

Flashback: All brains possess free will because there is no design in biology

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Published August 21, 2013

Citation

Brembs, B. (2013, August 21). Flashback: All brains possess free will because there is no design in biology. *Bjoern.brembs.blog*. <https://doi.org/10.59350/j6ydx-59906>

Keywords

Blogarchives, Evolution, Free Will, Spontaneity



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*During my [flyfishing vacation last year](#), pretty much nothing was happening on this blog. Now that I've migrated the blog to WordPress, I can actually schedule posts to appear when in fact I'm not even at the computer. I'm using this functionality to re-blog a few posts from the [archives](#) during the month of august while I'm away. This post is from [June 9, 2010](#):

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I have no idea when it started, but probably long before Darwin, the notion of 'design' kept creeping into descriptions of biological organisms or traits: Birds are designed to fly or the eye is designed to see. I've also been guilty of using the word 'design' for biological objects every now and then. However, after reading a fair bit and after thinking for some time now, I've come to the conclusion that the word 'design' is so misleading and not even wrong, that it should never be used in biology at all, ever.

I'm only partially saying this because of a prominent creationist movement in the US awfully dubbed 'intelligent design' (which couldn't be further from biological reality). My main reason is that the use of 'design' is pernicious for biological research. 'Design' or engineering approaches have been used over and over in biology and many if not most of them have gone the way of Newtonian mechanics: extremely useful and successful initially (and to some extent still today), but scientifically falsified eventually. Take a rather recent, prominent example: [Lee Hood's](#) automobile paradigm, according to which systems biology is akin to finding car parts without a manual in the fog and then trying to assemble the car. Current research shows that genetic networks are, in contrast to car components, highly plastic and forgiving of errors (a phenomenon termed robustness, often due to [degeneracy](#) in evolved systems). Even though the car analogy might seem daunting, it is still grossly oversimplified and biologically misleading. Indeed, expecting genetic networks to behave as stably as car components will lead to the wrong experiments and the wrong conclusions. Nevertheless, systems biology was and still is a very successful branch of biology. I'm not a systems biologist, but I would be surprised if many systems biologists still bought into the car analogy these days any more, after what they have found out until today.

For the same reasons, there is no [blind watchmaker](#), because there is no watch. The analogy may still be useful in a rule-of-thumb kind of way, but biologically it is completely false.

Another, much older engineering approach is that of brains as input-output systems in neuroscience (the 'sensorimotor hypothesis'), which purports that brains passively wait for stimuli to occur in order to respond to them, much like radios, computers or other equipment that we have designed. In some fields of neuroscience (and psychology) this approach has been so pervasive that *any* behavior is referred to as a response, assuming that there *always* must be an underlying stimulus triggering the behavior. It is not only recent ecological and ethological research on predators specializing in exploiting stereotypic behaviors in prey species which shows that being responsive is not an evolutionary stable strategy: responding reliably to the same stimuli in the same predictable way will neither get you to the unexpected food patch nor prevent a predator or competitor from predicting your next move. "Nature red in tooth and claw" will make sure that any predictable species will not last for long. There is a very good

ultimate cause for the Harvard Law of Animal Behavior: “Under carefully controlled experimental circumstances, an animal will behave as it damned well pleases”: species which didn’t obey the law have not survived. It thus appears that for the last 100 odd years, neuroscience has been studying the exceptions to the rule that brains are always active and are constantly producing output, on which sensory stimuli merely exert a modest, modulatory role. I think it is fair to assume that one reason for this research direction (apart from the relative experimental ease) is that there is no mechanism or object we have designed that works in such a way. Everything we have made responds to commands and so people thought this is how brains operate.

Given the success of this approach in biology and of Newtonian mechanics in physics, it is no surprise that some thinkers have come to see brains as deterministic Newtonian clockworks. Complicated, maybe, but deterministic and predictable none the less. Any observed behavioral variability was shrugged off as random noise, when indeed it was the one brain function that kept animals in the run for the next generation. It is high time that neuroscientists realize that Newtonian mechanics are as falsified in biology as they are in physics: the world is not deterministic and neither are brains. The fact that brains are not engineered, but evolved allows for freedom of choice without quasi-magical quantum computing in the brain. All the brain requires to be unpredictable is some source of variability from which it can generate spontaneity, and there is plenty of such variability in neurons and their components, with or without quantum effects. The selection pressure of predictable animals being outcompeted, eaten or left without a mate established early on that every brain is equipped with a function which allows for adaptive behavioral choice. In some animals, there was need for more of such capabilities. Those animals seem to have more freedom of choice. Other animals could get away with being more predictable, giving the impression of being less ‘free’ and more [robot-like](#). I’m starting to get the impression that the model systems used in neuroscience are predominantly of the latter sort. 🤖

Be that as it may, all animals possess this trait to a larger or lesser degree and have been using it for survival and procreation since the very first brain evolved. I think it is time biology sheds the last remnants of classical thinking and starts to study ‘free will’ as the biological trait it is: the ability to behave differently in the same situations, the ability to chose from identical options, the mental coin toss. The centuries of philosophical thinking on this topic have provided us with a wonderful framework within which these empiricial findings can be embedded. Because [brains are output-input systems](#) (rather than the other way around), our lab has started to study the [spontaneous choices of the fruit fly *Drosophila*](#) and how the brain generates them. Currently, a graduate student in our lab is studying where in the brain these processes take place in order to later be able to understand how the circuits mediating these choice function. It is a testament to the idiocy of creationists that [our research was featured on a creationist blog](#) as supporting creationism. The opposite is the case: all brains possess free will precisely because there is no design in biology. [Evolution](#) is the only reason why we have free will and it is neither dualistic, nor spiritual, nor mystic: it is biological.