Don McNeil
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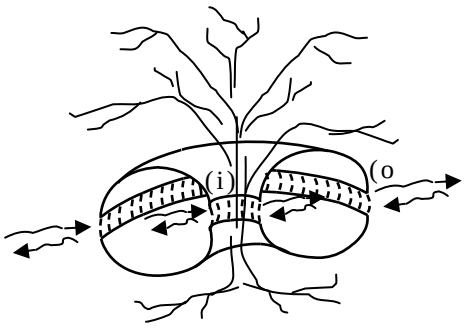
Dear Don,

So I spent a good part of the day messing with Autocad trying to get it to make surfaces I could draw things on to no avail, and ended up with the attached page and probably preferring my little freehand below. Your description of how you use the torus as a symbol was very helpful, that it has multiple kinds irreducible connectedness for example, not that it's the specific topology of the connections of any given system. It's tentative, but I was thinking of doing something with the torus to symbolize the kind of open connectedness that I focus on. It's sort of like adding your side pipes all around the rim. What if you split the torus into top and bottom halves with open environments floating in-between. I think it adds the 'broken links everywhere' to the list of puzzles about systems and opens the tree analogy of connections between branch + root to a special meaning.

To me the main problem of natural system connections is that there are both tight connections and loose ones made through open mediums of exchange. Connections through an open medium may be positioned close to each other but are *always* open to far flung minglings through lateral drift, and the actual connection is made from the pull side, not the push side. In the figure (i) is the open 'conversation' across the gaps on the inside of a system (through blood or sap for an organism, language & markets for a society), and (o) is the near and far open 'conversation' on the outside (outside resources & cross fertilization). There are special cases of extreme closeness of connection that still remain open, like the relation between pistol & stamen with pollen transfer and for semen transfer through sex, and neurotransmitter flow between neurons at synapses. The width or closeness of the inside and outside gaps may vary widely, say from 1% to 49% of each half loop's continuity, but they're never missing or I think you don't have a system.



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Maybe these and other ideas about the topology of connection might be helpful to the people building 'artificial life' with cellular automata. There are enough of them looking at the real problem I think (even if with lots of wrong assumptions), and making some progress. I've been very offended by 'wrong' ideas of systems on many occasions, seeing them as denials of the problem rather than vantage points on the problem. I think it may be worth assuming that many of the present threads of systems theory (complexity, whatever), are just different because they're looking at different features of the same beast. In any event, I think we probably won't have a useful result until they're somehow all put together.

I certainly wouldn't minimize the huge gulf between the various views I know of. For example, I've been working consistently for a year and a half with a very active and influential political group, upper West Side Manhattan activists. Their systems thinkers (progressive economists) saw what I showed them and accepted that the structure of the economic system changed around 1970, such that wages stopped growing as money and its influence kept growing. Still I haven't been able to sustain even a little private conversation with them on the subject... Dealing with reality is just not how they think politics is to be done! There are similar gaps with other groups of thinkers.

On other matters, I do agree that the old GST collapsed as a movement, but my reading of the citation record is that it spawned many sub disciplines, and though they changed the meaning of the words, the use of the term is still growing exponentially. The term may have gone from a rarified meaning back to more common meanings, but one possible interpretation is that real people are using the term ever more frequently in dealing with real systems. People are still looking for the answer.

Yes, anything that persists must 'cybernate', whether we understand it or not. That that is a persistent feature of everything we care about makes it harder, not easier, to see. I've long thought that much of this does not need modern science to be understood at all, and could have become common knowledge even before language, just from sitting around the fire watching the smoke twist up toward the stars every night for a million years or so, thinking about the hunts of the day. There are also some interesting corollaries, such as that anything that cybernates must have developed by growth, and to have halted its growth by diverting or being deprived of, it's positive feedback. Living things in particular, regularly switch off their own growth feedback before their explosion overwhelms themselves or their environments. I think it's a quintessential evidence indicating inside control, choosing of how much growth is enough.

I like your definition of a system (p2 top), though many of your terms require expert handling. I'm more inclined to just *point* to things and say my model is what they all have in common. I agree a system is best described as both the thing itself and our image of it, though. I see that as more a methodological choice so people don't get lost sorting out the fact that language confusingly uses the same words for our images and the physical things those images refer which are built very differently.

I do agree that the topology question is key, and that a torus is similar to the

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basic body plan of multi-cellular life, but a great many systems have both looser and more complex connectivity I think. What's important for teaching tools is that they hook you into the telling questions for the system you're studying. The similarity in shape of storm cells and trees, for example, clearly has a lot to do with gravity in three dimensions but may have less to do with having similar system structures. Clearly storms are systems, but their 'branches' and 'roots' are much different functions from a tree's.

The topologically interesting part of putting market links into the loop is the potential for the current to smoothly switch from any one thread to any other. It may be a little extreme, but potentially every meridian becomes normal to every other at both the inner and outer exchange medium crossings. I too have discomfort with the 'spheres of influence' notion, in that it does usually seem to concern controlling kinds of connections that would be normally out of control, a reductionist impulse.

As to how to elaborate visual metaphors I'm hesitant to say, though clearly I think a certain mix of simple concept with a thread of complication is needed. I see much of the problem to be that the topology of images and things are themselves utterly different. Images seem to be projections from rules, and as such are seamlessly connected and infinitely scaleable and divisible, like math. There's no physical thing like that, so representing things with images is problematic. Still, images is what we use, so to make them useful it's important to make an association between them and the stuff beyond their structure with which we want a little assistance.

I still need to read more to understand the subtle differences between the major cybernetic threads of Ashby, Wiener and von Foerster. I don't think any of them adequately deal with the rapid system evolution that growth always represents, perhaps because it's often just too complicated to fathom except with some loose metaphors. My experience is that the rapid system reorganization is always there wherever growth is observed and vis-à-vis. Where it stops for most observers is with the shape of a trend in some measure, and looking into the associated system and it's evolving loops and mediums of exchange is never attempted. There certainly is a difference between growth in quantity and growth in organizational development, indicating the first step of using growth dynamics in curves of any measure as a 'dousing stick' for systems evolution in general. Often it's both in my experience. Your turn toward the study of established systems, because that's where your tools led, seems similar to my turn toward unestablished systems, because that's where my tools led.

You say that continuity and discontinuity are in the mind of the beholder, or at least not absolute. I would say it's a more difficult distinction than usually appreciated, since mathematical continuity does not physically exist and physical continuity is not mathematically definable. This is another reason to marry both conceptual images and references to physical things in the model. When we do that I think there are real topologically identifiable boundaries to system individuals, saddle points of information flow or something, 'vorticulate' rather than 'particulate' as you say.

The question about the work of Meadows et all. is why the economists read it and

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still whole heartedly support our trying to increase consumption and change the earth ever more rapidly forever. It think Meadows, and systems theories in general, didn't clearly define the impenetrable wall of complexity we're rapidly approaching. The economic models are purely imaginary and thus infinitely extendable, just not taking into account that real people have to make ever bigger decisions ever faster to make it real. That imaginary models provide such perfect dead ends for systems sciences is quite amazing, and indicates the depth of the problem. There's a significant movement of business and insurance market leaders toward what they call 'sustainable' development, getting a big boost from the clear indications of what businesses will survive global warming, but whether the larger question of our system sustainability will be confronted in time to fix, or even in time to learn from, is admittedly doubtful. You the betting sort?

Best regards,

Philip F. Henshaw

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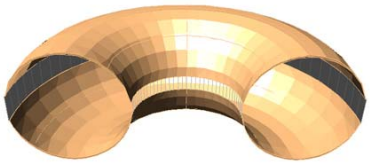
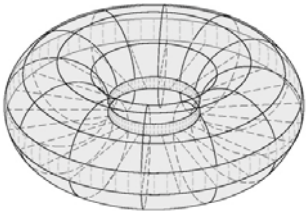
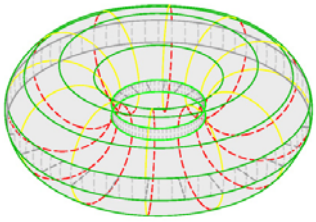


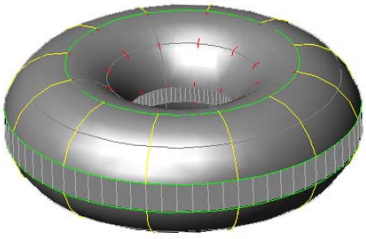
A. half a shaded open torus



B. wire frame open torus



C. wire frame open torus



D. shaded open torus

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