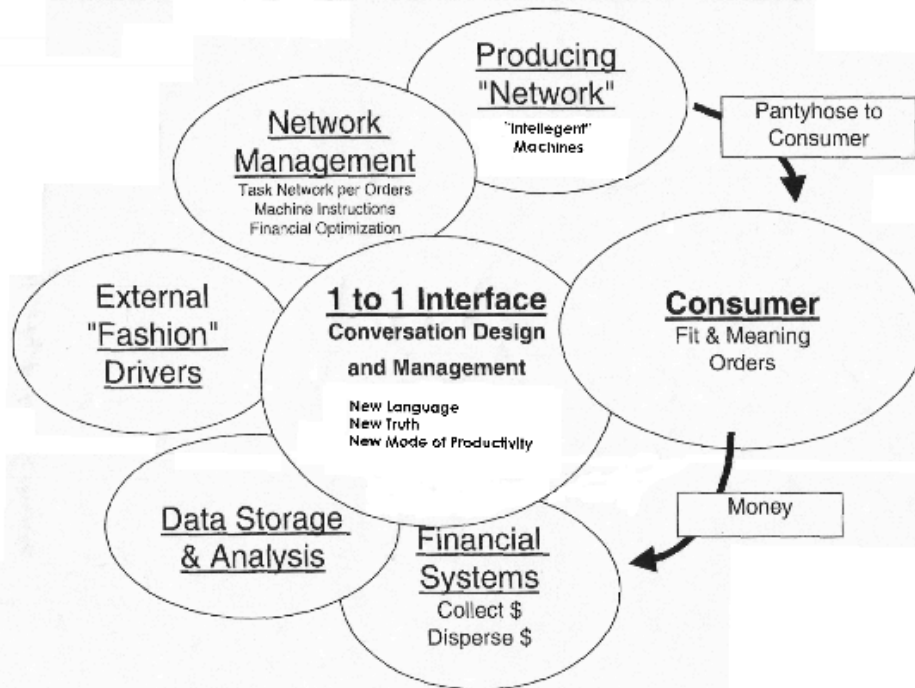
- Must be of problem class that replaces *transformation of mass and energy* with *actionable information flows*—so that it participates in the new economy
- Must have *economic potential*—removing uncertainty in the system/market is worth something
- Must be *consistent with the social system*—to connect with who we are (our history) and what we can see ourselves engaging in
- Must allow definition of and access to the *requisite variety of domains* of expertise needed to solve problem
- Must engage initial set of *individuals who want to do it*
- Must serve as an exemplar or *teacher for the business* as a whole—so that what is learned can be reproduced

A REAL-WORLD EXAMPLE

Let us give you an example of failed change-by-design. It was this failure that led to the need to understand power and the necessity of the concept of the Queen and her independence, which led in turn to designing a process of trial-and-error to eliminate the impossible. This failure clearly delineated the conditions of possibility—the only path to regeneration by design and the conservation of social capital.

This chart is a model of an actual project in Du Pont, implemented as an explicit focusing problem and brought fully through the phase of *design*. The economic, production, and distribution factors were fully worked out, but we want to focus here on the change in the truth, in the business model, in the social structure. By its nature, the social value in the new model shifts from the traditional VP’s to the system designer, the engineer of intelligent machines, the network engineer, etc. Jobs from the old model no longer have their status—and they may not even exist. Consider the threat to the manner of living of the ‘now’ power structure with all its language limitations and urgency. Naturally—it’s easy to say that now in hindsight—it was dismissed, just at the take-off point. The resistance, conscious or unconscious, is so great as to prevent such a change from happening. (Microsoft is not born inside of IBM.) But, have no doubt, someone outside the current social system will do it, hastening the selecting out of the old system.

Pantyhose - Consumer-Centered 1:1 Model



All subsystems connected in real-time

CONCLUSION

Regenerative change is nearly impossible for the existing social system, because of the high bio-cost of change and the threat to the manner of living of the individuals in it. We believe that regenerative change can occur through the following process, here outlined with some forward references to further steps in making 'change by design' a part of the methods of the modern corporation to innovate and preserve social capital. The focusing problem remains the basis for regenerative change by design, as it is a prescriptive means to the creative conservation of capital.

Regenerative Change by Design

- Conception/Inventing
 - Opening of a new semantic space
 - New distinctions arise as a consequence of synchronization across perspectives of previous domains [Pask]
 - To come together—"have sex"—produce new languages
- Birth & Development/Discovery
 - Communication of the invention through ontogenesis
 - Only possible from a focusing, purposeful problem
 - Extensions of the new language are required to bring the conception to fruition in the environment—to make a product/service that delivers value
- Specialization/Efficiency
 - Continual improvement of the product/service
 - Doing it better, scaling it further

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