

phil henshaw

From: Stanley Salthe [ssalthe@binghamton.edu]
Sent: Tuesday, November 18, 2008 4:29 PM
To: pfh@synapse9.com
Subject: RE: development / evolution

Phil --

Stan,

Phil -- continuing --

-snip-

PH: To me the illusion of a set plan appears to be a feature of our perception, and not the physical system.

S: It's a bit tricky, because when we impute a developmental script to, say frog's eggs, the overwhelming majority of subsequent observations do show change as if following that supposed script. If we are 'naive realists' we would say that we have 'discovered' parts of a script that is actually their ('in the genes'). Constructivists would rather say that we have 'constructed' that script, and in doing so, we may have left out a large part of what is / could be going on. I think it could be said that developments are, either way, products of systematic observation.

[ph] That still seems to say the physical development is a "product of" the observer's awareness? Sometimes it's indeed tricky to tell whether you're observing something other than your own theory of it. For me the main signs are that I can 1) either find answers I didn't know before by exploring it's details or 2) by finding it to be organized in a way that is deeply incomprehensible to me, both indicating that what I'm observing exists independently.

S: Agreed.

[ph] great, could we call them "test 1" and "test 2" of material existence perhaps??

S: As you like.

We may tend to have the same image of the system from the beginning of its development to the end, and ignore that the system itself needs to create its own path as it goes along. That requires it to take on new forms at every stage. I think it's apparent in your example of the 'developed' world's attitude to the 'developing' world. We look upon them as only fulfilling the role we make for

them in our model, adopting OUR learning paths. Our effort to help them grow in our way ignores that they don't have our kinds of starting points, and need to grow their way. We've often seemed to give the people hand outs to quiet them down, with the effect of destabilize their cultures with growing population and demands, in exchange for our being allowed to come in and take their resources.

S: It is interesting here to bring up the phenomenon of convergent evolution. In biology we see the evolution of focusing eyes of substantially the same 'design' independently in vertebrates, cephalopod molluscs (squids, etc.), jellyfish, and even in single celled dinoflagellates. Closer to our discussion here, we have the (supposedly) independent evolution of irrigation agriculture, cities, calendars, etc. in various human cultures. These similarities in independent lineages have not been explained. Some thinkers have imputed limited possibilities in the evolution of human cultures -- that is, they have imputed development.

-snip-

S: Well, you can define things in any way you wish, but I think it not wise to stray from accepted definitions. The definitions I use are based on those used in biology.

[ph] I guess that's just my point too. The definition of development as 'unchanging accumulation' widely conflicts with the consistent use of the term elsewhere.

S: I don't think I used that term. 'Accumulation' connotes willy-nilly taking on board, as in evolution. 'Unchanging' could connote a script.

[ph] I did mean to suggest a script there. I distinguished 'script' as a pattern of 'unchanging accumulation' because that is actually a rare kind of accumulation. Most 'conserved change' (changes that remain) accumulate with smooth fluctuations at several scales and change progressively. In growth there are both local variations that also change by fairly regular %'s, increasing for a while and then decreasing for a while. Those are the varying paths of development as local process find the path that the germ initiated. Each part has no choice but to build with what it finds, and that involves how the environment and the system respond to each other too. As there is no manifestation in the environment of the program of expectations we may have for it, it seem that development is entirely up to the local processes of evolutionary exploration at it's leading edges to negotiate the particulars of the environmental relationship.

S: Please give examples

[ph] Development is a design process everywhere I know. People generally start a development process with a rough, if 'inspired', kind of premonition of the future, an image of great achievements, of a new love, or pile of money, a work of craft or genius. Every development of personal relations, starting a business, creating a technology or designing a software program or a building is like that. The thing that starts it only remotely describes the end form, just starts the path of exploration along which the final form is found.

S: So, finality is involved. That is important. The developing frog egg has an 'aim' too.

[ph] Finality as a determining goal is great to imagine and a good short cut sometimes, but time seems to only operate in the present anyway. The premonition isn't the end, it's the beginning, it's the germ, the seed, the egg. To me the egg does not have an 'aim', but is the aim itself, a possibility for beginning a new development to be guided by what it finds.

S: That's an interesting view. It does fit with the 'natural' development method of roughing out a beginning and gradually increasing its definiteness as the process continues -- as opposed to the invented assembly line method of making pieces first and assembling them later.

[ph] I guess my phrasing comes from my own observation that I and others use that first concept for things as a 'dream template' to go around with when exploring the environment for what other things might connect. Usually in the end some sort of "spirit" of the original idea is all that's left of it. That can be a metaphors for other things, a 'place holder' in our mental scripts, say, for what other searching systems use to guide their developmental searches (other than noise diffusion).

That same kind of 'unformed germ' of 'fertilization' is found at the beginning of growth for anything that grows, so it would appear. It's the 'little spark', that sets off the 'big boom' of development. Neither the initiating 'spark' nor the culminating 'boom' have a built-in plan or map or a set course, however. They just have the one they discover as their leading edges 'poke around' the possibilities of the of their discovered paths in their environment.

S: Well, looking at the tadpole again, it does have this genetic information, which produces various roadblocks and facilitations on dynamics which are the substance of the 'frog script'. In a culture there are various habits, norms, propensities, interests, etc. (But why should these in totally different cultures tend to produce 'civilization?')

[ph] you can say the genome is a store of information. We don't how it is read, though, as calling it 'information' implies we do. Maybe it operates differently than information does in our minds. It might not be mechanistic, for example. It might be more like a supply cabinet for a jungle of independent chemical exploration processes to go shop in. Basically, it's clear that the genes are information TO US. It does not seem clear that they are information with a plan TO THE ORGANISM.

S: My general functional definition of 'information' is that it is any constraint on dynamics.

[ph] In a model or explanation, yes. In physical systems I think the problem often the opposite, though, that you need things to enable dynamics, as much or more than to constrain them. It's harder for me to refer to enabling elements of the environment as information to the system that uses them. They generally do not have "information processing units", for one thing. Things in the environment seem to be truly information only to an observer. The system that finds them useful would then treat only the usefulness to it as information to it, it seems. That usefulness to something else may not even include what an observer takes note of. This is one of the sticky places for theories of systems it seems to me, and part of why I ended up with a theory of questions instead ;;-)

S: It's likely that all constraints are simultaneously constricting and enabling. For a simple physical example: a tree falls into a stream. This now blocks the flow it had, but might enable to access a pathway previously out of reach, but which overall allows faster flow to the big river.

The question of why systems tend to be so distinct from each other, either as species or as uniquely different individuals is still more or less beyond me. It seems that a developmental process requires a nearly infinitely complex uniqueness from the start and that it is retained in every feature of it as it develops. That all seems quite untraceable or explainable. Frogs do seem more different from chickens than a statistical noise distribution would account for.

I think I understand where that contradiction came from, the idea that predictable things have somehow already happened before they happen, and getting the time-line of events tangled in that way, but at least there needs to be some broadening of the term to allow for 'development' to refer to 'path finding'.

S: Then you would be conflating the terms, a move which you have proposed previously, the motivation for which I fail to appreciate.

[ph] I'm linking evolution and development, tentatively as different scales of the same thing. Maybe I said it well in my last note to Mary, so look there too.

S: That note was 'well said'. I found no objection.

Part of the problem is that the word 'evolution' is dominantly interpreted according to an assumed model of classical statistical mechanics, a theory of inheriting random changes. That's part of the physics model that rules out the existence of independent development at all, except as statistical patterns projected by a single set of permanent deterministic laws. There is not place in it yet for emergent local organization, laws and learning. Ordinary observation points to natural systems being more like "little worlds" with unique and

indispensible laws of their own that evolve locally, and you can closely watch the progression in many cases, seeing it as a multi-level exploratory path finding process, not a general randomization process. In connecting the two words I'm trying to connect those two worlds.

I do also accept 'evolution' to be a word for whatever it is that alters the form of organisms, the classical meaning without the theory as to how.

S: OK. It's synonym, usefully, is 'individuation'. In fact, I think this latter term is preferable because it does not have those Darwinian connotations, which, even in biology, are of secondary import.

[ph] Then development would be a part of individuation along with 'sparkle' of evolutionary discovery at it's leading edges. perhaps other things are needed for individuation too, like aspects of maturation that involve becoming 'one with' or a 'partner in' the environment?

S: Possibly.

[ph] That conclusion of joining and becoming part of the larger scale system is sometimes a main interest that others have in development. There are software people who see the two stages of development as "self-organizing" and then "self-adapting", in which the latter is when the adaptive software becomes part of the system it is intended to serve. I think it comes up as 'synchronization' too, and the same software people sometimes work to keep their control systems from becoming synchronized that so they don't develop independent dynamics that the designer can't predict and control.

I think that is unavoidably a process that alters a recurrent developmental process, and reasonably can't do so except by being some kind of fast or slow developmental process itself. It's definitely not just 'random' changes, which would only be scattering in the end.

S: That is coming into the consciousness of evolutionary biologists as we speak.

[ph] well so how the hell do I find someone capable of reading my blinking 13 year old paper on the subject then!!

S: I expect you need to update it first. Try BioSystems, or Biological Theory or Journal of Theoretical Biology.

[ph] One always has to go to a great deal of effort to learn each journal's odd approach to life. One problem is that the paper is not biology, its mathematical paleontology, and I'm not a biologist. The important issues are the same maybe. Are any of those the kind of interdisciplinary forum that I would actually need to find like minds?

S: The above journals, except maybe the last, are fairly interdisciplinary.

The other kind, without accumulative organizational change for all means and purposes, would be 'deterministic process' not development then.

S: As I say, define anything in any way you wish. But you will continue to have problems with folks understanding you.

[ph] Yes, that's precisely what I'm saying too, however, raising the subject because the definitions in common use conflict with the "in-physico model" (i.e. physical things spoken of as if a model) of the systems we're talking about. Evolution is missing it's developmental dimension (because physics assumes it away) and development is missing it's evolutionary dimension (because physics assumes it away), and it has to do with the coordination of scales of order and local learning in complex distributed systems, and how that is maintained with continual whole system change.

S: Development, as in biology, is NOT a deterministic process because it does incorporate unforeseen accidents, and so it is, precisely, homeorhetic, not fully deterministic. There's a script, but it can be fudged, thereby incorporating individuation (= evolution).

[ph] OK, but as you use it is seems implicitly deterministic.

S: The definition does have that implication, but no biologist would think of 'deterministic' in a physical way. A script, we might note, requires interpretation, while determinism has no interpretation involved.

[ph] I think it's still important to maintain a duality between the bundle of explanations, metaphors, models, value judgments and felt impressions we find convenient to use in representing and explaining things, and the things themselves that seem to operate quite easily without all that stuff.

S: But we need these tools in order to think and design experiments. They are aspects of discourse, which is what folks do.

[ph] Well, they'll work better if we also reliably avoid referring to our own models when claiming to be pointing to some feature of the physical commons that others go look at themselves. If what you're pointing to is physically located in your own mind, offering to others to go look for it in the environment won't be successful. Our language is a mess of confusing mixed references to where the things we refer to are located. The distinction between 'script' and 'path' seems like a good one though. The scripts and stories are for observers to follow, and paths are for things to follow, and people are both. I think that's fairly clear as to the observers world not being found in the observed world, but a fabrication of our own.

The habit of scientists to use extreme verbal shorthand, phrases with a wink attached, like about how the genes want to do A or B or how the genes compare the chances of option A or B, is such rubbish and so deceptive in trying to communicate the real beauty of the subject and the core useful information too.

Even the idea of 'script', though a crutch we'd certainly find hard to do without, seems important to keep represented as located in our minds, not in the system.

S: As I said earlier, these scripts are our models of putative natural tendencies.

[ph] There's no doubt at all that they're useful to us, quite indispensable, but they're our expectations located in a mental construct.. Their use is to give us good questions to channel through our usual linkages to the physical parts of the world to which they refer. We use them to connect with other scripts in our artificial world of explanations, and to help us go through physical channels to connect with other physical things that operate by their own systems.

S: That sounds about right to me.

I see only complex processes in complex systems, no linear scripts of any sort anywhere. Maybe it better to say 'path' rather than 'script'. The word 'script' clearly implies observer control as that is what a script literally is, and 'path' implies user control, and an individual navigating an environment.

S: yes, but loosely so -- tendency. Deterministic process, from physics, is rigidly predictable. Nothing in biology fits this mode.

[ph] The problem is determining the location of the implied 'scripts' in nature and finding the mechanisms nature uses for 'following' them.

S: Easier in biology than with the developmental tendencies / propensities of cultural (so-called) 'evolution'.

[ph] Oh sure, some kinds of questions are easier to find an answer to one place than another. In cultural development the evolution may occur in the idle conversations around the dinner table or at the bar. It's real clear that powerful conceptual reorientation does indeed occur though, and generally by developmental processes which display some kind of moment of germination in their history. You don't get to watch that aspect of change in biological evolution much at all, however, and then with cultural change you have no 'nugget' of accumulated memory to study as in the genome.

It's late and I'm having a scotch, so I might as well mention that I myself think the genome probably operates more as a nifty multi-faceted shopping list, and is not an instruction set at all. The thing just sits there to be zipped and unzipped

by other stuff, so it really does not seem to be in the loop as to what the cell's internal mechanism is actually doing. Something tells one of the zippers to go look for, say, "jelly" in the event of the supply of "peanut butter" having finally arrived, is my image of it.

S: It could be! Certainly it is all like biochemical weather down there in the cell.

[ph] I've seen some animations of what transpires in the cellular chemical dance, and it's really enormously complicated and highly organized it seems. As it's all fluid and without a 'controller', per se, all happening at once and with one big passive 'history book' floating in the middle, it's almost as if each molecule is acting as a free agent. There may be diffusion, but it seems unequivocally not driven by diffusion processes, but a 'dance' of some sort. I get the impression that these kinds of questions are starting to be asked in many fields as we begin to deal with the fact that nothing in the world happens statistically and as things happen individually they usually seem improbably rare, locally animated and self-organizing.

That may be how WE find it convenient to predict things, but it's not the same as the multi-level complexities of the physical processes by which things physically happen. When you look in nature for a location where the scripts we see are located, and how they are implemented, the only place we can actually find them to be operative is in our own minds.

S: I think it fair to say that we humans deal with our own constructs. We have biological biases, cultural, discursive and also personal biases.

[ph] yes, and despite it all we even occasionally identify something in common we can refer to, understanding that reality is quite often what is just barely in our grasp than what we can capture and hold with great confidence!

The biological mechanisms themselves, for example, do not actually seem to have any random variables except as our own uncertainties. Things in nature are actually happening in all their complete particularity, with nothing omitted, and only the observer is uncertain about how to 're-present' them. Still, it would seem to be our representations that we find useful in a loosely or rigidly deterministic way, but they are not actually operative in any of the physical process we predict with them. As I see it the resolution is that the local physical processes discover their own paths by an evolutionary learning process (greater variation on the leading edge). That's what that quirky paper of mine at the 1985 SGSR meeting was about, how systems develop by a local learning process. It was called "Directed opportunity, Directed impetus", which I'd now simplify to "exploratory variation at the leading edge", or something.

S: This does tie in with neoDarwinian and Skinnerian precursors, as well as with Ashby's 'requisite variety'.

[ph] Skinner was a pure statistical rationalist I thought, and Ashby was maybe trying to stem that sort of tide with demanding that explanations at least

correspond in some rough way with the things explained. We spend so much time with explanations simply and purely because we have some emotional preference for thinking of things that way, with no basis whatever other than seeming 'suitable' it seems.

S: I was referring to idea of picking a path out of a variety of possibilities.

[ph] Yes, and my test would take that conceptual observer's idea of a probability, and test it by seeing if it would lead me to finding the instrumentality by which the system accomplishes something like that end, by its own means.

I have no doubt that it's remarkable and clear how similar the developmental paths of congenital twins are, for example.

S: But they differ in, e.g., fingerprints, venous patterns, etc.

[ph] yes, I forgot, the freely wandering bits, also including neuron tendrils that find each other and form the synapses in doing so I would expect too, right? He genes some how give the nutrients for neuron development, but the neurons need to individually make their own connections is how I read it. Is that right?

S: It seems to be where the thinking is heading.

[ph] Can you add to the list? What is the catalog of biological structures that don't follow a 'script' or appear to have a pre-determined 'path' of development, but just wander off on their own and make do with whatever they bump into, i.e. do their business more like ants in a colony do ?

S: This would be tough task in biochemistry, possibly easier in animal behavior.

[ph] I was thinking of just filling out the list you started, with finger prints, and veins, to which I added neurons, synapses, and might suggest arteries and capillaries that use some path finding means to distribute the goods to hungry cells. Maybe it includes hair as something that is opportunistically seeded, rather than predetermined. Think of any others?

S: Others would certainly be needed if our systems is getting contacted by some others.

That evolution over long periods has been successively adjusting very reliable developmental pathways is evident. The evidence is that each part learns it's role in the process of doing it, and that the outcome is directly nothing more than the accumulation of that learning, is identical to the more freely evolutionary developmental processes you find in all kinds of other complex learning systems. What seems to distinguish them all from 'lifeless' developments is that the parts participate in discovering 'limitless' opportunities that they exercise in an

immature growth fashion to the point of interacting with their environment of limits and maturing if they are to achieve some kind of self-organized 'state' or homeostasis.

S: OK. Characteristic trends and tendencies, guided by genetic information, give rise to broadly predictable results, which differ, however, in details. These details can give rise, if important and inheritable, to evolutionary change in the lineage.

[ph] Yes that's the traditional model of useful simplified prediction, but it seems inconsistent with physical behavior in that physical system behavior requires a multiplicity of individual parts doing their own independent learning processes, with no corresponding controls anywhere around.

S: That's where the "details" come in!

[ph] well, plus learning to read whole system and environmental diagnostic measures and responses. There's always too much going on to not read the details you do know as indicators of the details you don't. All seem to be under the control of internal loops you don't see anyway!!

Best,

[ph]--- wow that should be enough grist for the mill. I'm falling a bit behind too. If there's some nugget above or below that you think would be good to refocus on that would be good. I'm inching along in Elsassser. So far I'm liking very much how he defines the problems of multi-scale order, but he seems to be trying to extend the deterministic model of statistical mechanics. He's very layered in his thinking, though, so I don't yet know quite know where he's going.

S: I think he's maybe best known for his view that actual things and occasions have so many degrees of freedom that physical techniques cannot deal with them.

[ph] Right, that's clear in what I've read so far. But he seems to be aiming at, or intending to find, a way to resolve that. My way to resolve it was on realizing that every individual thing behaved individually was to come up with a useful list of questions to ask about them, rather than an artificial theory to represent them. Does his 'solution' have to do with a kind of multi-level selection 'script' that he sees being followed or something? That might be why you said his work foreshadowed the mode of evolution I've been suggesting. I'm just guessing because you seemed to think I would find it right off and I haven't.

S: My point was not that he had a solution, but that he foreshadowed your search. I don't recall if he solved his problem. I don't think so. He was concerned to warn against using physical techniques in biology. Time for my highball!

STAN

Phil

STAN

Best, Phil