Chance in animate nature, day 3

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Citation

Keywords

Copyright

On our final day (day 1, day 2), I was only able to hear Boris Kotchoubey's (author of "why are you free?") talk, as I had to leave early to catch my flight. He made a great effort to slowly introduce us to nonlinear dynamics and the consequences it has for the predictive power of science in general.

Applied to human movement in particular, he showed that nervous systems take advantage of the biophysics of bodily motion to only add the component to movement, that biophysics (think your leg swinging while you walk) doesn't already take care of. This is an important and all too often forgotten insight that I recognize from the work of the laboratory of Hillel Chiel in *Aplysia* biting behavior. He explained work studying hammer blows, where the trajectory of all arm joints did not seem to follow any common rules – the only commonality that could be found between individual hammer blows was the trajectory of the hammer's head. This is reminiscent of the distinction between world- and self-learning in flies, where the animals can use any behavior very flexibly to accomplish an external goal, until they have performed the behavior often enough to become habitual, at which time this flexibility is (partially?) lost.

Halfway through the talk, he arrived at the uncontrolled manifold hypothesis, where the nervous system isn't trying to eliminate noise, but to use it to its advantage for movement control. Not entirely unexpectedly, he went from this to chemotaxis in *Escherichia coli* as an example of a process which also takes advantage of chance.

He differentiates between two different kinds of unpredictable systems: a) highly complex and incomputable systems b) unique unrepeatable systems. The differences between these two systems breakdown as soon as the uncertainly principle is an actual property of the universe that poses absolute, non-circumventable limits on the potential knowledge anyone can have about these systems.