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RECONSTRUCTING A LATE ARCHAIC-PERIOD DIONYSIAN SHIP CART

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Abstract. The Greek deity Dionysos had a particular affinity for war galleys, a relationship perhaps explained by the Homeric Hymn to Dionysos in which Tyrsenian pirates kidnap him on their galley. Soon grape vines entangle the rigging and some of the pirates attempt to escape their fate by jumping into the sea: Dionysos transforms them into dolphins. This hymn served as an occasional motif in pagan art and may explain the miniaturized replicas of seagoing oared ships that played an integral role in the ancient Dionysian cult. These flimsy Dionysian ship carts moved overland in parades, either on wheels or upon the shoulders of celebrants. While the earliest examples may date to the Late Bronze Age, they are best known from a series of three late Archaic-period representations on black-figure *skyphoi*, now in museums in Athens, Bologna and London. No two Archaic-period Dionysian ship-cart representations are identical in all details. While perhaps due to painters' whims, this diversity in appearance may reflect changes to the ship carts at each annual appearance, analogous to modern-day parade floats. Due to the two-dimensional nature of these ship-cart images, it is impossible today to determine whether the Dionysian ship carts reflected in them consisted of actual vessels—purpose-built and placed on wagons during the procession, employed solely for the Dionysian celebrations—or floats in the form of miniaturized galleys. This paper supplies context and explains the process of creating a three-dimensional digital reconstruction of a generic Late Archaic-period Dionysian ship cart employing contemporaneous imagery and artifacts.

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The Context

The Greek deity Dionysos had a particular connection with war galleys. In the Homeric Hymn to Dionysos, Tyrsenian pirates who are unaware of his godhead, kidnap Dionysos in their galley (*Hymn. Hom. Bacch.*).⁴ Immediately, grape vines climb the rigging and some of the pirates leap into the sea where they are transformed into dolphins. This hymn served as an occasional motif in pagan art (Fig. 1; Arias & Hirmer 1962, pp. 301–302, pl. XVI; *LIMC*, s.v. Dionysos; Beazley, 1986, pl. 67; Basch, 1987, p. 226, fig. 471; Spathari, 1995, p. 97, fig. 109; Isler-Kerényi, 2007, pp. 180–187, fig. 104; Yacoub, 2007, pp. 172, 173, figs. 86, 174). From the end of the Bronze Age galleys, or replicates of these vessels, played an important role in the Dionysian cult (Wachsmann, 2013, pp. 120–121, 203–204). In some contexts, celebrants transported these cultic miniaturized galleys overland, either as a wheeled ship cart, or supported on their shoulders. The Dionysian cult has

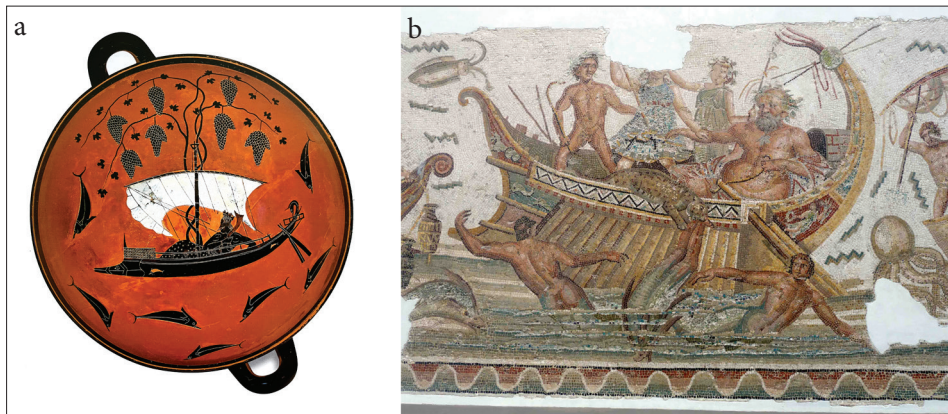


Fig. 1. Examples of the Homeric Hymn to Dionysos in art: A) The Exekias Cup, circa 535 BC (from Spathari, 1995, p. 97, fig. 109); B) Mosaic from Dougga, Tounisia, Third-century AD (photo by S. Wachsmann)

⁴ For a glossary of nautical terms, see Appendix 4.

also been linked to galley races and related terracotta ship models have been found in the sea, apparently arriving there as part of a cult practice (Gardner, 1881a; 1881b; Harrison, 1885; Wachsmann, 2013, p. 128, fig. 3.48, pp. 131–132).

The return of Dionysos in the spring from overseas by ship was celebrated in Athens at a time of the first wine (Robertson, 1985, pp. 292–293). Most authors connect this to the *Anthesteria* festival, which took place in the Athenian month of *Anthesterion*.⁵ As part of the festivities in honor of Dionysos, an actor role playing the deity arrived in Athens for a *hieros gamos* with the *basilinna*, transported in a highly decorated mock galley on wheels—i.e., a ship cart—accompanied by two aulos-playing actors dressed as satyrs (Pickard-Cambridge et al., 1968, p. 11, n. 8, 12; Parke, 1977, pp. 110–113).

In Ionian cities during the third century AD religious processions termed *katagogia* included Dionysian ship carts. At Smyrna, a local Dionysian ship cart took part in the *Anthesteria*. Philostratus (circa AD 230–238) in describing the honors bestowed by that city on Polemo, a Sophist, writes (Philostr. VS I.25.531; translation by W. C. Wright in Philostratus and Eunapius, 1921, p. 107): “...for they bestowed on him and his descendants the right to preside over the Olympic games founded by Hadrian, and to go on board the sacred trireme. For in the month



Fig. 2. Dionysos on a ship cart on a black-figure *skyphos* now in the Athens Museum (after Kerényi, 1976, ill. 57)

⁵ See Robertson, 1985, p. 292, n. 119 for references. Robertson himself disagrees with this view.

Anthesterion a trireme in full sail is brought in procession to the agora, and the priest of Dionysus, like a pilot, steers it as it comes from the sea, loosing its cables”⁶

While at Delos no references have been found regarding the ship cart of Dionysus itself, texts from there do indicate that a purpose-built road made of wooden planks was constructed for the Dionysian ship cart and payments are recorded for workmen for ballasting the ship cart with lead (Sifakis, 1967, p. 10,

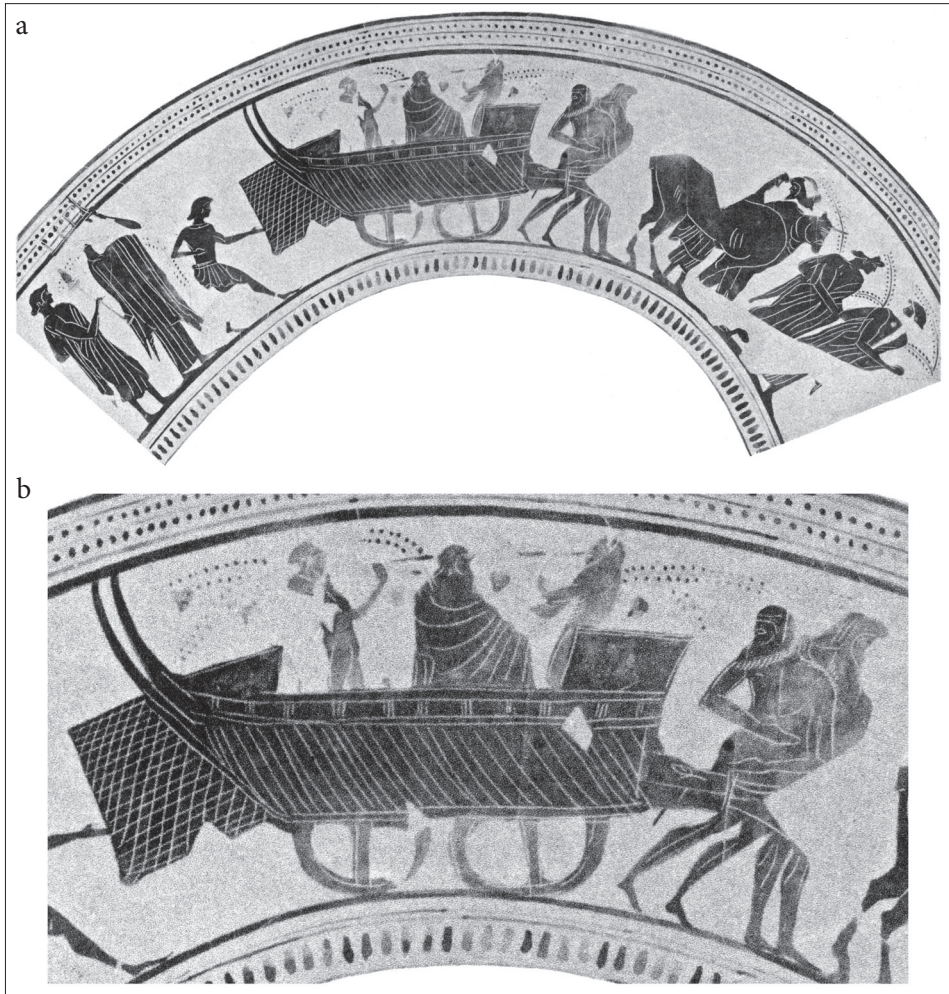


Fig. 3. Scene of Dionysos on a ship cart painted on an Attic *skyphos* now in the Bologna Museum (from CVA Bologna 2 (Italy 7) Tav. 43: 88.4)

⁶ The use of the term ‘trireme’ in this late context by Philostratus is curious. This designation continues to the fourth century AD, but may be intended here simply for a replica of a vessel, or copy of a vessel, resembling an old-style warship (W. Murray, pers. com.).

ns. 7–9). As G. M. Sifakis (1967, pp. 10–12) notes, the ballasting of this vessel with lead suggests that it must have been launched on water, at least at Delos. Also unusual is the fact that lead is referenced as ballast as this metal was not normally used for this purpose in antiquity.

Undoubtedly, the best known depictions of the Dionysian ship carts are a series of three painted on Attic black-figure *skyphoi*, dating circa 500 BC and now in museums in Athens, Bologna and London (the British Museum) (Figs. 2–4; Simon, 1983, p. 94, fig. 12; Robertson, 1985, p. 291; Basch, 1987, pp. 227, 228, fig. 475 [Athens Acropolis 281, Bologna Museum no. DL 109 and British Museum B 79]).



Fig. 4. Dionysian ship cart depicted on an Attic *skyphos* now in the British Museum, London (from Kerényi, 1976, ill. 59: B–A); Fig. 4: B © The Trustees of the British Museum)

The ship carts consistently appear in a starboard view so that the bow with boar-head waterline ram faces right. This is the typical type of ram known from the Archaic period (Spathari, 1995, pp. 82–99, figs. 91, 94–5, 97–102, 103, 106–108, 113, 114; Casson, 1995, figs. 81–85, 88–90). From the center of the forecastle aft a row of closely-spaced vertical lines—presumably representing a row of oars—descend from near the sheer strake. Due to its seeming rigidity, S. Wachsmann (2013, p. 121) interprets this element as indicating a panel made of some light material, such as wood or a light framework covered with plaster, with the oars carved and/or painted on to create the illusion of oar banks. These Dionysian ship carts are clearly relatively light and modest devices more akin to floats as, first, they appear consistently with only three actors inside roleplaying Dionysos and his two companion aulos-playing satyrs and, second, they role on two pairs of spoked wheels.

These proportions are the complete opposite of another class of the cultic ‘land’ ships of Athens—the Panathenaic ships—which were used to transport the specially-woven peplos of Athena every four years during the ‘Great Panathenaea’ celebration (Wachsmann, 2012; 2013, pp. 132–155). These behemoths rolled on four sets of apparently solid wooden wheels.

The oar panels hide the carts’ wheels except for about the bottom third of their circumference. The wheels are of two types. On the Bologna *skyphos*, the ship cart has four-spoked wheels while the other two move on wheels with crossbar spokes, which are known from other contexts from sixth-century BC Greece and Italy in both iconography and the archaeological record (Von Bothmer, 1985, pp. 64, 182 [Cat. 47]: right and front, 184, fig. 100: A; Crouwel, 2012, pp. 81–83, pls. 94–96, 98, 101–103, 107–109, 114–115). These wheels have two secondary spokes that bisect a single long spoke that crosses the diameter of the wheel. Similar wheels



Fig. 5. Black-figure of Dionysos at sea on a galley bearing stern ‘drapery’ (from Basch, 1987, p. 226, fig. 470: A)

appear on a Dionysian ship cart depicted on a lead sheet from Montagna di Marzo in central Italy, but this has been identified as a fake (Wilson, 1987–1988, p. 135, fig. 36; Wachsmann, 2013, pp. 121, 126, fig. 346; Tiverios, 2013).

Archaic depictions of Dionysian ship carts include what appears at first glance to be heavy ‘drapery’ of some sort. On two of the *skyphoi* this object is carried over the stern, hanging down over the stern castles (Figs. 2, 4). On the British Museum *skyphos* this ‘tapestry’ appears to hang in folds at the bottom. The Bologna ship cart, however, carries this item over the stern stretched on a yard. In all three cases, these devices are depicted with a lattice decoration. This stern decoration seems to be a hallmark of the Dionysian cult on Greek ships. This same device also appears at the stern of a galley carrying Dionysos and his entourage depicted on an amphora now in the Museum of Tarquinia (no. 678) (Fig. 5; Basch, 1987, pp. 225–226, fig. 470: A). Greek depictions of this device

on galleys that are not connected to Dionysos appear on two ship scenes in which Odysseus is shown lashed to the mast of his ship in vignettes depicting his encounter with the harpies (Basch, 1987, pp. 237–238, fig. 497, p. 270, fig. 574; Spathari, 1995, p. 105, fig. 121).

This ‘fabric-like’ element is also seen draped over the stern castles of terracotta models of galleys found in the sea; presumably their arrival there was the result of a cultic practice connected to Dionysos. A particularly notable example of this comes from Gytheion, the port of Sparta (Fig. 6:

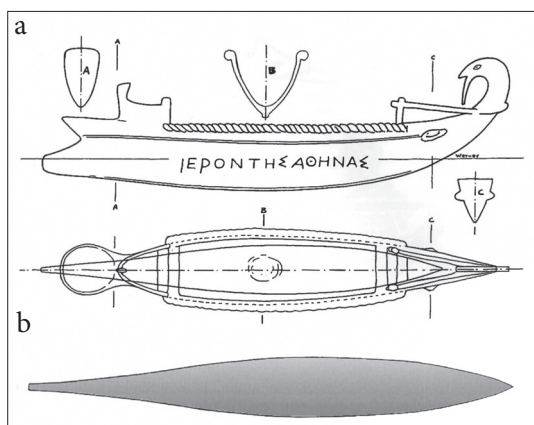


Fig. 6. A–B) Line drawing of the Erechtheion model: a) Port side and plan view (from Göttlicher, 1978, Taf 27, no. 362); b) Waterline plan view (after Göttlicher 1978, Taf 27, no. 362); C) The terracotta galley model from the sea at Gytheion, the port of Sparta (photo by S. Wachsmann)

C; Basch, 1987, pp. 428, 432, figs. 936–938, p. 433, figs. 939–943, p. 434, figs. 940–941, p. 435; Spathari, 1995, pp. 136–137, fig. 165; Göttlicher, 2004; 2008). An Archaic-period tomb painting of a galley from Elmalı, Turkey also has a somewhat similar covering (Toby, 1979, p. 8, fig. 3). O. Höckmann (pers. comm.) has brought attention to Phoenician coins of Sidon and Arados dating to the fifth–fourth centuries BC that also carry a similar device (Basch, 1987, p. 321, figs. 675–676, 678, p. 322, fig. 681, p. 323, fig. 682, p. 324, fig. 685, p. 325, figs. 687, 692–693, p. 329, figs. 703–704, p. 330, figs. 712–715).

What is the meaning of these stern hangings? They have been identified as fabrics or draperies (Basch, 1987, pp. 227–228, fig. 475). Galleys on black-figure vases often bear forecastles decorated with crosshatching, at times containing similar decorations in the form of circles, dots or stars (Basch, 1987, pp. 207–220; Spathari, 1995, pp. 84–88, 93, 97, figs. 94–100, 106, 109).

A single sherd now in the Tübingen Institute for Classical Archaeology, gives the most detailed representation of this item (Fig. 7; Watzinger, 1924, p. 31, no. 53, Taf. 15: D53; Göttlicher, 1992, p. 105, Abb. 60; Wachsmann, 2013, pp. 121, 124,



Fig. 7. Black-figure sherd with bow section of a Dionysian ship cart now in the Tübingen Institute for Classical Archaeology (Inv. S./10 1497). This is the most detailed account of the ‘screen’ element. In this case, the screen stretches the entire length of the hull appearing on the sherd. (Courtesy of the Tübingen Institute for Classical Archaeology)

127, fig. 3.47: B). The sherd depicts part of a Dionysian ship cart facing right. The ear and part of the eye of the boar-head ram are visible at the far right indicating that we see the forward part of the hull. A four-spoked wheel appears below the boat cart. In this example, the ‘drapery’ replaces the oar panel for the entire length of the hull visible on the sherd. The Tübingen sherd example is the most detailed existent representation of this feature. The decoration has a hatched diagonal grid pattern with wavy lines. In the pattern of alternating gray and black rectangles formed in this manner each one bears a central motif (a flower?) and seems to represent a richly embroidered, or woven, fabric. This appears to be an illusion, however.

Elizabeth J. W. Barber notes that, while the pattern seems to replicate a heavy hanging fabric, this interpretation is problematic.⁷ Although the pattern

⁷ See below: E. J. W. Barber, Appendix 1: The Fabric-Pattern on Archaic Dionysian Ship Carts.



Fig. 8. The Gurob ship-cart model (Courtesy of the Petrie Museum of Egyptian Archaeology, University College, London)

forms a grid typical of textiles, Barber notes that this wave-like pattern is exceptionally difficult to create with ordinary repetitive weaving techniques, either in plain-weave-based fabrics or in tapestry. She concludes, therefore, that the pattern that the artist depicted represents a design painted on planking or canvas intended to replicate a textile, or that the pattern was the invention of the artist.

As the same lattice pattern appears on the other Dionysian ship-cart representations, Wachsmann prefers Barber's first explanation; that is, the decoration represented here is a textile design painted on another medium, such as carved wood, stucco or canvas. If this interpretation is correct, then it implies that this replication of 'drapery' in another medium must have evolved from an age predating the Archaic period when actual drapery was used for this purpose and that, over time, this was replaced by a panel that represented that original textile.

That Dionysian ship carts were an 'old' item in the Archaic period is hardly surprising. While Dionysos was considered a 'new' or a 'young' god in Classical times (Hdt. II, 2.49), this is strange, since Dionysos is documented in Linear B texts from Pylos and Khania (PY EA102 [previously Xa 102], and Xa 1419; KH Gq 5; Ventris & Chadwick, 1973, pp. 127, 411; Chadwick, 1976, pp. 85, 87, 99–100; Baumbach, 1979, pp. 146–147; Ruipérez, 1983; Hallager et al., 1992, pp. 76–80, 86, pl. 6A; Duev, 2017, pp. 226–230).

Wachsmann (2013, pp. 203–204) suggests that the Gurob ship-cart model replicates a Late Bronze/Early Iron Age Dionysian ship cart (Fig. 8).⁸ The broken

⁸ Regarding the date of the Gurob ship-cart model, see Wachsmann, 2013, p. 28; Prior, 2013.

model, together with loose pieces from it—including four wheels—were the only items found in Tomb 611 (Brunton & Engelbach, 1927, p. 17, pl. LII). This raises the likelihood that the burial may have been intended solely for the model itself.⁹ Among the loose pieces in the tomb was a small item of woven material that might, perhaps, represent a precursor to the drapery-like decoration on Archaic Dionysian ship carts (Wachsmann, 2013, pp. 29, fig. 1.28: D, 30).

A Late Helladic III fragment of a terracotta ship model from Pyrgos Livanaton (Homeric Kynos), roughly contemporaneous with the Gurob ship-cart model,

bears a perforation intended for an axle to support a pair of wheels; this is the earliest evidence at

present for a representation of a

ship on wheels in the Aegean region (Fig. 9; Dakoronia, 2002, pp.

283–284, 289, figs. 1–4). Nearby excavation revealed a terracotta wheel

(Dakoronia, 2002, pp. 283–284). The excavator considers the ship model a

child's toy but notes that such toys-on-

wheels are unknown from this period. If

the Kynos ship model on wheels is cultic

rather than a toy, which seems likely, still

there is no hint of to which cult it may

be related. Following the Kynos ship, the

next appearance in the Aegean world of

depictions of ship carts are the Archaic-

period Dionysian ship carts that are the

focus of this paper.

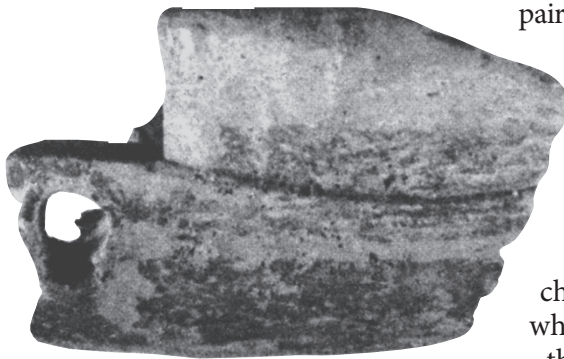


Fig. 9. A terracotta ship model fragment from Pyrgos Livanaton (Kynos) bears an axle hole for wheels (from Dakoronia, 2002, p. 289, fig. 2; Courtesy of the Hellenic Institute for the Preservation of Nautical Tradition)

Two other representations have been identified as Dionysian land-based cultic vessels. J. Boardman (1958) convincingly reconstructs a meager group of sherds purchased at Luxor, but said to have come from Karnak, as a panel with a group of men carrying a Dionysian 'land' cult ship on their shoulders *sans* cart. The second scene appears on the Anavysos Chous; the *chous* is a one-handled jug type linked to the Dionysian Anthesteria (Pickard-Cambridge et al., 1968, pp. 1–25; Richard, 1992). R. Hamilton (1978) suggests that the Anavysos Chous may represent a Dionysian ship cart, but the relevant scene seems better understood as representing a stage purpose-built in the form of a ship for a dramatic performance than as an actual cultic ship cart (Wachsmann, 2013, pp. 125, 131, fig. 3.51). Cultic ships on wheels, or transported by porters, are a rarity in the Minoan and Mycenaean cultures. One exception, if it even can be accepted as

⁹ On boat burials in ancient Egypt, see Creasman & Doyle, 2015; Inglis, 2020.

such, is the model of a ship carried by a mourner on the Hagia Triada Sarcophagus (Late Minoan IIIA) (Long, 1974, pp. 46, 48–49, pl. 19, fig. 52).

A possible hint as to the source from which the use of wheeled conveyances became associated with cult already in Iron Age Greece perhaps may be seen in the three-wheeled bull-head chariot statuette from Karphi in Crete (Pendlebury et al., 1937–1938 (1940), p. 81, Cat. no. 24: D, pl. XXXV: 4; Seiradaki, 1960, p. 28, n. 3, pl. 13; Hutchinson, 1962, pl. 21; Gesell, 1985, p. 210, pl. 159: a–b; Sakellarakis, 2006, pp. 95, 97, no. 11046; Mohen & Eluère, 2000, p. 128). The three-wheels of the Karphi chariot, topped by animals, implies the introduction into Crete at this time of a foreign element. Its remarkable arrangement indicates a specifically European source. Three-wheeled cult objects, such as the better preserved of the two Dupljaja bird chariots from Serbia (Dubovac-Žuto Brdo culture, ca. 1600–1300 BC), to later cult object of the Urnfield culture that integrate three wheels with the ubiquitous water bird that was so vital to their belief system seem to point in this direction (Kossack, 1954, pp. 10–12, 28, 53, 59, 79, Taf. 1, 3: 1b; Schauer, 1987, p. 17, Abb. 13; Pare, 1989, p. 85, fig. 4; Mohen & Eluère, 2000, p. 96; Vasić, 2004; Bouzek, 2005, pp. 27–28). Thus, the Karphi chariot suggests a syncretic mixture of bulls, sacred to Crete, with the central European motif of a three-wheeled cultic conveyance. Additionally, another possible link between the Dupljaja bird chariot to some depictions of Mycenaean chariots are parasols that apparently represent a foreign element (Wardle, 1973, pp. 328, 331, fig. 19; Crowel, 1973; French, 1973).

Reconstructing a Generic Archaic-Period Dionysian Ship Cart: Archaeological Considerations

We supply below details of the reconstruction creation process from the viewpoints of both the archaeologist (Wachsmann) and the 3D model builder (Sanders). Our goal has been to create a generic 3D version of an Archaic-period Dionysian ship cart by utilizing the clearest evidence for any given component, selecting from the contemporaneous iconographic or archaeological evidence. The following aspects were considered:

- As a rule, assumptions should be strenuously avoided in archaeological research (Wachsmann, 2019, pp. 11–12, n. 12). Reconstructing a Dionysian ship cart, however, made it unavoidable that some details had to be based on our best assumptions. A major aspect of the development of the 3D model was decision making regarding how to differentiate between what was documented in the evidence and what required inference. This entire process was by no means linear, both in the sense of Wachsmann's understanding of the evidence and how Sanders and his team created the 3D reconstruction, which was constantly being tweaked, corrected and refined.

- Given the variety of details apparent in the representations, it was necessary to make decisions when selecting what would typify A) the *most common* appearance of any given detail and B) the *most detailed* exemplar of that item. For example, the Institute for the Visualization of History (VIZIN) reconstructions have oar panels as depicted in two of the representations, and not the pseudo-drapery along the sides of the hull, as depicted on the Tübingen sherd. Conversely, the pattern from the Tübingen sherd's simulated drapery was selected specifically because it is the most detailed exemplar of the decoration of this element. Thus, it is important to emphasize that a Dionysian ship cart that appeared exactly like our generic 3D reconstructions was unlikely to have ever existed in reality.

- The reconstructed ship-cart's scale was determined based on the mean stature of men in ancient Greece based on skeletal remains.¹⁰

- While the existent representations of archaic-period Dionysian ship carts are all similar, no two are identical in all details. These divergences may be the results of the whims of the artist(s) who created these exemplars. More likely, however, it might reflect changes to the ship cart at each yearly appearance, exactly like a float taking part in a modern carnival parade. In the latter scenario, the 'ship' could have consisted of little more than a basic wooden framework



Fig. 10. Boat belonging to the Abdul Sharif family being placed on a wheeled wagon prior to the commencement of the Abu Haggag festival parade (*dura*) in 1998 (photo by S. Wachsmann)

¹⁰ See below: K. T. Glowacki, Appendix 2: Visualizing the Human Scale in the Recreation of the Dionysian Ship Cart.

hidden behind the oar panels and/or pseudo-drapery and with a galley's bow and stern recreated at each end. To a contemporaneous observer it would have looked like an actual miniaturized hull in the form of a galley. The iconographic evidence does not allow determination which of these two possibilities is correct, and it is not impossible that ship carts constructed in both manners were used at times in different Ionian cities. Due to the two-dimensional nature of these ship cart images, it is impossible to determine whether their prototypes were actual miniaturized hulls on carts, for example, like those used in the modern annual *moulid* (birthday festival) of Abu Haggag in Luxor, Egypt (Fig. 10; Wachsmann, 2022a; 2022b) or were simply floats in the form of a ship, lacking an actual structural hull. For our reconstruction we assumed an actual hull, but in the final version we present both possibilities.

- While no Archaic-period models of Dionysian ship carts are known to us, terracotta models found in the sea and outfitted with the pseudo-drapery element at their sterns—thus, linking them to the Dionysian cult—are always represented as galleys, with long and narrow dimensions (Fig. 6: C). Therefore, the ship carts may reasonably be assumed to have had a somewhat similar 'beam-to-keel' profile.

- Relevant comparable examples of the 'ship' part of the Archaic ship carts appear in the form of miniaturized models of an Archaic galley, presumably a *pentakonter*, that is a fifty-oared ship with 25 rowers to a side. These were long and narrow vessels (Basch, 1987, pp. 202–233; Casson, 1995, figs. 88–90; Spathari, 1995, pp. 82–99). As a concept model for the VIZIN 3D models Wachsmann selected the Erechtheion model, a miniaturized bronze model of a sixth-century BC Archaic galley dedicated to Athena found during the excavations of the Erechtheion (Fig. 6: A–B). Wachsmann (2012, pp. 248–255; 2013, pp. 135–136, 138, 142, 144–149) elsewhere has presented the evidence that this lamp/ship model is of fourth-century BC date and represents a Panathenaic ship, used in Athens every four years in the Great Panathenaia, in honor of the goddess Athena. The Panathenaic ship, however, was clearly patterned after an Archaic-period galley, so the Erechtheion model serves our purposes for the relative proportions of a miniaturized sixth-century BC Archaic-period galley (Wachsmann, 2012, pp. 248–255; 2013, pp. 135–136, 138, 142–149).

- Some parts of the ship cart do not appear in contemporaneous iconography but must have existed for it to function. For example, the cart must have had some form of base or platform that was at least roughly proportionate to the 'beam-keel' ratio of the 'ship'. Axles for the two sets of wheels must have been attached to the carriage. If an actual hull was used, then chocks would have been needed to keep it from keeling over. Also, the actor role-playing Dionysos sits amidships. It is difficult to determine whether the accompanying two satyr's that make up the god's entourage are meant to be sitting or standing. We assumed the latter option and added three thwarts. Note that none of these items are

visible in the ship-cart depictions. These ‘invisible’ items appear translucent in the VIZIN reconstructions.

- As noted above, Late-Archaic ship carts are shown with two different types of wheels. The VIZIN reconstructions roll on the spoke-and-bar type. At first, we considered using the spacing derived from ancient cart ruts. Some of these, perhaps dating to the Archaic period, seem to average about 1.4 m between the ruts (Pritchett & Miller, 1980, pp. 167–181; Casson, 1994, p. 69; Adkins & Adkins, 2005, p. 213). The *Diolkos*, on which cargoes, and sometimes ships (galleys) were transported across the Isthmus of Corinth, has ruts spaced 1.5 m apart (Pettegrew, 2011, p. 554; Adkins & Adkins, 2005, p. 213). We experimented with this spacing but abandoned this effort when it became clear that this spacing would not have permitted the wrapping of oar panels in the way depicted on the *skyphoi*. The ship carts must have had a narrow wheel base as replicated in the models. This could have made the ship carts prone to tipping

over, which may explain the need for a purpose-built, smooth, wood-covered road at Delos noted above.

- The reconstructions’ boar-head ram is patterned after the small (35 cm long) bronze Canellopoulos ram (Fig. 11; Zarkadas, 2017, pp. 79–82). This ram lacks boar’s ears but ears do appear prominently both on representation of ship carts as well as on depictions of actual galleys (Figs. 2–3, 7; Basch, 1987, p. 228, fig. 475; Spathari, 1995, pp. 86–87, 91, 95, 99, figs. 95–97, 104, 107, 113). This suggests that the boar-head ram’s ears may have been attached to hulls as pieces separate from the ram itself. Thus, the ears were added to the VIZIN reconstructions as stand-alone items (Fig. 14).

- To replicate the appearance of the oars of an actual galley, initially the oar panels were attached directly to the reconstructed hulls at a 45-degree angle (Fig. 14). Subsequently, this arrangement proved to be erroneous because on the Athens and London ship carts the pseudo-drapery at the ship-carts’ sterns covers the oar panels (Figs. 2, 4:



Fig. 11. The Canellopoulos boar-head ram (from Zarkadas, 2017, p. 81, figs. 1–4)

A). For this overlap to have been possible, the oar panels must have hung vertically, or at least very nearly so. When this issue was tweaked on the digital ship cart, however, the wheels intersected the oar panels (Fig. 15). In this manner, the digital model indicated clearly that this iteration of the reconstruction was patently incorrect; the ship cart must have had some type of spacer to which the oar panels had been attached in order to distance them from the wheels. Indeed, adding spacers to the 3D models at caprail height allowed the oar panels to clear the wheels (Fig. 16). From the existent iconographic evidence, it is not possible to determine how this was accomplished, nor its actual appearance. On the VIZIN reconstructions, translucent spacers support the oar panels away from the wheels. As the ship cart bumped its way through the rough streets of a Greek polis during a parade, we assume that the oar panels also would have benefited from an additional set of stabilizing spacers lower down in the structure for stability and to prevent the oar panels from knocking against the wheels.¹¹ Finally, to allow the oar panels to stand away from the hull, but also disappear behind the drapery device, the oar panels must have had a slight curve or arch (Fig. 17). Figure 18 demonstrates how such an Archaic-period Dionysian ship cart might have appeared, while Figure 17 shows the ship cart reconstructed as a simple framework float. The fully rotatable 3D model allows the reader to examine and test the reconstruction in greater detail.¹²

Reconstructing a Generic Archaic-Period Dionysian Ship Cart: 3D PDF Construction Considerations

Historians often hypothesize about objects and scenes depicted on wall decorations or on ancient pottery vessels. Correctly interpreting that imagery can be the key to successfully understanding the past, matching pictorial evidence to details found amidst archaeological assemblages or architectural configurations, and intuiting historical nuances lacking from excavations (Wachsmann, 2019). Difficulties can arise, however, because this analytical process tries to compare two-dimensional graphics to actual three-dimensional environments, actions, or artifacts. Carefully converting what is seen in two-dimension into three-dimensions, then, would seem to permit more detailed comparisons and thus more accurate conclusions. One example of just this sort of dualistic approach will be described here, in a process involving Shelley Wachsmann attempting to understand an object repeatedly represented in ancient iconography and the

¹¹ One can only speculate whether this solution on the Dionysian ship carts served as the inspiration for the invention of the outrigger that was soon to appear on triremes to enable three superimposed levels of rowers to work their oars. On the introduction of the outrigger, see Casson, 1995, pp. 80–88.

¹² See below: D. H. Sanders, Appendix 3: Navigating the 3D Pdf.

Institute for the Visualization of History (VIZIN), which specializes in creating innovative three-dimensional visualizations.

Dionysian ship carts can be found represented both as 2D representations on ancient pottery and as small 3D artifacts, such as the Gurob ship-cart model (Wachsmann, 2013). Would it be possible to use these examples collectively to build a detailed 3D computer model of a typical ship cart in order to better appreciate and understand its construction details, materials, and size? Are there enough clues among the many bits of related ancient evidence to allow us to reach reasonable conclusions to support a 3D model? What innovative tools are there for visualizing the resulting digital model so that scholars can interact with the model and closely examine the results? This excursus sets out to answer those questions while explaining the process that led to the final model, more-or-less in chronological order, so that the decisions can be understood in relation to the process of creating and refining the model. The evidence that we used is fully discussed in Wachsmann's section above, though passing reference to the relevant artifacts and illustrations will be made here.

When Wachsmann invited VIZIN to assist his investigations into the nature of an ancient ship cart used during a particular ceremony of the Dionysian cult, some progress had already been made at creating a 3D computer model of the vessel. These early attempts, by then graduate student Ryan Lee, had brought the model and initial assumptions to a preliminary stage. Some of the evidence was already used for basics, such as general hull shape, length, and width, as well as for testing some fundamentals about accessories: the shape, positioning, and design of the pseudo-drapery; the spacing between the wheels; the size and positioning of the oar panels; and the nature of the interior space for the actors (Fig. 12). Lee provided the initial models to Wachsmann using the then (2011–2012) relatively new format of 3D pdfs, the industry standard Portable Document Format invented by and then reconfigured by Adobe Systems, Inc. to enable the display of interactive 3D models.

One feature of that document-viewing format is that once embedded, the models cannot be extracted by a third party (mostly for file security and data integrity reasons). Thus, since Lee was no longer available to assist on the project nor to transfer the original model files, VIZIN began its modeling efforts using the same primary source material.

While the rebuilding of the model was underway, Wachsmann constantly revised his opinions regarding the shape and size of the ship cart, as well as about details of the decoration not previously addressed in earlier models, such as the nature of the pseudo-fabric covering at the stern and the shape and position of the boar-head ram while trying to imagine how it may have been mounted to the replica ship's bow and determining whether the ears had been attached separately to the 'vessel.' These were our first tasks (Fig. 13).

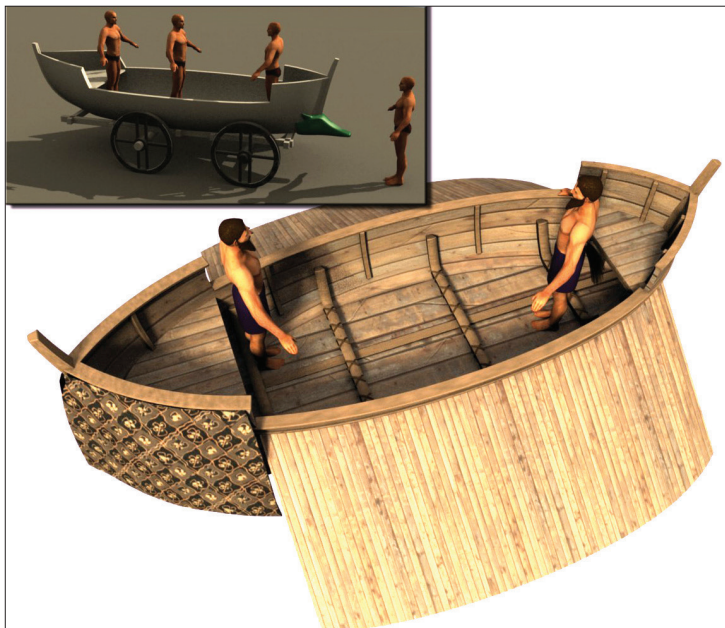


Fig. 12. Render output from the preliminary 3D model built by R. Lee (Courtesy of R. Lee)

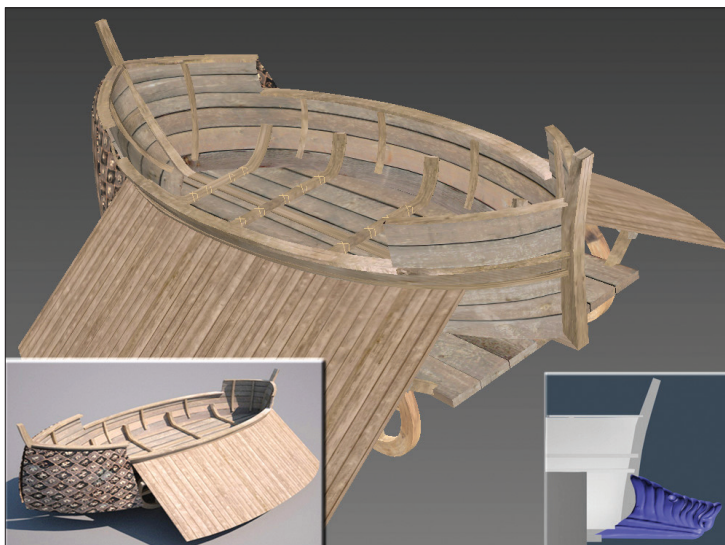


Fig. 13. Renderings from a very preliminary model by VIZIN while attempting to visualize options for the fabric and bow features (© 2012 Institute for the Visualization of History, Inc.)

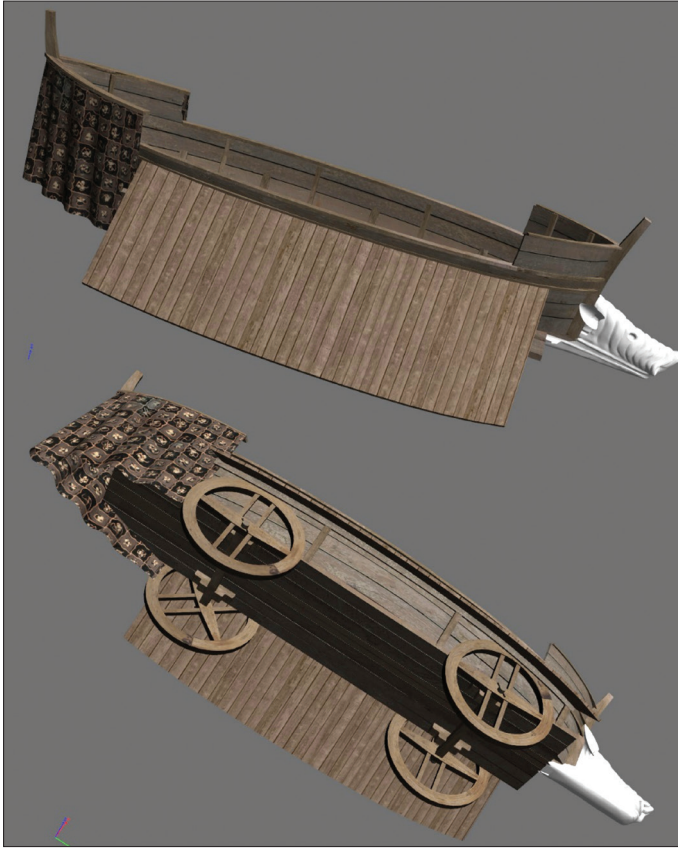


Fig. 14. Renderings showing subsequent versions of the ship-cart model as we adjusted the shape and proportions of the main hull and oar panels, and worked with versions of the boar-head ram (© 2012 Institute for the Visualization of History, Inc.)

During the next iteration of the model, the proportions were adjusted to match those of the Erechtheion ship model but wrapping the stern pseudo-fabric more like that on the terracotta model from Sparta (Fig. 6: A–B). The boar-head ram was completed, but not yet textured, including adding the ears, although, looking at the various examples, we had not yet decided whether the ears were actually part of the ram or part of the ship itself (Fig. 14). Based on the representations on the black-figure cups, Wachsmann suggested that we try shrinking the hull considerably in order to match the 2D pottery proportions given the size and spacing of the wheels in the depictions. While evaluating the differences among the representations, however, we could not come to a firm conclusion as to the relationship between wheel placement and hull size. The next major decision revolved around picking the number of oars to appear on the large wooden ‘oar panels’ on either side of the hull, as well as fixing the angle and length of the panels.

We initially settled on depicting 25 oars per side, as per the oars of a *pentakonter*, on the large oar panels. We again adjusted the overall proportions of

the vessel and, thus, of the entire model, which meant that the wheels would have to be closer together, which in turn seemed to create a model that more closely matched the imagery on the *skyphoi*. We also moved the ram farther back along the hull tucked under the front edge of the oar panels. The delivery platform of the initial test models, the 3D pdf format, had been updated by Adobe now allowing more interaction with the model: the ability to adjust the lighting, and the ability to turn on and off particular portions of the model for more detailed study. The next version included a figure for scale and tested the width of the model, which would, in real life, have needed to hold the three actors role-playing Dionysos and his two attendant satyrs (Fig. 15).

At this point in our modeling process, the ship cart was based most directly on the Erechtheion ship/lamp model in its plan view taking into consideration that it had to shrink a bit to pull the wheels closer together. We could have made the hull a bit wider, but then the overall proportions would have suffered somewhat.

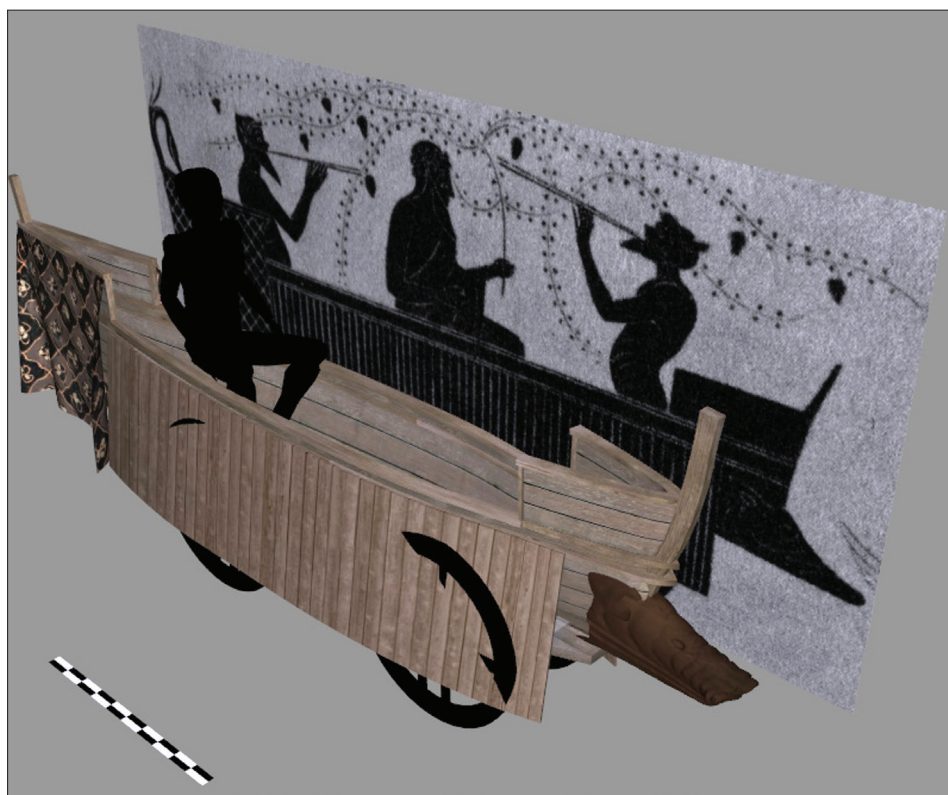


Fig. 15. Renderings showing progress in the adjustments of the hull and boar's head placement as well as the addition of a person to test the width of the hull (a dimension not present in the 2D representations). Note how the wheels intersect with the oar panel(s) (© 2012 Institute for the Visualization of History, Inc.)

We debated our priorities: widen the hull so that the figure representing Dionysos could sit comfortably, or retain the full proportion of the Erechtheion version, but altered so that the wheels are close together? We could not model all of them at once. Examining the *skyphoi* oar panels, it seemed that they number about 34 on the Athens cup, 30 on the Bologna example, and 54 on the British Museum example. In the British Museum and Athens depictions, the oar panels clearly continue behind the pseudo-fabric at the sterns. This indicates that the oars had to be set in a more vertical plane so that the pseudo-fabric could hang over the panels and away from the hull at the stern. We were not entirely sure how that would work in reality, unless the fabric were flowing out and around the oar panel, but still attached at the top to some bar that overhung the oar panel.

Working with the ship as a 3D digital model is akin to working with the actual physical timbers. The modeling process allowed us to ask more detailed questions about the construction and then actually test theories such as, for example, comparing the track of ancient wheel ruts with what the model tells us about how the ship cart was built to see if there is any correspondence. At this point in our research, the track of the wheels was based on the platform carrying the ship, which was based on the width of the Erechtheion model. If we had followed that model in all its proportions, then indeed the whole cart would have become quite narrow and, thus, wobbly for the actors sitting in the ship.

Focusing next on the British Museum example, we reconfigured the stempost to include a slight curve continuing above the forecastle screen and remodeled the sternpost as a recurving bird head. A border was added to the pseudo-fabric to make it more like that depicted on the Tübingen sherd. These changes were made, even though we realized that not all the extant depictions show these details the same way.

After some back-and-forth discussions, it was tentatively decided to represent 30 oars on the oar panels, which in turn were tilted to a more vertical plane. This change led to an interesting turn of events. As a consequence of this the wheels intersected the oar panels and the hull becomes so narrow that figures would have a difficult time fitting (Fig. 15). The only way to prevent this was to either make the wheels smaller—contra the iconographic evidence—or change the shape of the hull to flare outward more in order to extend the attachment points of the oar panels farther away from the wheels. However, and contrarily, if there had been no complete ship, the fabricators would only need a simple framework onto which to attach the oar panels, which would mostly hide the hull and interior of the vessel and negate the need for those elements. If we were to retain the proportions and shapes that we see in the depictions of these ships on pottery and the general design on the Sparta or Erechtheion examples, then something had to give, because we could not make it work to suit the current thinking. Any single change now would affect much of the rest of the ship design, and assumptions would need to be adjusted to determine

what construction remains hidden in the ancient depictions that might explain some of the discrepancies we are now seeing creep into our design.

It was agreed that the latest iteration was an excellent example of how we could quickly make corrections based on the 3D model and evaluate which details of the design could not have existed. Based on the current designs, new interpretive directions emerged. For example, Wachsmann began to wonder if the corrections needed in order to make the oar panels on the Archaic-period Dionysian ship carts miss the wheels might not have been the inspiration, in the following Classical period, for the invention of the outrigger that appears on triremes (*trieres*) and their descendant warships.

As a result, the solution we selected to allow the oar panels to clear the wheels was to attach the panels to small struts (nascent outriggers?) and to increase the number of oars again. Discussions about outriggers, the placement of the oar panels, and the width of the ship, then led us to explore a point only imagined earlier, and one that ultimately produced a radically new ship-cart design. We began to consider the possibility that the ship cart is mostly an insubstantial float used during a ceremony. Therefore, the vehicle might not actually need to be a fully constructed ship nor constrained by nautical concerns. Perhaps only the external bits that celebrants would actually see would have been required to make the ship cart seem like a fully-hulled ship existed.

That is, perhaps the problems we were encountering with the size and position of the oar panels suggested that there is no real ship behind them, but instead only a minimal structure built to hold the figures in their stations. The stern pseudo-drapery, ram and forecastle would have helped obscure the rest and render complex ship construction unnecessary. All that was necessary to complete the illusion were proper oar panels, the front and rear decorations, and three thwarts to seat the actors. The result would be a very simple float that would give the impression of a complete ship but without an actual hull.

New 3D pdfs were generated of the current status to visualize the subtle changes. We settled on using the British Museum depiction as the background image for our pdf to enable viewers to see the correspondence between our computer model and the ancient evidence. We still wanted to remain true to the Erechtheion model as a guide for the hull shape and proportions, and thus tweaked the computer model to better reflect the details of the vessel and the figures shown on the *skyphoi*, such as, the number and placement of the oars on the oar panels, the stern post, bird-head stern decoration, and the auloi played by the satyrs (Fig. 16). To examine the theory that there was no need to use an actual hull, we also created a second computer model of the ship cart as a float, lacking an actual vessel (Fig. 17). Minor adjustments followed, such as adding the two satyrs; making the platform, chocks, and axles translucent; adding additional pleats to the pseudo-drapery; and making the oar panel match the painting on the British Museum *skyphos* (Fig. 18).

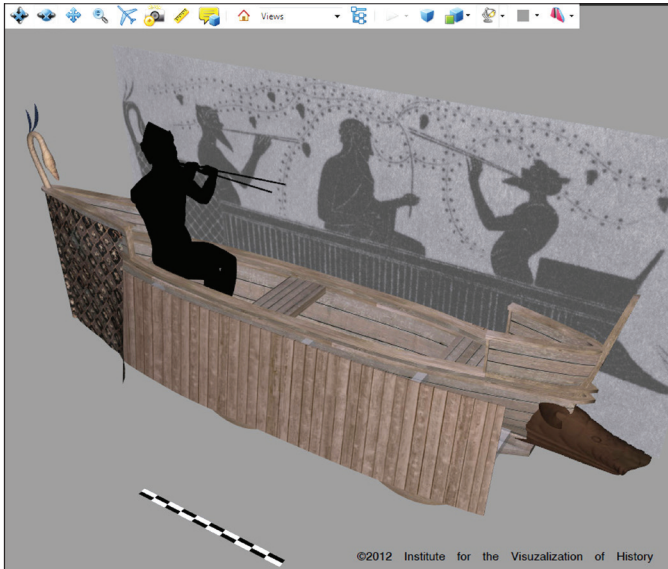


Fig. 16. A rendering of the revised version of the ship cart showing the results of our drastic re-imagining of how the whole would have been used and seen in practice (© 2012 Institute for the Visualization of History, Inc.)

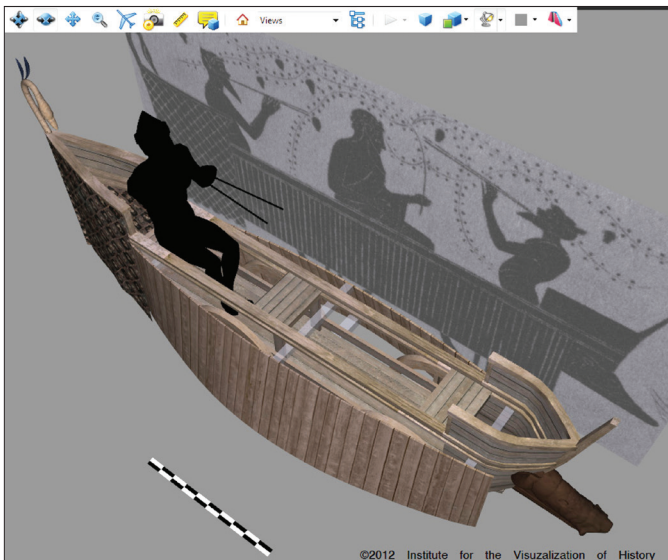


Fig. 17. A rendering from the latest model showing the minimal skeletal construction needed to be both parade float and give the impression of a complete vessel (© 2012 Institute for the Visualization of History, Inc.)

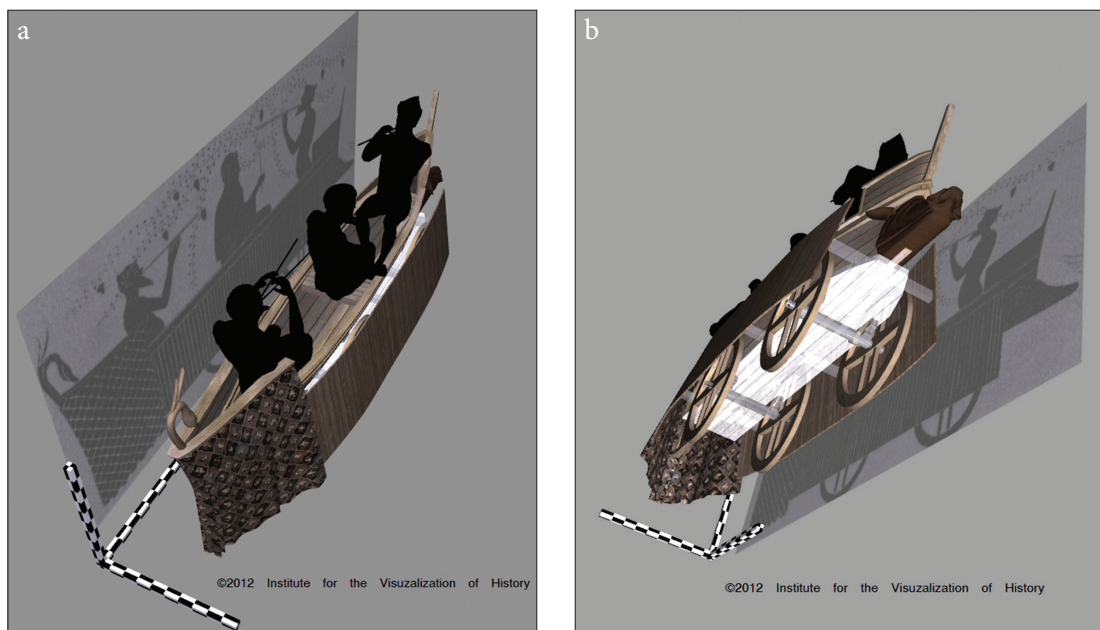


Fig. 18. Renderings showing top and bottom views of the final model reconstructed with a hull (© 2012 Institute for the Visualization of History, Inc.)

In total, the process took about 70 hours of modeling and programming and unfolded over 23 major iterations throughout Wachsmann's research.

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Appendix 1: The Fabric-Pattern on Archaic Dionysian Ship Carts

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Attic Archaic representations of Dionysian ship carts show them as carrying a large item either wrapped around the stern, carried from a yard, or lining the side of the ship cart in place of the standard ‘oars.’¹³

These items generally are decorated with crosshatching, which permits several interpretations (e.g., basketry, fabric). Fortunately, a single sherd now in the Tübingen Institut für Klassische Archäologie shows the decoration in more detail. At first glance, it appears to be heavy hanging fabric rather like a kilim (Fig. 7).

There are problems with this interpretation, however. Although the pattern forms a grid, typical of textiles, the lines dividing up the grid in both directions are wavy. Wavy lines are quite difficult, even ‘unnatural,’ to create with the plain-weave-based techniques, done on a warp-weighted loom, that I have reconstructed as native to ancient Greece, where patterning was principally in overshot. Nor are they any easier to create in tapestry, a technique apparently imported into Athens in the early 5th century BC by foreign weavers using a vertical two-beam loom.¹⁴ Zigzags are much easier to weave, and it is conceivable that the painter simply rendered a grid formed by zigzags with more quickly paintable wavy lines.

In studying this decoration, however, I then wondered if the Tübingen ‘textile’ might represent knotted pile, where wavy lines are possible if the knots are closely spaced as, for example, in the case of small Persian (i.e., asymmetrical) knots. I put this question to Brian Morehouse who, in addition to having a background in Near Eastern archaeology has been a rug merchant for many years. While in his view such a pattern would be possible, in his many years of studying rugs—ancient and modern—he had never seen such a pattern. It just felt wrong.

Morehouse then asked whether this fabric-looking pattern might have been painted on the ship cart, because if such an extensive fabric became wet, it would immediately become extremely heavy. While this fabric-like pattern appears on cult vessels carried through dusty streets, it does also appear on a ship shown at sea (Fig. 5); all the more reason to remain skeptical that it could be a real textile. Our combined view is that the pattern was most likely painted directly onto planking, or even onto canvas attached to the ship cart (but not to a sea-going ship).

¹³ See above: pp. 141–143.

¹⁴ Foreign tapestry weavers worked in Athens from the early 5th century BCE onwards, almost certainly using a vertical two-beam loom. On these foreign weavers, see Mansfield (1985, pp. 2–18, 54–58). For a fuller discussion of 5th-century BCE Athenian textile knowledge and abilities, see Barber (1992).

Appendix 2: Visualizing the Human Scale in the Recreation of the Dionysian Ship Cart

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Proportion and scale are among the most fundamental principles of art and architecture in all periods of time. Proportion, the relationships of the various parts of an object to each other and as well as to the whole, is often analyzed in terms of modules and mathematical ratios (or ‘canons’) that produce sensory consistency and visual harmony.¹⁵ Scale, while related to proportion, is the size of an object in relation to a known module or unit of measurement (Curl, 2006).¹⁶ Architectural plans and models, ceramic profiles, and other scientific drawings are frequently reproduced at sizes smaller than the actual measurements of the object being illustrated, along with a scale ruler or some standardized indication of the dimensional relationship (e.g., 1:2, 1:6, 1:100, 1:500). Scale can also be expressed qualitatively in terms of relative importance (e.g., hierarchical, hieratic, divine) or the natural world (e.g., full-scale, larger than life, miniature, monumental, colossal). In the study of ancient Greek sculpture, for example, it is common to describe scale in terms such as over life-size, life-size, under life-size, half life-size, etc. although few studies detail the actual standards and evidence used to define such terms.¹⁷

For three-dimensional models, whether physical or virtual, some easily decipherable reference to scale is not only key to understanding the size, proportions, and spatial relationships between the individual elements, but essential for establishing the visual context that allows a viewer to comprehend what

¹⁵ For a brief overview of the importance of proportion and scale in architecture, see Ching, 2015, pp. 305–348. Different proportional systems and their quantitative and qualitative meanings in architectural history have recently been reviewed by Cohen (2014a, 2014b). Proportion in ancient Greek architectural design has been treated by Coulton (1977, pp. 64–68) and Wilson Jones (2014, pp. 114–116). For canons of human proportions used in art, and the significance of their different treatments in various cultures throughout time, see Panofsky, 1955. Systems of proportion in ancient art include well-known examples from Egypt (Iversen, 1975) and Greece (Pollitt, 1995).

¹⁶ See also Ching, 2015, pp. 306, 341–348.

¹⁷ For an exemplary discussion using skeletal information from the North Cemetery at Corinth to inform the analysis of Corinthian terracotta statues from the late 6th and early 5th centuries BCE, see Bookidis, 2010, pp. 28–29.

she or he is seeing. As noted by architect and architectural historian J. S. Curl (2006, p. 682), “The key to appropriate scale is often the human figure seen in relation to the building.” But what is an appropriate human scale (“life-size”) when transforming two-dimensional representations, such as those on Archaic Athenian vases, into three-dimensional renderings?

In the recreation of the Dionysian ship cart developed for the present study, the male figures have been scaled to represent a standing height of about 170 cm (or just under 5 ft 7 in). This dimension is based upon the mean stature estimates for ancient Greece as a whole, as determined from skeletal data (Bisel & Angel, 1985).¹⁸ The evidence for the “Classical” period (defined by Bisel & Angel (1985) as ca. 650–300 BCE, and so encompassing both the Archaic and Classical periods) suggests that the mean stature of adult women was 156.2 cm (or 5 ft 1 1/2 in), while that of adult men was 170.5 (or 5 ft 7 1/8 in) (see Table below). In consideration of this data, the figures of Dionysos and his satyr attendants are scaled to between 160 and 170 cm in the reconstruction.

Mean Stature in Ancient Greece: Neolithic to Roman (after Bisel & Angel, 1985, table 4).		
Period	Adult Female	Adult Male
Early Neolithic	155.5 cm	169.6 cm
Late Neolithic	154.3 cm	161.3 cm
Early Bronze Age	152.9 cm	166.3 cm
Middle Bronze Age “Common”	153.5 cm	166.1 cm
Middle Bronze Age “Royal”	160.1 cm	172.8 cm
Late Bronze Age Mycenaean	154.5 cm	166.8 cm
Early Iron Age Greece	155.1 cm	166.7 cm
Classical	156.2 cm	170.5 cm
Hellenistic	156.4 cm	171.9 cm
Roman	158 cm	169.6 cm

¹⁸ Kron (2005, pp. 72–74) notes that stature estimates from ancient cemeteries may actually underestimate the maximum height of full-grown adults, since the remains include those of individuals of all ages, including the aged and sickly, who may have experienced a decrease in height through bone loss.

Appendix 3: Navigating the 3D Pdf

Donald H. SANDERS

This paper includes a navigable 3D pdf. Please note that in order to view the ship cart 3D pdf, it must first be downloaded. It is available at the following URL:

<http://www.vizin.org/DSC/pdf-download.html>

The pdf allows the reader to examine for themselves our reconstruction of a generic Archaic-period Dionysian ship cart. However, before you download the file, please be sure that your browser preferences are set to open such files in its native Adobe Acrobat program, not in your browser's tabs. Each browser does this with different settings; you may need to check your browser's Help files for support. The 3D pdf will not work properly or at all if it is opened in a browser tab. Further, for Apple computer users: (a) the Safari browser will sometimes override your preferences, therefore, we suggest you choose another browser, and (b) the interactive 3D pdf will work better directly in Acrobat Pro, rather than in Acrobat Reader. For PC computer users, both Acrobat Pro and Reader work equally well.

For those unfamiliar with the nuances of the 3D pdf file format, this appendix describes both the navigation methods and the document's specific tools. Although VIZIN saves the pdf file with certain preset values, Adobe provides users with a wide variety of options for changing and manipulating how the model is displayed. Upon opening a 3D pdf file, there may be a security notification (often a yellow bar across the top of the document); if this appears, simply either click on the 'Options' button and allow access by 'trusting' the file or click on the 'Enable All Features' button. It may be necessary to click once again inside the blank central portion of the document in order to see the contents. Once the 3D model appears there will likely be a menu bar across the top and along the left-hand side of the page. These bars present an array of tools for manipulating the 3D model and associated functionalities associated with the pdf file format.

The left side of the page displays icons for some standard pdf tools, such as going to specific pages or bookmarks, which are not generally applicable to 3D model files. Of interest to users of 3D pdfs, however, is the hierarchy fly-out screen, indicated by the icon with squares and lines denoting a hierarchy tree. The submenu that opens has options for many export and viewing modes, but also for selecting and turning on and off specific objects of the 3D model. These tools are very useful for isolating individual elements for analysis, or turning off objects that might be interfering with studying other aspects of the model. Note that 'hull' and 'float framework' should not be turned on together. They represent two divergent possible reconstructions for the Dionysian ship cart. A list of predefined or user-defined camera viewpoints is also displayed for quick access.

Note that, if necessary, this left panel can be resized smaller to enable the model to be seen and manipulated at a larger size; to resize the panel grab its right edge and gently slide it to the left. To expand the hierarchy of clickable features in the model, you may need to first expand the list of available elements. To do this, click either on the small right-facing arrow or the small plus sign to expand the Scene Root and then the Ship Cart Root entry. Below the main hierarchy list of features is a listing of the preset camera views. There you can select to view the model in its Standard ship format or its Float Framework format.

The small arrow at the top left of the fly-out panel closes the panel to regain space for navigating the model. One can also navigate the model by dragging it with a mouse or other external pointing device independently of the control icons in the pdf.

Across the top of the page are the basic navigation tools. Starting from the left, there are four tools that swivel, rotate, pan, or zoom the model. The airplane icon signifies 'fly' mode, most useful for flying over an architectural model; it enables the user to appear to animate the model as if flying toward, over, or through it. The camera icon accesses a separate menu whose interactive sliders control how the 3D model appears on the screen in order to define a particular view of interest to the user, which is separate from the predefined camera locations created by the modeling team, as VIZIN has done, indicated by the small images of the ship cart, which can be accessed by the arrows at the bottom of the screen.

Clicking on the ruler icon enables the user to measure elements of the 3D model. A tooltip will appear with hints on how to use the tool, and once activated, a submenu also pops up providing additional measuring options and measurement types, such as, linear, angular, or radial. Once a measurement is created by clicking and dragging the mouse along a feature of the model the results are posted in a small popup window. The 3D comment tool, acts like the comment tool on regular pdf files, enabling the user to leave text notes inside the document. Right-clicking on the note accesses a submenu with further options for documenting the note; these notes are saved with the file when the pdf file is saved.

The house icon indicates a return to the home or preset original view of the model. Additional views of the model can be accessed by clicking on the 'views' pull-down menu next to the Home icon. The initial set of views are the ones preset by VIZIN for this model but new ones can be added by using the camera tool mentioned above. The next icon, which looks like a bunch of squares connected by lines, is the 'hierarchy' tool, which, when clicked, closes the toolbar and opens a new set of tools at the left, discussed more fully below with the left-side toolbar icons.

The arrow to the right of the hierarchy tool is only active if there is an animation to play inside the file. The arrow will start the animation; the tool is grayed out if there is no animation to play. Next is the 'cube' icon that serves as

a toggle between viewing the model in orthographic or perspective projection. To the right of that is an icon with a pull-down menu giving access to a series of options for changing how the 3D model is displayed, such as in wireframe mode or as an illustration without the associated model textures. The table lamp icon opens a pull-down menu offering a choice of lighting conditions for the model. Next to the lamp is a shaded square with a pull-down menu giving the user options for changing the background color of the scene. The last icon on the right indicates the cross-section tool. The accompanying pull-down menu choice for cross-section properties provides the user with the ability to slice the model in any direction and any angle, in order to view aspects of the model and its pieces that are otherwise hidden or to see cross-sections of parts of the ship cart for more detailed inspection.

Appendix 4: Glossary of Nautical Terms

AFT	Towards the stern.
BOW	The forward of end of a watercraft beginning where the hulls starts curving inward toward the stem.
GALLEY	A vessel propelled primarily by oars. Galleys also usually carried sail.
OAR BANK	A row of oars on one side of a galley.
OUTRIGGER	A rowing box or frame (Gk. <i>parexeirsia</i>) on Greek triremes and later galleys to facilitate superimposed banks of rowers.
<i>PENTAKONTER</i>	Greek term for a 50-oared galley.
SHEER STRAKE	The highest uninterrupted run of planking from bow to stern.
SHIP CART	A ceremonial platform that consists of a wagon moving on wheels transporting a miniaturized representation of a prototype watercraft in the form of an actual hull or a float framework.
STARBOARD	Right side when facing the bow.
STERN CASTLE	A raised deck in the stern or the structure constructed to enclose it.
THWART	A beam placed from side to side, across a hull, which can be used as a rower's seat.
TRIREME (GK. <i>TRIERES</i>)	A three-banked war galley in which a single rower pulls each oar.
YARD	A spar set on a mast to support a sail.

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Реконструкција дионизијског култног брода на колицима из позно-архајског периода

Резиме

Грчки бог Дионис имао је посебан афинитет према ратним галијама, што се можда објашњава Хомеровом химном Дионису у којој га тиренски пирати киднапују на својој галији. Чим је винова лоза почела да се увија око брода и јарбола, поједини пирати покушали су да избегну своју судбину скачући у море само да би их Дионис претворио у делфине. Ова химна служила је као повремени мотив у паганској уметности и може објаснити минијатурне реплике бродова са веслима који су играли важну улогу у древном култу посвећеном Дионису. Ови минијатурни бродови нејаке конструкције, постављени на платформама, кретали су се копном на парадама, било на точковима или на раменима учесника церемоније. Иако најранији примери датирају из касног бронзаног доба, они су најпознатији из серије од три приказа из позно-архајског периода на црнофигуралним *скифосима*, који се данас налазе у музејима у Атини, Болоњи и Лондону. Не постоје две исте слике дионизијског култног брода на колицима. Иако се ова разноликост може приписати хировима уметника, она, такође, одражава промене у представљању ових бродова на колицима при сваком годишњем појављивању, слично данашњим платформама на парадама. Због дводимензионалне природе ових слика, данас је немогуће утврдити да ли су дионизијски култни бродови били права пловила, наменски изграђени и постављени на платформе током процесије која се одржавала искључиво у Дионисову част или су пак само имали облик минијатурних галија. Овај рад даје контекст и објашњава процес стварања тродимензионалне дигиталне реконструкције дионизијског култног брода на колицима из позно-архајског периода користећи слике и артефакте из тог времена.

Кључне речи: Бахус; култ; дигитална археологија; Дионис; наутичка археологија; култни брод (на колицима); скифоси; виртуално наслеђе; виртуална реалност; 3D моделовање.



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