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The Religious Life of Greek Automata

This paper examines the religious lives of Greek automata. An automaton is an object that has been constructed to move on its own.¹ I argue that ancient Greek automata at first had a solely magical life, later attained a mechanical life, and that this change from magical to mechanical allowed automata to proliferate in religious contexts. While automata were originally imagined as purely magical, the advent of advanced mechanics later in antiquity made it possible for automata to be realized and also caused Greeks in the Hellenistic and Roman ages to reinterpret magical automata as mechanical. Later Greeks' projection of mechanical knowledge onto the magical automata of the past mirrors twentieth and twenty-first century scholars' tendency to reinterpret ancient automata as "robots" in line with technological advances in their own time. Changes in mechanics in antiquity and the response of people to those changes leads me to advance the concept of "relative modernism." I argue that modernism is a mind-set that recurs throughout history rather than one that emerges in a unique period of history.

From Magic to Mechanics

In common parlance, an automaton is a self-moving or self-operating machine. In historical and literary studies, "automaton" is used especially to designate those self-operating machines that were created before the twentieth century. These include Leonardo da Vinci's fifteenth-century "mechanical knight," Jacques de Vaucanson's eighteenth-century "digesting duck," and the many clock-work dolls, animals, and music boxes of the nineteenth century.² Though no automata survive from classical antiquity, we do have ancient texts that describe them.³ The oldest of these appear in Homer's *Iliad*. In *Il.* 18, Thetis enters Hephaestus' workshop to commission new armor for Achilles, and finds the god already hard at his characteristic work:

[Hephaestus] was making tripods, twenty in all, to stand around the sides of his well built hall, and below the base of each one he set golden wheels so that of their own accord [*automatois*]

1 LSJ, s.v. *automatos* (2). Some Greek *automata* (both natural and artificial) are associated with the *automatos bios*, or golden age; see Ruffell 2001 and Baldry 1953.

2 For the history of automata, see Kang 2011 and Reilley 2011.

3 See Humphrey, Oleson, and Sherwood 1998 for further reading in Greek and Roman automata. For the purposes of this paper, I will not treat "living statues," i.e., statues that come to life, for which see Francis 2009, Spivey 1995, Morris 1992: 215–238, and Freedberg 1989: 283–316.

they could enter the divine assembly and again return home, a wonder to behold (*Il.* 18.373–377).⁴

The tripods are “a wonder to behold” because they are *automatoi*, self-moving. Hephaestus is outfitting the tripods with wheels so that they can return to him automatically; he will not have to carry or wheel them back himself. A little later in the scene with the automatic tripods, Hephaestus stops his work and approaches Thetis with the help of golden maids:

Golden attendants in the form of living maidens moved quickly to support their lord. They have sense in their hearts, and speech and strength, and know handiwork from the deathless gods (*Il.* 18.417–420).⁵

Like Hephaestus’ tripods, the golden maids are also automata, but they demonstrate an even greater degree of functionality since they not only move when bidden, but possess sense and reason to anticipate their master’s needs. As we learn from Homer and Greek mythology at large, Hephaestus is lame, and needs the maids’ help to move from place to place in his workshop.⁶

The automata in *Il.* 18 were obviously fictional at the time of the poem’s composition. Although we have very old tripods from ancient Greece that survive in the archaeological record, they certainly do not move of their own accord, nor do we have any evidence that the Greeks of Homer’s time could have built an automatic tripod.⁷ Yet we do have ancient Greek instructions for the building of real automata, the best-known of which date from the first century C.E. writer Heron of Alexandria.⁸ His writings cover a range of topics, from hydraulics and mechanics to optics and artillery

4 Translations are mine. All texts are taken from the TLG except where indicated.

...τρίποδας γὰρ ἑείκοσι πάντας ἔτευχεν
ἐστάμεναι περὶ τοῖχον εὐσταθέος μεγάρου,
χρύσεια δὲ σφ’ ὑπὸ κύκλα ἐκάστω πυθμένι θῆκεν,
ὄφρα οἱ αὐτόματοι θεῖον δυσσαΐατ’ ἀγῶνα
ἦδ’ αὖτις πρὸς δῶμα νεοῖατο θαῦμα ιδέσθαι.

5 ... ὑπὸ δ’ ἀμφίπολοι ῥώνοντο ἄνακτι
χρύσειαι ζῶησι νεήνισιν εἰοικυῖαι.
τῆς ἐν μὲν νόος ἐστὶ μετὰ φρεσίν, ἐν δὲ καὶ αὐδὴ
καὶ σθένος, ἀθανάτων δὲ θεῶν ἄπο ἔργα ἴσασιν.

6 Francis 2009 notes the connection between the golden maids and Hesiod’s Pandora. The giant Talos is another human-like automaton in Greek literature, for which see Buxton 1998. For the stationary guardians Hephaestus constructs, including the dogs that guard Alcinous’ palace, see Faraoe 1987.

7 Most extant tripods are stationary, but Morris 1992: 10 notes several (non-automatic) wheeled versions. See especially Catling 1964: 207, pl. 36.

8 For the evolution of mechanics from the fourth century onward, see Drachmann 1963, Lloyd 1973: 91–112, and Cuomo 2000: 97–104. Aristotle provides some of our earliest references to real automata, for which see Berryman 2009: 71–73, De Groot 2008, and Bianchi 2006.

construction, and most were transmitted in their original Greek, though some survive only in Latin or Arabic translation. Because Heron relied on the work of earlier engineers, although to what extent is not clear, it is hard to date precisely the technology in his works.⁹ None of Heron's automata survive, and so there is no proof that he himself constructed the devices he describes. But modern reconstructions show that his automata, even if never built, could be built and would have functioned as promised.¹⁰

In his treatise *Spiritualia Pneumatica* (*Spir.*, hereafter), for example, Heron tells readers how to build 78 devices that are powered by compressed water or air. Because these devices are elaborately ornamented and have limited time- and labor-saving applications, scholars have often dismissed them as “toys” or “gadgets.”¹¹ It is true that some of the entries in the *Spir.* demonstrate different pneumatic principles, different kinds of siphons, for example, and would have been of primary interest to those with an academic investment in mechanics. Others, however, seem designed for social use, and of these, several have symptomatic overtones. The twenty-fourth entry of the first book (= Woodcroft 24), for example, describes a device that mixes wine and water in desired proportions. While it has been convincingly argued that these wine-pouring and mixing devices were designed for private, elite consumption,¹² others are suited to a larger ritual, religious, or theatrical context.¹³ These include an automatic holy-water dispenser (1.21 = Woodcroft 21)¹⁴ and temple door-opener (1.38 = Woodcroft 37), as well as a number of figural automata, including whistling birds (1.15 = Woodcroft 15), drinking animals (1.30 = Woodcroft 30), and one of Heracles that, when it shoots an apple, causes a snake to hiss (1.41 = Woodcroft 40). These could be kept in miniature form for private entertainment, but also adapted to larger tableaux, such as Heron describes in the *Automatopoetica* (*Aut.*, hereafter). In this work, Heron provides instructions for building two elaborate scenes, one in which Dionysus and his followers dance and pour libations, the second which stages the story of Nauplios.

Whether Heron expected a temple to use his automatic door-opener or holy-water dispenser is impossible to say, but we know that a figural automaton like those in the *Spir.* appeared in Ptolemy Philadelphus' third-century BCE Grand Procession. This magnificent parade included statues of Dionysus and scenes from his life,

⁹ For the dating of Heron and his relationship to his predecessors, see especially Drachmann 1948: 74–81. See Boas 1949 For Heron's influence on sixteenth- and seventeenth-century mechanics. Tybjerg 2005 discusses Heron's reworking of his sources.

¹⁰ See Woodcroft 1851 and Schmidt et al. 1899 for examples. Tybjerg 2005: 216 notes Heron's emphasis on the physicality of the devices and the reader/builder's sense-perception of them, which may indicate that the devices were in fact constructed.

¹¹ Tybjerg 2003: 444, n.5 catalogues these dismissals.

¹² Schürmann 1991: 158–220.

¹³ Tybjerg 2003, Schürmann 1991: 223–249, Murphy 1995.

¹⁴ The first number refers to Schmidt et al. 1899, the second to Woodcroft 1851.

as well as an automaton of his nurse, Nysa, dressed in Bacchic costume that sat, stood, and poured milk libations.¹⁵ This automaton might not have been truly mechanical,¹⁶ but it is reasonable to think that Heron was both inspired by the form of this automaton and intended his treatises to contribute to the proliferation of automata in royal processions. Processions would be ideal for showing off the tableaux in the *Aut.* and for combining the smaller figural automata of the *Spir.*

The fact that the automaton in the Grand Procession appeared in the Dionysiac section of the parade is also significant for understanding Heron's automata. Several of the devices refer to Dionysus directly (the whistling thyrsus at *Spir.* 2.9 (= Woodcroft 48); the tableau of Dionysus and Maenads in the *Aut.*), while others feature wine-pouring, including *Spir.* 1.37 (= Woodcroft 36), which features a Satyr, the god's typical companion. As the emphasis on Dionysus in the Grand Procession makes clear, the god was very popular with the Ptolemies; they traced their lineage from him and used Dionysus' association with Alexander the Great to further legitimize their reign.¹⁷ Heron's use of Dionysiac imagery is most likely a legacy of his predecessors, many of whom worked under Ptolemaic patronage.¹⁸ Yet the fact that his treatises reuse this imagery implies that Heron expected Dionysus-themed automata to retain their appeal. The more recent memory of Cleopatra and Antonius's use of Dionysus in their self-promotion may account for this.¹⁹

The Dionysiac imagery in Heron's treatises may play on another sort of association between Dionysus and automata as well. Although Bonner ultimately rejected the idea, he proposed a connection between Dionysus' spontaneous gift of wine (*h. Hom.* 7.35) and wine and milk (*Ba.* 141; 704 ff.), and Hesiod's golden age, when the earth spontaneously (*automate*, *Op.* 117) bore its fruit.²⁰ If this association between Dionysus and the golden age were felt in antiquity, a device that automatically produced wine and milk would play on the application of the word *automatos* to both mythic crops and machines. We know that Dionysus' worshippers re-enacted his miraculous providence at festivals, producing wine and milk through, as Bonner 1910 says, a "pious fraud." Automata that seemed to produce wine spontaneously, as

15 Rice 1983 provides a text, translation, and commentary of Athenaeus' description of the Procession. See pp. 62–68 for the Nysa automaton in particular. Leslie Day has suggested that the Karphi goddesses with swinging feet (Pendlebury 1937/8: pl. 31) were used in processions (public comment). While not automatic, these figures might have been a precursor to Nysa and other processional automata.

16 But see Schürmann 1991: 243–245. As Tybjerg 2003 says, "Hero ... may thereby be seen as providing the know-how behind the massive display of religious and secular power featured by the Grand Procession" (462). I wonder whether the cave that gushes milk and wine (*Ath.* 200c) was also mechanical. Polybius 12.13.11 tells us of a snail automaton that appeared in a procession for Demetrius of Phaleron. See Schürmann 1991: 239–240.

17 Rice 1983: 83–86, Tondriau 1946, Pamiás 2004.

18 Schürmann 1991: 13–31.

19 Hazzard 2000: 152–153.

20 Bonner 1910. Gatz 1967: 177 includes the Bacchae in his concept of the golden age.

many of Heron's do (including the tableau in *Aut.* that gushed wine and milk), could be used for the same purpose. As Bonner 1929 implies, the Nysa automaton in the Grand Procession and Heron's automata might have been replicating, in a more convincing way, a ritual that was usually performed by human beings.²¹

In private gatherings of elites, Heron's automata would have been examined closely and perceived as "wonderful" in a playful sense.²² But when viewed in public, in processions or festivals, his devices could have produced a wonder more akin to awe or fear. To see a device produce wine and milk would have made Dionysus seem truly present, and would have accorded his powers to those who had produced the automaton. Even those automata that were not associated with Dionysus would, in public display, evoke literary automata that were divinely animated, like Hephaestus' automata in *Il.* 18. Although metal-working connotes science today, in the ancient world it was associated with magic, and Hephaestus was seen as a magician.²³ In a religious context where miracles were at least theoretically possible, automata that made those miracles seem real would have been a powerful tool for instilling religious awe.²⁴

Advances in mechanics thus allowed automata to proliferate in religious contexts, and the imagery with which Heron adorns his automata suggest that he anticipated religious uses for them. For those unaware of recent developments in mechanics, these automata would seem magical, just as Hephaestus' automata were magical. There is evidence that this was not an unintended side-effect of the device's construction, but part of their purpose: Heron was both aware of the fact that his automata would be largely understood as magical and played up this fact in their design. Karin Tybjerg points out that Heron repeatedly tells the reader how to keep the mechanism of the automata a secret; he instructs his readers to "hide" (*kruptein*) key features of the automaton or make sure the mechanism remain "unseen" (*aphanes*).²⁵ An entry in the *Spir.* for a drinking animal automaton offers a clear example:

In any place where there is running water, [make] an animal of bronze or some other material. And when it is offered a cup, it [will] drink with a noisy slurp [lit. noise and bellow], so as to produce the appearance [*phantasia*] of thirst ... Let the mouth of the animal be at R, through

²¹ Bonner 1910: 182, Bonner 1929: 373; Nilsson 1906: 291–293. The main textual witnesses are Pausanias 6.26, Pliny 2.231; 31.16, and Diodorus 3.66. As Diodorus says, "καὶ Τήϊοι μὲν τεκμήριον φέρουσι τῆς παρ' αὐτοῖς γενέσεως τοῦ θεοῦ τὸ μέχρι τοῦ νῦν τεταγμένοις χρόνοις ἐν τῇ πόλει πηγὴν αὐτομάτως ἐκ τῆς γῆς οἴνου ρεῖν εὐωδία διαφέροντο."

²² For wonder in Heron's own discourse, see Tybjerg 2003.

²³ Blakely 2006, Faraone 1987, Graf 1999.

²⁴ Tybjerg 2003: 458 argues that Heron associates himself with Hephaestus' cunning; this association would extend to those who built the automata as well.

²⁵ Tybjerg 2003: 451.

which a concealed [*kruptes*] pipe runs along one of the animal's feet or some other part into the base; let the pipe be RST (Heron, *Spir.* 1.29 = Woodcroft 28).²⁶

In order for the automaton to produce the appearance, *phantasia*, of thirst, the pipe through which it sucks up water must be hidden from view. We can see from this passage that mimicry is essential to Heron's device and to the automaton as he conceives of it. Automata replicate processes that were otherwise associated only with animate beings. For this replication to work, the mechanism behind the automaton must remain out of sight.

Tybjerg does not discuss this passage of the *Spir.*, but it supports her conclusion: "By hiding mechanisms ... Hero[n] creates a boundary between the unknowing spectator and the knowing mechanician. He thereby places the mechanician in an epistemically superior position because he can see the causes of the movements and the spectator cannot."²⁷ As Tybjerg notes, it makes sense that Heron would want to hide the mechanism of his automata from most people. Making these devices seem magical makes Heron seem like a magician, maybe even a divine magician like Hephaestus, and it allows those who build and use his automata to associate themselves with Hephaestus' powers.²⁸ This does not mean that Heron himself saw the devices as magical—indeed, his entire work aims at demystifying the wonderful for his readers while he simultaneously maintains it for uninitiated viewers—but this effort itself assumes that demystification is necessary, and that perpetuating the devices' magical appearance is desirable. Heron does not so much take a philosophical stance towards the (un)reality of magical phenomena as he recognizes how his devices will be seen, and how he wants them to be seen.²⁹ The word *phantasia* is crucial to this distinction. Although usually translated as "appearance" (as I have done here), in Plato *phantasia* is the useful (if also fallible) knowledge we attain by sense-perception, especially sight.³⁰ Heron's *phantasia* is precisely that: an appearance that convinces the mind of one reality while obscuring another.

26 Κατασκευάζεται δὲ ἐν τινὶ τόπῳ ὕδωρ ἐπίρρυτον ἔχοντι ζῶον εἶτε χαλκοῦν εἶτε ἐξ ἄλλης τινὸς ὕλης· προσενεχθέντος δὲ αὐτῷ ποτηρίου πίνει μετὰ ψόφου καὶ βοῆς, ὥστε φαντασίαν ποιεῖν δίψης ... τὸ δὲ τοῦ ζωδίου στόμιον ἔστω πρὸς τῷ Ρ, δι' οὗ σωλὴν κείσθω φέρων δι' ἐνὸς τῶν ποδῶν ἢ δι' ἄλλου τινὸς μέρους τοῦ ζωδίου κρυπτῶς εἰς τὴν βάσιν· ἔστω δὲ οὗτος ὁ ΡΣΤ.

27 Tybjerg 2003: 451.

28 Hiding the mechanism might also excite Greek anxieties about the improper use of *techne*. See Cuomo 2007: 29–34 for "the trouble with *techne*."

29 Tybjerg 2005: 214, n. 41 notes Heron's allusions to different philosophers and their theories.

30 Watson 1988: x, 1–13. Aristotle extends *phantasia* to some nonhuman animals and gives a different account of its mechanics, but does not alter Plato's definition in a way that concerns us here. See Watson 1988: 14–37 and Sheppard 2014. Heron uses *phantasia* comparably at *Aut.* 30.5. In *Definitions* 135–138, the final sections of his mathematical work, *phantasia* means something closer to "imagination," as was often the case in later philosophy, but these sections are considered spurious. See Giardina 2003.

The advent of advanced mechanics gave rulers a reason to build religious automata and exploit the ability of automata to mimic magic, but advances in mechanics also created a rift within the concept of the automaton itself. Though Heron designed his devices to remain mysterious and magical to most spectators, engineers who could use Heron's instructions to fabricate mechanical automata knew that they were not magical at all. This knowledge caused at least some of them to reinterpret the magical automata of the past as mechanical. The bT scholiast says of Hephaestus in his workshop:

δηλος δέ ἐστιν εἰδῶς μηχανικῆν.

It is clear that [Hephaestus] knows mechanics (bT on *Il.* 18.373).³¹

Although the adjective form of *mechanike* means merely “resourceful” or “inventive,” the noun form is found only after the fourth century BCE, when mechanics had developed into a complex discipline.³² When the bT scholiast says that Hephaestus knows *mechanike*, mechanics, he means the sort of mechanics that Heron had access to, not those that were known to Homer. The bT scholiast has projected the technology of his own time onto the automata of Homer's time, transforming Hephaestus from a magician into a mechanic and the automatic tripods from magical creations into works of engineering.

As E.R. Dodds has said, quoting the words of Jacob Burckhardt, “rationalism for the few and magic for the many,” might on the whole be said of Greek religion from the late fifth century onwards.³³ The same situation pertained to Greek engineering from at least the first century CE onward. Those who read Heron and similar treatises rationalized works of divine engineering in Homer just as their counterparts in natural philosophy rationalized Homer's gods. But the majority of Greeks who heard or read the Homeric epics and saw one of Heron's automata in action probably maintained a magical understanding of both Heron's automata and Homer's.

Lest this sound too much like a recapitulation of Nestle's *Vom Mythos zum Logos* (1940),³⁴ I must highlight the incomplete and dynamic nature of mythic and mechanical understandings in antiquity. Magic for the many is what the mechanician wanted, perhaps what his patrons wanted, too. Furthermore, the ignorance that would lead Hellenistic spectators to interpret mechanical automata as magical also ensured that they would continue to interpret literary automata, including Hephaestus' creations in *Il.* 18, as they were originally written to be understood. Mechanical automata succeed magical ones in time, but mechanics is not the *telos* of objects that move of their own accord. Magic is often dismissed as false or erroneous science, as a system

³¹ The bT scholia transmit material that ranges from Alexandrian to late antique. For dating, see Dickey 2007: 19–20. For the worldview of these scholia, see Schmidt 1976.

³² Schürmann 1991: 33–38.

³³ Dodds 1966: 192.

³⁴ Buxton 1999: 1–24 chronicles the history of this work and its reception.

of explanation that people fall back on in the absence of science.³⁵ Magical explanations do sometimes give way to scientific ones, as when automata go from being magical and fictional to mechanical and realizable. But the bT scholiast demonstrates that science is also sometimes false or erroneous magic; that science imposes itself into magical situations, like Hephaestus' workshop, because mechanical knowledge has deprived readers of the ability to see things magically.

Automata and Modernity

The fact that advances in mechanics within antiquity changed how people could and sometimes did see automata has an analogue in classical scholarship. In current scholarship on automata, there is both a tendency to call ancient automata “robots” and a concomitant tendency to say that “robot” is an inaccurate term for ancient automata. Hephaestus' automata are “robotic” (Lively 2006: 279), Heron describes “*automi-robot*” (Cambiano 1994: 624), and “Hephaestus create[s] robots to serve the gods” (Humphrey, Oleson, and Sherwood 1998: 61). Considering this phenomenon alongside the reinterpretation of automata within antiquity reveals a shared aspect of human cognition, the tendency to project one's own technology backward in time.

Robots, in current parlance, are more advanced automata. Engineers will say that robots function electronically and are programmed by computers, neither of which was possible before the mid-twentieth century; thus, English-speakers today use “robot” to describe electronic and computer-programmed automata. But the terms “*automaton*” and “robot” are slippery, and while electronics and computer-programming furnish neat criteria by which to differentiate automata from robots, these criteria are also somewhat arbitrary. Pierre Jaquet-Droz' 1774 Writer automaton, for example, though not computer-programmed, can be programmed by hand. Should it therefore be classed as an “early robot” or “proto-robot” rather than a “complex automaton,” which is how it is usually described? Nevertheless, this is the terminology as we have it.³⁶

The problem of what to call Heron's creations is relatively simple. He himself called many of them, in Greek, *automata*. The Greek word *automaton*, which describes a self-moving object, is very close to the English derivative, which describes a self-operating machine; there is a good fit between the English use of this word and Heron's. Furthermore, Heron's automata are materially very similar to the automata of the Mediterranean middle ages, Renaissance, and early modern period. Like them, Heron's automata are powered by mechanical processes; pneumatics is a sub-type of mechanics. Scholars who call Heron's automata “robots” are guilty of failing to en-

³⁵ For the relationship between magic and science, see Lloyd 1979, Dickie 2003, and Collins 2008. On the issue of ancient belief in what today may seem unbelievable, see Lehoux 2012.

³⁶ See Voskuhl 2013 for the Jaquet-Droz workshop. Sharkey 2007 suggests that one of Heron's automatic theaters might also have been programmable.

force the difference between self-moving machines that operate electronically and have been computer-programmed (robots) and those that do not (automata).

The problem of what to call Homer's automatic tripods is more vexing. Although self-moving, Hephaestus' creations cannot have been thought to function mechanically at the time of the poem's composition. As Sylvia Berryman says:

[Stories like Homer's] should not be read as evidence, then, that the creators of this early literature imagined the building of 'mechanical' automata. This is not only because there is positive evidence to suggest that divine animation is needed: it is *a priori* unreasonable to expect mechanical conceptions before the development of mechanics ... We should not expect people to be able to *imagine* what devices can actually achieve, without practical experience ... While it may be tempting to read accounts of 'statues that move' as anticipating modern robots, this is not warranted, unless there is evidence of technology available that could give some content to such a conception. It would be risky to assume the conceivability of techniques that were only developed later, and to suppose that the ancient storyteller must be imagining something comparable. What seems possible to us may have seemed to an ancient to require intervention by divine or supernatural agency.³⁷

Berryman argues that scholars cannot understand Hephaestus' automatic tripods as anything like later mechanical automata, let alone electro-mechanical robots, because there was not mechanical technology to inspire these literary creations at the time of the poem's composition. One might object that Berryman's argument does not allow writers to imagine anything new. For her, there has to be real, on-the-ground technology in order to inspire stories about technology. But setting that reservation aside, her conclusion, that "what seems possible to us may have seemed to an ancient to require intervention by divine or supernatural agency" is certainly true, especially of the automatic tripods and golden maids of *Il.* 18. They are Hephaestus' creations, and while we are not told how he animates them, there is no reason to believe that Greek readers before the advent of advanced mechanics would have understood them as governed by reproducible mechanisms. To the contrary, Christopher Faraone has argued convincingly for Hephaestus' associations with magic in general and with the magical animation of automata in particular.³⁸ Hephaestus' tripods are divine creations that operate by magic, not mechanics. The first Greek automata are thus as far from being robots in a material sense as they can be; they are someone's creations, true, but they are magical creations, not applications of reproducible science.

I suggest that scholars who conflate the magical and mechanical in ancient sources are not applying a worked out theory of automata and robots (one that would, perhaps, question the common association of robotics with electronics and computers), but are, rather, revealing an unconscious outcome of human cognition, the result of how having technology changes the way people see the world. When scholars

³⁷ Berryman 2009: 27–28.

³⁸ Faraone 1987. See also Blakely 2006, Graf 1999.

call Hephaestus' tripods "robots," they are absorbing these objects into their own technological frame of reference. Because they live in a world in which electronic, computer-programmed robots do exist, they have a tendency to project this technology onto objects that look similar to them. In one sense, this phenomenon could be considered a species of what G.E.R. Lloyd has called "argument by analogy,"³⁹ but I am saying something more specific than that people today understand ancient automata by analogy to the robots in their lives (or fantasies). Moderns absorb ancient automata into the category of the robot even when they have every reason to observe the distinction between the two—even when, for example, they are scholars who are attuned to the important differences between ancient Greeks, Romans, and themselves. Understanding ancient automata by analogy with modern robots is an understandable first move, but it is sustained in the scholarship because there is something special about how technology changes perception. Once humans come to possess a technology, it is very hard to unsee it. This explains why even Hephaestus' automata, which most scholars know were originally understood magically, are nevertheless rationalized and called robots in the modern literature.

This process, by which people project their technological understanding onto the past, happened also in antiquity when technology changed. Berryman is right that Hephaestus' tripods were not originally understood mechanically, but mechanical automata did come into existence later on in antiquity, by the first century CE at the latest, as we know from Heron. While Homer's original audience would have understood the tripods as having divine and magical life, Heron's readers and anyone else familiar with mechanical automata could have reinterpreted Hephaestus' magical creations and projected their own mechanical understanding of automata onto these objects. The bT scholiast, who noted that Hephaestus must have known mechanics, does just that.

When Berryman took her colleagues to task for calling ancient automata "robots," for projecting their own technological understanding backwards, she said, quite rightly, that "what seems possible to us may have seemed to an ancient to require intervention by divine or supernatural agency." But although true enough for the Greeks of Homer's time, this sentence pits us, the moderns, against them, the ancients and erases technological change within antiquity. As Bruno Latour has said, "The adjective 'modern' designates a new regime, an acceleration, a rupture, a revolution in time. When the word 'modern', 'modernization', or 'modernity' appears, we are defining, by contrast, an archaic and stable past."⁴⁰ But the past was not stable, as we have seen.

Technology changed within antiquity, and with that change came new understandings of the things of the past. If we take ancient technological change seriously and consider how it affected people, then it is no longer appropriate to pit us against

³⁹ Lloyd 1966.

⁴⁰ Latour 1993: 10.

them, to pit modernity against antiquity as we are accustomed to doing. Instead, I suggest that we think of ourselves as one group of moderns among many, and consider modernism a mind-set, or a process that recurs throughout history, rather than as a single time period that forever opposes us to a monolithic past. If we do this, then modernism becomes something relative and dynamic. Not only are we modern with respect to Homer, but so are Heron and the bT scholiast. This is not only because both we and Heron and the bT scholiast understand mechanics, whereas Homer did not, but because we are all in a position to project our understanding backwards and outwards onto everything we see. As an example of relative modernism and in conclusion, I offer a scene from a more recent classic.

The fairytale of *Beauty and the Beast* usually involves a beautiful young woman whose father is imprisoned in the castle of the Beast, a man cursed into semi-animal form. The Beast frees the father in exchange for his daughter, whom he hopes will release him from the curse by loving the Beast as he is. In Disney's *Beauty and the Beast*, the father-figure, Maurice, is an inventor and his inventions play an important part in the movements of the plot.⁴¹ He is traveling to a fair to display his automatic wood-chopper when he loses his way and washes up at the Beast's castle, and later, imprisoned by the evil Gaston (his daughter's suitor), he and his daughter, Belle, are freed by that same machine. Maurice, who himself invents automata, is a foil for the enchanted servants in the Beast's castle who have come to resemble automata by virtue of their enchantment. The housekeeper, Mrs. Potts, is now a teapot. Fifi the maid is now a featherduster. The two highest-ranking servants in the castle, Lumiere and Cogsworth, have been transformed into a candlestick and clock, respectively. When Maurice, lost on his way to the fair, enters the Beast's castle seeking shelter, Lumiere greets him.

"Incredible!" Maurice says, looking at Lumiere, and then picks up Cogsworth, winding, shaking, and examining him. "How is this accomplished?" he asks.⁴² At first stupefied by the wonderful, "incredible" sight before him, he immediately begins to assimilate Cogsworth to his own technological frame of reference, asking how such a thing has been "accomplished," that is, brought into being by the kind of technology he himself possesses. When Maurice shakes and winds Cogsworth, he is behaving as Tybjerg's "epistemically superior mechanician," someone who has dedicated himself to inventing through mechanics what the enchantress of the Beast's castle has achieved with magic.

This scene is an analogy for the process at work when twentieth- and twenty-first century scholars read about ancient automata from their technological vantage point and when later Greek readers within antiquity, including Heron of Alexandria's readers and the bT scholiast, looked back on self-moving objects that were described in literature before they could be realized by human hands. *Beauty and the Beast* offers

⁴¹ To my knowledge, this is the only version of the story in which this is so.

⁴² *Beauty and the Beast* 1991 DVD: 14.30; <https://www.youtube.com/watch?v=JdzY6vFKLXs>: 0:29.

a vivid example of modernity as a mindset rather than a particular time in history. Maurice is modern with respect to the Beast's castle and the enchantment it is under, even though to us he seems at most early modern (he occupies what looks like eighteenth-century France). He is modern not only because he has technological knowledge, but because he projects it onto everything he sees. Heron's readers and the bT scholiast are modern with respect to Homer; when they read *Il.* 18 in the light of mechanical treatises, they can ask, as Maurice does, "how is this accomplished?"

Arthur C. Clarke's famous third law, "any sufficiently advanced technology is indistinguishable from magic,"⁴³ is usually taken to mean that to people who understand things magically, technology seems magical. Heron was banking on Clarke's third law when he encouraged his readers to hide the mechanism of the automata he had designed. But we can understand the third law in reverse as well. To those who are sufficiently technologically advanced, magic can and probably will be reinterpreted as technology. This is a feature of modernisms across time, our modern condition and the modern condition of later Greeks within antiquity.

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⁴³ Clarke 1982: 36.

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