

entropy production and emergence in behavior LO20446

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Replying to LO20330 (At de Lange)

-again incorporating contributions from a plethora of posts by a number of different individuals

Greetings LOers!

First of all, At (Greetings once again), I want to thank you for explaining the minimality criteria for entropy production once again. Your comments were very helpful to me in understanding the relationship of positive and negative reinforcement in introducing energy into behavioral systems and thereby causing entropy production. I am going to try to explain some of the connections that I have been trying to make so that others may question, comment, correct and improve them.

First, some background. In LO20330 you wrote:

*>What is the hammering which the surroundings have to take in case 2?
>Since entropy production is the cause of diversification, the
>surroundings will have less opportunity to diversify. It is like a big
>corporation with many divisions. When the one division is usurping
>most of the profits earmarked for expansion, the other divisions will
>stagnate. What is the gain for the system when the surroundings have
>to take this hammering? By increasing the entropy production,
>additional bifurcations can be reached and thus new possible actions
>be explored. This is how human systems gain knowledge of "all possible
>changes".*

In paragraph, you gave the example of a corporation that chooses to invest its profits (free energy) in one particular division in order to maximize the entropy production in that division. This is done with the goal of accelerating the production of bifurcations necessary for the the division to self-organize into a higher state of order. In doing this, the corporation chooses to forego opportunities for the other divisions to use this free energy in their own entropy production, and hence these other divisions stagnate.

One key observation that I made in this example was that there was free energy (in the form of profits) available in the corporate system for this entropy production. In this case, there is no need to introduce energy to do this work from outside the system. I would liken this illustration in some ways to the example that I gave of a behavioral system with free energy (potential outcomes not being realized that are more desired than the outcomes that are presently being realized) in LO20309. In such a situation, the system is in a state of labile equilibrium and the potential exists for the system to spontaneously reorganize into a new state of equilibrium attracted by these more desired outcomes. Some of the free energy available to the system must be used to place the system in contact with the additional potential outcomes (acting as a catalyst and "guiding" the system to the edge of chaos and to an ensuing bifurcation), but once this occurs, the system will spontaneously reorganize (emergence - irreversible self-organization requiring no further free energy - as At notes in LO20410, this may even be harnessed as a source of free energy). Leo Minnich's reservoir example in LO20345 illustrates this beautifully. For the period of time that the free energy is focused on guiding, or facilitating, the reorganization of the one behavior, other areas of the system may have to decrease the rate at which their entropy is increasing to compensate.

At wrote, again in LO20330:

*>OK. Human systems can gain much knowledge of "all possible changes".
 >History shows that the majority of humans do not worry too much on the
 >hammering which the surrounding have to take in terms of reduced
 >diversity. But there is a "silent hammering" which the system itself
 >takes and which may be worse when it tries to live persistently at the
 >edge of chaos. Since it seldom produce entropy minimally, it seldom
 >have the opportunity to mature into a dynamical equilibrium with
 >respect to that change. This phase is necessary to produce a new
 >source of free energy. For example, a young sapling has to grow into a
 >mature tree to produce enough fire wood. The system jumps from the one
 >revolution to the other like a cat on a hot tin roof, using up all its
 >sources of free energy. Eventually the system will collapse with
 >little effort. ...snip...*

*>This is why I have to caution once again that when we are involved in
 >the change of other people - please take it slowly. Allow for each
 >change to feed and mature into a dynamical equilibrium. Otherwise all
 >the immature changes will add up a cause a "burn out". ...snip...*

Also, in LO20274 At wrote:

*>If the entropy is produced outside the system (requiring the seven
 >essentialities) to fill up the system with it, there is no guarantee that the
 >seven essentialities will also be sufficiently developed within the system
 >to respond with an emergence to the ensuing bifurcation. The mere
 >fact that we want to produce the entropy outside the system points to
 >the fact that we already are tacitly aware that the system itself*

>could not do it. In such cases we usually expect immergences to happen
>and our expectations are seldom wrong. In my opinion we should rather
>guide the system how to produce self its own entropy sufficiently so
>as to reach the edge of chaos where the bifurcations happen. In that
>case we can expect the bifurcations to evolve into emergences rather
>than immergences.

In the last paragraph by you above (from LO20274), you conclude that we should avoid using energy from outside the system to cause nonspontaneous reorganization. As you mentioned, this usually leads to an immergence rather than an emergence of the system. Here, your observations of the ultimate consequences of increasing the entropy of a system maximally for an extended period of time are extremely relevant (see the two paragraphs above this one that I quoted). When we try to force nonspontaneous reorganization by introducing energy from outside of the system as so often happens in organizations, and, as you have pointed out, we are doing with our natural resources as we speak, we are on a path that leads to "burn out" and the collapse of the system (immergence). The likelihood of this happening increases in a nonlinear fashion if negative reinforcement is used as the means for introducing energy into the system.

>From a behaviorist perspective and by adopting a systems perspective, we can understand why this phenomenon of increasing entropy maximally today at the sacrifice of the entire system in the future might happen by revisiting the decay of delay in feedback loops. The more distant the consequence from the behavior, and the more uncertain it is to occur, the more that it is discounted in decision making. The ultimate collapse of the system is far removed in time (you mentioned 30 years for our natural resources) and is viewed as uncertain (as you also mentioned, many are placing their faith in the belief that someone will create the inexhaustible source of energy between now and then). In the immediate present, we are powerfully positively reinforced by the conveniences that the technology consuming the natural resources affords us. As a result, we choose to increase our entropy maximally and ignore the fact that we are not replenishing the energy that we are using. As Stephen Covey says, we are too busy driving to stop for gas.

This scenario parallels the dynamics that are established when we use negative reinforcement to drive change. As I mentioned in LO20081 by drawing a parallel between the use of negative reinforcement and the shifting the burden systems archetype described in chapter 6 of the Fifth Discipline, the use of negative reinforcement to push behavior has many undesired (but delayed) consequences which ultimately undermine the behavioral system. It requires a continuous and costly investment of free energy from outside the system to maintain the change (the system will never spontaneously reorganize in alignment with the direction established by the negative reinforcement - one result of the spreading caused by the pushing force). It results in indeterministic actions in the system as you point out in LO20330. In LO19894, I described some of these "side effects" as being an artificially low ceiling for performance (the most

you can expect is the least required to escape or avoid the negative outcome), the possibility that individuals may choose to exit the situation rather than endure it, and resistance on the part of individuals to this method of influence that may increase over time, even to the point of the manifestation of outright aggression. Those in the system begin to feel unempowered, boxed in, cynical, and burned out. The harder you push, the more the system pushes back, and the greater the amount of energy is required to simply maintain the present state of organization. In effect, we are using up all of the sources of free energy faster than we can grow new sources of free energy, and the system will ultimately collapse. We are "silently hammering" the surroundings to the system, and the price will have to be paid.

Despite all of these consequences, the use of negative reinforcement is prevalent in organizations. Why? Because the person who uses negative reinforcement is frequently, immediately, and positively reinforced with the compliance of the "target" to the direction of their influence, and the situation, in the short term, appears to be improving. Everything appears to be on the right track. The use of positive reinforcement is usually not reinforced as powerfully as the use of negative reinforcement. However, more and more resistance begins to manifest itself, and more and more effort is required to sustain the organization. What is the individual likely to do? Unfortunately, more of what they have done in the past (they have been positively reinforced for doing it). Their common sense and experiential learning (without theory) leads them down this path. As Deming said, "Working harder only digs deeper the ditch they are in."

To this point, most of the dialogue in which we have been engaged has focused on making connections between the behaviorist perspective, systems thinking, and entropy production to encourage emergences in behavior. However, so far, I think that we have spent most of our time talking about why we should do this, and what we can expect if we don't, but only recently have we started to discuss how this should be done. I have made several attempts to explain how to go about doing this (in explaining how to "build the bridge" using positive reinforcement). Leo Minnigh (LO20246 and LO20345) and John Gunkler (LO20363) have participated in the dialogue and have begun to open up the "how" question (I originally began this post with the intent of getting deeper into the "how to apply" issues, but, given that I have been pecking away at this post for days already, I will have to save some of what I had intended to say for a later post).

For example, in LO20330, At wrote the following statements:

*>Nowadays many people come under the impression that complex systems
>cannot be "deterministic systems". They use all sorts of arguments (like
>linearity and closedness) to vindicate their tacit knowledge that a
>system may lose its deterministic property - that it may act like a
>loose cannon on a ship. The loss in determinism is a fact and thus not
>the issue. The reason for it is the issue. You have identified the correct
>reason.*

>Forcing NON-SPONTANEOUS behavior by negative reinforcement leads to
>indeterministic actions.

[ABSOLUTELY YES!!!! Understanding this is paramount. This is why I made the bold (brash?) statement in LO20081 that the behaviorist perspective is, IMHO, the Sixth Discipline (or at least 5.5) necessary for Learning Organizations. It essentially applies the systems thinking perspective to the unique context of behavior - an extension that allows us to see with clarity where the "levers for change" exist in systems of behavior and human interaction.]

>To regain deterministic behavior, spontaneous behavior based on
>positive reinforcement should be promoted. In other words, the system
>should be allowed to follow its own course of irreversible
>self-organisation by producing its own entropy. This is how every
>living species have been acting since times immemorial. Our task is to
>"guide" human systems to focus on a particular course through
>self-learning. I have used quotation marks to stress that the word
>guide does not give precisely the meaning which I want to articulate.
>When I think of "guide", it excludes regulation, enforcement, ruling
>controlling, authority, dominion or similar things. In other words,
>when I think of "guide" it excludes pushings and includes pullings.

At, I couldn't agree more. This captures the essence of the very reason that I asserted in LO19894 that the behaviorist perspective is much more than an amoral technology for changing behavior. It has helped me to see with a clarity why "doing the right thing" is more than just taking the moral high ground, but is also the ONLY way that we can truly achieve the visions of our hearts and minds. And it has enabled me to see HOW to do "the right things" to the best of my present ability, and to be equipped to continually learn how to improve my ability to do this. I believe that there is an appropriate time and place for "aversive methods" to be used (for example when a behavior MUST stop or change immediately for reasons of safety), but, as you stated in LO20274, "when the time arrives that we have to enforce the missing complement, we should do it with compassion. Thus we need to know what will happen when we are responsible for causing the entropic force-flux pair and the subsequent increase in chaos.". This has affected me in my professional life, as I work towards my personal goals, and in my roles as husband, father and friend. I am forever changed as a result (I have irreversibly self organized!).

To pick up on a long dangling observation of At's (responding to John Gunkler) that made an impact on me fairly early on in the "changing another person" thread. At wrote in LO20074:

>A Systems Thinking (ST) should give a coherent and consistent account
>of why one person should not change another person without "permission
>based on a sound knowledge". If the ST cannot give such an account,
>then using such a ST will change another person without "permission based
>on a sound knowledge".

At went on to explain this point from an understanding of entropy production, but I think that we have also been able to explain this from a behaviorist perspective. This also brings me to another point that I have been wanting to make regarding the exclusivity of entropy production or the behaviorist perspective as means for understanding the process of change. In short, I don't believe that these (or any other) approaches are exclusive in the sense that they provide the only path for understanding these underlying "truths" (dare I say "truths"?). Having said this, I do want to say that, for me, the behaviorist perspective has provided an awfully good place to begin my search for understanding, as I think entropy production has done for At. I once asked a good friend of mine for his recommendations as to a good place to start investigating some of these ideas. His response was "Start anywhere - its a system." This fits well with the SCIENCE MAP as explained by Leo Minnigh in 20331, or, as At mentions in LO20274, "...we must open ourselves up to more and more topics. But we have to do it along a web and not haphazardly. Thus we need a web that encompasses all of reality."

In LO20353, John Gunkler wrote the following regarding "our founding discipline":

*>It is the ideas of systems dynamics, with emphasis on feedback loops
>and trying to understand reality in ways similar to the way those who
>live in it understand it, that gave rise to the idea of creating a learning
>organization. And it is system dynamics that offers hope that we, simple
>creatures that we are, might be able to actually understand and control
>(to some degree) the complexity in which we find ourselves. ...snip...*

*>Many of the difficult questions posed on this list find answers, or at least
>find hope of creating answers, in the discipline of system dynamics. Other
>disciplines (chaos theory, general systems theory, analogies from
>biological and other sciences) have much to contribute - but, at this
>early stage, I think system dynamics is the only one that comes close to
>providing real tools, structure, and the ability to handle complexity in
>an understandable way. The other disciplines provide analogies, language,
>creative ways of thinking about things - but few solutions, few process
>descriptions, and little practical help.*

This post, in its entirety, must have really struck a chord amongst those on the list, judging by the amount of reaction that it has caused. I happen to agree to a large extent with what John has written, but I might broaden the context of his statements a bit. In my own thinking (and I may be reading more into John's words than he intended to say), the thrust behind his message is the desire to expose others to a framework that he (and many others) have found very useful in helping them to integrate the many other disciplines that inform organizations and management (I think that this would also include such fields as psychology, organizational behavior, and even marketing, economics and finance as well as those mentioned by John). This is at least my own motivation in sharing my understanding of the behaviorist perspective and trying to connect it with systems thinking, entropy production, etc... Some of the objections to

John's post have centered on themes such as 1)there is evidence of learning organizations that predate the inception of system dynamics, 2)many other fields seem to account for many of the factors involved in creating learning organizations. These observations are true, but I don't think that these arguments necessarily invalidate his.

On the other hand, given the argument that I made above that no one perspective has an exclusive grip on providing the path to understanding the complexity that we experience in our organizations, certainly system dynamics can't make this claim either (and for that reason, I might temper what John has said above slightly). I think that richness of the dialogue on the list demonstrates that others, in their quest for learning, have created their own "web of reality" that has lead them to their own deep understanding.

[On the other, other hand, I think that there are still many who may feel that they are floundering in the face of the complexity and have been drawn to this list in search of some way to pull this all together.]

In considering all of this, I think that it might be helpful to revisit the process-structure, form-mechanics, or content-dynamics complementary duals that have been the topic of some discussion recently. For example, in LO20344, At wrote the following:

*>In all problems concerning the incomplete, the "form-content" duality is
>essential to obtaining the solution. The problem is either an incomplete
>form or an incomplete content. The solution is to generate a complete form
>(by using the dynamics of the content) or to generate a complete content
>(by using the mechanics of the form). Thus the "form-content" duality is
>very important to systems thinking.*

We can link this idea to numerous examples from a number of threads over the past several months. For example, in the continuous vs continual improvement thread, At observed that continual improvement had to do with the process of improvement, while continuous improvement had to do with the structure of improvement. In the knowledge management in academia thread, John Gunkler called for a focus on process (dynamics) descriptions rather than state (structure or mechanics) descriptions (recall from LO20324 his example of the recipe description of the cake vs the physical description). I think that this may also be related to John's call for renewed emphasis on system dynamics, the attempts of At to help us understand entropy production, and my desire to introduce some of the principles from behavioral psychology to the list. All of these provide avenues through which we may understand the PROCESS of change, and are fields that have already been formalized to some extent. This absolutely doesn't rule out the possibility that anyone may develop a tacit understanding of this process in their own terms (which they may have formalized for themselves) and it also doesn't exclude the possibility that there may be a number of entirely different avenues for explaining the process that have not yet been introduced to the list. I think that all three of these areas provide an excellent framework which can guide an

individual along a "web of reality", allowing them to incorporate the pieces from different fields which may have spent more time delineating the structural side of organizations. This is the value of adopting a process or systems perspective. It doesn't invalidate what we knew before so much as it informs it.

For what its worth,

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