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# Part I

## Interrogating Historiography



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## 1

Heron of Alexandria's 'Toy Theatre'  
Automaton: Reality, Allusion and  
Illusion*Richard Beacham*

The Emperor Nero (37 BC – AD 68) was notoriously known, as '*imperator scaenicus*',<sup>1</sup> a patron and practitioner of theatre so excessive in his espousal that his personality and reign came to be seen (then and later) as theatricalism 'run rampant'; wrought up to encompass painting, architecture, public ceremony, political rhetoric, and all manner of both public and private expression. Of course, with a performing Emperor, such a cult of theatricalism was endorsed at the highest level, and emulation (and condemnation) followed. Seneca lamented how 'Throughout the whole City the private stage (*privatum pulpitum*) resounds; 'it is danced upon by both men and women; wives and husbands compete over which displays a more sensuous thigh' (*Nat. Quaes.* 7.32.3). Dio, recounting elite behaviour during the reign of Nero, notes dramatic performances, music, pantomimes, and choral presentations, enacted by people of both sexes and all ages, 'everyone displaying to best advantage whatever talent they possessed, with all the most distinguished people... and everyone taking instruction for the purpose' (61.19.2). Taking his show on the road, the Emperor undertook a grand tour to Greece, performing (and winning 1808 victories) in the cycle of sacred agons: great competitive festivals comprising (in addition to athletic contests) theatre, poetry, and music. Shortly after the scandalous 'actor's triumph' staged to mark his victorious return, he was forced to take his life in an appropriately theatricalized suicide.

His advisor – and eventual victim – Seneca, in describing the *ars ludicra*<sup>2</sup> so fervently espoused by Nero noted 'to this class you may assign the stage machinists (*machinatores*) who invent scaffolding that rises of its own accord... and many other surprising devices as when objects that fit

together then fall apart, or objects that are separate then joint together automatically, or objects that stand erect and then gradually disappear. The eyes of the ignorant are astonished by this; they marvel at all such sudden things, because they do not know the causes' (*Epist.* 88.22).

In Alexandria, Seneca and Nero's scholarly contemporary, the mathematician and engineer Heron, 'got in on the act', composing a treatise, the *Peri Automatopoietikes*, in Book Two of which he described how to construct, as an automaton, a toy theatre capable of presenting the scenario of a drama, *Nauplius*, through five separate scenic settings.<sup>3</sup> Heron's text survives from a thirteenth-century manuscript and four others, one from the fifteenth, the others from the sixteenth century.<sup>4</sup> These contain, in addition to Heron's Greek text, later copyists' attempts to provide illustrations of the elements detailed by Heron in the original manuscript. His text uses letters to identify the parts of the mechanisms he describes and their functional relationship, and these were accompanied by designs incorporated into the original manuscript, but for the most part severely garbled in the later copies. There is an English translation by Murphy (1996) and an earlier illustrated German translation by Schmidt (1899, 338–453).

The work has attracted relatively scant attention, with discussion focused either upon describing and understanding the very impressive working mechanics of the automaton itself – even characterizing it as one of the earliest examples of 'programming language'<sup>5</sup> – or the possible relationship of the scenario to a lost play by Sophocles or, alternatively, to works by other Greek or Hellenistic authors thought to have drawn upon the myth of Nauplius.<sup>6</sup> The fullest surviving account of this is by Gaius Julius Hyginus (c. 64 BC – AD 17) in his *Fabulae* (116).

When the Danaans were returning home after the capture of Troy and the division of spoils, the anger of the gods caused their shipwreck on the Cepharean Rocks. They sent a storm and contrary winds because the Greeks had despoiled the shrines of the gods and Locrian Ajax had dragged Cassandra from the statue of Pallas. In this storm Locrian Ajax was struck with a thunderbolt by Minerva... When the others at night were imploring the aid of the gods, Nauplius heard, and thought the time had come for avenging the wrong to his Palamedes. And so, as if he were bringing aid to them, he brought a burning torch to that place where the rocks were sharp and the coast most dangerous. Believing that this was done out of mercy they steered their ships there. As a result many ships were wrecked, and many of the troops and their leaders perished in

the storm, their limbs and entrails dashed on the rocks. Those who could swim to shore were killed by Nauplius.

(*The Myths of Hyginus*, trans. Grant)

Heron's work is a remarkable and intriguing document, not just for the sophistication of the mechanical apparatus he describes in considerable detail, but also (although this aspect has been neglected) for what we may reasonably infer from it about ancient scenic practice and theatrical aesthetics. Scholars have thus far only touched in passing upon the possible theatre-historical significance of the work, and failed, I believe, fully to recognize the extraordinarily suggestive evidence it may provide for ancient scenic practice and dramaturgy.<sup>7</sup> Another area suggested by Heron's work and inviting further study are ancient concepts of visual and cognitive theory (for example the concept and practice of *ekphrasis*) and the intermedial relationships engendered amongst these and expressions of theatre and theatricalism, including Heron's miniature stage.

Before exploring these topics, and by way of 'headlining' what I believe to be their importance, it is useful to remind ourselves of the accepted and orthodox narrative of European theatre history regarding the evolution of scenic practice, which is routinely and invariably cited in every major (or minor) work on the subject. Look wherever we will, and we read confidently and authoritatively stated that the use of perspective scenery (including moveable and changeable stage settings) to depict a unified stage picture contained within the proscenium arch 'picture frame' format first arose in Italy in the sixteenth century. Prior to that, medieval and early renaissance stages (including the Elizabethan) deployed a polyscenic stage of juxtaposition, in which scenic elements were dispersed (without regard to the creation of a unified stage picture) variously upon platforms, in a courtyard, market place, or church, on carts, or within a circular enclosure.

Following the advent of perspective scenery (introduced by Girolamo Genga and Baldassare Perruzzi around 1513 and illustrated most comprehensively and influentially in Sebastiano Serlio's *De Architettura* of 1545), a new type of theatre architecture rapidly revolved: the proscenium arch format. The earliest known extant illustration of such a 'picture frame' stage of monoscenic illusion is that of Bartolmeo Neroni deployed in 1560 at Siena for a visit by Cosimo de' Medici.<sup>8</sup> The earliest changeable scenery probably appeared between 1556 and 1585. In due course this 'Italianate' theatre migrated throughout the rest of Europe, appearing prominently in Britain in the first decade of the seventeenth century through the medium of the hugely influential masque stagings

of Inigo Jones in the Stuart Court.<sup>9</sup> Its hegemony remained unchallenged until the early twentieth century when Adolphe Appia first 'abolished' the proscenium arch through his experimental work at Hellerau in which there was no barrier between audience and performers, and no attempt to create a 'stage picture' containing performers and pictorial scenery within an autonomous perspectively fashioned space.<sup>10</sup>

This received chronology claiming to identify and chart the first appearance of what became the 'iconic' proscenium arch theatre is false. Heron described precisely such a theatre (in both its form and function) a millennium and a half before its subsequent reappearance in renaissance Italian courts. As I discuss below, he not only posited the 'archetypal' picture frame format, but gave details of other staging requisites including a space beneath the stage floor for the operation of the scenic apparatus; a 'fly tower' above for concealing and lowering scenery; the use of an upstage cyclorama to provide spectators with a 'moving picture'; the deployment of both a backcloth and drop curtains; and a moveable 'flat' (in this case depicting the goddess Athena) which transverses the stage on a track: all elements traditionally associated with post-renaissance theatrical practice.

As part of the research undertaken better to understand the nature and significance of Heron's treatise, and working in collaboration with an architectural student, Janis Atelbauers, I prepared a 3D model interpreting and representing as closely as possible what Heron describes in his text. At some points this required an element of hypothesis and guesswork, but such occasions were rare; to a remarkable degree, Heron's description enabled us confidently to fashion and depict plausible and functional realizations of the scenic elements and stage architecture he described. Using these, we were then able to prepare animations showing how the *Nauplius* scenario he outlined would have appeared as it was enacted.

We must begin our account and analysis by quoting in full Heron's summary of the *mise-en-scène* fashioned for his toy theatre. At the beginning of his text on automata he gives a general account of how such a 'toy theatre' could present any play:

...a toy stage with open doors stands on a pillar, and inside it an arrangement of figures has been set up in line with some story. To begin with, the stage is closed, and then the doors open by themselves and the painted representation of the figures is displayed. After a little while the doors close and open again of their own accord, and another arrangement of figures, sequential to the first one, appears.

Again the doors are closed and opened and yet another arrangement, which logically follows the one before it, appears; either this completes the planned story, or yet another display appears after this one, until the story finally is finished.

(2.1.1–4)<sup>11</sup>

He later describes how *Nauplius* could be staged in the course of five scenes:

Scene by scene, it went like this. When the stage was first opened, twelve painted figures appeared, arranged in three rows. They were made to portray some of the Greeks repairing their ships and busy-ing themselves about launching them. These figures moved, some sawing, some working with axes, some with hammers, others using bow-drills and augers, making a lot of noise, just as would happen in real life. After sufficient time has elapsed, the doors were closed and opened again, and there would be another scene: the ships would appear, being launched by the Achaians. When the doors were closed and opened again, nothing appeared in the theatre except painted sea and sky. After a short time, the ships sailed out in a line, some hidden, some visible. Often dolphins swam alongside them, sometimes diving into the sea, sometimes visible, just as in real life. The sea gradually turned stormy, but the ships ran on. However, when the stage was closed and re-opened, none of the voyagers was visible, but only Nauplius holding a torch and Athena standing next to him; and a fire was lit above the stage, as though it were the flame of the torch. And when the theatre was closed and opened again, the wreck of the ships appeared, and Ajax swimming; [and Athena] was lifted on the crane above the stage, and with a peal of thunder a lightning bolt fell in the theatre itself, upon the figure of Ajax, which disappeared. And thus, as the theatre closed, the story reached its climax. Such was this presentation.

(2.22.3–6)

Heron next proceeds to detail how this scenario would be presented through (for the most part) precisely described mechanical and pictorial devices. My intention here is not to recount his intricate instructions for the design, construction, and operation of each scene. I wish instead, drawing upon Heron's text, briefly to review and then illustrate from our model the likely appearance of each scene as it functioned, in order to give substance to some larger inferences (and hypotheses)

about what Heron's treatise tells us about the state of actual ancient theatre practice in the Hellenistic period, and the visual and cognitive theory that informed it. The validity of such interpretation rests upon my belief that Heron is not merely describing a discrete and autonomous 'novelty' with little or no connection to actual theatre practice. To be meaningful to its viewers (and justify Heron calling it a 'theatre'), it must have exhibited some close affinities and been to a significant degree analogous with what they understood theatre to be. And indeed at several points (for example in respect to a thunder machine, and the appearance of Athena as a *deus ex machina*), Heron explicitly states that what he presents in his toy theatre has a 'real-life' equivalent in actual theatre practice.

He also stresses that what he writes may in turn serve as a generic model which can provide the basis for other toy theatres 'The example of one toy theatre will suffice; for these things are all managed by the same methods' (2.21.2), a point he had made earlier: 'it is possible ... to create different and varied scenarios while still using the same methods. Your scenario will turn out better if it is well designed' (1.2.12). And he reiterates this in his conclusion: 'So this is how these effects are taken care of in the toy theatre. The individual movements of the figures and those of stage action all come about through the same devices, and all toy theatres are similarly operated by these means' (2.30.7). The fact that Heron's theatre is not a one-off novelty, but rather intended to serve in effect as a handbook illustrating how the *types* of scenic machinery he details were deployed generally in miniature theatres, lends further support for believing that such theatres were meant to have (and be seen by their audiences to display) affinities with practice in 'real life' analogues: actual Hellenistic theatres.

Vitruvius had made a similar point in *De Architectura*, Book Ten (devoted to machines), which he introduced with the hope that his discussion would be of direct practical relevance for those deploying machinery 'in plays with a theatrical setting'. After citing 'all those other things which, in accordance with theatrical tradition, are provided for popular spectacles by means of machinery', he stressed (directly addressing Augustus, an avid patron of the spectacles<sup>12</sup>): 'nothing of this sort is done without mechanical contrivance to which careful and dedicated attention has been applied ... because each year the *praetors* and *aediles* must prepare the machinery for the spectacles, I thought it relevant, *Imperator* ... to explain in this book ... what the principles of machinery are, and the rules which guide them' (*De. Arch.*, 10, *Praef.* 3).



Indeed, negligence or poor planning by those responsible for the scenic contrivances could be costly not only in financial terms (which Vitruvius stresses), but fatal. Suetonius records that Nero's predecessor, the Emperor Claudius, 'for slight and hasty reasons if any automatic device (*automatum*) or mobile scenic structure (*pegma*)<sup>13</sup> or anything else of the sort had not worked properly he would force the carpenters or assistants or others of that type to fight [in the gladiatorial shows]' (Suet., *Claudius*, 34).

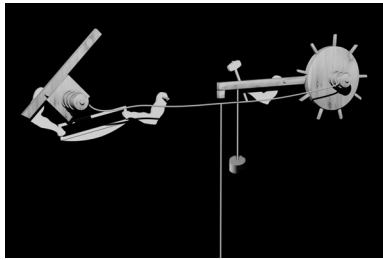
It is important to observe (as Heron stresses) that his automaton for the enactment of *Nauplius* was closely based upon one created and described by his predecessor, Philon of Byzantium, who is believed to have written in the mid-third century BC. While asserting that in describing moving automata his work is a great improvement upon those by his predecessors, 'as is obvious to anyone who has tried the earlier plans', Heron acknowledges that his scenario for a stationary automaton is derived from Philon's treatise – presumably now lost sections of his *Automatopoeica* – and that apart from improving upon his presentation of Athena, and adding details on how to construct the thunder machine and lightning bolt, 'I am quite happy about all the other things that happen severally in the *Nauplios* scenario, as explained in order and methodically by Philon' (2.20.5). This is significant since it indicates that the scenic dramaturgy implied by the model is not particular to the first century AD, but may provide evidence as well for earlier practice.<sup>14</sup>

Heron describes his theatre as a large decorated box (its width six times its depth) which rested upon a hollow wooden column filled with sand. Earlier in his Book One (on moving automata), he stipulated that it should not be so large that a person could be concealed within it. 'It would arise suspicion that someone was working these effects from inside ... you must be careful of size because of the resultant scepticism' (1.4.4). He was evidently mindful of the type of incredulous astonishment felt by spectators to which Seneca had called attention.

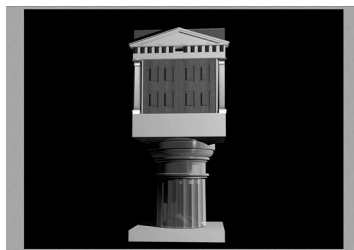
As the sand was allowed to flow out of the tube-like column following the removal of a plug in its base, a weight resting upon it slowly descended.<sup>15</sup> Connected to this were a great many cords, each in turn attached at its other end to one or more scenic devices. The length of these cords was calibrated according to the descent of the weight and the point in the scenario in which each scenic device was to be deployed. In turn, the scenic machines were themselves designed to 'trigger' one or more events controlled by them at the precise point in the unfolding scenario in which each was required. These devices were engaged incrementally as

22 *Interrogating Historiography*

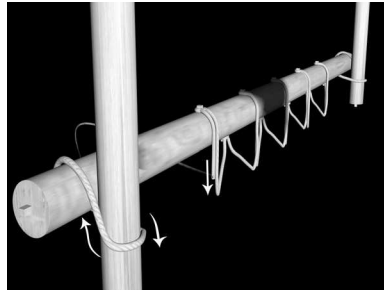
*Figure 1.1* Opening shipbuilding scene depicting 12 men arranged in three rows. Heron stipulates that this be painted on the actual rear wall of the stage box



*Figure 1.2* The mechanism operating the hammers and sawing of the first scene. The arms holding tools are carved from thin horn and attached to the wall of the set so they fit onto the figures painted upon the front of that wall. The mechanism behind the wall is activated by a cord down to the main counterweight which when pulled causes the arms to move. When the wheel-like mechanism is activated, a second small counterweight causes the wooden beam to strike a metal peg making a hammering noise



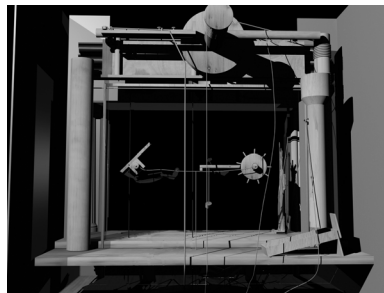
*Figure 1.3* General view of the toy theatre which rests upon a hollow column filled with sand. As the sand drains out, the counterweight resting upon it descends, and the cords attached to it cause the scenic apparatus to be activated. The horizontal architrave and pediment, together with the vertical pilasters, forms a proscenium arch 'picture frame' stage. The areas concealed above and below the stage house scenic machinery



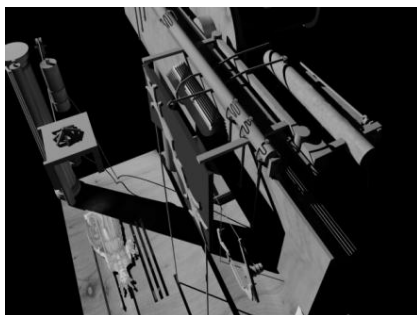
*Figure 1.4* The mechanism for operating the doors. The cord indicated by the arrow pointing down is attached to the counterweight. As that descends, periodically the other cords, when released from the pins on the horizontal axle, twist the vertical door hinges for each door wing back and forth and thus open and close the doors. See also fig. 8.



*Figure 1.5* The second scene – the launching of the ships – in which the first of four backdrops which are rolled up and concealed in the hollow area above the stage (as depicted in Figure 1.19) has been released to fall down and cover the back wall of the stage. Three of these when deployed cover the entire rear wall, the fourth and final (used to 'blank out' the figure of the drowning Ajax), only a portion of it



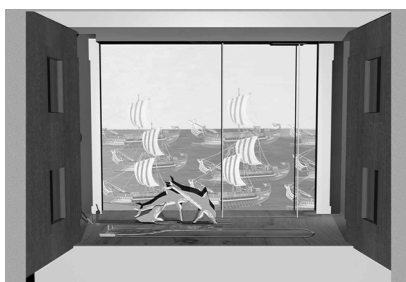
*Figure 1.6* Cutaway view of the backstage area showing mechanisms deployed for moving the sawing and hammering arms, for creating the sound of thunder (cf. Figure 1.15), and for pulling the papyrus cyclorama across the stage

24 *Interrogating Historiography*

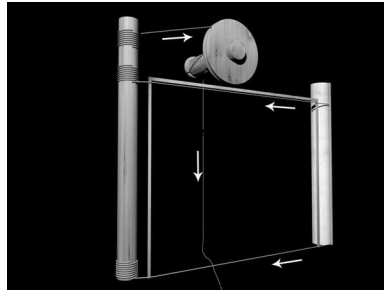
*Figure 1.7* View above the stage showing (from left): wood chips which when ignited represent Nauplius' torch; thunder machine; prone Athena figure before her activation; slots in the floor for the appearance of the dolphins (cf. Figures 1.9 and 1.11); descending thunderbolt; rollers which when turned cause the scenic backdrops to fall



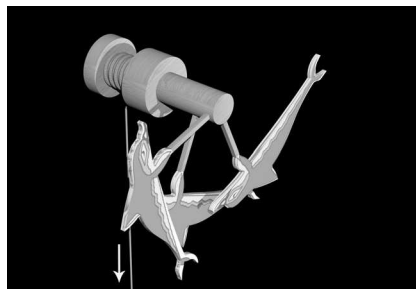
*Figure 1.8* View under the stage showing the mechanism which controls the opening and closing of the stage doors. Above the horizontal rod operating this is the system of cords and pulleys which cause the figure of Athena to stand, move around the stage on a track, and then recline again



*Figure 1.9* The third scene, showing the cyclorama in the process of unrolling to show first a placid seascape (cf. Figure 1.12), then ships at sea sailing upon it, then darkening clouds and a stormy sea with ships foundering. The cut-out dolphins (shown in Figure 1.11) swim in the foreground



*Figure 1.10* Mechanism for unrolling the papyrus scroll cyclorama. The vertical cord attached to the counterweight, when pulled, activates the wheel which in turn causes the vertical take-up rod at the left to turn, winding the papyrus roll (to the edge of which it is attached by cords) from the supply rod, across the back of the stage, and to wind up upon the take-up rod



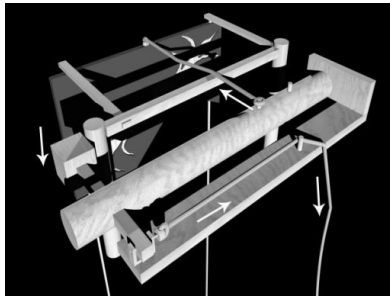
*Figure 1.11* The mechanism for the jumping dolphins. The wheel attached by a cord to the descending counterweight, when turned, causes the cut-out dolphin figures to appear and disappear through slots cut in the floor of the stage



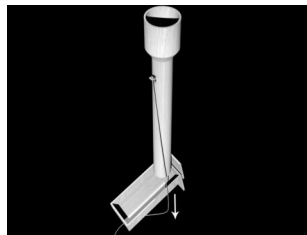
*Figure 1.12* A hypothetical depiction of the seascape scene, ships, and storm which Heron stipulates should be painted upon the papyrus cyclorama, and rolled out incrementally across the rear wall of the stage

26 *Interrogating Historiography*

*Figure 1.13* The fifth and final scene. The figure of Athena has been raised up from where it lay on the floor, to then move on an elliptical track around the stage. The backcloth shows Ajax in the sea. At the same moment when the flat depicting the thunderbolt falls from above, and disappears into a slot cut in the stage floor, a small second backcloth (painted so that it exactly matches a portion of the seascape) suddenly descends to cover the figure of Ajax, as if he has vanished into the sea



*Figure 1.14* The mechanism above the stage which causes the lightning bolt flat, and also the small painted backcloth depicting a portion of sea, to be released. The vertical cord attached to the counterweight, when pulled, releases a pin at the left, activating the hammer-like lever which then causes the horizontal roller to turn, releasing both the lightning bolt flat and the small backdrop with sea painted upon it



*Figure 1.15* The thunder machine mechanism which Heron indicates is like that used in full-size theatres. A pin, when pulled by a cord attached to the counterweight, allows lead balls in the container above to fall upon a stretched drum-like piece of taut, dried hide, making a rumbling sound

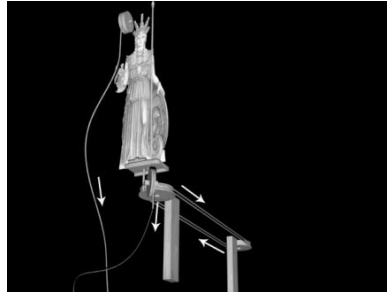


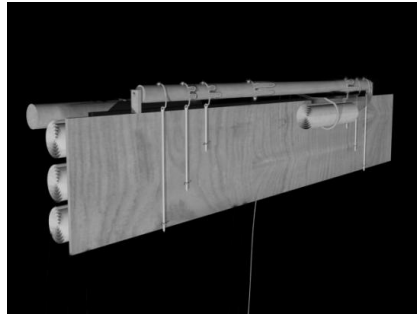
Figure 1.16 View from below of the Athena mechanism, based upon the hypothesis suggested by Schmidt, *Heron Alexandrinus, Opera* (LXIV–LXVIII). (Cf. Figures 1.7 and 1.13)



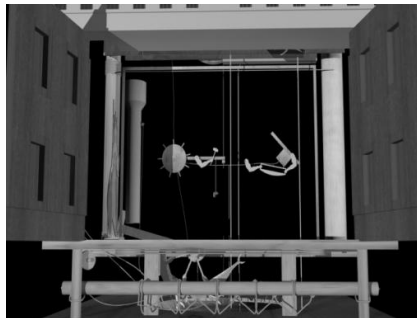
Figure 1.17 The fourth scene. A painted backcloth depicts Athena and Nauplius, who stands above the sea cliffs brandishing the torch used to lure the mariners towards the rocks. The two vertical cords are used later when the thunderbolt falls from above into the slot in the stage below



Figure 1.18 The mechanism for causing the fire representing Heron's torch to flare up. A cord attached to the counterweight, when pulled, causes, by means of a pulley, the vertical axle to revolve. This pulls a chain that removes a lid covering a small oil lamp, thereby allowing its flames to ignite wooden shavings that have been placed upon it. The fire is then viewed through an aperture cut into the architrave or pediment of the theatre box



*Figure 1.19* The mechanism used for releasing the three rolled up full-sized scenic backdrops, as well as the smaller partial backdrop deployed in the final scene of the presentation. The cord attached to the counterweight, when pulled, causes the horizontal rod to revolve, in turn causing the vertical metal pins one after another to be pulled. This in turn releases cords upon which each of the rolled-up backdrops rests, allowing it to fall



*Figure 1.20* General view of the stage area of the toy theatre without the backdrops, and with its back wall removed to show the location of several of the scenic devices

the descent of the weight caused the 'programmed' cords to tighten and thereby activate them.

At its front, facing the spectators, the box was fitted with a set of double doors 'so that both doors will be alternatively closed and opened with one motion' by a cord which 'is hung from the counterweight, and when pulled gently, will open and close the theatre establishing the timings and intervals' (2.23.6; 2.23.8). Moreover, 'the stage will have concealed hollow spaces at each side of the doors, by the hinges, finished on the front to look like pilasters' (2.26.1). Within these spaces at either side were vertical rods, which, when rotated, caused a roll of



papyrus upon which painted scenes were depicted, to unwind as a continuous cyclorama across the rear wall of the stage.

In addition, Heron described a series of scenic backdrops set up 'to unroll from the top...the space the rolls of cloth occupy should be blocked by boards so that they will not be seen'.<sup>16</sup> The frontal board which concealed this space and stretched across the top of the stage opening was 'to be made into an architrave with carved mouldings, so as to have a finished appearance' (2.25.7). Thus the vertical side pilasters together with the horizontal architrave created a picture frame format, the interior of which was revealed (each time displaying a different scene) whenever the doors opened and shut. On top of the architrave was fitted another board 'which masks the cylinder that activates the sailing scene' (by causing the rods connected to the papyrus roll cyclorama to turn) and served to create a space which was effectively a fly tower. He stipulated that in order that 'the board is not left sitting there inexplicably ... there should be a pediment attached on the front of it, fitted just as to a shrine' of the temple-like theatre box (2.28.2-3). This area also concealed a mechanism for lighting a lamp (evoking the torch that Nauplius used to lure the sailing ships to their destruction), whose flame suddenly appeared through an aperture in the pediment. Intriguingly, he also required that the visible parts of the masking board on top of the architrave and which projected to either side behind the triangular pediment attached to this board be painted black or sky blue hinting perhaps at a theatrical convention which persists to this day, namely that objects or areas painted black 'do not exist' in terms of the scenic illusion notionally evoked. This masked space also contained a scenic thunderbolt painted upon a thin piece of board backed by a small piece of lead plate, which dropped suddenly from above to disappear below into a slot cut in the stage floor (2.30.1-5).

Heron concealed still more scenic apparatus beneath his stage. This included the mechanism for opening and closing the doors (whose pivots protruded though the stage floor into the hollow space beneath it), by means of a rotating horizontal axle (2.23.2-3). In addition, he described the provision of diving dolphins fitted onto a wheel and made to emerge from beneath the stage by turning an axle attached to a pulley. Also located below the stage floor was a device which caused a cut-out image of Athena (painted upon a flat) suddenly to appear on the stage and move in an ellipse as she traversed it before vanishing at the moment the thunderbolt fell upon Ajax.<sup>17</sup>

In addition to anticipating to an extraordinary degree the scenic provision of subsequent theatre practice by some 1500 years, Heron also

provides an intriguing and rare window into ancient theatrical technology and scenic theory. In fact, his provision of a proscenium arch format to present a series of painted scenic elements arguably in itself reflects an approach to theatricalized visualization in the Hellenistic period for which we have some other (albeit scant) evidence. Archaeological remains, together with a few textual descriptions, indicate that theatre in the Hellenistic period increasingly made use of painted scenery, depicted upon boards called *pinakes* (Πίνακες); a term which in fact Heron uses to describe the painted flats in his theatre.<sup>18</sup>

According to Aristotle (*Poetics* 1449a), the deployment of painted scenery, *skenographia*, was first introduced by Sophocles in the fifth century. It may at that early date have been used to decorate the front facade of the *proskenion* with painted panels before which the actors performed. As evidence Bieber (*History of The Greek and Roman Theater*, 115) cites a joke by the fourth-century comic poet Antiphanes in which 'the courtesan Nannion is compared with a *proskenion* because she had a lovely face, much gold, and expensive clothes, but when naked she was unusually ugly'. Later, from perhaps the late third or early second century BC, the so-called *thyromata* stage, widespread in the Hellenistic period, provided dedicated spaces into which painted scenery could be inserted. For example, inscriptions relating to the theatre at Delos beginning in about 300 BC trace the use of painted wooden panels, first to face the front of the stage itself, level with the orchestra, and later, about 180 BC, as backdrops against the scene building behind the raised stage. Painted depictions placed in large apertures along the front of the scene building, intended to evoke different settings could be presented and changed by removing and replacing these panels.<sup>19</sup>

Another of Heron's devices, the cyclorama referred to earlier, is similar in effect (if possibly not entirely in function) to the *scaena ductilis* (pulled scenery) briefly described by the fourth century grammarian Marius Servius in his commentary on Vergil's third *Georgic* (3.24.2ff.). 'From that time the *scaena* was made of wood... Now the scenery that existed then could either be turned [*versilis*] or drawn [*ductilis*]; it was turned when it was entirely revolved by a certain contrivance, and displayed another form of picture. It was drawn, when, with panels pulled on one side and the other, a painted scene was revealed behind.'<sup>20</sup> Heron, while describing in detail how to built the papyrus rolling device that stretched across the back stage area, notes 'when the stage is closed, turn the rod far enough to make the papyrus which will have sea and sky painted on it, mask the whole back cloth. You must see to it ahead of time that the papyrus moves into place automatically, and

when the heavy counterweight pulls it, it is deployed quickly to produce the effect of a great number of ships sailing by' (2.26.6).

Although of course no scenic panels or drapes have survived, and 'no securely identifiable remains of the *scaena versilis* and the *scaena ductilis* have been found at any theatre' (Csapo and Slater, 258), bases of some kind of scenic machine were found in the Large Theatre at Pompeii. Mazois (V. 4, 1838) records that in 1792, remains of a mechanical apparatus were found at either side of the stage. There were stones with iron clamps around them in which were holes fitted with iron rings that still contained the remains of wooden beams. He interpreted these to be the remains of the *scaena versilis* or *periaktoi*. Sear (8) records that similar evidence was found in the Roman theatre at Lyons. And Bieber (74) notes that what may have been tracks for the operation of a *scaena ductiles* were found at the Greek theatre of Megalopolis.

Heron's dropping scenic curtains (four are deployed in the course of the scenario), call to mind other ancient literary references to curtains deployed upon the stage and associated with changes of scenery. The Roman *siparia* according to the ancient sources (collected and assessed in Beare, 270–4),<sup>21</sup> were apparently portable curtains or screens that could be used both to conceal actors, as well as serving as a back scene. The latter use would seem to fit Heron's description of how in the course of the scenario, three such curtains, serving as backdrops, are used to change the scene (each covering the entire back wall of the stage) with a fourth but smaller curtain deployed in the final scene:

When the lightning bolt falls... there is another cloth prepared just like the others which are concealed, but small, just big enough to mask the figure [of Ajax]; and the sea and waves are painted on it in the same pattern as they are around the figure... so that when the figure is covered the scenery will be the same... it is rolled up and held in place by the same pin that controls the lightning bolt, so that when this is pulled out, the lightning bolt is cast down on the figure and the figure is covered by the cloth at the same time, so that it looks as though the figures disappears because it is struck by lightning.

(2.30.5–6)

In the light of the passages cited above from Vitruvius, which make clear the continuing importance, cost, extravagance, and intricacy of scenic machinery in the imperial age, Heron's account gains further credibility as evidence for the nature of scenic conventions in full-scale

theatres. Even after the Roman stage building had become a permanent structure, evidence suggests the expectation that the stage façade could be wrought anew for each festival persisted, and that temporary fore-structures might be set up in front of permanent masonry façades. For example, the articulated masonry façade of the theatre at Herculaneum appears to have been augmented by extensive wooden scenic architecture, and traces of similar materials were discovered in the large theatre at Pompeii. Indeed, it is striking that such remains were discovered in both of the two permanent articulated stage façades from which evidence of such a practice might uniquely have been preserved by the circumstances of their burial.

Moreover, after Rome had acquired three permanent theatres, temporary stages continued to be erected (as both Vitruvius and other textual evidence document), and the same was probably true throughout the Empire.<sup>22</sup> The use of temporary stages did not die out. On the contrary, for some considerable time, it seems likely that many theatrical performances during the year, even in cities (such as Pompeii) that boasted one or even two stone theatres, would have continued to employ purpose-built, and subsequently dismantled, temporary stages.

Apart from their potential as surrogates or even experimental 'testing grounds' for full-scale scenic machinery and effects in large theatres, automata also featured in philosophical and aesthetic concerns. Aristotle (*Generation of Animals*, 734b11–19) cites 'miraculous automata' as analogous to how embryos progressed having once been set in motion, to their subsequent development and realization without further intervention. 'The parts of these automatons, even while at rest, have in them somehow a potentiality; and when some external agency sets the first part in movement, then immediately the adjacent part comes to be actuality.'<sup>23</sup> He also drew comparisons between automata and the operation of the cosmos, once initiated by the single act of a divine agent, 'to produce all kinds of results easily by means of a single motion, just like the operators of machines who produce many varied activities by means of the machine's single release-mechanism' (*On the Cosmos*, 6.398b13–20).

Heron says nothing about the circumstances under which his toy theatre might be used. However, the deployment of automata (large and small) in a variety of venues is well documented.<sup>24</sup> Xenophon (*Symposium* 4: 55) refers to a dinner party in the late fifth century where reference is made to the use of marionettes to present shows at private parties. Athenaeus (*Deipnosophistae* I.19e) asserts that such performances even took place in the venerable Theatre of Dionysus; 'The Athenians even

yielded to Potheinus, the marionette player, the very stage on which Euripides and his contemporaries performed their inspired plays.<sup>25</sup> During the period in which Heron wrote his treatise, Petronius describes a number of mechanical tricks (including automata) featured as part of Trimalchio's *triclinium* entertainments (*Sat.* 34.8–10; 36.3–4; 60.1–3). Indeed his guest Encolpius, conditioned by the ludic nature of the occasion, came to expect such things; 'so I proceeded to look all round the *triclinium* in case any automaton should jump out of the wall' (54.4).

We have a great many references to the types and variety of entertainments presented at private Roman dinner parties, including prominently recitations of poetry and performances of plays or scenes from plays. It seems altogether likely (since automata clearly featured at such occasions) that a toy theatre presentation would be ideal. This could appropriately be accompanied by a recitation of texts relevant to any drama being thus 'staged'. In that regard, it is striking how in Heron's scenario each of the scenes depicts an episode of precisely the type which in actual tragic performance as it customarily took place would not have been *enacted*, but rather *recounted* by the chorus. In other words, events which in conventional theatre practice were evoked and painted in the mind's eye of the spectators through *language*, were in Heron's theatre depicted by actual *images*.

Heron stipulated (2.22.3) that for the first scene there should be 'twelve painted figures arranged in three rows', representing sailors who appear again in the second scene, launching the boats. This corresponds to the number of performers typically deployed in a Greek tragic chorus in the first part of the fifth century, in the course of which it is believed to have increased to 15.<sup>26</sup> Such a chorus, however, would narrate as onlookers and commentators – while perhaps evoking through choreographed gestures and movements – the events they described, rather than actually acting them. Nor, of course could an act of violence, such as the destruction of the sailors, and of Ajax be shown on stage. It seems to me probable and appropriate that a 'performance' of the scenario could be accompanied by someone narrating from a text based either upon the myth, or indeed drawn from the actual choral odes of the 'original' drama as represented by the automaton. As noted earlier, Heron remarks that (if, for example, more time were required to explicate a scene) the operation of an automaton could easily be stopped and restarted

In fact (and as a very suggestive analogue), a conjunction of images and language presented intermedially to viewers/listeners/readers for the purpose of edification or entertainment (in addition to its most

obvious deployment in the theatre itself) was commonplace in antiquity, through the rhetorical and literary practice of *ekphrasis*. A commentator in effect 'narrated' to his audience a highly evocative account of what was described as taking place in a painting or other art object, through which the static moment 'frozen' graphically in the painting was enlivened in such a way that it took place imaginatively in both time and space in the 'mind's eye' of the audience.<sup>27</sup> In other words, the painting, through exegetic description, becomes a sequential scenario whether for a live audience or for those reading the ekphrastic text. The most comprehensive surviving example of *ekphrasis* is Philostratus the Elder's *Eikones* believed to have been written early in the third century AD. It exists of course as written text, but Philostratus presents this as if it were an account – virtually a transcript – of an actual ekphrastic performance through which some 64 paintings in a villa on the bay of Naples were explicated and vividly brought to life before an audience of young students.

In Heron's work, layers of intermediality and cognitive blending are introduced through what is (A) a written text; purporting to be (B) a first-hand account; of (C) an actual event; at which (D) real paintings were at hand; which moreover are showing (E) 'actual events', but often characterized as if the narrator were also evoking (F) 'theatrical enactments' of their content that might have taken place in an actual or mechanical theatre. Philostratus presents a large number of images depicting myths that were the subject of theatrical performance, and he often refers his audience (both fictional and those reading his text) to such enactment, as well as frequently paraphrasing in his text identifiable passages from the dramas themselves. Such works include, for example, the *Madness of Hercules* (2.23), *Hippolytus* (2.4), *Antigone* (2.29), and the *Bacchae* (1.18).

In each case, although discussing a single painting, Philostratus provides an account of multiple episodes in a manner that forcefully reminds us of the several scenes through which Heron presented the *Nauplius*. For example, his discussion of the *Bacchae* includes in addition to the episode of Pentheus' destruction such sequential episodes as 'choruses of Bacchantes, and rocks flowing with wine'; 'in the foreground we now see Thebes and the palace of Cadmus and lamentation over the prey, while the relatives try to fit the corpse together'; the women having come to their senses; Agave with the head of her son; 'Harmonia and Cadmus are there, but not as they were before; for already they have become serpents from the thighs down...and the change of form is creeping upward.' In the *Madness of Hercules*, Philostratus notes, 'indeed I have heard him in the play of Euripides... The Fury which has gained

this mastery over him you have many times seen on the stage.' The description provided for *Hippolytus* (closely echoing Euripides 1166 ff.) evokes the destruction of his chariot 'the horses overcome with panic and terror...they neigh shrilly, unless you fail to hear the painting', while framing the narrative with references to 'the story up till now'.

A particularly suggestive example is Philostratus' treatment of *Cassandra* (2.10). He writes, 'If we examine this scene as a drama, my boy, a great tragedy has been enacted in a brief space of time, but if as a painting, you will see more in it than a drama.' He details the scene of destruction in which Agamemnon and his followers have been butchered while Clytemnestra is about to bring the axe down upon Cassandra (something which, in fact, could only be narrated not depicted on stage). 'As the axe is now poised above her, she turns her eyes toward it and utters so pathetic a cry that even Agamemnon... will recount it to Odysseus in Hades.' Philostratus (while implicitly evoking the *Odyssey* 11.421) also explicitly compares it to a theatrical enactment. 'The most prominent place in the scene [Philostratus uses here the word *skéné*] is occupied by Agamemnon, who lies... among boys and women-folk.' As Squire points out (2013, fn. 68), 'the speaker weighs up the resources of tragedy against those of painting, all the while knowing that, like theatre itself, this 'painting/description' blurs the boundaries between seeing and hearing.'

Of course a 'drama' was itself the live performance of a text which in turn was the textual evocation of a myth. So – in both an ekphrastic account well as the example of a toy theatre – we have a loop involving myth, text (drama), imaginatively evoked allusions to theatrical enactment of the text in performance, while of course such performance in the theatre was in turn an attempt by actors within a real/fictional space (the stage) to embody, give voice to, kinetically enact, and unfold sequentially in time, this same material, 'theatricalized'. Intermedial and cognitive wheels, within wheels, within wheels. Or in the case of Heron's theatre, allusions and illusions conjured up by a 'real' mechanism of weights, doors, cords, spindles, axles, pulleys, wheels, drops, fire, flats, and a cyclorama, all in the service of show business: the *ars ludicra*.

## Notes

1. Pliny (1969); *Paneg.* 46.4. Pliny lamented 'Could any place remain ignorant of the miserable mood of adulation, when praise of the Emperors was celebrated in shows and competitions, while dancing and shrieking and every sort of sound and gesture was expressed in effeminate buffoonery? (Pliny, *Paneg.* 54.1–2).

36 *Interrogating Historiography*

2. For additional use of the term, see e.g. Livy, 7.2.13; 45.32.9; Quintilian, *Inst. Orat.* 3.6.18; Plautus, *Aulu.* 626; Cicero, *Rep.* 4.10.
3. *Peri Automatopoietikēs (On Automaton Building)*, 2.20–30: Book Two ‘On Stationary Automata’. Heron’s date is securely established by his reference to a lunar eclipse known to have taken place in AD 62. It is at least possible that Heron’s work was known to Nero. In his book on Pneumatics, he describes a hydraulic organ; a topic in which Nero was keenly interested. Suetonius records how Nero ‘spent the day exhibiting some water-organs of a new and hitherto unknown form, explaining their several features and lecturing on the theory and complexity of each of them; and he even declared that he would presently produce them all in the theatre’ (Suet. *Nero.* 41) On the vexed question of whether ancient performances were actually customarily composed and presented in discrete scenic units, see R. Ferri, ‘Scenes in Roman Drama: A Lexical Note’, *Classical Quarterly* (New Series) 58:2 (December 2008), 675–81.
4. These are cited and described in W. Schmidt, *Heron Alexandrinus, Opera*, Vol. I, *Druckwerke und Automatentheater Griechisch und Deutsch Herausgegeben* LI–LXIX (Leipzig: Teubner, 1899), 53–6.
5. See Sharkey, who notes, ‘A program is simply a set of instructions that tell a machine what to do. They don’t have to be written out; they can be hard-wired into a machine. The important point is that these instructions can be changed without having to dismantle or rebuild the entire mechanism – in other words, the program has to be separate from the rest of the machine’s workings’ (32). He claims that in effect, Heron employed a ‘mechanism [that] provides the basis of a simple programming language’ (35). N. Sharkey, ‘I Ropebot’, *NewScientist*, 7 July 2007, 32–5.
6. The evidence is considered by C. W. Marshall, ‘Sophocles’ *Nauplius* and Heron of Alexandria’s Mechanical Theatre’, in A. H. Sommerstein (ed.), *Shards from Kolonos: Studies in Sophoclean Fragments* (Bari: Levante Editori, 2003).
7. Cf., however, Formigé who, exceptionally, believed that Heron’s Book Two provides important evidence for Hellenistic staging conventions. J. Formigé, ‘Note sur les machines des décors mobiles dans les théâtres antiques’, *Bulletin de la Société Nationale des Antiquaires de France* (1921), 190–5.
8. Brockett, Mitchell and Hardberger, *Making the Scene*, 80–1. The development of such scenery is detailed in a great many theatre historical books, most recently and comprehensively by Brockett et al., 62–109. The first translation into Italian of Heron’s work on automata was by Baldassare Baldi, published in 1589. Leclerc believes moveable scenery first appeared with experiments to create the Roman *scaena versilis* and *scaena ductilis*; H. Leclerc, *Les origines italiennes de l’architecture théâtrale moderne: l’évolution des formes en Italie de la Renaissance à la fin du XVIIe siècle* (Paris: Droz, 1946).
9. The earliest known sketch by Jones showing a proscenium arch is for *The Masque of Queens*, 1609. See S. Orgel and R. Strong, *Inigo Jones: The Theatre of the Stuart Court* (Berkeley, CA: University of California Press, 1973), 138, and fig.15.
10. See Richard Beacham, *Adolphe Appia: Theatre Artist* (Cambridge: Cambridge University Press, 1987), 57–8.



11. All translations used here from Heron are quoted from S. Murphy, 'Heron of Alexandria's *On Automaton-Making*', in G. Hollister-Short and F. James (eds), *History of Technology*, Vol. 17 (London: Mansell Publishing, 1995), 1–44.
12. See Richard Beacham, 'The Emperor as Impresario: Producing the Pageantry of Power', in K. Galinsky (ed.), *The Cambridge Companion to the Age of Augustus* (Cambridge: Cambridge University Press, 2005), 151–74.
13. For references to the use of the *pegma*, a sort of scenic flying device, see Richard Beacham, *The Roman Theatre and its Audience* (Cambridge, MA: Harvard University Press, 1991), 180–1. Juvenal (4.122) notes how it could 'whisk boys away, up into the awning'.
14. In that regard, cf. R. Schöne, 'Zu Hyginus und Hero', *Jahrbuch des Kaiserlich Deutschen Archäologischen Instituts*, Vol. 5 (1890), 73–7. He notes that Heron states he accepted most of Philon's scenario 'except Athena's crane; here ... he made the mechanism unnecessarily difficult, because it is quite possible for her to appear on stage, and then disappear again without a crane' (2.20.2), going on to outline the method which he, Heron, subsequently includes (2.29.1) in his description of the fifth and final scene. And yet, as Schöne points out, elsewhere in the text of his treatise Heron nevertheless refers to the presence of a crane (in the 'fly tower' above the stage). Schöne takes this contradiction (or negligence) as evidence to suggest that in fact, apart from his description of scene 5, 'the largest part of Book Two of the [Heron] text... is taken very faithfully, and perhaps *verbatim*, from Philon.' (My translation from the German.)
15. Heron mentions the plug and how by opening and closing a lid the flow of the sand could be stopped and started (in his description of the column used for a moving *automaton* (1.9.4–5)) to pause and then recommence its movement. However, the same mechanism could easily be used for the column of the stationary toy theatre, thus allowing the descent of the weight to stop, and the scenario to be paused, if, for example, a narrator wished to linger over a particular scene.
16. Margarete Bieber, *The History of The Greek and Roman Theater* (Princeton, NJ: Princeton University Press, 1961), 283, fn. 31, cites Bulle, 'Untersuchungen an griechischen Theatern', 50 ff., who suggested that post holes associated with the Theatre of Dionysus at Athens were 'for shelves, where rolls of painted canvases used for scenery were stored'.
17. Heron notes in regard to the crane-like mechanism called for by Philon to raise Athena above the stage, 'for some reason he made the mechanism unnecessarily difficult'. He suggests a different method 'since it is quite possible for her to appear on stage, and then disappear again, without a crane' (2.20.2).
18. Cf. Marshall, C. W., 'Sophocles' *Nauplius* and Heron of Alexandria's Mechanical Theatre', in A. H. Sommerstein (ed.), *Shards from Kolonos: Studies in Sophoclean Fragments*. (Bari: Levante Editori, 2003), 263.
19. The best account of the Hellenistic theatre structure and the evidence for its scenic provision remains Bieber, chs 6 and 9. Leacroft presents some useful depictions of several Hellenistic theatres, including some with *thyromata* (which he dates to mid-second century BC. R. Leacroft and H. Leacroft, *Theatre and Playhouse* (London: Methuen, 1984), 16–26.

38 *Interrogating Historiography*

20. Varro also refers to *scaenae ductiles*. See Gino Funaioli, *Grammaticae Romanae fragmenta collegit* (Lipsiae, in aedibus B. G. Teubneri, 1907), fragments 309–16. The evidence for the use of changeable scenery in Roman theatres is presented by P. Kragelund, 'History, sex, and scenography in the Octavia', *Symbolae Osloenses*, 80:1 (2005), 112–13. See also W. Beare, *The Roman Stage*, 3rd edn (London: Methuen, 1964), Appendices F and H.
21. Beare also discusses (271–2) how the large curtain, the *aulaeum* which dropped (or might also be raised) at the front of the stage, to conceal and reveal the entire scenic space, was used together with the smaller *siparia* to effect scene changes. Heron's deployment of his stage doors successively to reveal a new scene on stage seems analogous to this. It would seem that the *siparia* were similar in function and purpose if not indeed the same as the Greek *katablemata*, referred to by Pollux (Onomasticon, 4.131) 'the *katablemata* were hangings or flats that contained pictures suitable for use in dramas'. Bieber (74) notes 'The backdrops or screens are called *katablemata*, throw-overs, wrappers, by Pollux... they could be thrown over the more permanent frame very quickly' to effect changes of decoration. Beare records that Bulle (24ff.) 'is of the opinion that these decorations were movable scenery with pictures painted on canvas or wooden tables and attached to a permanent frame'.
22. Vitruvius (5.5.7): 'Many theatres are built every year in Rome... our public theatres are of wood and contain a great deal of boarding.' References to wooden theatres at Rome continue into the imperial period with examples cited in the reigns of Augustus, at the *Ludi Saeculares* of 17 BC, and later during the reign of Caligula, and of Septimius Severus in 204 BC. See the discussion in Beacham, *The Roman Theatre and its Audience*, 63–8, and 'Playing Places: The Temporary and the Permanent', in J. Walton and M. McDonald (eds), *The Cambridge Companion to Greek and Roman Theatre* (Cambridge: Cambridge University Press, 2007), 202–26.
23. See Berryman for a discussion focused upon Aristotle and the role of *automata* (including the inventions of Heron) in Greek philosophical thought. S. Berryman, 'The Imitation of Life in Ancient Greek Philosophy', in Jessica Riskin, (ed.), *Genesis Redux: Essays in the History and Philosophy of Artificial Life* (Chicago, IL: University of Chicago Press, 2007).
24. Schürmann (2002) 44 notes that 'automatic and semi-automatic mechanical devices became an important part of private and public representation. Literature offers us many examples' (44). He also suggests, 'It is possible that during the third and second centuries BC – when mechanics was emerging as a new science – Philon's little pneumatic scenarios and automatic theatres were presented at private *symposia* in addition to or in replacement of the puppets and marionette-shows' (45). A. Schürmann, 'Pneumatics onstage in Pompeii: Ancient Automatic Devices and their Social Context', in J. Renn and G. Castagnetti (eds), *Homo Faber: Studies on Nature, Technology, and Science at the Time of Pompeii* (Rome: L'Erma di Bretschneider, 2002), 35–55.
25. For the philosophical and theological 'role of puppets' in antiquity, see the discussion in Scott Shershow, *Puppets in Popular Culture* (Ithaca, NY: Cornell University Press, 1995), ch. 1. In later times a statue of the puppeteer Eurycleides was erected in the Theatre of Dionysus, see A. Haigh, *The Attic Theatre* (Oxford: Clarendon Press, 1889), 161.

26. For the significance of a chorus numbering 12, see D. Wiles, *Tragedy in Athens: Performance Space and Theatricals Meaning* (Cambridge: Cambridge University Press, 1997), 94–6.
27. Petronius' character, the philosopher and poet Eumolpus, gives an ekphrastic presentation in verse detailing a painting of the fall of Troy (*Sat.* 89–90). Some people in the area throw stones at him. He notes, 'whenever I go into the theatre to recite something, this is the sort of low-life mob that greets me.' When he recites at the baths, he is thrown out just as in the theatre (*Sat.* 92).