

Re: Characterizing complexity

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From: Guy Hoelzer (hoelzer_at_unr.edu)

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Hi Jim,

in article cecilia1bqh1@darwin.ediacara.org, Perplexed in Peoria at jimmenegay@sbcglobal.net wrote on 7/29/04 9:24 PM:

> "Guy Hoelzer" <hoelzer@unr.edu> wrote in message
> news:ceb6ck1a10tu1@darwin.ediacara.org...
>> in article ceb6ck1a10tu1@darwin.ediacara.org, Infinity Squared at
>> infinitysquared@gmail.com wrote on 7/29/04 8:50 AM:
>>
>>> I note that another viewpoint has appeared in the recent
>>> biological literature.
>>>
>>> This is work by Allan Orr, where he has treated the number of
>>> phenotypic characters that describe an organism as a measure
>>> of its intrinsic complexity.
>>>
>>> This work follows on from RA Fisher's "geometrical" model,
>>> where he computed the proportion of beneficial mutations
>>> of organisms with a number of phenotypic characters.
>>>
>>> A question that remains open is how many independent characters
>>> are needed to describe an organism.
>>
>> I disagree with this last sentence. What we choose to call "characters",
>> like "traits", are hopelessly entangled with our views and interpretations.
>> Parsing the bits of an organism in an information theoretic sense, as
>> suggested here, is relatively objective, but such methods are also only
>> loosely tied to the functional subdivision of the organism. This approach
>> also ignores the essential functional hierarchy of parts that constitute the
>> organism. I am not arguing that there is nothing to gain from taking this
>> approach at this early stage of trying to get a quantitative handle on
>> something like organismal complexity, but we should recognize its
>> substantial flaws and limitations and keep an eye on where all this should
>> eventually lead. Ultimately, we must aim to quantify the complexity of the
>> organisms functional design. The rest is just a meaningless distraction
>> (IMHO).
>

- > *Hmmm. You seem to be suggesting that it is important to*
- > *distinguish functional complexity from structural complexity.*
- > *And claiming that it is the functional complexity measure that is*
- > *the significant one.*

I recognize that from an evolutionary or dynamical perspective, functional and structural complexities are part and parcel of the same phenomenon. My concern about the application of a complexity measure like Orr's is that we can be easily misled by arbitrary or biased ASSUMPTIONS about the scales and numbers of parts that actually constitute the organism. For example, I would argue that my liver is ONE of my parts, but it too is certainly composed of many parts (cells). IMHO it is essential to look only one level down in the hierarchical organization of matter to find the elementary parts of a system, but this is a highly subjective thing to do, at least at the moment. I get particularly worried about the influence of subjectivity in complexity measures when I see someone like Alan Orr rely on the concept of "phenotypic characters", because there are no objective or justified guidelines for determining what is or is not a phenotypic character. Is having hair one character, or is each hair a character? Given the effects of such decisions on the number of characters and kinds of characters on an estimate of complexity, I see such claims of quantification as resting on an unstable sea of qualitative assumptions.

- > *That may be, but it suggests a conjecture: Any apparent structural*
- > *complexity which does not support functional complexity, can be*
- > *found (on detailed study) to not really be very complex after all,*
- > *in Kolmogorov's sense. Such pointless apparent structural complexity*
- > *probably has a very simple causal explanation. As an example, I*
- > *might point to human fingerprints or to the leopard's spots.*

I understand your view, but we may disagree here. My view is that patterns like fingerprints and leopard spots are actually generated by thermodynamically functional processes that burn out early in development, leaving the frozen patterns behind to degrade. This process is very similar to crystallization. I think that you could see the function/structure relation as the pattern is being produced, but the fact that the pattern remains long after the function has dissipated can lead to the illusion that the pattern was never related to a function. I am taking a thermodynamic view here, and I am not treating function in the Darwinian sense; although leopard spots add to organismal crypticity and fingerprints are important for grip and sensitivity.

It is not unusual for complex dynamical systems to "spin off" frozen patterns, some of which may no longer play a role in the function of the creative system. Human artwork is often like this. Perhaps a better example is "doodling," which functions to facilitate brain processes in the creation of patterns, but which are usually discarded as having no function afterwards.

You may be correct that considering these frozen, no longer dynamically-integrated (i.e., no longer structurally interactive, with

two-way feedback) phenotypic characters should not be part of an estimate of current complexity. If you bleached the fur of a leopard would you consider it less complex? Is an albino leopard less complex than one with spots? I think they would be equally complex from a purely functional point of view.

- > *It suggests a second conjecture as well: Functional complexity*
- > *resists compression. Functional complexity never has a simple*
- > *causal explanation (at least in terms of efficient causality).*

Excellent point. I searched for a couple of years to find a word that articulates this aspect of functional complexity. The word that finally satisfied my search was "renitent." Dictionary.com offers 2 definitions:

1. Resistant to physical pressure; not pliant.
2. Reluctant to yield or be swayed; recalcitrant.

When I explored the meaning of the word, I found its meaning to be a bit richer than this. A trampoline is renitent because the harder you push on it the harder it pushes back.

- > *I don't know whether these conjectures are true, but they seem*
- > *plausible to me.*

I'm glad to hear it. This subject is of great interest to me.

Cheers,

Guy