

Aunt Hillary and the Anteater

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In this moment when the collective actions of humans seem to be hurtling towards several cataclysms (burning up the planet, ending the American Experiment), I am reminded of a powerful image that invaded my psyche some 45 years ago. It was from Douglas Hofstadter's magnum opus, *Gödel, Escher, Bach* (1979) and concerned his investigation of what became popularized as “emergent behavior” and “self-organization.” This was in the early days of chaos theory and Holland's emerging complexity theory. Conway's artificial life cellular automaton, the Game of

Life, was the screen saver on countless computer terminals and burgeoning personal computers. It was also the time when neural nets were beginning to capture the imagination of machine learning researchers among the artificial intelligence community.

Hofstadter's aim was to explore these ideas as they related to understanding the brain and he used the vehicle of an ant colony. It was clear that such a colony only consisted of a collection of ants each with a limited number of neurons, but the colony as a whole had sufficient neuronal capacity to exhibit “intelligence”—all mediated solely by the actions and interactions of the ants. So he imagined an Anteater conversing with an ant colony named Aunt Hillary ([1]). One part of the exchange was the following (p.314, p.330):

Crab: Yes, Aunt Hillary is quite eccentric, but such a merry old soul. It's a shame I didn't have you over to meet her last week.

Anteater: She's certainly one of the best-educated ant colonies I have ever had the good fortune to know. The two of us have spent many a long evening in conversation on the widest range of topics.

...

Anteater: There occurred an incident one day when I visited with Aunt Hillary which reminds me of your suggestion of observing the symbols in Achilles' brain as they create thoughts which are about themselves.

Crab: Do tell us about it.

Anteater: Aunt Hillary had been feeling very lonely, and was very happy to have someone to talk to that day. So she gratefully told me to help myself to the juiciest ants I could find. (She's always been most generous with her ants.)

Achilles: Gee!

Anteater: It just happened that I had been watching the symbols which were carrying out her thoughts, because in them were some particularly juicy-looking ants.

Achilles: Gee!

Anteater: So I helped myself to a few of the fattest ants which had been parts of the higher-level symbols which I had been reading. Specifically, the symbols which they were part of were the ones which had expressed the thought, “Help yourself to any of the ants which look appetizing.”

Achilles: Gee!

Anteater: Unfortunately for them, but fortunately for me, the little bugs didn't have the slightest inkling of what they were collectively telling me, on the symbol level.

Achilles: Gee! That is an amazing wraparound. They were completely unconscious of what they were participating in. Their acts could be seen as part of a pattern on a higher level, but of course they were completely unaware of that. Ah, what a pity—a supreme irony, in fact—that they missed it.

This particular excerpt highlights one salient aspect of emergent behavior that has wider social import: the agents of the behavior are ignorant of its existence. Furthermore, the emergent behavior was not pre-existing and imposed on the agents (ants) but rather arose from the multitudinous “mindless” interactions of the agents. This is the essence of evolution and natural selection, which led to the revolt against its implications by those whose religious beliefs, like modern advocates of intelligent design, held that there was a foreordained plan that led to the population of all living species.

To accept that things happen as the result of random interactions by agents with limited understanding is frightening. So humans try to invest purpose into the proceedings, cause and effect, everything has an understandable reason—understandable by a human with limited neurons. Supposedly there is a human (leader) who knows what to do and can be a guide. But that leader has no more neurons than the rest.

And so I have been bedeviled by Hofstadter's Aunt Hillary and the Anteater for years as I watch the tumult of millions of humans and wonder where it is headed.

(Even before I could post this article, we have another example of complexity beyond our ken: “What the Microsoft Outage Reveals” ([2]). And don't forget: all vehicle driving automation is based on neural nets and machine learning.)

References

- [1] Hofstadter, Douglas R., “Ant Fugue”, in *Gödel, Escher, Bach: an Eternal Golden Braid, A metaphorical fugue on minds and machines in the spirit of Lewis Carroll*, Basic Books, 1979, pp. 310-336.

This section is quite long—Hofstadter is *very* verbose and he also weaves in some of his other themes regarding Bach's music, which is rather distracting, and Gödel's self-referencing, which is stimulating. But it is a valuable exploration of where “meaning” or “purpose” comes from in a system like an ant hill or a brain. The ideas Hofstadter presented 45 years ago are quite relevant to the modern grappling with the likes of ChatGPT involving massive neural networks and machine learning. He is fascinated by the layers involved in these mechanisms, and the way they create the illusion (?) of purposeful behavior.

Of course the ant hill is not just a metaphor for the brain as years of research into the behavior of ants, termites, and bees can attest.

- [2] Arbesman, Samuel, “What the Microsoft Outage Reveals”, *The Atlantic*, 19 July 2024. (<https://www.theatlantic.com/ideas/archive/2024/07/microsoft-outage-technological-systems-fail/679110/>, retrieved 7/20/2024)

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