

Acts of Creation

Ancient robots and today's intentionally imperfect quest for artificial intelligence. BY WILLIAM A. WILSON

Their mission accomplished, the weary travelers set out for home across the vast, inhospitable void between civilized worlds. The journey takes longer than expected and, needing supplies, they are forced to land in a strange and remote place. There they come under attack from an ancient, automated defense system: A colossal metal giant, constructed with technology far beyond their ken and programmed to defend the area, bombards their ship. It is implacable, lightning fast, and nearly indestructible—until one of the ship's officers, a master psychologist and artificer, causes the automaton to become self-aware and thereby terrified of its own mortality. The officer then cunningly suggests a procedure supposed to make the metal monster immortal; in fact it deactivates a crucial subsystem. The vast machine collapses, the crew provisions in peace—and Jason and Medea continue their long journey back to Thesaly with the Golden Fleece in hand.

This may seem like an odd retelling of the story of the Argonauts' showdown with Talos on Crete, but if Stanford historian Adrienne Mayor is to be believed, it is close to the original spirit of the story. Greek mythology, she argues in her new book, is an ancient genre of science fiction. And, anticipating the tropes and obsessions of modern s.f., it is littered with stories exploring “the promises and perils of staving off age and death, enhancing mortals' capabilities,

[and artificially] replicating nature.”

That last is the major topic of Mayor's book, because the Greek myths as she tells them are overflowing with robots. Robot sentinels like Talos, ferocious killer robots like the Stymphalian birds, sinister androids like Pandora, robotic assistants like Hephaestus' forge helpers, and on and on. What makes such things robots? Mayor offers two criteria: first, that they

are of mechanical rather than biological construction, and second, that they are the products of conscious artifice. The Greeks, she argues,

envisioned and described these beings as advanced technological artifacts driven by internal machinery and following rational principles of operation. They are not biological and though many of them are created by gods or heroes they are not magical: They are mechanical.

Mayor establishes the engineered nature of androids like Talos and Pandora through a close analysis of pottery fragments depicting their creation. In these, she finds echoes of real historical techniques used in classical sculpture, metal casting, and construction. This also nicely refutes those critics who might claim that artificial life achieved through engineering was an idea beyond the conceptual horizon of the ancients. As do the delightful and zany accounts by ancient travelers of marvelous automata to be found around the Mediterranean—including ones powered by clockwork, hydraulics, pneumatics, and magnetism—with which Mayor peppers her book.

In real life these reached their zenith in Hellenistic Alexandria, and the chapter on these lost marvels is one of the high points of *Gods and Robots*.

Gods and Robots
*Myths, Machines, and
Ancient Dreams of Technology*
by Adrienne Mayor
Princeton, 304 pp., \$29.95

Ptolemy II was said to have commissioned a magnetically levitating nude statue of his wife (who was also his sister). We know this to be a myth, since it runs afoul of Earnshaw's theorem, but the same Ptolemy's “grand procession” was not. Organized in the third century B.C. to honor Dionysus, the parade included dozens of massive automata borne upon floats. Among these was a 12-foot-high seated statue of Nysa, the mythical nursemaid of Dionysus, which, driven by a complex internal mechanism of cams, sprockets, weights, and gear wheels, would periodically stand up from its throne and pour out from a bowl a libation of milk before the flabbergasted spectators.

Less monumental but even more astonishing were some of the tiny automata of Heron of Alexandria, who cheekily advised that a great inventor should make his marvels small so that nobody could suspect that a person was hidden inside. The peak of Heron's craft was a miniature automatic theater that could be “programmed” to display multiple scenes from famous works of drama, complete with fires, sound effects, and dancing statues. With these and other mechanical imitations of nature well known in the ancient Mediterranean, it's hard to believe the concept of robots was unimaginable to them.

The second of Mayor's two descriptive criteria for robots—that they be the products of conscious artifice—may sound vague but is actually by far the more potent. Something that is made is first known completely, inside and out. An artisan or engineer dreams his creation into existence, and then, if all goes well, one day the dream steps into reality. But, as the protagonist of Jorge Luis Borges's short story “The Circular Ruins” realizes, before the dream can have an independent existence it must be perfect. Every detail must be nailed down with precision; the location of every wire or buttress or flange must be specified; the behavior of the creation must be simulated within the mind of the creator so that its every action is predictable.

The knowledge a creator has of his

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Talos of Crete: a bronze cast of a model made by Ray Harryhausen for the 1963 film Jason and the Argonauts

creation is simultaneously synoptic and reductive, uncompromising and total. It reminds us of nothing so much as God's knowledge of us. The meaning of the Psalmist's song "Thy hands have made me and fashioned me" cannot be fully comprehended until we too have fashioned something and seen its total vulnerability in our hands and experienced how intimately we know it inside and out. The fact that Adam and Eve were flesh and bone rather than actuators and steel plates does not change this relationship one whit. In fact, this is what makes the whole episode with the fig leaves so darkly hilarious: There is something ridiculous about our first parents' attempt to preserve their modesty from the One who molded their

vertebrae, traced the path of every nerve bundle, wove their tendons, and lovingly layered dermis and epidermis on top of subcutaneous fat.

Since a created thing first takes form within the mind of its creator, it is in some sense a part or an extension of its creator and thus definitionally lesser. Our creations rarely surprise us, and when they do it's either because of a bug in the design or because we were unable or unwilling to simulate its emergent behavior to a high enough degree of fidelity. Our creations also rarely display fundamentally novel abilities that we did not design or program into them. How different the situation is with our children! So much of the joy of parenting is bound up in

the fact that our children are fundamentally unknown to us—little alien intelligences maturing under our eyes, but into what we dare not guess. Our children may be better or worse than we at particular tasks; they may have fundamentally new skills that we never learned or lack entirely abilities we have mastered. But below it all there is a basic equality rooted in the fact that they are not designed, not made by us, not products of our imaginations, not the offspring of our minds—they are beyond our ability to simulate.

By contrast, Mayor repeatedly describes the robots of Greek myth as "made, not born," itself a winking reversal of the "begotten not made" formulation in the Nicene Creed. But if, as she argues, the Mediterranean had been marinating for hundreds of years in stories of gods fabricating superhuman androids, then perhaps the surprising robustness of the Arian heresy—the idea that Jesus was a creation of rather than the son of God, which belief the Council of Nicaea (A.D. 325) quashed—is easier to understand. The Nicene fathers, most of whom were Greek and doubtless familiar with the old pagan stories, would have understood the temptation of thinking this way. They were trying to differentiate their own dogma from the ancient myths when they underscored the equality between the first two persons of the trinity in describing their relationship as one of "begetting." What is offensive about Arianism is not that it makes Jesus, like Talos, into some kind of robot, but that it makes him lesser. The creed teaches that the Father's priority is "merely" ontological—he is the source of being, including of the two other persons of the trinity, but that's where it ends.

Mayor's two criteria for robotness need not necessarily coincide. Yes, Talos was made and a machine, and our children are begotten and biological. But in the Genesis story Adam was biological, yet very much made. Is there a fourth option? What would it look like to beget something in a nonbiological substance? We needn't look far: It's happening today in the burgeoning field of machine learning.

When inventors are called upon to produce artifacts too complex to be dreamed into existence within a single human mind, they fall back on a few tried and true strategies. One is to commit parts of the design to paper, so that it need not be held in mind in its entirety. Such an approach requires modularity in the artifact: There must be different subcomponents of the design that do not affect or impose on each other too much, so that the inventor can work on the details of one piece without bearing the others fully in mind. If such a modular decomposition is successful, a further step is possible: Different subcomponents can be designed by entirely different people or different teams. In theory, the only knowledge that must be held in common is of the specific boundaries, or interfaces, between subsystems. With techniques like these, teams of human inventors working together have produced technological artifacts vastly more complex than any individual could possibly imagine—and for a time, we thought that artificial life might be next, that through teamwork an entire organization of engineers might finally be able to match the wisdom and skill of Hephaestus. Lately, however, especially in the field of artificial intelligence, this way of thinking has fallen out of favor.

Contemporary techniques of machine learning look very little like the traditional image of an inventor or programmer sitting down to produce an artifact for a purpose and a lot more like trying millions of little experiments in “begetting” until we find one that works. The result of machine learning is something whose internal dynamics, rules of operation, and strengths and weaknesses are unknown and unknowable to us. It is an opaque little intelligence, hyperspecialized for now, that learns, grows in subtlety, and occasionally surprises us. Like our other inventions, we can view every little piece of it in perfect detail, but this time the pieces tell us nothing. My own digital creations frequently surprise me, and sometimes, when they overcome a trial I thought impossible for them or display an aptitude I didn’t

even know they had, I feel a tinge of almost parental pride.

Some artificial intelligence researchers would bristle at this description, pointing out that the high-level architecture of these systems is still the product of human design. (A rough analogy would be to a creator who sketches out a general plan for a body—legs here, arms there, basic structure and arrangement of the organs—and then leaves the details to work themselves out.) That’s true—for now. But the newest trend in the field is to let even these most fundamental properties emerge from optimization, evolution, or some other “organic” process. World-class AI researchers like Andrej Karpathy have gone on the record stating that such “architec-

ture search” is the only feasible short-term path to true intelligence, true artificial minds.

All of this suggests that those critics who disagree with Mayor and argue that the ancient Greeks could not have conceived of robots have it exactly backwards. Mayor is right: The ancient Greeks were *more* than able to conceive of artificial beings that were the product of wisdom and craft. Our best and brightest engineers and scientists today, however, increasingly are not. Artificial intelligence is becoming ever more a misnomer, since it is ever less the product of artifice. And if we succeed in finally realizing it—birthing it, you might say—it will be something unknown, unfamiliar. Something that, like our children, might surprise us. ♦



Powell's People

The friends and fights of the Dance to the Music of Time author. BY CARL ROLLYSON

Authorized biographer Hilary Spurling begins with the assumption that Anthony Powell (1905-2000) deserves his reputation as the English Proust. The work supposed to justify the comparison is Powell’s *A Dance to the Music of Time*. In that 12-volume sequence, he set about to canvass his society from the 1920s to the 1970s, presenting a comprehensive array of character types that has often invited comparison to the flashier Evelyn Waugh. Powell is more subtle than Waugh and sometimes so low-key he has been accused of banality. His work seems so close to life as it is actually lived that certain critics have been staunchly anti-Powell, claiming, essentially, that he is artless. Spurling won’t countenance

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Anthony Powell
Dancing to the Music of Time
by Hilary Spurling
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such debunking, although she dutifully reports the disparaging reviews of heavyweight Powell denigrators like Auberon Waugh, Evelyn’s son.

One surprising aspect of Spurling’s book is the disclosure that not only did Powell draw many of his characters very directly from life—not even assembling them as composites—but that friends and acquaintances for the most part were delighted and began to act like the characters in his books and offer the novelist suggestions about how to represent them. Only on a few occasions did anyone threaten to sue Powell; even then, Powell or others managed to point out aspects of the characters that mollified their real-life models. His work earned