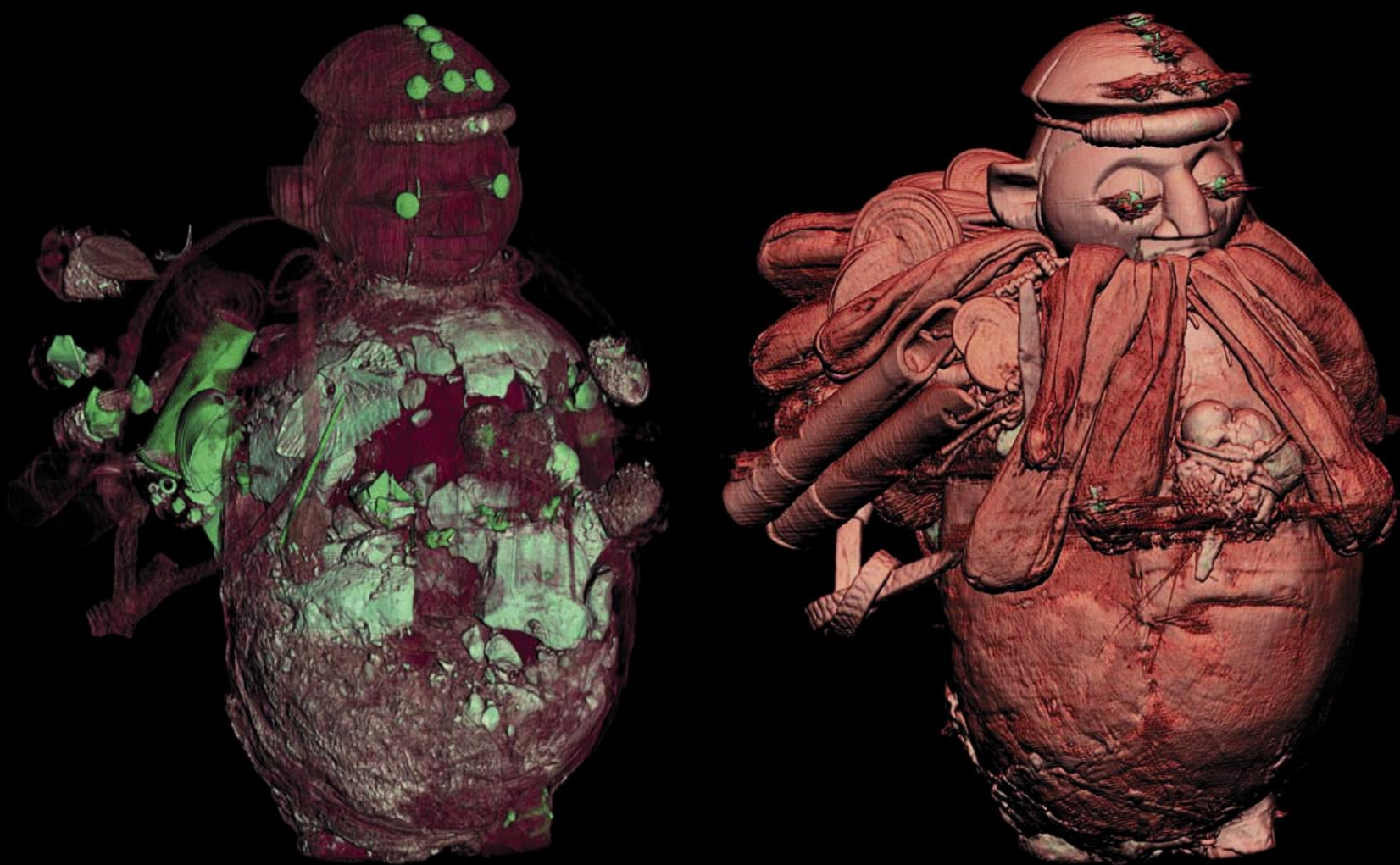




# Probing Art with CT Scans



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Marc Ghysels



In 2005, a series of masterpieces from the Ethnography Division of the Royal Museum for Central Africa in Tervuren (Belgium) were taken to the Ixelles Hospital to be scanned. The operation was not designed to dissipate doubts about their authenticity<sup>1</sup> but to shed light on their very structure and try to pierce the secrets of their inner life when they first came into being.<sup>2</sup> The idea was to write another page about their “social life,” to borrow the now famous title of Arjun Appadurai’s book,<sup>3</sup> in the sense that objects, like people, can have a private and social life.<sup>4</sup>

And these African figures certainly had a lively social life! Many of them came to the museum in the highly controversial context of the colonization of the Congo. They were first staged as curiosities to provide an exotic setting during exhibitions to the glory of colonization, then they were elevated to the status of masterpieces.<sup>5</sup> The change in the Western view of African art was spearheaded by a handful of major European artists. By admitting and demonstrating that they had been inspired by the bold forms and compositions of so-called “primitive”<sup>6</sup> art, these artists lent the figures credibility and consequently introduced them to the art market. This process—an artificial one considering the criteria that prevailed when they were made—completely disrupted their social life. From that time on, some of them embarked on a career as masterpieces, traipsing from exhibition to exhibition to be admired for their beauty.

So it is intellectually satisfying, if slightly ironic, to use highly sophisticated and undeniably Western technology to whisk them back to the instant of their birth, when the hands and know-how of African artists—forgotten in their “success story”—fashioned their astonishing forms. Because apart from the structure of the materials,

what the CT scan shows is the artist at work: his skill, technical expertise, and strokes of genius, even his feelings—but also his mistakes and remedial actions. Paradoxically, the scanner has become a tool for rehabilitating the memory of these “systematically silenced authors.”<sup>7</sup>

The oblivion into which they inevitably fell—or were pushed<sup>8</sup>—deprived them of acknowledgement and it is only in recent years that we have witnessed a rash of events that have focused on African artists along with their art.<sup>9</sup>

Two pieces have been chosen to illustrate some of the new research opportunities opened up by interpretation of CT imaging. Just as it serves to screen illnesses and internal malformations in the medical field, this method of investigation can be used to answer questions about art works and reveal unsuspected features. A set of CT images taken in the three spatial planes are complemented by three-dimensional images reconstructed on a computer. Wood, terracotta, stone, and other materials can be probed by x-rays but metal bounces back impaired images. Although industrial CT scanners have been developed to handle metal successfully, they are not easily accessible and this technology is not available in hospitals.<sup>10</sup>

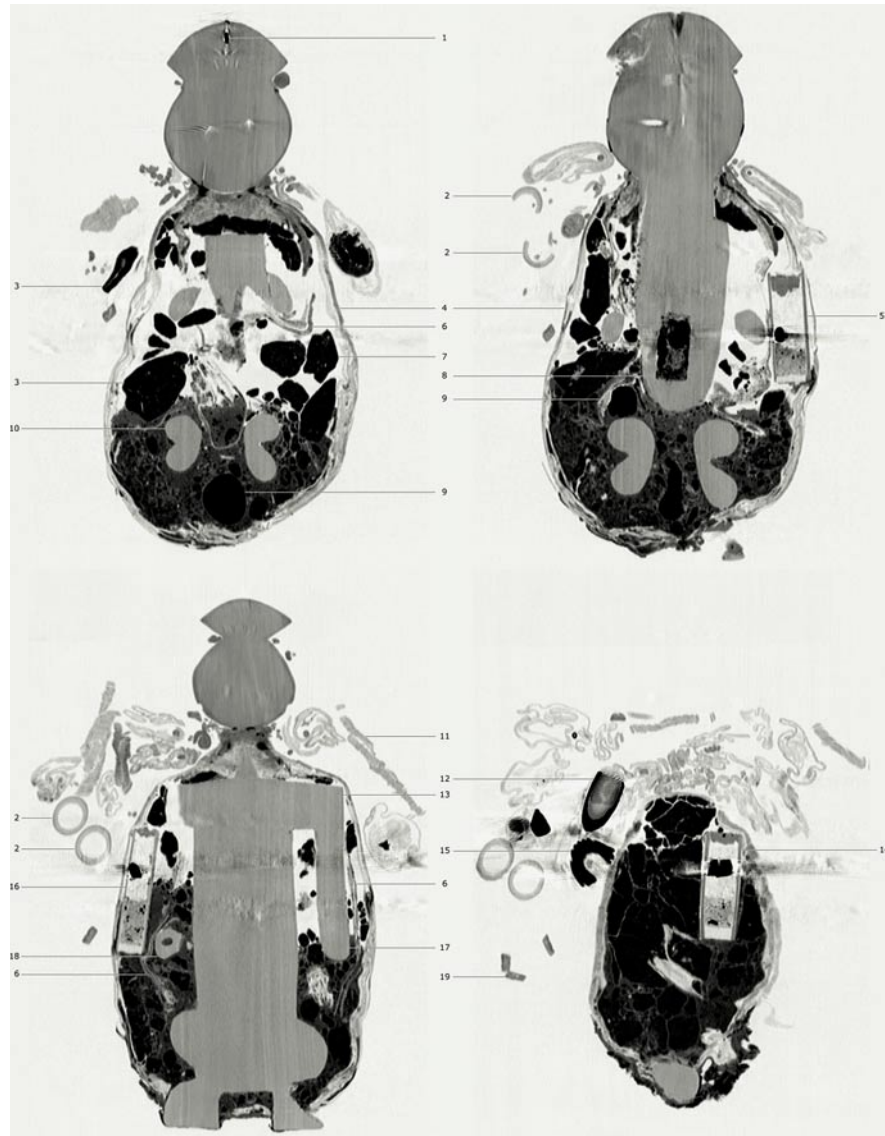
For the time being, therefore, art works are scanned by medical equipment, operated by highly trained radiologists, who are also practically the only people able to interpret the results. The use of medical equipment entails another parameter: the art works cannot be bigger than a human body if they are to go through the tunnel in which they will be bombarded with x-rays.

**The Yaka figure<sup>11</sup>** collected and given to the museum in 1931 by colonial administrator A. Verschaffel, looks like a carved head sitting on top of a compact textile ball to which an assortment of small items have been attached: pieces of bamboo, four Möbius strips made of plaited fiber, and shells (**Fig. 1**). The head, with its particularly broad nose and skullcap studded with upholstery tacks, is not specifically characteristic of the Yaka style.<sup>12</sup> It could fit into the *phuungu* group, in the classification of statuettes (*bitek*) proposed by Arthur Bourgeois,<sup>13</sup> although it is unusual in that no legs protrude beneath the bundle of composite materials.<sup>14</sup> *Phuungu* are owned by the headman of the lineage who keeps them in his house and exploits their apotropaic<sup>15</sup> qualities. The figure has been carved from *n-hala* wood (*Crossopteryx febrifuga* or the ordeal tree) which is known for its toxic properties, but which also can be used for medicinal purposes, which corroborates the protective but potentially aggressive role of this object and its assorted magical charges.<sup>16</sup>



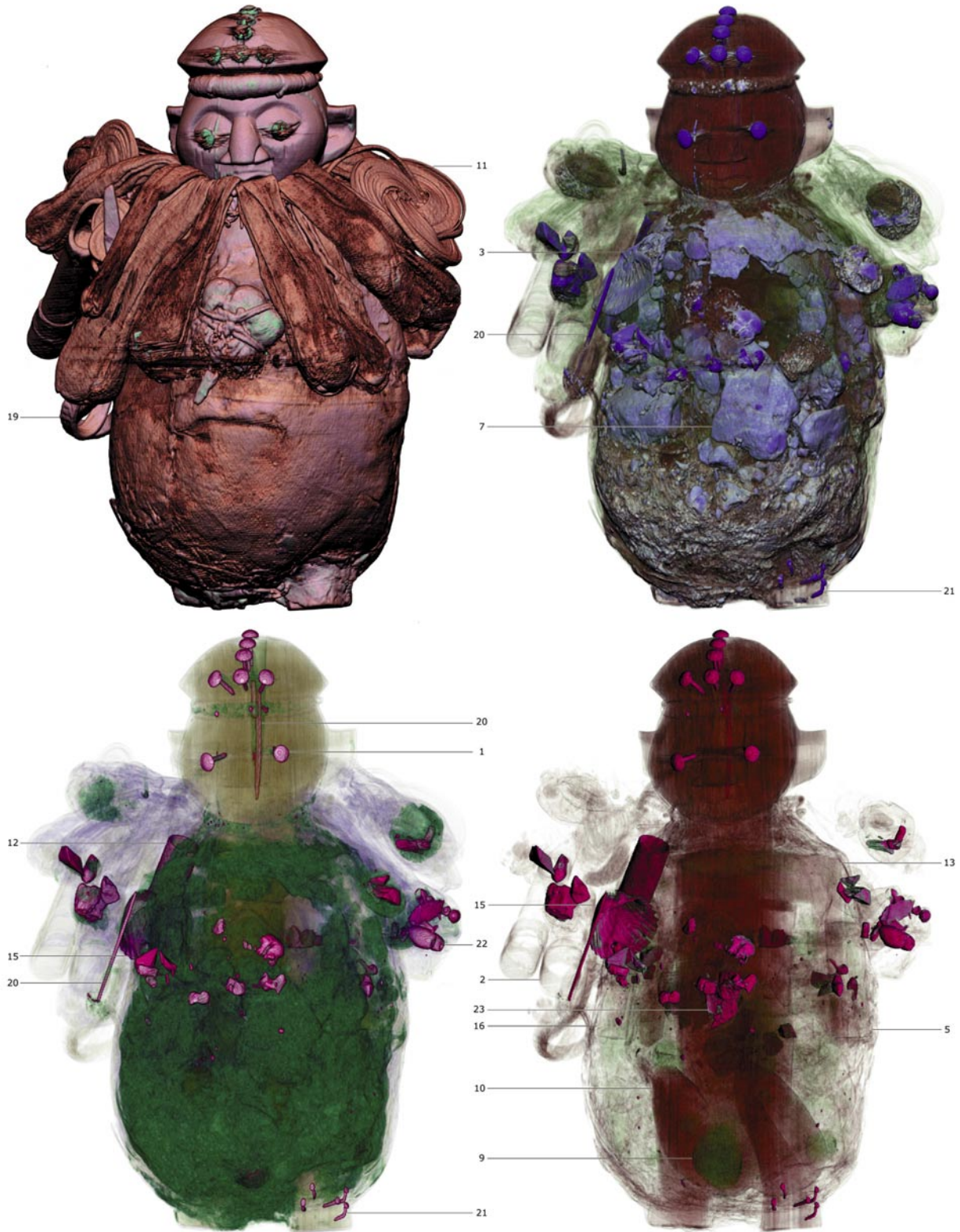
**Fig. 1.** Yaka figure EO 0.0.32982, Democratic Republic of Congo.

Photo R. Asselberghs © Royal Museum for Central Africa.



**Fig. 2.** Scan of the Yaka figure EO 0.0.32982, MPR slices (multi-planar reconstruction) in the frontal plane. © Marc Ghysels. Four successive 0.75 mm thick slices taken from the front towards the back of the figure. In MPR slices, the various shades of grey reveal different densities: from light grey, for low-density materials such as wood and textile, to very dark grey for high-density materials such as terracotta, pebbles or nails.

**Fig. 3.** Scan of the Yaka figure EO 0.0.32982, VRT images (volume rendering technique) in the frontal plane. © Marc Ghysels. VRT images are three-dimensional reconstructions obtained by processing the two-dimensional slices piled up like a deck of cards. Color can then be arbitrarily attributed to the various tones of grey and therefore to the different densities, which amounts to transforming the scale of greys into a color scale. Opacity, transparency, brightness, shadows etc. can then be artificially adjusted for each color. We are viewing the same thing on each VRT image; except that the display settings have been changed for each type of density. Interface contrast can also be enhanced, so that the passage from air to material shows up clearly.



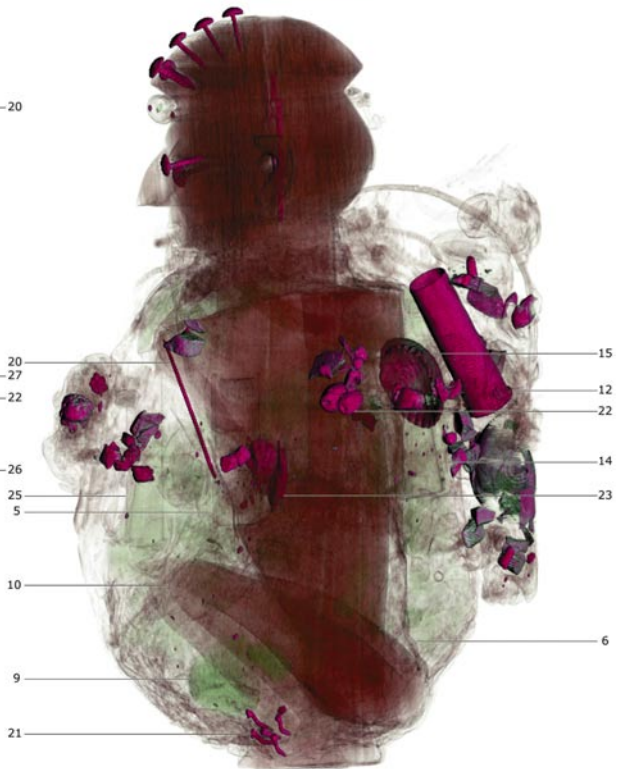
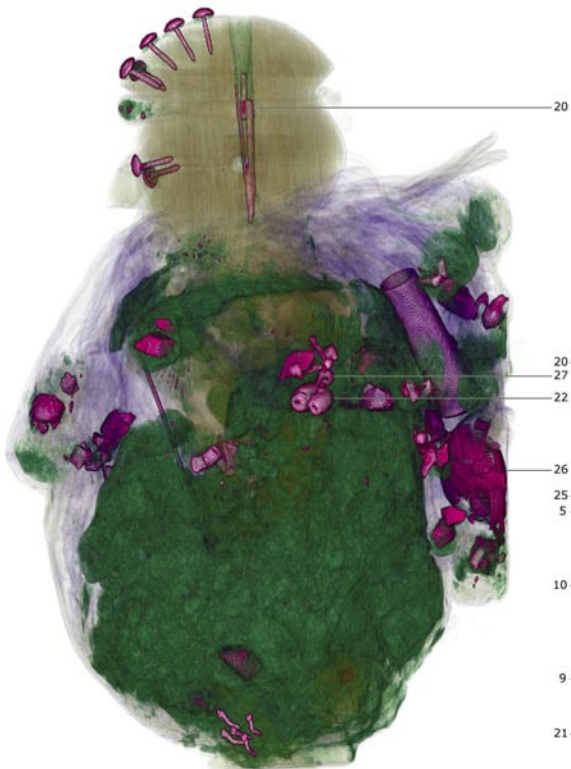
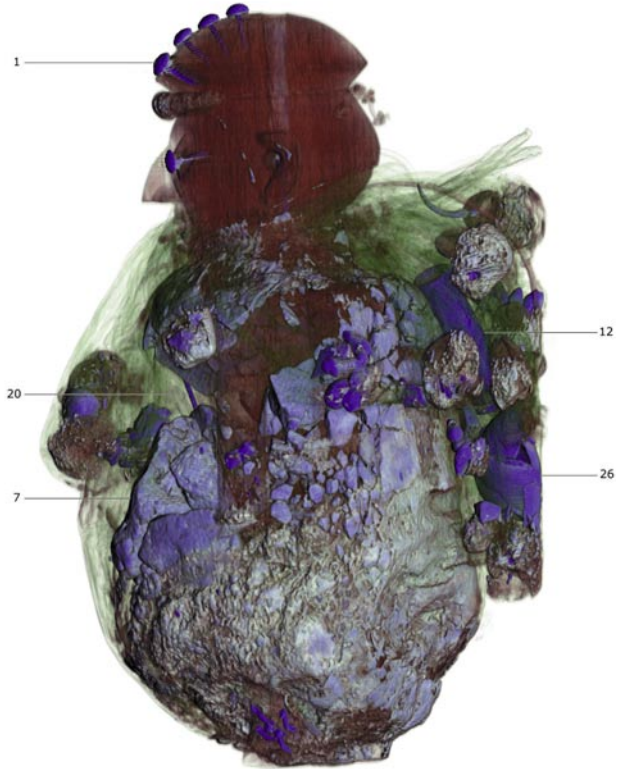


**Fig. 4.** Scan of the Yaka figure EO 0.0.32982, MPR slices (multi-planar reconstruction) lateral view. © Marc Ghysels. Four successive slices in the right side of the figure, from the outside towards the inside (from the right elbow to the navel, with its magic charge).

**Fig. 5.** Scan of the Yaka figure EO 0.0.32982, VRT images (volume rendering technique), lateral view. © Marc Ghysels.

For figures 2, 3, 4 and 5 :

1. upholstery tack – 2. outer bamboo – 3. bone of a small animal – 4. outer textile wrapping – 5. powder box #1 – 6. inner textile wrapping – 7. fragment of terracotta
8. umbilical cavity – 9. oval pebble – 10. right knee – 11. Möbius strip – 12. metal tube (a cartridge?) – 13. left shoulder – 14. powder box #2 – 15. shell
16. powder box #3 – 17. left elbow – 18. bound right elbow – 19. leather thong – 20. metal needle – 21. square pin – 22. glass bead
23. magical charge in navel cavity – 24. seed – 25. powder box #4 – 26. egg shell – 27. snail shell







The CT scan shows that the head poking out of the bundle is in fact the head of a squatting wooden figure carved in the round (**Figs. 3 and 5**). Magical substances are tucked away in a cavity in its belly. There is clear evidence that the object was made in several stages and was perhaps adapted to something other than its original purpose. There would certainly have been no point in carving the figure fully if it were to be bundled up in its charges. Could it first have been used as a small carved squatting figure invested with power by the substances lodged in its body? Its posture is unusual in Yaka art, which includes some kneeling but very few squatting figures. In the Tervuren collections, some of the seated figures seem to be crouching (see **Fig. 6**). Another figure, illustrated in Bourgeois' book and more likely to belong to a Yaka subgroup or even a related group,<sup>17</sup> represents a young woman in a position associated with childbirth. Her uplifted arms clasped behind her neck accentuate the thrust of her pointed breasts. If it does not portray a woman giving birth, the carving certainly symbolizes the potential fecundity of womankind (**Fig. 7**).

**Fig. 6.** Yaka figure EO 12354, Democratic Republic of Congo.  
Photo R. Asselberghs © Royal Museum for Central Africa.

The scan also shows a ligature at the figure's right elbow (Fig. 4), a detail which supports the idea that it had a different use before it was bundled up.

Close observation reveals that an inner layer of cloth was wrapped around the statuette (Figs. 2, 4 and 5), perhaps in an attempt to homogenize the carved surface before adding what was to become the stuffing of its present spherical form. Soil, lengths of bamboo filled with various powders, and blocks of compact substances, particularly fragments of pottery, have been used as stuffing. The assortment of decorative and ritual items (small cloth bags, Möbius strips made of vegetable fiber, bamboo, shells, etc.) attached to the outside of the ball makes the fetish powerful in both appearance and function. While he was adding the ingredients that would endow it with magical powers, the artist clearly took aesthetic pleasure in harmonizing the whole figure.

Several studies have shown that Yaka sculptors possess esoteric knowledge, recipes, and remedies that they use when making their sculptures.<sup>18</sup> Among neighboring groups, the Kongo for example, the ritualist *nganga* is given the responsibility of "charging" the figures made by the artists.<sup>19</sup> The Yaka ritualist and diviner (*nganga*) prescribes a particular type of object for his client<sup>20</sup> who then goes to a sculptor skilled in making the "fetish" he needs. Incidentally, the controversial term "fetish" has been rehabilitated by extensive research in recent decades.<sup>21</sup> It is probably the most suitable term for this kind of figure, a forceful object that is part of what could be called an "aesthetic of the sacred."<sup>22</sup>



**Fig. 7.** Female Yaka figure EO 1955.32.1. Democratic Republic of Congo.

Photo J.-M. Vandyck © Royal Museum for Central Africa.

R. Devisch ventured an explanation: “Perhaps the bags about the neck go to evoke toxic *n-hala*<sup>23</sup> fruit.”<sup>24</sup> The many tiny tubular cloth bags hanging around the figure’s neck are more than just an evocation because they actually contain seeds of several kinds (Fig. 4). However, when the seeds identified in Figure 4 were compared with seeds gathered<sup>25</sup> from the ordeal tree, it became quite clear that they were not from the species *Crossopteryx febrifuga*. The seeds are therefore not related to the wood from which the figure has been carved or, by extension, to its medicinal properties.

**The Luba water pipe**<sup>26</sup> (Fig. 8) is one of the undisputed masterpieces of the Tervuren Museum. It was carved in the nineteenth century and brought back to Belgium by Commandant Hennebert, probably in the early twentieth century. The Ethnography Division recorded it in 1973 as a purchase from Hennebert’s grandson. Pipes were commonly used among the Luba (Fig. 9). Depending on the circumstances, they smoked tobacco and, occasionally, other narcotic substances. Tobacco needs long drying. Water pipes had the advantage of making the smoke milder and less irritating for the throat and lungs than traditional pipes; they also made it possible to smoke leaves that had not been completely dried in the sun.<sup>27</sup> Most water pipes were made from calabashes. The water in the calabash cooled the smoke before it reached the smoker’s mouth. This skeuomorphic<sup>28</sup> object has deliberately imitated the shape of a calabash. Its outstanding quality suggests that it belonged to a dignitary or person of high rank. The clay bowl and the reed that carried the smoke to the water have disappeared.

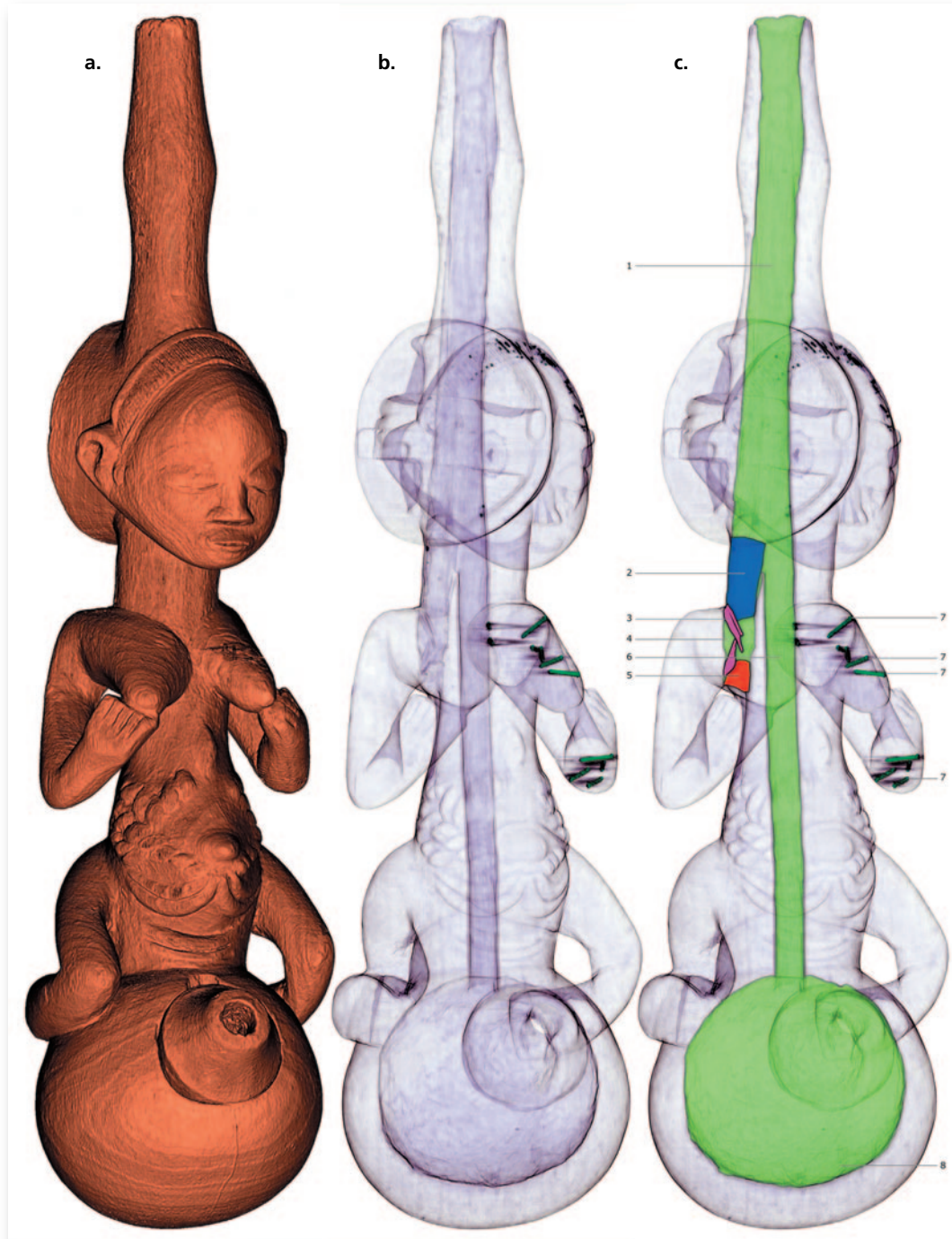


**Fig. 8.** Luba water pipe EO 1973.73.1. Democratic Republic of Congo.

Photo R. Asselberghs © Royal Museum for Central Africa.



**Fig. 9.** *Luba man with water pipe (calabash).* Photo C. Lamotte (Inforcongo) EP.0.0.8783 © Royal Museum for Central Africa.



Research on the Luba, especially by Mary Nooter Roberts, has highlighted the extreme complexity of the group's social, religious, and political organization. In particular, Robert's studies have brought out the role of memory and memorization in the context of sacred royalty, the stability and power of which relied on oral tradition. Certain initiates, ritualists, and diviners constantly glorified, recounted, and even reinterpreted the heroic deeds of the ancestors of the various chiefly lineages as a way of establishing their legitimacy. Matrilineal descent was, in this context, a fundamental factor that was part of the ambiguity of the notion of sacred power, at once beneficial and dangerous. In this system, the king's heirs were chosen from among his sisters' children, which gave women an important role in any accession to power.

Items of Luba material culture convey all these key notions and many of them seem to waver between genders: not only do they try to represent the chief's male and female components, but they have to evoke the fertilizing power required to produce (male) royal power in every female figure. More than this, women also symbolize the interiorization needed to protect the secrets and taboos linked to royalty<sup>29</sup>. Water pipes do not escape from this system of representation: they symbolize the relationship between the sexes. The reed, a phallic element, penetrates the bowl of the pipe on one side and the calabash of cold water on the other; in so doing, it links two female components and facilitates the passage from hot to cold. The process also evokes the hot/cold antagonism in a woman's nature. This interpretation is further confirmed by the fact that on some water pipes the calabash and the bowl are decorated with copper wires twisted into the pattern of female genital scarifications.<sup>30</sup>

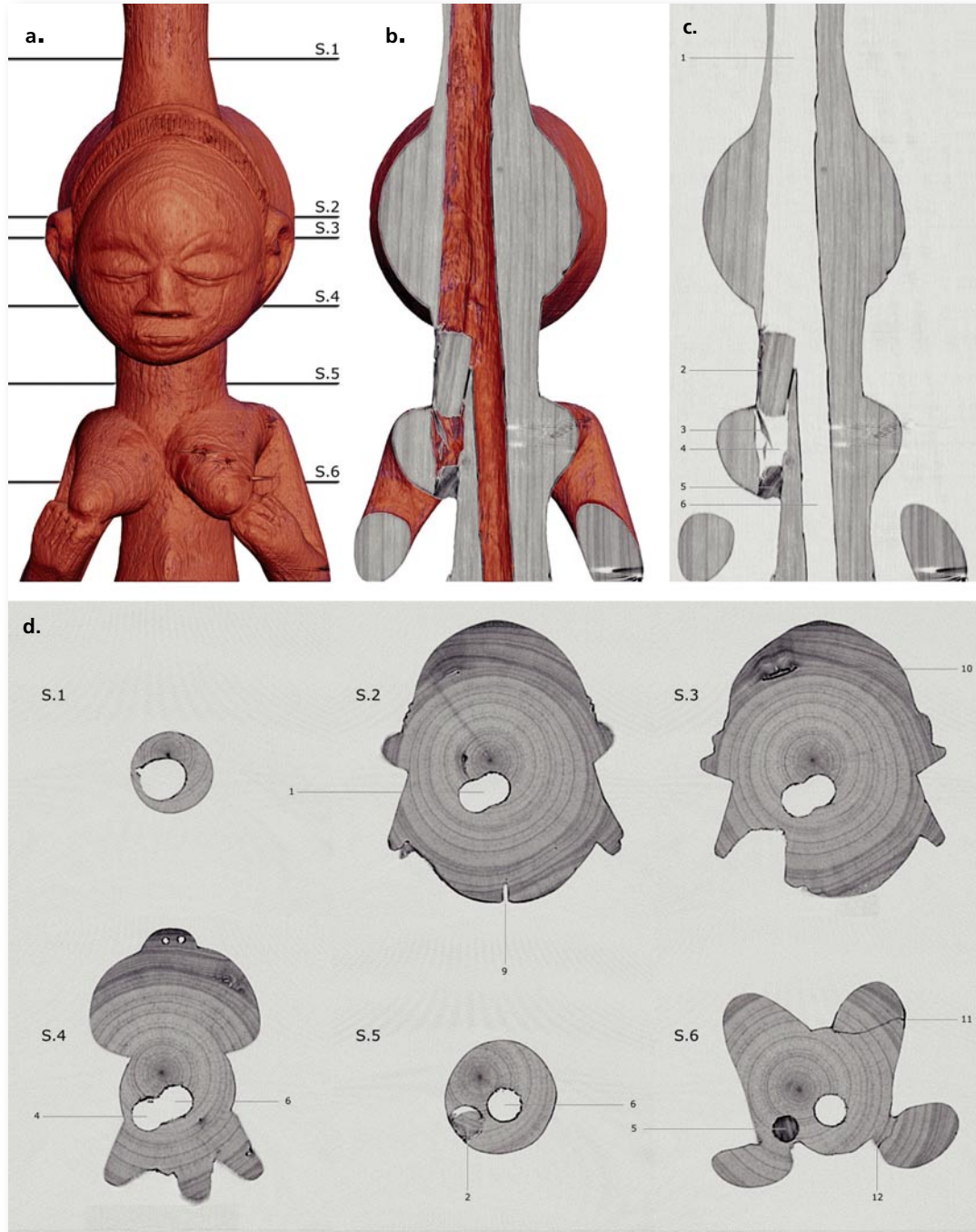
The scan sheds light on an important stage in the making of the pipe. The artist obviously failed in his first attempt to pierce a funnel to take the cooled smoke to the smoker's mouth. By mistake he swerved into the figure's right shoulder and had to plug the false route with wooden stoppers (**Figs. 10 and 11**). Makeshift repairs have been made in two places: along the neck where the wall has obviously been damaged and patched, and in the armpit itself where the repair can hardly be detected with the naked eye. Without the scan, it could be thought that the problem was due to the grain of the wood but, in fact, the sculptor bored too close to the right side of the neck and broke through. In the end, the breach gave him easier access from the outside to correct his mistake by driving a red-hot metal rod directly into the water reservoir. He then plugged up the hole (**Figs. 10 and 11**). In this case, the scan answers a question and furthers our knowledge of the internal structure of the figure, which could be extremely useful if it ever needed restoring or suffered further accidental damage. The artist who made what is now regarded as a major piece of African art appears to have proceeded by trial and error in this operation, and it is particularly moving to relive the steps in the process with him. It also becomes apparent that the shoulder, elbow, and left breast were broken at some stage in the object's life and mended with metal pins: four of these iron implants are clearly visible in the breast, four more in the elbow, and three in the shoulder (**Fig. 10**). The break to the arm can be seen with the naked eye, but the pins are not detectable. We know that a coloring agent was used by the museum's restoration department in 1973 to mask the damaged area. Could it have been an original repair made with European nails?<sup>31</sup>

**Fig. 10.** Scan of Luba water pipe EO 1973.73.1, VRT images. © Marc Ghysels.

**a.** Opaque VRT image.

**b.** The same VRT image but displayed with translucent settings.

**c.** The same translucent VRT image overlaid with a color diagram emphasizing the path of the funnel and repairs to the mistaken trajectory.



**Fig. 11.** Scan of the Luba water pipe EO 1973.73.1, VRT images and MPR slices.

© Marc Ghysels.

**a.** Frontal VRT image.

**b.** The same frontal VRT image as **a** has been virtually sliced in two lengthwise along the funnel. The anterior part has been rendered virtually invisible, while the posterior part has been kept opaque revealing the MPR slice corresponding to the section plane used. The plugs in the first funnel appear clearly, held in place by several wooden wedges.

**c.** The VRT environment has been effaced, leaving only the 0.75 mm thick MPR slice.

**d.** Six horizontal 0.75 mm thick MPR slices, arranged in descending order at the levels indicated by the horizontal marks on figure **a** ( $S_1$  to  $S_6$ ).

**S<sub>2</sub>-S<sub>3</sub>** Horizontal slices between the ears revealing the beginning of the two funnels, which shows up as a figure of 8: the true funnel boring vertically towards the calabash-shaped recipient and the erroneous funnel which swerves into the armpit after damaging the neck.

**S<sub>5</sub>** Horizontal slice at neck level: the two funnels are now clearly separate, the upper plug can be seen in the erroneous funnel.

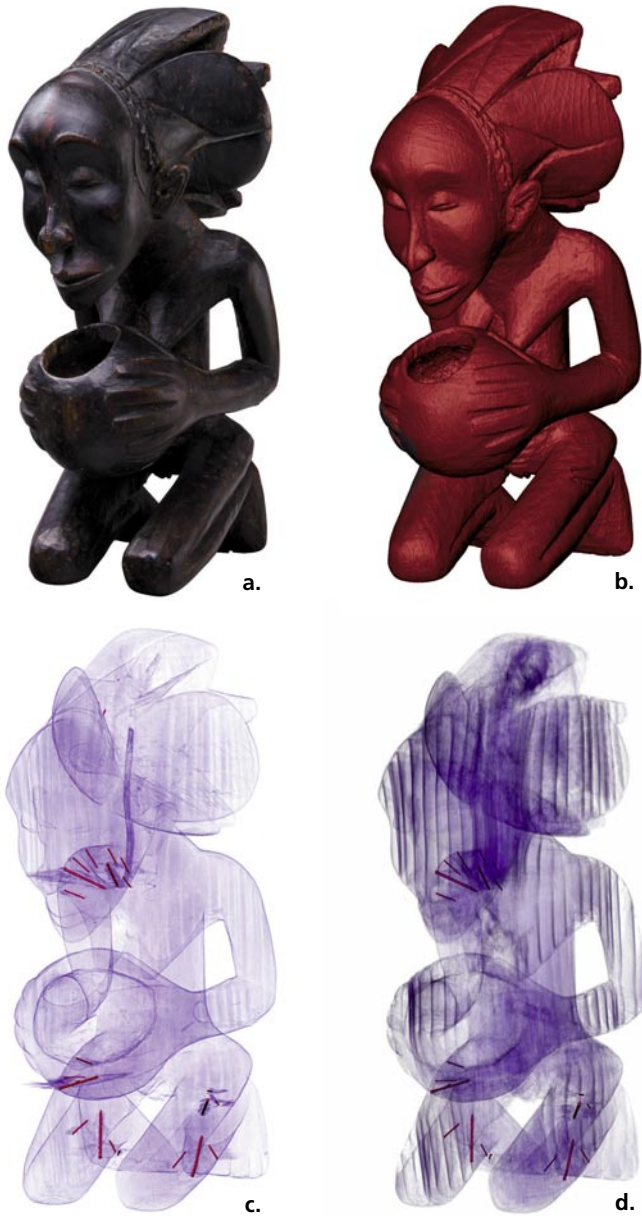
**S<sub>6</sub>** Horizontal slice at shoulder level showing the lower plug made from a different type of wood from the upper one. A line of glue crosses the left breast and shoulder.

For figures 10 and 11 :

- |                 |                         |
|-----------------|-------------------------|
| 1. upper funnel | 7. brad nail            |
| 2. upper plug   | 8. water reservoir      |
| 3. wooden wedge | 9. pin hole             |
| 4. false route  | 10. parasite scar       |
| 5. lower plug   | 11. glued left breast   |
| 6. lower funnel | 12. glued left shoulder |

The Luba certainly had access to this kind of material in the late nineteenth century but it would appear that deliberately invisible restoration was unusual.<sup>32</sup> So it is highly unlikely to have been an original repair, especially since the scan reveals the presence of glue (**Fig. 11d slice S<sub>6</sub>**). Moreover, scans of the internal structure of another major Luba piece—the cupbearer of the master of Buli (**Fig. 12a**)—also revealed nails and glue (**Figs. 12c, 12d, and 13**). For both these objects,<sup>33</sup> therefore, there is a strong presumption that the repairs made in the first half of the twentieth century were European. In the Luba pipe, a hole punched in the headdress proved, when scanned, to contain a deposit of high-density material, probably metal (**Fig. 11D slice S<sub>2</sub>**). The central position of the hole suggests that it once held an anvil-shaped iron pin, a highly symbolic object extensively described in anthropological literature. The shape of this type of pin evokes the complex metalworking techniques that the cultural hero, Mbidi Kiluwe, taught the Luba along with various hunting practices.<sup>34</sup> Moreover, during royal investitures, the cultural transformation of metals by the blacksmith serves as a metaphor for the forging and hardening of the king.<sup>35</sup> These pins were used by the king himself,<sup>36</sup> but also by various officiating priests in order to “pin down” a spirit<sup>37</sup> and secure its action. The iron pin therefore





concentrates an astonishing string of information about Luba culture and, more specifically, about the forging of the function of the sovereign. Its presence in a headdress clearly signals a high-ranking figure.

Various defects in the structure of the wood are also brought to light: there is one in the area behind the figure's right eye, probably a parasite scar that shows up as a hyperdense zone or dark spot (Fig. 11d slice  $S_3$ ).

The CT scan of the water pipe has taken us on a journey through time from the initial carving of the sculpture to its end use, recording the accidents that befell it along the way.

**Fig. 12.** *Luba cupbearer EO 0.0.14358, Democratic Republic of Congo.*  
Royal Museum for Central Africa.

**a.** Photo R. Asselberghs © Royal Museum for Central Africa.

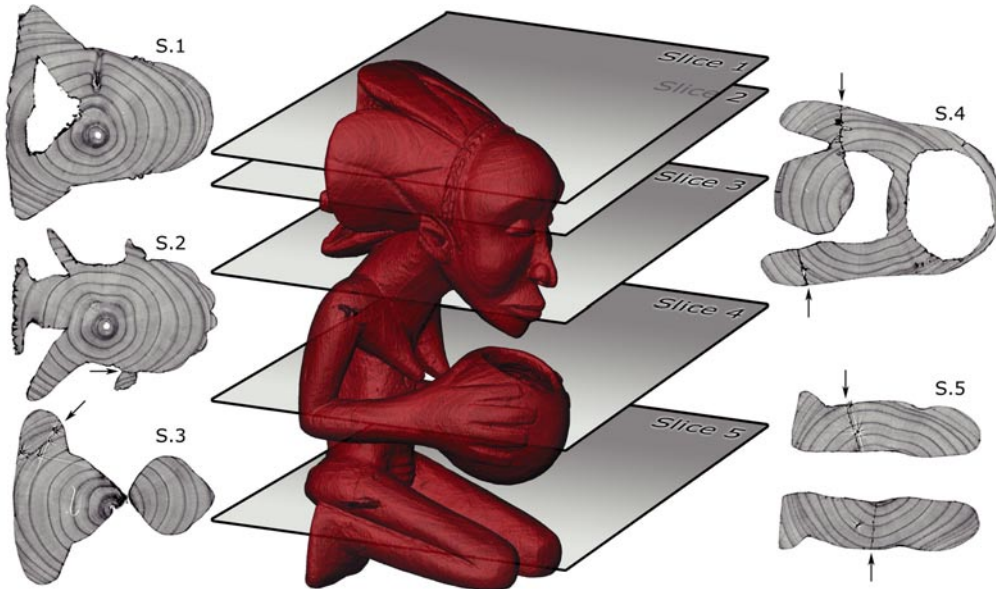
**b.** Scanner, opaque VRT image. © Marc Ghysels.

**c. d.** Scanner, translucent VRT images which show the structure of the wood and 22 metal nails in the right shoulder and legs. © Marc Ghysels.

This brief review of a Yaka fetish and a Luba water pipe taken from the Ethnography Division of the Tervuren Museum gives a glimpse of the many possibilities opened up by the use of CT scanners to probe art works. This sophisticated, non-invasive method of investigation yields slices and three-dimensional images that reveal unexpected facts and answer a number of questions. It lays bare earlier repairs and restoration work and shows up extraneous elements concealed within objects made from materials of all kinds.

**Fig. 13.** Scan of the Luba cupbearer EO 0.0.14358. © Marc Ghysels. Five MPR slices at the levels marked on the central VRT image revealing glue lines at the:

- left ear (slice  $S_2$ ),
- right shoulder (slice  $S_3$ ),
- forearms (slice  $S_4$ ),
- legs (slice  $S_5$ ).



## BIOGRAPHIES

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**Dr. Marc Ghysels**, M.D., is a specialist in radiology and medical imaging. He comes from a family of artist and collectors and, in 2002, he set up an agency in Brussels to carry out radiological appraisals of antiques and works of art. marc.ghysels@skynet.be

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## NOTES

1. Which can be one of the advantages of using CT imaging as we shall show in this article by pointing out the type of problem, construction, reconstruction, and assemblage that the scanner can reveal.
2. Ghysels 2003, 116.
3. Appadurai 1986.
4. Kopytoff 1986, 66-68.
5. Bouttiaux 1999, 595.
6. Barbier-Mueller 2006, 21, 25; Madeline 2006, 21.
7. Wastiau 2000, 11.
8. They were inevitably forgotten because most of the artists are anonymous and deliberately because this anonymity seems to be particularly attractive for collectors (Price 1989, 100); and, of course, it makes speculation much easier. See, too, Martin 2006, 155.
9. This phenomenon can be seen with contemporary urban art but also, to some extent, with "traditional" arts, despite the anonymity of the artists.
10. Hargrove 1997.
11. Inventory no. EO.0.0.32982, collected in the region of Popokabaka, south Bandundu, Democratic Republic of Congo (DRC), H. 26 cm; wood (*Crossopteryx febrifuga*), upholstery tacks, textile, fiber, and bamboo.
12. Devisch 1995, 304.
13. Bourgeois 1984, 107–10.
14. A photo taken by Bourgeois in the field, however, shows another *phungu* almost entirely wrapped up in a spherical bundle; 1985, 23, plate XXII.
15. Able to ward off evil spells. *Ibid.*, 110.
16. Devisch 1995, 304; on the other hand, the author's comment about the possible involvement of the object in protecting manioc crops does not seem relevant. The letter to which he refers (from the colonial administrator A. Verschaffel dated 17 February 1931) indeed mentions a fetish protecting the manioc fields but it was probably not this one. Verschaffel describes the sculpture as "(...) a fetish which is unfortunately very antiquated but its heads are very well preserved and admirably carved." (Ethnographic file no. 552).
17. Bourgeois 1985, 267.
18. Bourgeois 1984, 140; 1995, 303.
19. MacGaffey 1995, 286.
20. Bourgeois 1985, 6.
21. de Surgy 1985, 1993, 1994.
22. Tobia-Chadeisson 2000, 182.
23. *Crossopteryx febrifuga*.
24. Devisch 1995, 304.
25. And analyzed in Côte d'Ivoire, courtesy of Professor Zoro Bi Irié, Agronomy Department of the University of Abobo Adjamé, Abidjan.
26. Inventory no. EO.1973.73.1, collected by Commandant Hennebert between 1898 and 1900, Democratic Republic of Congo (DRC), H. 61 cm., 1, 14 cm., wood (*Ricinodendron rautaneii*) manketti nut or featherweight tree.
27. Roberts 1995, 360–61.
28. Which deliberately imitates the shape of one material in another; in this case, the shape of a calabash in wood.
29. Roberts & Roberts 2007, 54-55; 57-58.
30. Roberts 1995, 361.
31. Pins or nails from which the heads have been removed.
32. Among the Luba or in African arts in general, broken pieces were usually tied or nailed together and the nails were not concealed.
33. Both carved from *Ricinodendron rautanenii*, a very light wood.
34. Roberts & Roberts 2007, 130, entry for object no. 39.
35. *Ibid.*, chapter 'Forger la royauté, 41-45'; Petit 1993, 482–83.
36. Who, incidentally, wore a female headdress during his enthronization, see Roberts & Roberts 2007, 32–34.
37. *Ibid.*, 32–34 and 131, entries no. 41 and 42.

