February 23, 2007

Don McNeil
P.O. Box 312
Wyalusing, PA 18853
570-746-1646

Phil Henshaw
680 Ft. Washington Avenue - #1A
New York, NY 10040

Dear Phil,

I was pleased to meet with you last week. There is no substitute for face-to-face discussions, especially where the subject matter can be elusive. Thanks for going out of your way to get together. I hope that the remainder of your trip went well.

The draft pages I gave you were pulled together on the same day we met, though the material in them has been accumulating for more than forty years. It is my first potentially satisfactory reconstruction since the original "Construing Systemicity" pages of a dozen years ago, and it may work out after all. My "What's Going On ...?" paper for SEED in 2003 was a good practice run, and I stand by it, but there has to be much more and it has to be much better. Now that a core of a presentation has been organized, additions and corrections make more sense and are being made nearly every day. I am keeping this project to a strictly limited audience for the foreseeable future, so it is <u>not</u> for websites or other distribution, As for our exchange of letters, I think its placement on your website would be harmless and probably widely ignored, but I hope you will mark it "copyright" to you and me so as to give pause to would-be borrowers.

If you can direct me to the charted data websites which you mentioned, perhaps I can find out whether those authors are using competent charting tools which I could use to supplant Visio. Manual conversion of my raw Genealogy data would be a terrible chore, as it was last time I did it, and I can't promise I'll do it again, but it was a good project in every other way, so I would like to have some options open to salvage it.

I have read carefully your "Learning from Natural Systems" pages, and I hope you will continue to develop them. I strongly endorse your assertions that every system is an individual and is history-dependent, that a real system must cybernate whatever else it is or does, that positive feedback has to turn sooner or later, that scientific formulas are merely abstracted models of underlying cybernation, that equations fail where cybernating systems become unpredictable as they grope their way along into adaptations, and that statistics are quantified ignorance of what is really going on. I agree with your trace of the life cycle of a system (and I have used it for decades), though I posit that while the initial development period is a proper sigmoid, the final collapse tends to be relatively sudden, relatively steep, and not necessarily sigmoidal. (In my trend traces, I use "senescence" differently than Stan Salthe does. For me it represents the late phases of an operational plateau where service levels of operation decline while costs of operation increase, and then comes the threshold of abrupt collapse, i.e., the "nursing home" principle.) Your suggestions about continuity of changes where there is no fixed structure resemble my suggestions that there be more emphasis on topology and less emphasis on morphology in systemic discourse. I would go further to replace the word "structure" with the word "process" in several places, e.g., "autonomous *processes*. I think I would agree with much of what you have to say about design and development, in particular that even the best planned deliberate development process takes twists and turns because of learning, invention, and contingencies, but until I provide you with some documentation from my syllabus for a course about "organized development," we can't be sure the extent to which we are harmonizing on the same tune.

Where I would differ with you about choices of words and of examples would be in references to "structure" where "process" seems more fitting and in references to "hierarchy" where "heterarchy" might offer a better insight. I would avoid the metaphor of the "game," since games are deliberate constructs which have clear rules and explicit goals, and can be replayed, while systemic processes have obscure and/or changing rules, no necessary goals, and — most of all — are not generally reversible or subject to replay. I would suggest distinguishing quantitative "growth" from qualitative "development" at all times, though it is true that the former can lead to the latter and vice versa. Also, I have come to believe that the phrase "edge of chaos" is worth avoiding, that it is a Santa Fe Institute conceit derived from stochastic thinking by people with large egos which dissolves into irrelevance in a properly cybernetic perspective. Finally, I caution against using computers or their software as examples of systems per se, since the former two are deterministic physical and/or logical *machines* which can be engineered precisely. The fact that computer software is typically not well-engineered does produce systemic effects because of its impact on people and operations outside the computer, but that is merely a reminder that a "computer system" — properly so called — necessarily includes the people and operations around the hardware-software machine acting as a mechanistic part, The standard cop-out by computerists is that their physical and logical products are "systems" and are therefore inherently intractable, so any failures must be "bugs" which walked in on their own six legs, hence are nobody's fault. In several decades of teaching, I tried always to make the point that every defect in computer software is somebody's fault and that the industry could not progress for the benefit of all concerned until people took responsibility for doing better engineering work. I'm still waiting.

I guess by repetition at least I have made the point to you that I rank Odum's Systems Ecology tome and Powers' Behavior: The Control of Perception book up with Weinberg's General Systems Thinking book as among the best references that a serious student of systems needs to assimilate. I contrast them with Miller's 1200 page Living Systems monstrosity and lots of other "systems" works which range from ignorant to misleading to seriously wrong-headed. I don't agree completely with any of these better books, but at least they all provide substance worth arguing. (My most obvious complaint with Odum and Powers is that they present heterarchical networks and call them "hierarchies.") Meanwhile, Weinberg provides an overview and sets a mood. (It is a crime that the two companion volumes about stasis and change which he originally promised were never written, for those would have put his views of cybernation in systems into circulation.) As for Powers, he leaves out more than half of what goes on in the human system and works wonders nonetheless. H.T. Odum reduces everything to models expressed in an "energy language" but rebuilds an empirically checkable world convincingly with an encyclopedic coverage of systems of all kinds and a very principled approach. Both Odum and Powers eschew behavioralism and explicitly claim to provide insights about the *insides* of systems, but I must leave it to you to decide whether they satisfy your concerns in this matter. Powers' central principle is that of the servomechanism operating as a cybernating loop derived from control theory; Odum's is that of a "maximum power principle" in the presence of energy flows. For better or worse, both works are too rich with content to be dismissed merely because their core principles may not seem appealing. For my part, I find reminders of ubiquitous, ineluctable cybernation clarified by both of them. Would that they could have combined their efforts. Although it is imperative to read Weinberg and Powers from cover to cover, one can get a lot of good information from the 600 odd pages of Odum by reviewing his essay paragraphs and chapter summaries. Now that I am reading and annotating his every page, however, I am all the more impressed. I believe that he addresses most of your expressed and implied concerns about resource usages, gaps, intermittent connections, positive-to-negative feedback transitions, dynamical steady states, energy quality, self-design, sigmoids, and life cycles. He puts equations in their place as piecewise definite transformations in otherwise non-formulaic webs. Although Odum does not bother to enrich the notion of "information" beyond the Shannon characterization, he does make a lot of additional sense of "control." He has much to say about pulsed energy, and if he had thought to do so he could have suggested that life-cycle humps are examples of how the very existence of systems pulses environments (for maximum power?) simply by their developing, living, and dying. If you can get through Odum's first 475 pages, the last few chapters would be very relevant to your work, whether or not you agree with his interpretations.

After your call ...

I am leaving my comments above as they were before your call, but there are a few other notes to make now. As regards computers and their software, their operations are more perfectly deterministic than those of any other machines which humans construct, and that makes them imperfect in peculiar ways. Software has always had the disease of determinism; hardware gained it gradually after semiconductors replaced vacuum tubes and when error correcting encodings became ubiquitous. The theory of computation does indeed say that aspects of a computation cannot in principle be completely known in advance, but this seldom matters in practice. As a practical matter, everything that goes wrong with computer software in operation is the result of inadequate engineering by people. Except in the rarest of circumstances, a computer is a perfect slave, doing what it is programmed to do, nothing more and nothing less, even if it is programmed to re-program itself to emulate non-slavishness. This is its beauty and its downfall. When a computer program of any kind — including an "operating system" — trips over a fault in its logic or an anomaly in the data it encounters, there may be wild and unpredicted consequences, but they are observable with proper instrumentation and repeatable in principle and in practice, hence the feasibility of troubleshooting and repair. To use your example, division by zero would normally produce a program exception when detected by hardware and would then transfer program control to an error-handling subroutine. Better yet, software subroutines for arithmetic would check in advance the denominator of any division and if that number were to be zero — or sufficiently close thereunto — would flag an error but also return as a dummy result the largest number which the available arithmetic precision allowed. Calling programs would then have at least two different ways to proceed coherently: signal a confounding error and terminate related operations in an orderly manner, or use the dummy answer and plunge ahead in a logical manner. In any event, the response to a detected error should be such that no damage or ambiguity would result. In particular, an "infinite loop" should not be produced nor should there be a stupid message like "Unknown error – 12345." Unfortunately, software engineering has not advanced to where this is generally agreed. It is surely ironical that the very mechanisms most closely associated nowadays with "cybernetics" are the ones which cybernate most poorly in their machinations unless they are carefully programmed for self-control.

In any event, the world reduced to models can only be piecewise formulaic, e.g., amenable to representation as scientific equations or as algorithms. This is one principled reason that a "final theory of physics" can never be made to cover everything, quite apart from all the practical impossibilities of such a mission. This is why Odum treats equations in the circumspect way that he does, and it is one reason that the grail of the "unity of science" has been such a frustrating quest: every science and every branch thereof has its own pet formulae, many of which are disconnected from most others and some of which are flat out incompatible with some others. My opinion is that there can be no "fundamental" theory of the microcosm from which everything else follows but rather that it is cybernation which is ubiquitous at all echelons of order all at once. As you know, Isaac Newton was a religious occultist besides being a mathematician and physicist and alchemist, etc. He is said to have been an "occasionalist" who thought that his laws of motion nominally applied, e.g., to planets in orbit, but that moving objects gradually stray from their predicted paths and have to be put back on track by an *occasional* intervention by God. In other words, Newton was a bit of a closet cybernetician, though he apparently didn't have an idea of how the "invisible hand" might operate without omnipotent intervention. The great determinist Laplace made calculations which convinced himself (and scientists ever since) that Newton's equations were necessary and sufficient for prediction of the course of phenomena, so Laplace had no need (he said) for God in his hypotheses. For my part, I believe that planetary motion as well as all other activity described by scientific formulae proceeds cybernetically, albeit in loops having extremely high gain feedback control. Among other things, that would suggest that while some measurements of physical phenomena deviate from predicted values due to measurement errors, others deviate due to actual physical departures from formulaic predictions, since the regulation in force is tight but varying and never exact. Most cybernetic phenomena familiar to us are not so tight as those identified with classical physics, of course, hence the vagaries of chemistry, biology, ecology, psychology, sociology, etc., and perhaps even of the microcosm which remains mysteriously "statistical" despite advances in quantum physics. My conjecture plus someone with a real brain to prove it would be worth a Nobel prize if anything is. (So let's don't publish this paragraph anywhere just now.)

Turning to your letter of January 28, I must recommend again Powers' real book and Coren's "evolutionary trajectory" and hope that you will relax about the concept of "control" — internal and external — in light of Powers, Odum, and perhaps my draft pages. When we remark about how systems of thought cybernate we are just repeating G.M. Weinberg's "Law of Conservation of Laws" which says that people will adjust observations, fudge facts, and do every other thing before they will relinquish cherished beliefs. It is no wonder that people who differ about what is "the truth" so often make war in an effort to create a vacancy without naming a successor. Far short of such final solutions, we can turn to sanguine spokesmen for reasonability and continue to search for Weinberg's "gentle systems theory." While I doubt that it is in your nature to be satisfied with anyone else's answers, it is my view from a safe distance that some composite of the best of Weinberg, Powers, Odum, and von Foerster (plus a few other references of your choosing) would do wonders for your questions.

For my part, I take cybernation to be the essence of what identifies wholeness, selfness, and autonomy per se, this as regards both convergent and divergent processes. The question of what more (and other) there is besides cybernation, like the question of what more (and other) there is besides energy flow as presented by Odum, is the age old question of what's wrong with reductivity. "It's nothing but ..." is such a famous trap that we all fall into it, or resist it by going mystical and murmuring of mysteries unknown and unknowable. In terms of physics, energy is a kind of ultimate and Odum gives it life in ways that conventional texts do not. As for cybernation, it provides a way to debunk theories of ultimate structural "particles" while providing a composite unit-of-organization relevant to every echelon of order. But physics nowadays has new anomalies such as "dark" energy. Cybernation too, once mysterious itself, may have ineffable counterparts round and about. If we wanted to get rich we could adopt a simple message and sell it, witness Oprah and Gates, but that only indicates how it happens that we can't get rich. For me the key question is one of enoughness in comprehension, i.e., enough conceptual clarity and enough practical applicability to make sense of what matters to me. At the risk of being simplistic and reductionistic I must say that (ubiquitous) cybernation and (toroidal) topology have done more for me in this regard than I ever supposed would be possible. At the same time, just as cybernation shows how perfection depends upon error (and vice versa), so too the ultimate generalization has to be that particulars always matter. The principles may be ineluctable but the angel is in the details.

Best regards,
Don