SHORT NOTES ON BIOLOGICAL SYSTEMS

GONÇALO BRAGA

Quick Note 1 *I believe that problems like the halting problem (and generalized undecidable problems) that appears in computer science, and Gödel's incompleteness theorems in mathematics, and some other ones regarding decisions and internal consistency of systems, be them formal or not, can be taken to be repercussions if we assume evolutionary selection to be true.*

Mathematics, and other approaches to formal systems, I believe are not out of reality in a Platonic sense. They are inherently hanging on our evolutionary constraints, the perception mechanisms that emerge out of these constraints, and the relevant set of foundational axioms that we choose, given what "makes sense" (concerning our perceptions), as every other theorem being able to be proven given this initial set, until internal consistency breaks. What is really in a Platonic realm is the universal set of logical and deductive frameworks being realizable given arbitrary evolutionary constraints to the systems "building and discovering" these frameworks. But for practical manners, this is useless, if not for the philosophical implications, as these systems evolve under resource scarce conditions causing the exploration of this universal set to be infinitely small.

Quick Note 2 *Regarding the "unreasonable effectiveness of mathematics", it is just a consequence of what was previously said. Any type of internal model of the world that a certain system might be able to build, and the reasonability with which it infers given past data, and that happens at the same time to be evolutionarily advantageous, taking also into account its costs (costs to develop extensive feedback loops, that might have more significant emergent properties like stronger memory, stronger convergence to a certain subset of state-space, etc) will in essence be transversal in respect to building formal*

systems, which happen to be more "ordered", without such chaotic features as the natural world. Furthermore, concepts that we readily use, as deterministic or stochastic, inherently miss the observer dependency of such categorization. As a gradient, no system is going to have perfect information about its environment, as that would imply it being a spectator, without any type of causal chain. Such system might be constituted by feedback loops with a certain amount of components, that nonetheless don't rely on resource abundance, precisely the opposite. Selection doesn't only act on the fitness of the resulting system, but also on long evolutionary scales on the fitness of the whole network. Larger networks inherently constrain the state-space of smaller ones, as that happens to be the most reasonable way evolutionarily, to keep unprobable events from eliminating such network. Here for unproable events say for example, a large enough deviation, genotype wise or even for that manner phenotype wise, that increases ecological breakdown. Increased predation, increased lifespan, etc. These for themselves are adaptations that flatten themselves out, if not associated to other beneficial factors for the whole network. If a large enough amount of ecological relationships happen to build upon these characteristics, then such adaptations have positive evolutionary pressure.

Question 1 *Don't forget. The fundamental question, that might even span numerous field of study that we separate is: How do systems that evolve under resource scarcity, therefore having imperfect information about their environment, make their next decision?*
Not only that, but notice that each component has its own incentives, also being constituted by components with their own incentives.
This also applies to infering how Nature works. In essence, Evolutionary epistemology or Meta Evolutionary Epistemology, are nonetheless problem solving attempts by systems trying to understand their environment. They are therefore evolutionary constrained. The "slice" we perceive, evolutionary advantageous as it might be given our evolved perceptions, is still a "slice" nonetheless. And what might be "worse" is that other "slices" will presumably not "make sense" as they are most likely juxtaposed relative to our perceptual mechanisms now. Nonetheless, they would to some degree still reflect some "truth" about Nature.
All you have are perspectives, but we can't forget the observer dependency, otherwise we get into internal inconsistencies issues.