

Why Nothing Is Truly Alive

By FERRIS JABRMARCH 12, 2014

On a windy day in Ypenburg, the Netherlands, you can sometimes see sculptures the size of buses scuttling across a sandy hill. Made mostly from intricately conjoined plastic tubes, wood and sails, the many-legged skeletons move so fluidly and autonomously that it's tempting to think of them as alive. Their maker, the Dutch artist Theo Jansen, certainly does. "Since 1990, I have been occupied creating new forms of life," he says on his website. He calls them [Strandbeest](#). "Eventually I want to put these animals out in herds on the beaches, so they will live their own lives."

Poetic, most would say, but Strandbeest are not alive. They are just machines — elaborate, beautiful ones, but inanimate contraptions nonetheless. A few months ago I would have agreed with this reasoning. But that was before I had a remarkable insight about the nature of life. Now, I would argue that Strandbeest are no more or less alive than animals, fungi and plants. In fact, nothing is truly alive.

What is life? Science cannot tell us. Since the time of Aristotle, philosophers and scientists have struggled and failed to produce a precise, universally accepted definition of life. To compensate, modern textbooks point to characteristics that supposedly distinguish the living from the inanimate, the most important of which are organization, growth, reproduction and evolution. But there are numerous exceptions: both living things that lack some of the ostensibly distinctive features of life and inanimate things that have properties of the living.

Crystals, for example, are highly organized; they grow; and they faithfully replicate their structures, but we do not think of them as alive. Similarly, certain computer programs known as "digital organisms" can reproduce, mate and evolve, but ushering such software through the gates to the kingdom of life makes many people uncomfortable. Conversely, some organisms — such as gummy bear-shaped microanimals called tardigrades and brine shrimp (whose eggs are sealed up in little packets like baker's yeast under the brand name Sea Monkeys) — can enter a period of extreme dormancy during which they stop eating, growing and changing in any way for years at a time, yet are still regarded as living organisms.

In the 1990s, a group of scientists tasked with helping NASA find life on other planets devised a working definition of life: a self-sustaining system capable of Darwinian evolution. Even this phrase does not satisfactorily

identify the fundamental difference between living things and nonliving things.

Consider a virus: a bit of DNA or RNA encased in protein that hijacks a cell to make copies of itself. Viruses are incredibly efficient reproducers and they certainly evolve — much faster than most creatures. Yet biologists have disagreed for centuries about whether viruses belong among the ranks of the living, the inanimate or in some kind of purgatory. Gerald Joyce, one of the scientists who helped devise NASA's working definition of life, says that viruses do not satisfy the definition because they are not "self-sustaining" — that is, they can only evolve in the context of the cells they infect.

The same is true, though, of many larger parasites that everyone agrees are alive. Bloodthirsty intestinal worms, vines that suck the sap from other plants, fungi that extrude filamentous antlers of flame orange through the shells of spiders they have killed — all are just as dependent on their hosts to reproduce and evolve as is a virus.

About 10 years after serving on the NASA panel, Mr. Joyce embarked on experiments that further deflated the agency's working definition of life. In the lab, he and his colleagues coaxed into existence two rather unique molecules of RNA that can indefinitely make copies of one another by stitching together sequences of nucleotides, their building blocks. Four billion years ago, in Earth's primordial soup, similar self-replicating RNAs may have spontaneously formed from linkages of free-floating nucleotides. As naked pieces of RNA, they are even simpler than viruses and, because they can reproduce and evolve, Mr. Joyce admits that they, too, meet the working definition of life. Yet he hesitates to say they are alive.

Why so much ambivalence? Why is it so difficult for scientists to cleanly separate the living and nonliving and make a final decision about ambiguously animate viruses? Because they have been trying to define something that never existed in the first place. Here is my conclusion: Life is a concept, not a reality.

To better understand this argument, it's helpful to distinguish between mental models and pure concepts. Sometimes the brain creates a representation of a thing: light bounces off a pine tree and into our eyes; molecules waft from its needles and ping neurons in our nose; the brain instantly weaves together these sensations with our memories to create a mental model of that tree. Other times the brain develops a pure concept based on observations — a useful way of thinking about the world. Our idealized notion of "a tree" is a pure concept. There is no such thing as "a tree" in the world outside the mind. Rather, there are billions of individual

plants we have collectively named trees. You might think botanists have a precise unfailing definition of a tree — they don't. Sometimes it's really difficult to say whether a plant is a tree or shrub because "tree" and "shrub" are not properties intrinsic to plants — they are ideas we impinged on them.

Likewise, "life" is an idea. We find it useful to think of some things as alive and others as inanimate, but this division exists only in our heads.

Not only is defining life futile, but it is also unnecessary to understanding how living things work. All observable matter is, at its most fundamental level, an arrangement of atoms and their constituent particles. These associations range in complexity from something as simple as, say, a single molecule of water to something as astonishingly intricate as an ant colony. All the proposed features of life — metabolism, reproduction, evolution — are in fact processes that appear at many different regions of this great spectrum of matter. There is no precise threshold.

Some things we regard as inanimate are capable of some of the processes we want to make exclusive to life. And some things we say are alive get along just fine without some of those processes. Yet we have insisted that all matter naturally segregates into two categories — life and nonlife — and have searched in vain for the dividing line.

It's not there. We must accept that the concept of life sometimes has its pragmatic value for our particular human purposes, but it does not reflect the reality of the universe outside the mind.

Recognizing life as a concept is, in many ways, liberating. We no longer need to recoil from our impulse to endow Mr. Jansen's sculptures with "life" because they move on their own. The real reason Strandbeest enchant us is the same reason that any so-called "living thing" fascinates us: not because it is "alive," but because it is so complex and, in its complexity, beautiful.

Watch a Strandbeest's sail undulate in the wind, its gears begin to turn, its legs bend and extend in sync over and over — so dauntless, so determined. It does not matter whether this magnificent entity is alive or not. Just look at it go.

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