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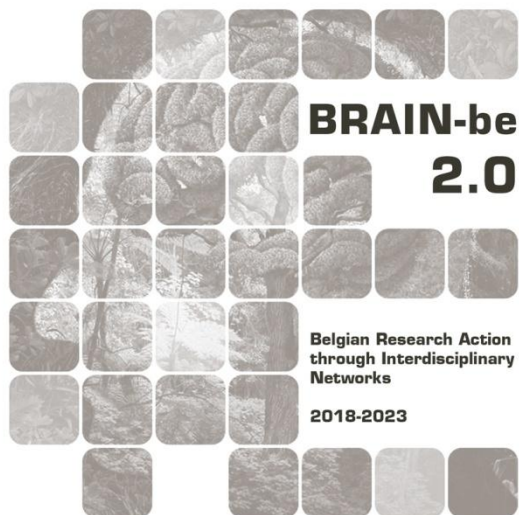
2018-2023

CONteXT

CONgolese heritage objects examined and contextualized through X-ray Tomography

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Pillar 2: Heritage science

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NETWORK PROJECT

CONteXT

CONgolese heritage objects examined and contextualized through X-ray Tomography

Contract - B2/233/p2/CONteXT

FINAL REPORT

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Sofie Dierickx, Wannes Hubau, Jan Van den Bulcke, Hans Beeckman. *CONteXT: CONgolese heritage objects examined and contextualized through X-ray Tomography*Final Report. Brussels: Belgian Science Policy Office 2025 – 56 p. (BRAIN-be 2.0 - (Belgian Research Action through Interdisciplinary Networks))

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ABSTRACT

Context

The 2-year CONteXT project (CONgolese heritage objects examined and contextualized through X-ray Tomography) was launched in March 2023 as a continuation of the TOCOWO project (Tomography of Congolese Wooden Objects). During TOCOWO, 129 wooden cultural artifacts from the Royal Museum for Central Africa's (RMCA) collection were transported to UGent, where they were scanned using X-ray microtomography. The primary aim of this initial research was to assess the viability of this non-invasive imaging technique for identifying wood species. By the project's conclusion in February 2023, the high-resolution 3D scans had not only provided insights into the anatomical structure of the wood but had also revealed a wealth of additional information that remained to be explored. The CONteXT project was established to further investigate these data, delving deeper into the objects' material composition, craftsmanship, signs of degradation, and past conservation treatments.

Objectives

The primary goal of the CONteXT project is to enhance the understanding of Congolese heritage objects through advanced imaging and analysis. By delving into the scans and systematically examining the information this unprecedented dataset holds, the project wants to explore the possibilities to visualize and document any construction details, traces of use, deterioration processes and old restoration treatments. The insights provided by these hundred collection objects about their creation and use, as well as about the interaction of their materials with past and present environments. Beyond material studies, the project aims to address ethical considerations surrounding the scanning of sacred and religious artifacts, particularly those containing concealed spiritual elements. By actively engaging with knowledge-holders from both Belgium and the Democratic Republic of Congo (DRC), the project seeks to incorporate source community perspectives in determining how the scans and results of this project should be disclosed and valorised. Additionally, CONteXT foresees knowledge dissemination through public and academic outreach, including exhibitions, an open-access online database, and scholarly publications.

Conclusions

Over the course of the project, we have made significant progress in deepening the contextual understanding of Congolese heritage objects. The integration of scientific analysis with ethical discourse has facilitated a more nuanced approach to cultural heritage preservation. Challenges such as time constraints and evolving ethical considerations required adaptations to the original research plan. Despite these, the project has successfully contributed to the knowledge of the cultural objects, advanced material heritage research, and fostered dialogue with source communities.

Keywords

Cultural heritage, Sub-Saharan African heritage, tropical wood species, X-ray µCT, wood identification, wood selection

1. INTRODUCTION

The collection housed at the Royal Museum for Central Africa (RMCA) has a long and complex history, much of which remains only partially documented. Most of the Congolese wooden heritage objects in the museum's storage were removed from their original contexts during the first half of the 20th century. The limited information available about these objects was typically recorded and interpreted by the collectors themselves, often without input from the communities from which they originated. This vast and diverse collection presents significant challenges for research, preservation, and public engagement due to the scarcity of documentation, the varied materials within the artifacts, and the sheer size of the collection. In line with the museum's scientific strategy to expand knowledge on Central African societies, past and present, historical and anthropological studies have sought to supplement these gaps. However, one often-overlooked source of knowledge lies within the objects themselves. Their construction methods, material composition, signs of damage, and past repairs can reveal valuable insights into their historical significance, original use, and cultural context. Understanding this material evidence is essential both for deepening knowledge about the objects and for ensuring their long-term preservation.

The CONteXT project (CONgolese heritage objects examined and contextualized through X-ray Tomography) built upon previous research conducted through the TOCOWO project (Tomography of Congolese Wooden Objects), which ran from 2020 to 2022 as part of the BRAIN research program. During TOCOWO, 129 wooden Congolese objects from the RMCA's collection were scanned using high-resolution X-ray microtomography (µCT) at UGent. This advanced imaging method provided a three-dimensional, non-invasive view of the objects, offering insights that could not be obtained through traditional analysis without risking damage. While TOCOWO primarily focused on exploring the feasibility of wood species identification through µCT scanning, CONteXT took a broader approach. It sought to analyse the high-quality scans in depth, applying methodologies from Conservation Science and Material Culture Studies to systematically examine construction details, traces of use, deterioration patterns, and past restoration treatments. The goal was to extract new knowledge about these artifacts, which could then be extrapolated to similar objects within the RMCA's extensive collection. This interdisciplinary research was intended to be of great value to art historians and anthropologists studying the collection, as well as to conservators and collection managers responsible for its preservation.

Beyond material analysis CONteXT addressed the fundamental challenge of the ethical dimension of studying and revealing information about African heritage objects. From a scientific point of view, the discovery of hidden construction techniques, accumulative ceremonial use, and other structural details is often celebrated as a breakthrough. However, for many living Congolese cultures, certain aspects of an artifact's design or ritual function are considered privileged or even secret knowledge. This is particularly relevant in the case of power objects such as Mankishi figures, which sometimes contain internal cavities filled with Bishimba, sacred substances believed to hold spiritual power. The unrestricted visualization of such elements raises critical ethical questions about what should be revealed and to whom. While protocols for handling sensitive cultural heritage have been developed in North America and Australia—particularly concerning artifacts containing human remains—similar considerations for African objects remain underexplored. CONteXT sought to address this gap by engaging both Western heritage professionals and knowledge holders from the source communities in discussions about when and how African objects should be examined, sampled, and visualized. The

project aimed to draft ethical guidelines that will assist future researchers and museums in making informed decisions regarding the study of African cultural heritage.

Finally, CONteXT was committed to sharing its findings with a broad audience. In addition to engaging the academic community through publications and conference presentations, the project wanted to present the 3D scans and the information uncovered through the research in a publicly accessible online database. This platform would allow individuals worldwide to explore the objects, their histories, and their material compositions, ensuring that the knowledge gained is widely disseminated beyond academic and museum spaces.

By combining cutting-edge imaging technology with ethical reflection and inclusive collaboration, CONteXT aspired to deepen the understanding of Congolese heritage objects, while ensuring that research and museum practices remain respectful of their cultural significance.

2. STATE OF THE ART AND OBJECTIVES

X-ray computed tomography (CT) scanning has emerged as a particularly powerful tool in heritage research. Initially developed for medical applications, it enables non-invasive visualization of an object's internal and external structures without altering its physical state (Fernandez, 2020; Albertin et al., 2019). This capability is especially valuable for conservators, as it allows for unlimited internal analysis while preserving the integrity of artifacts. Past and ongoing projects demonstrate the potential of X-ray CT in studying heritage objects across different materials, though many studies are constrained by the availability of medical or industrial scanners and tend to focus on a limited number of Western art objects (Dominguez-Delmas et al., 2021; Rankin et al., 2021; Darmstädter, 2016).

A few museums and researchers have applied this technology to wooden objects from ethnographic collections. For example, in 2013, the Indianapolis Museum of Art scanned two Songye power objects (Hersak, 2013), and in 2020, the Musée du Quai Branly conducted a similar study on another Songye object (Charlier et al., 2020). The Virginia Museum of Fine Arts used X-ray CT scans to analyze a privately owned Pende power object in 2016, revealing its complex accumulated components (Weiss et al., 2016). In Belgium, the Royal Museum for Central Africa (RMCA) scanned a selection of its masterpieces with a medical scanner in 2005, uncovering hidden structural details (Gheysels & Bouttiaux, 2008). More recently, the Museum aan de Stroom (MAS) initiated a project to scan Songye Nkishi figures in collaboration with Congolese scholars, highlighting the need for greater involvement of African researchers and institutions in such studies (Dibwe, 2021).

Despite these advancements, ethical considerations in the study of African heritage objects remain underexplored. From a strictly scientific perspective, uncovering details about an artifact's construction and use is considered a breakthrough. However, for many African cultures, such information—particularly concerning ritual or ceremonial practices—is considered privileged or even secret, with some traditions still actively practiced today. While North America and Australia have seen increasing awareness and the development of protocols for handling sensitive heritage, particularly objects containing human remains (Odegaard & Cassiman, 2016), similar recognition in African heritage research is lacking (O'Hern et al., 2016; Hugounenq, 2022).

Objective 1| The primary objective of CONteXT was to expand the knowledge available on the objects in the RMCA collection by examining their material composition and historical context using high-resolution X-ray µCT scans. This dataset—comprising 129 Congolese objects—offered an unprecedented opportunity due to its scale, diversity, image quality, and historical significance. By systematically analyzing the scans, the project aimed to document construction techniques, traces of use, deterioration processes, and past restorations. The insights gained not only improved understanding of these specific objects but also provided valuable comparative data for similar artifacts within the RMCA's extensive collection. The findings proved to be of great value to art historians and anthropologists studying the collection, as well as conservators and collection managers working to preserve it.

Objective 2| CONteXT also sought to engage both Western researchers and African knowledge holders in a critical discussion about the ethical implications of examining, sampling, and visualizing African heritage objects. A central question was whether the benefits of material analysis and improved conservation outweighed potential breaches of secrecy inherent to certain cultural artifacts.

The project aimed to develop ethical guidelines for the responsible study of African heritage objects, helping museums and researchers navigate issues of cultural sensitivity and shared custodianship.

Objective 3| The final objective of CONteXT was to make both the scanned objects and the research findings accessible to a broad and international audience. The results were prepared to be presented in a temporary exhibition at the RMCA, where visitors were invited to explore the material histories of the artifacts and reflect on the ethical questions raised by the research. In addition, the X-ray μCT scans and associated data were integrated into a publicly available online database, ensuring that scholars, community members, and the general public could engage with the objects and their stories from anywhere in the world.

3. METHODOLOGY

The conducted research delved into an existing database of high-resolution X-ray µCT scans of Congolese heritage objects to gain deeper insights into their condition, history, and cultural context. While low-resolution X-ray techniques have been used in heritage studies for decades—primarily through medical imaging systems—this project takes an innovative approach. It surpasses previous case studies in scale, origin, and the quality of the dataset, examining 129 Congolese heritage objects from the FSI collection. These objects, varying in dimensions, materials, typology, and geographical distribution within the Democratic Republic of Congo, were scanned with a µCT scanner at the UGent facilities (UGCT), yielding high-resolution, three-dimensional data. Figure 1 presents the size of the dataset of scanned objects in the form of a map, showing the objects scanned from various regions and cultures in the DRC. A list of all 129 objects scanned and examined during the course of the TOCOWO and CONteXT projects can be found in the annex at the end of this report.
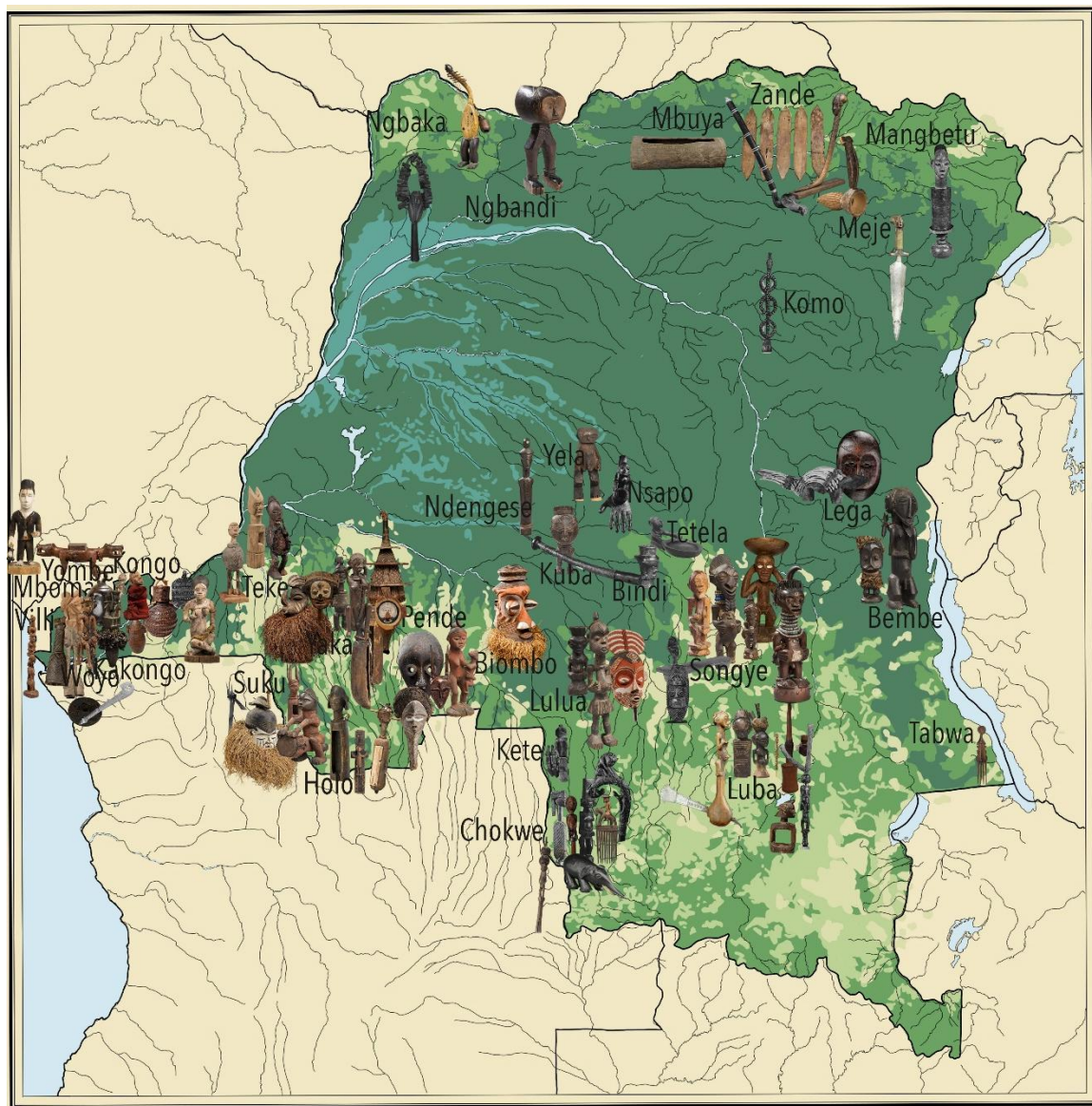
Figure 1: geographical distribution of the 129 collection objects scanned during the TOCOWO project
©RMCA ©UGCT ©UGent-Woodlab

Beyond its scale, the project introduced an innovative perspective by treating the material condition of the objects as a valuable source of knowledge. Physical traces within the material—such as wear, repairs, and modifications—offer insight into the objects' original context, use, and historical journey. By combining X-ray µCT scans with oral accounts from knowledge holders in both the Belgian diaspora and the DRC, the CONteXT project seeks to reconstruct the original significance and lifecycle of these objects.

Additionally, the research critically engages with the ethical dilemmas surrounding the study of African heritage. By consulting knowledge holders from source communities and Western heritage researchers, the project aims to identify potential concerns regarding the sampling, analysis, and disclosure of information related to power-associated objects.

Processing and examining scans| The acquired X-ray µCT scans were processed and analyzed using specialized software that converts 2D cross-sectional images into detailed 3D renderings, enabling an in-depth virtual examination of both the external and internal structures of the objects (Dierickx et al. 2024). VGStudio MAX© was used to generate high-resolution 3D models, isolate different materials based on their X-ray attenuation properties, and offer a range of visualization options. Additionally, ImageJ, an open-source software, facilitated the reslicing of 2D projections, making it possible to extract cross-sections from any angle within the object. To ensure consistency in data processing and interpretation, the research followed a standardized protocol developed during the TOCOWO project (Dierickx et al. 2024). By applying these advanced imaging techniques, the study provided an unparalleled view of the objects' material characteristics, shedding light on construction techniques, signs of use, deterioration patterns, and past restoration efforts. Figure 2 shows the diverse visualisation possibilities of the scanned volume: next to the photo of a small Kongo bell are two 3D renderings, one at 0% transparency and one at 80%. In addition, 2D reslices of the same scanned volume are shown: on the far left from the top of the object to the bottom; on the right reslices along the length of the object.

Figure 2: The various ways to visualise the three-dimensional information of a high-resolution scan of a Kongo bell MO.1955.113.17 (10.9 x 3.7 x 2.5 cm, scanned at 62µm) : on both sides of the figure 2D reslices of the bell, in the middle two 3D renderings at different trancparency. ©RMCA ©UGCT ©UGent-Woodlab

Field research and ethical considerations| As part of a collaborative provenance research initiative between two research projects at the AfricaMuseum (PROCHE (***PRO****venance Research on the Ethnographic **C****ollection)* and CONteXT), and the IMNC (Institut des Musées Nationaux du Congo), field research was carried out in five provinces of the Democratic Republic of Congo. Five anthropologists visited communities in both urban and rural areas, engaging in discussions about the ethical considerations surrounding the study and scanning of Congolese heritage objects. An additional two days of fieldwork, funded specifically for this project, were dedicated to presenting the X-ray μCT research to local communities and recording their perspectives.

To ensure a systematic and inclusive approach, a survey was developed in French and adapted for oral delivery in Lingala, Swahili, and other local languages, allowing participants to comfortably express their views. Designed collaboratively by anthropologists, historians and provenance researchers of the IMNC and the AfricaMuseum, this survey sought to document opinions on the appropriateness of X-ray scanning for cultural heritage objects, ethical concerns related to revealing internal structures, and the ways in which research findings should be shared.

Online image database| To make the research more accessible to a broad audience, the project collaborated with the AfricaMuseum's PROCHE project (https://proche.africamuseum.be) to integrate 3D surface renderings of the scanned objects into an online database. These digital models, created using VGStudio MAX, will allow users to interact virtually with the objects, exploring their external features in a dynamic and engaging way. However, to respect cultural sensitivities, the database will only display surface renderings, ensuring that no privileged or sensitive internal details are revealed. By providing this interactive platform, the project aims to foster greater engagement with Congolese heritage while maintaining ethical considerations surrounding the study and presentation of these objects.

4. SCIENTIFIC RESULTS AND RECOMMENDATIONS

Over the course of two years, budgetary and time constraints necessitated a reassessment of priorities and an adaptation of methods to achieve the core objectives of CONteXT. Despite these challenges, the project successfully met its main goals through collaboration and innovative problem-solving, resulting in a comprehensive and insightful interpretation of the research aims.

Objective 1| Analysis and contextualisation of the scanned objects

A key outcome of this objective was the creation of detailed information sheets for each scanned object. These sheets serve as a valuable resource for researchers, conservators, and museum staff by compiling essential data on the objects' material composition, construction techniques, and historical context.

The first page of each sheet presents fundamental details drawn from the museum's database, supplemented by relevant literature on the objects or comparable artifacts. It also includes technical information about the scan setup, such as images of the objects' positioning inside the scanner, providing a reference for future research endeavours.

The second page focuses on conservation insights, documenting evidence of construction techniques, degradation patterns, use, and previous restorations. This analysis not only enhances the understanding of individual artifacts but also contributes to a broader comprehension of the museum's collection as a whole. The research revealed recurring degradation phenomena, including insect infestations in nearly 50% of the scanned objects. Many objects, predominantly made of or incorporating large wooden elements, exhibited cracks caused by historical fluctuations in temperature and humidity within storage environments.

The final section of each sheet details findings from Region of Interest (ROI) scans—high-resolution imaging of the objects' internal wood structure. This includes an anatomical description and wood identification, accompanied by information on the wood species' properties and geographic distribution. By tracing the origins of the wood, the study establishes connections between the tree from which an object was carved, the sculptor's material selection, and the cultural significance of these choices. Figure 3 presents a complete data sheet for a Pende sculpture depicting a mother and child. All information sheets have been integrated into the museum's database, allowing staff and researchers to access this additional material data alongside existing records.

In March 2025, a research paper was published examining the potential of material studies to expand knowledge about the museum's collection (Dierickx et al. 2025). This study focused on 20 Sub-Saharan African heritage objects from the scanned dataset, each differing in size, material composition, and form. The research explored some key questions: if it was possible to identify the wood species based on the μCT scans given this variation in physical attributes and, in the case of a successful wood identification, if the wood's properties—such as density, durability, and acoustic characteristics— could provide insights into the object's original function, its cultural significance, and the craftsmanship involved in its creation?

Sculpture
- Pende culture (DRC)

Museum registration
Registration number: EO.1980.2.2664
Typology: Sculpture
Culture: Pende
Dimensions: 50 x 15.7 x 15 cm
Materials: wood, pigment
Acquisition: Bequest
Date: March 24th, 1980
Donor: Marie-Jeanne Walschot

Geography

Use
General
This Mother and Child statue from the Pende culture represents a child seated on its mother's hip. Adorned with red and black pigment, the sculpture has endured the passage of time, with one of its arms now missing.

Literature
Oberhofer, M., Mannes, D. and Stenger, J. 'Between inside and outside: a female power object by the Congolese Central Pende' in Congo as Fiction: Art Worlds between Past and Present. Museum Rietberg Zürich. 2020.

Overview scan
Date scanned: June 2022
Scanner: HECTOR
Scan time: 6
Voxel pitch: 110 µm
Scan settings: 100kV, 30W, 0,5mm Al, 2401 projections, 500ms

Object set-up
The object could stand on its own and was stable during scanning. Due to the relatively homogenous width throughout the object, there was a limitation to the highest achievable resolution on the ROI scan. For this, the head of the figure was targeted.

Overall scan set-up

ROI set-up

Conservation insights

Construction of the object
The object is carved from a single wood block. The pith of the tree runs centrally through the sculpture (orange arrows A & B), and has dried partially detached from the juvenile wood (C).

Damages to the object
The right arm of the mother figure is lost.

There is some intensive insect damage present in certain parts of the sculpture. The worst part affected is the child figure's head. On the three-dimensional rendering (D) and the cross-section (G) the empty and frass-filled galleries caused by insect activity are clearly visible. There are also small zones near the surface of the mother figure's sculpture with this damage (E, F & H)

Three are some large cracks inside the wood, starting from the pith of the tree and running outwards. The largest of these cracks are in the base of the object.

Old conservation treatments
The base of the sculpture received a treatment in the past. The documentation for this treatment can't be retraced in the museum database, but the glue used to repair a large fracture in the base of the object lights up in the X-ray scan.

Ethical considerations
Several small, oval-shaped holes (about 4.5 cm in height) could be seen on the exterior of the sculpture (J & K) at the height of the mother's hips. At first, these tunnels appeared to be deliberately crafted, as they were arranged neatly along a horizontal plane and were regular in both size and shape.

However, further examination of the scans ultimately disproved the hypothesis that these tunnels were man-made. The hollow canals trace back to the central pith of the wood, and contain phloem tissue which connects to the shrunken pith cells. This leads to the conclusion that these structures were naturally occurring. This finding was significant, as a similar case was previously documented in a Pende statue studied at the Museum Rietberg in Zürich. The wood bares anatomical and morphological resemblance to scientific reference material from Alchornea, a genus where branching in horizontal planes has been observed.

Establishing that the channels were a natural phenomenon rather than the result of human intervention was a crucial factor in the interpretation and dissemination of the scans: had the canals been man-made and linked to privilged information, we would not have shared the 3D renderings or 2D realice of the inside of the object.

Region of Interest scan
Registration number: EO.1980.2.2664
Scanner: HECTOR
Scan time: 62 min
Voxel pitch: 10 µm
Scan settings: 100kV, 10W, 0,5mm Al, 3301 projections, 1000ms

Object set-up
The forehead of the mother figure was targeted for the Region of Interest scan

Wood identification

Transverse plane | Radial plane | Tangential plane

5 mm | 5 mm | 5 mm

1 mm | 1 mm | 1 mm

Most notable qualitative features

IAWA anatomical list code	Indication
9a - vessels in radial multiples of 4 or	a
68p - fibres very thin-walled	
77p/80a/85a - axial parenchyma diffuse-in-aggregates, not aliform, nor banded	
98a - no wide rays	c
136p - prismatic crystals present	d

Quantitative features

IAWA anatomical list code	Mean value	Indication
40a/43a - mean vessel size	100 µm	Blue
46p - vessels per mm²	4	Green
53p - vessel element length	475 µm	Red
rays per mm²	/	Orange

Wood identification

Wood anatomical description: 9a 40a 43a 46p 53p 68p 77p 80a 85a 98a 107a 108a 136p179p

Phase 1 - Genus query on InsideWood
Phase 2 - Species selection based on geographic distribution
Phase 3 - Species ranking based on comparative microscopy

Ranking	Retained species (occuring in Central Africa and with available visual references)	Incompatibilities
1.	Alchornea floribunda Müll.Arg.	Best fit
2.	Alchornea cordifolia (Schumach. & Thonn.) Müll.Arg.	Best fit
3.	Alchornea hirtella Benth.	10a/47p vessels not in multiples, too many per mm²
4.	Alchornea laxiflora (Benth.) Pax & K.Hoffm.	10a/47p vessels not in multiples, too many per mm²
5.	Alchornea mildbraedii Pax & K.Hoffm.	10v/47p too many vessels per mm²
6.	Alchornea occidentalis (Müll.Arg.) Pax & K.Hoffm.	47p too many vessels per mm²
7.	Alchornea yambuyaensis De Wild.	47p too many vessels per mm²
8.	Neoboutonia macrocalyx Pax	10a vessels not in multiples
9.	Neoboutonia mannii Benth.	10a vessels not in multiples
10.	Neoboutonia melleri (Müll.Arg.) Prain	10a vessels not in multiples
11.	Lepidobotrys staudtii Engl.	10a/47p vessels not in multiples, too many per mm²
12.	Leeuwenbergia letestui Letouzey & N.Hallé	10a/86p vessels not in multiples, axial parenchyma in narrow bands
13.	Leeuwenbergia africana Letouzey & N.Hallé	10a/86p vessels not in multiples, axial parenchyma in narrow bands

Visually most similar to *Alchornea sp.*

Wood species properties

Alchornea sp.

Specific gravity: 0.53
Source: Tervuren database

Resistance to dry wood borers: not found

IUCN Red list of threatened species: not threatened
https://www.iucnredlist.org/search?query=alchornea&searchType=species

Geography

Occurance of *Alchornea sp.* on African continent:
Source: RAINBIO database

Legend
● Pende culture
● Alchornea cordifolia
● Alchornea floribunda

Figure 3 shows a full data sheet on a Pende sculpture, depicting a mother and child. The wood of this sculpture is anatomically described and identified on the bottom two pages of the sheet. ©RMCA ©UGCT ©UGent-Woodlab

Despite the diversity in object dimensions and materials, 18 out of the 20 heritage objects were scanned with a voxel size of less than 8.5 µm, enabling a high degree of accuracy in wood identification. All 20 objects were successfully identified, with two—the Bindji pipe and the Chokwe elephant sculpture—containing two different wood species. Of the 22 total wood identifications, 18 were determined at the species level, three at the genus level, and one was classified as a liana, with a likely botanical family assigned.

The study demonstrated that X-ray µCT is a viable and effective tool for non-invasive wood identification in heritage objects. By analysing both quantitative and qualitative anatomical features at varying resolutions (ranging from 3.5 µm to 20 µm voxel sizes), researchers could systematically narrow down species identifications. This dataset, spanning a broad range of object types, builds on previous case studies and further validates the feasibility of µCT for wood identification in heritage research.

Identifying the wood species used in these objects provides crucial insight into their material origins and the choices made by artisans. It links each artifact back to the tree it was carved from, the craftsperson who selected the material, and the object's intended function within its original community. By correlating wood species with their technical properties—such as density, durability, and availability—the study highlights how material selection was guided by both practical and cultural considerations. These findings not only enhance our understanding of African material culture but also offer valuable knowledge for conservation efforts, ensuring that these objects are preserved with a deeper awareness of their structural vulnerabilities and historical significance.

Objective 2| Ethical considerations of X-ray scanning African heritage As proven by the results published in response to the first objective, X-ray µCT can uncover information and help reconstruct lost knowledge about cultural objects. While this might be crucial information, especially when studying an under-documented collection such as is housed at the AfricaMuseum, they also pose significant ethical concerns. Should knowledge that was deliberately concealed by its creators be accessed? Does retrieving and sharing this information serve the interests of the source communities? And is it appropriate to present such findings in academic or public settings? Ultimately, only the source communities—the original makers and custodians of these objects—can provide clear guidance on how to approach these dilemmas.

The findings from this research are currently being compiled into an article in collaboration with Congolese researchers who conducted the fieldwork, along with researchers from the PROCHE project (**PRO**venance Research on the Ethnographic **C**ollection*)* at the AfricaMuseum. This publication will explore the ethical complexities surrounding the study of heritage objects from colonial collections and propose preliminary guidelines for conducting such research responsibly. The goal is to balance the pursuit of knowledge with a deep respect for the cultural and spiritual values embedded in these artifacts. To systematically record participants' opinions, a survey was developed to assess their perspectives on the conducted research, as well as its dissemination. The survey was collaboratively designed with the five researchers who conducted the fieldwork and the provenance researchers from the AfricaMuseum and IMNC.

A total of 57 individuals across the Democratic Republic of Congo participated in the study, with at least seven participants from each fieldwork site. The participants, averaging 50.2 years of age, represented a broad range of professional and social backgrounds. Each of the five field researchers

spent three months at their respective locations, dedicating two days to interviews with individuals who voluntarily shared their perspectives on material studies and the use of X-ray CT scans on their heritage objects. Efforts were made to ensure diverse representation, and special care was taken to secure informed consent for the inclusion of participants' insights in this publication. Figure 4
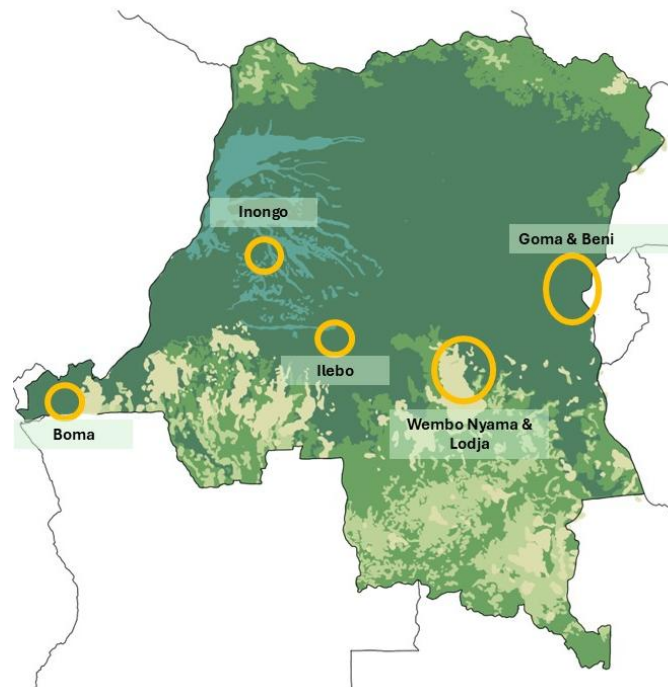
illustrates the provinces where the research was conducted.

Figure 4: Vegetation map of the DRC. Indicated with orange circles are the cities and villages visited by the five IMNC researchers. ©RMCA ©UGCT ©UGent-Woodlab

In addition to examining individual responses, the data was systematically analysed to identify trends based on key factors such as age group and professional background. For age-related analysis, participants were divided into five groups, each covering a 15-year range: 20–35, 36–50, 51–65, 66–80, and 81–95 years. Those who did not disclose their age were classified as "not recorded." Figure 5 provides an overview of participant distribution across these age groups.
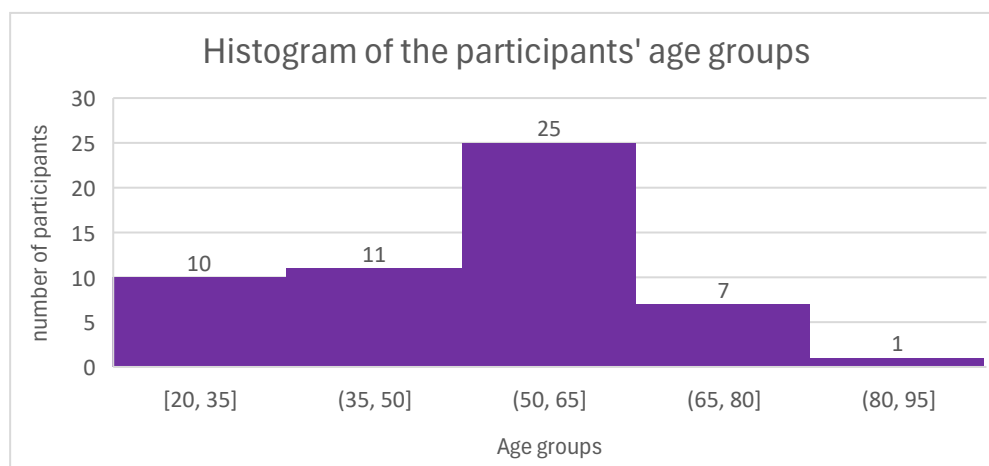
Figure 5: histogram of the age groups and distribution of the 57 participants ©RMCA ©UGCT ©UGent-Woodlab

To account for the wide range of professional backgrounds, participants were divided into ten occupational categories. These included government employees (state agents), academics (such as historians and PhD students), and artists (including sculptors and woodworkers). Educators, such as teachers and "chefs de travaux," were grouped separately, as were healthcare professionals, including doctors and nurses. Museum staff and village leaders—acknowledged as key custodians of traditional knowledge—were also categorized individually. Other fields represented included social work and transportation. A final category, "not recorded," was designated for individuals who chose not to disclose their profession. Figure 6 illustrates the number of participants within each professional category. A publication on the results of the survey is in preparation.
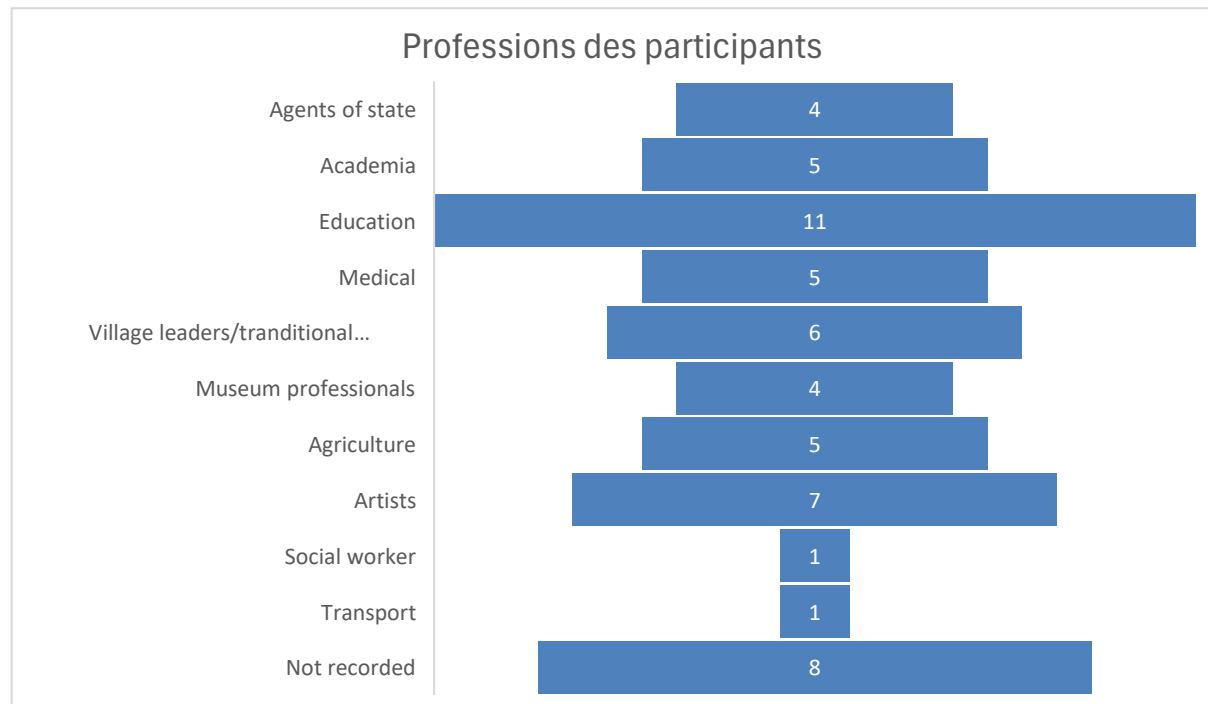
Figure 6: Distribution of the participants across the different professional categories ©RMCA ©UGCT ©UGent-Woodlab

Objective 3| Dissemination of the results is explained in detail in point 5 below.

5. DISSEMINATION AND VALORISATION

(Inter)national presentations | Over the past two years, many opportunities presented themselves to share the CONteXT project and its intermediate results at international conferences. All the presentations listed below represented enriching experiences, offering a chance to build and expand a network and to collectively reflect on the presented topics.

- o 29-31 March 2023 - **Taking care** -Stuttgart
  Exchanging expertise and experience across continents: towards a sustainable co-stewardship
  Presentation at the Creative study lab Taking Care

- o 16 March 2023 – **ArtBio Matters** (online)
  "Non-invasive" techniques: X-ray tomography of Congolese wooden objects
  Online presentation on the ethical considerations of scanning African heritage

- o 17-19 April 2023 - **Diversiteitdagen St.Rita college** - Kontich
  Cultural awareness debate with presentations, focus on restitution of Congolese heritage.
  Presentation and guiding debate for first grade students (12-13 years old)

- o 23 March 2023 - **MAS-RMCA workshop** – Antwerp
  Presentation of scanned collection object at an internal workshop in Antwerp, comparing research results and methodology on similar Songye Mankishi.

- o 5 December 2023 – (internal) **Woodbiology workshop** – Tervuren
  Inside Inside Wood
  Co-organising and presenting internal woodbiology workshop to exchange insights and experiences

- o 9 February 2024 **– UGCT seminar** – Ghent
  Where science and rituals meet. The challenges of scanning African cultural heritage.
  Presenting at UGent seminar

- o 11 April 2024 – Stichting Ebenist international conference – Amsterdam
  Weighing knowledge and respect: the opportunities and pitfalls of researching Congolese heritage objects
  Presenting on ethical considerations when researching African heritage

- o 30 May 2024 – **Forest to Heritage Conference** – Helsinki
  Wood species identification using X-ray µCT scanning: A multi-resolution comparative study
  Presenting a methodological experiment

- o 4 June 2024 – **InArt conference** – Oslo
  A scan of worms
  Presenting on the possibilities of visualizing and quantifying insect-damage through X-ray µCT

Follow-up committee | During the course of the project, the Follow-up committee was assembled three times, to benefit from the experiences and unique insight of each of the committee members, present preliminary results and discuss hurdles and questions. The members of the committee:

- Jessica Hensel, professor at the University of Amsterdam and objects conservator at the NMVW (National Museum for World Cultures, Netherlands),
- Dr. Matthieu Boone, professor at the University of Gent in Belgium, and head of the tomography facility there
- Liliane Feza Tshikuta, wood conservator at UNESCO Kinshasa,
- Beth Edelstein, head conservator at the Cleveland museum of Art,
- Jeremy Uden, head conservator at the Pitts-Rivers museum in Oxford.

Meeting 1
June 8th 2023

The first follow-up committee meeting provided a chance to introduce the various committee members to each other, as well as (re-)introduce the project after its initial start in March 2023. The objectives were set out as

- further analysis of the data set,
- building of a knowledge exchange network,
- engaging in the ethical discussion,
- disclosing the dataset.

The discussion after the first presentation served to answer some initial questions. Matthieu Boone, professor at the UGent, gave some tips on visualization techniques of the scans. Liliane Feze Tshikuta provided some great insights into the set-up of the ethical quandary.

Meeting 2
February 24th 2024

This online meeting started with a short presentation to update the committee on the research progress since the first meeting. Restating the project's main objectives, the presentation focused mainly on the changed priorities and feasibility of these objectives due to financial changes and a time constraint on the project. The preliminary results of the scans and the planned collaboration with the 5 Congolese researchers on the ethical considerations were also presented. After the presentation, discussion was invited. Main comments came from Liliane Feza Tshikuta, who had specific tips on the object selection for the second publication. Beth Edelstein had questions about the opportunities of wood identification using X-ray μCT, as well as expressed a great interest in the results of the fieldwork of the 5 researchers that had then just started.

Meeting 3
March 24th 2025

At the end of the CONteXT project, a final committee meeting was held, to present the results after 2 years of work. Special attention was given in presenting the results on the published article in the Journal of Cultural Heritage, as well as the finished field work on the ethical considerations of X-ray tomography on African heritage. The results were well received, and possible follow-up leads were discussed. There was also discussion on the objectives the project did not get to fulfill, in particular the planned display of the results in a temporary exhibition at the museum. The committee members helped to think about alternative ways of a (virtual) exhibition around the scans made and the reconstructed stories around the objects.

Virtual dissemination of the scans | Building on insights from the ethical survey discussed in Objective 2, the decision was made to share the scans online to ensure broad and international accessibility. However, to protect potentially sensitive or privileged information, only surface renderings of the scanned objects were created for public viewing. These renderings allow users to interact with and examine each object from all angles in a virtual space, but they do not reveal any internal structural details.

Figure 7 presents an example of one such rendering, featuring a scanned wooden cup (12 x 9 x 8.4 cm) from the Mbuun culture in the DRC. Each surface rendering will be integrated into the AfricaMuseum's online cultural collection database, developed and hosted by the PROCHE project (https://proche.africamuseum.be/simplesearch). By making these renderings available, the CONteXT project aims to engage not only Western researchers but also members of source communities who wish to study and reconnect with their heritage.

 Figure 7: Surface rendering of a Mbuun cup (12 x 9 x 8.4 cm), EO.1980.2.426, available online through the PROCHE database ©RMCA ©UGCT ©UGent-Woodlab

6. PUBLICATIONS

Dierickx, S., Beeckman, H., Josipovic, I., Charkaoui, C., Genbrugge, S., Hubau, W., Boone, M. and Van den Bulcke, J. 2025. Bridging technology and culture: X-ray µCT-based wood identification of Sub-Saharan African heritage. Journal of Cultural Heritage, 73 (1): 110-121. https://doi.org/10.1016/j.culher.2025.03.001

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ANNEXES

The annex contains a full list of all 129 objects scanned from the AfricaMuseum's cultural collection. They are subdivided by culture of origin (or in case the culture is unknown, the country of origin). For each object a photo is shown, and some basic information is given, such as the museum registration number, a description of the object and its dimensions. The materials included in the object are listed, and the scans made with the achieved resolution (expressed in reconstructed voxel size).

Angola

Object photo	Description	Materials	X-ray µCT scans
	Museum registration: EO.1967.63.568 Description: sculpture Dimensions: 22.8 x 5.3 x 6.2 cm	• Wood	• Overview scan: 128 µm reconstructed voxel size • ROI scan: 4 µm reconstructed voxel size
	Museum registration: EO.1979.1.179 Description: sculpture in the form of a bird Dimensions: 5.4 x 4.5 x 1.4 cm	• Wood	• Overview scan: 25 µm reconstructed voxel size • ROI scan: 4.5 µm reconstructed voxel size

Angola - Chokwe culture

Object photo	Description	Materials	X-ray µCT scans
	Museum registration: MO.1967.63.952 Description: rattle Dimensions: 46 x 5.2 x 5.2 cm	• Wood • Fruit • Seeds • Plant fibre	• Overview scan: (tiled) 145 µm reconstructed voxel size • ROI scan: 5 µm reconstructed voxel size

Angola - Kakongo culture

Object photo	Description	Materials	X-ray µCT scans
	Museum registration: EO.1979.1.63 Description: fly chaser Dimensions: 29.2 x 5.7 x 4.3 cm	• Wood	• Overview scan: 155 µm reconstructed voxel size • ROI scan: 4.5 µm reconstructed voxel size

Beembe culture

Object photo	Description	Materials	X-ray µCT scans
	Museum registration: EO.1951.75.1 Description: sculpture - ancester effigy Dimensions: 34.5 × 12 × 9.5 cm	• Wood: *Crossopteryx febrifuga* • Ceramics: faïance	• Overview scan: 131 µm reconstructed voxel size • ROI scan: 5 µm reconstructed voxel size
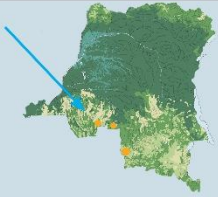
Bembe culture

Object photo	Description	Materials	X-ray µCT scans
	Museum registration: EO.1955.3.170-1 Description: sculpture with two faces Dimensions: 33 x 12.3 x 12.8 cm	• Wood • Plant fibres: raphia	• Overview scan: (tiled) 80 µm reconstructed voxel size • ROI scan: 10 µm reconstructed voxel size
	Museum registration: EO.1955.3.170-5 Description: sculpture with two amulets around its neck Dimensions: 46 x	• Wood big sculpture • Wood small sculptures • Plant fibres: raphia	• Overview scan: (tiled) 161 µm reconstructed voxel size • ROI scan big sculpture: 9.5 µm reconstructed voxel size • ROI scan small sculptures: 8 µm reconstructed voxel size

Bindi culture

Object photo	Description	Materials	X-ray µCT scans
	Museum registration: EO.1957.35.2 Description: Pipe Dimensions: 11.3 x 50.5 x 4 cm	• Wood bowl: *Crossopteryx febrifuga* • Wood stem: liana • metal	• Overview scan: 131 µm reconstructed voxel size • ROI scan: 5 µm reconstructed voxel size

Biombo culture

Object photo	Description	Materials	X-ray µCT scans
	Museum registration: EO.0.0.15003 Description: mask Dimensions: 32.8 x 15.3 x 15 cm	• Wood • Plant fibres: raphia • Pigment	• Overview scan: (tiled) 160 µm reconstructed voxel size • ROI scan: 11 µm reconstructed voxel size

Chokwe culture

Object photo	Description	Materials	X-ray µCT scans
	Museum registration: EO.0.0.28741 Description: Comb Dimensions: 17.5 x 6.5 x 2 cm	• Wood	• Overview scan: 70 µm reconstructed voxel size • ROI scan: 8 µm reconstructed voxel size

Object photo	Description	Materials	X-ray µCT scans
	Museum registration: EO.0.0.43327 Description: Cane handle Dimensions: 33.2 x 5.9 x 5.2 cm	• Wood	• Overview scan: 157 µm reconstructed voxel size • ROI scan: 4 µm reconstructed voxel size
	Museum registration: EO.1948.20.184 Description: Cane handle Dimensions: 19 x 4.6 x 3.7 cm	• Wood	• Overview scan: 78 µm reconstructed voxel size • ROI scan: 4 µm reconstructed voxel size
	Museum registration: EO.1948.20.193 Description: Sculpture Dimensions: 73 x 16.2 x 6.3 cm	• Wood body: *Microdesmis puberula*	• Overview scan: 97 µm reconstructed voxel size • ROI scan: 8 µm reconstructed voxel size
	Museum registration: EO.1948.20.196-4 Description: Cane handle Dimensions: 41 x 4.8 x 5.9 cm	• Wood	• Overview scan: 83 µm reconstructed voxel size • ROI scan: 5 µm reconstructed voxel size
	Museum registration: EO.1948.20.200 Description: Sculpture in the form of an elephant Dimensions: 9.7 x 7.1 x 23.6 cm	• Wood body: *Vitex doniana* • Wood tusks: *Crossopteryx febrifuga*	• Overview scan: 97 µm reconstructed voxel size • ROI scan: 8 µm reconstructed voxel size
	Museum registration: EO.1950.24.161 Description: Chair in the form of a bird Dimensions: 36 x 26.2 x 26 cm	• Wood body	• Overview scan: (tiled) 120 µm reconstructed voxel size • ROI scan: 14 µm reconstructed voxel size

Object photo	Description	Materials	X-ray µCT scans
	Museum registration: EO.1953.72.1 Description: Chair Dimensions: small fragment was scanned	• Wood	• Overview scan: none made • ROI scan: 4 µm reconstructed voxel size
	Museum registration: EO.1958.30.36 Description: Cane handle Dimensions: 14.5 x 2.1 x 3.1 cm	• Wood	• Overview scan: 83 µm reconstructed voxel size • ROI scan: 5 µm reconstructed voxel size
	Museum registration: EO.1979.1.550 Description: Chair Dimensions: small fragment was scanned	• Wood • Leather	• Overview scan: none made • ROI scan: 4 µm reconstructed voxel size
	Museum registration: EO.1979.1.1670 Description: Mask Dimensions: 32 x 20 x 28 cm	• Wood • Plant fibre • Pigment • Metal	• Overview scan: 119 µm reconstructed voxel size • ROI scan: 32 µm reconstructed voxel size
	Museum registration: EO.1984.34.34 Description: Chair leg Dimensions: 25.4 x 4.8 x 4.5 cm	• Wood	• Overview scan: 145 µm reconstructed voxel size • ROI scan: 7 µm reconstructed voxel size

Dikidiki culture

Object photo	Description	Materials	X-ray μCT scans
	Museum registration: EO.1953.74.1731 Description: Fly chaser with anthropomorphic wooden handle Dimensions: 54.5 x 14 x 8.5 cm	• Wood • Metal • Hide	• Overview scan: 136 μm reconstructed voxel size • ROI scan: 4 μm reconstructed voxel size

Holo culture

Object photo	Description	Materials	X-ray μCT scans
	Museum registration: EO.1949.48.14 Description: Cross Dimensions: 28.6 x 8.6 x 4.5 cm	• Wood	• Overview scan: 160 μm reconstructed voxel size • ROI scan: 4.7 μm reconstructed voxel size
	Museum registration: MO.1953.74.2711 Description: Violin Dimensions: 51 x 9.4 x 8.9 cm	• Wood: *Entandophragma cillindricum* • Metal • Horn • Feathers	• Overview scan: (tiled) 82 μm reconstructed voxel size • ROI scan: 7 μm reconstructed voxel size
	Museum registration: EO.1953.74.2866 Description: Slit drum Dimensions: 36.9 x 9 x 10 cm	• Wood • Plant fibre	• Overview scan: 131 μm reconstructed voxel size • ROI scan: 8 μm reconstructed voxel size

Kete culture

Object photo	Description	Materials	X-ray µCT scans
	Museum registration: EO.1953.74.4983 Description: Amulet Dimensions: 11.1 x 3.6 x 3.2 cm	• Wood • Plant fibre	• Overview scan: 62 µm reconstructed voxel size • ROI scan: 6.5 µm reconstructed voxel size

Komo culture

Object photo	Description	Materials	X-ray µCT scans
	Museum registration: EO.1951.12.17 Description: Sceptre Dimensions: 44 x 7.9 x 2.4 cm	• Wood • Pigment • Metal	• Overview scan: 135 µm reconstructed voxel size • ROI scan: 4 µm reconstructed voxel size

Kongo culture

Object photo	Description	Materials	X-ray µCT scans
	Museum registration: EO.0.0.33952 Description: Power object Dimensions: 14.8 x 8.9 x 7cm	• Wood • Textile	• Overview scan: 85 µm reconstructed voxel size • ROI scan: 6 µm reconstructed voxel size

Object photo	Description	Materials	X-ray µCT scans
	Museum registration: EO.1951.77.2 Description: Sculpture Dimensions: 12.5 x 6 x 5 cm	• Wood	• Overview scan: 52 µm reconstructed voxel size • ROI scan: 4.5 µm reconstructed voxel size
	Museum registration: EO.1954.52.3-1 Description: Powder flask Dimensions: 12.2 x 5.3 x 5 cm	• Wood	• Overview scan: 69 µm reconstructed voxel size • ROI scan: 4 µm reconstructed voxel size
	Museum registration: EO.1958.10.4 Description: Powder flask Dimensions: 12.2 x 5.3 x 5 cm	• Wood • Plant fibre	• Overview scan: 80 µm reconstructed voxel size • ROI scan: 8 µm reconstructed voxel size
	Museum registration: EO.1975.51.37 Description: Calendar Dimensions: 10.7 x 7.4 x 1.1 cm	• Wood • Plant fibre	• Overview scan: 63 µm reconstructed voxel size • ROI scan: 5.6 µm reconstructed voxel size
	Museum registration: EO.1980.2.2663 Description: Sculpture mother and child Dimensions: 62 x 24 x 23 cm	• Wood • Pigment	• Overview scan: (tiled) 155 µm reconstructed voxel size • ROI scan: 9 µm reconstructed voxel size
	Museum registration: MO.0.0.410 Description: violin Dimensions: 48.5 x 13 x 15.4 cm	• Wood • Metal • Plant fibre	• Overview scan: (tiled) 151 µm reconstructed voxel size • ROI scan: 4.5 µm reconstructed voxel size

Object photo	Description	Materials	X-ray µCT scans
	Museum registration: MO.1955.113.17 Description: Bell Dimensions: 10.9 x 3.7 x 2.5 cm	• Wood	• Overview scan: 62 µm reconstructed voxel size • ROI scan: 4.5 µm reconstructed voxel size
	Museum registration: Sj.2208 Description: Three arrows Dimensions: 69.1 x 2 x 2 cm	• Branch • Feathers • Fur	• Overview scan: 110 µm reconstructed voxel size • ROI scan: 7.5 µm reconstructed voxel size
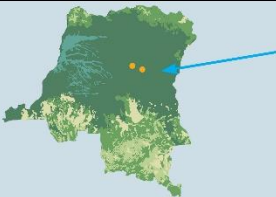
Kotchi culture			
Object photo	Description	Materials	X-ray µCT scans
	Museum registration: EO.1967.63.269 Description: Power object Dimensions: 10.5 x 40 x 5.7 cm	• Wood • Textile • Resin • Glass	• Overview scan: 85 µm reconstructed voxel size • ROI scan: 4 µm reconstructed voxel size

Kuba culture

Object photo	Description	Materials	X-ray µCT scans
	Museum registration: EO.1950.24.12 Description: Cup Dimensions: 21.5 x 13 x 13 cm	• Wood	• Overview scan: 125 µm reconstructed voxel size • ROI scan: 9.5 µm reconstructed voxel size
	Museum registration: EO.1957.32.21 Description: Power object Dimensions: 5 x 29.7 x 2.5 cm	• Wood • Plant fibre	• Overview scan: 105 µm reconstructed voxel size • ROI scans of nose and button: 4 µm reconstructed voxel size

Lega culture

Object photo	Description	Materials	X-ray µCT scans
	Museum registration: EO.1951.35.5 Description: Mask Dimensions: 22.4 x 14.1 x 3.3 cm	• Wood: *Alstonia sp.*	• Overview scan: 123 µm reconstructed voxel size • ROI scan: 14 µm reconstructed voxel size
	Museum registration: EO.1962.46.4 Description: Power object Dimensions: 5.6 x 19.5 x 3.5 cm	• Wood: *Albizia adianthifolia* • Bones	• Overview scan: 76 µm reconstructed voxel size • ROI scan: 3.5 µm reconstructed voxel size

Lengola culture

Object photo	Description	Materials	X-ray µCT scans
	Museum registration: EO.1951.12.15 Description: Sceptre Dimensions: 65.5 x 7.3 x 6 cm	• Wood • Plant fibre	• Overview scan: 130 µm reconstructed voxel size • ROI scan: 4.5 µm reconstructed voxel size

Lualaba culture

Object photo	Description	Materials	X-ray µCT scans
	Museum registration: EO.0.0.673-3 Description: Spoon Dimensions: 21.9 x 7.7 x 5.5 cm	• Wood	• Overview scan: 115 µm reconstructed voxel size • ROI scan: 7.7 µm reconstructed voxel size

Luba culture

Object photo	Description	Materials	X-ray µCT scans
	Museum registration: EO.0.0.740-4 Description: Arrow holder Dimensions: 77.6 x 24.5 x 9.3 cm	• Wood: *Synsepalum subcordatum*	• Overview scan: (tiled) 110 µm reconstructed voxel size • ROI scan: 7.7 µm reconstructed voxel size

Object photo	Description	Materials	X-ray µCT scans
	Museum registration: EO.0.0.9415 Description: Axe Dimensions: 39.7 x 6.2 x 31.8 cm	• Wood • Metal	• Overview scan (without the metal blade): 140 µm reconstructed voxel size • ROI scan: 7µm reconstructed voxel size
	Museum registration: EO.1949.37.1 Description: Power object Dimensions: 27.2 x 7.2 x 8.3 cm	• Wood • Horn • Textile	• Overview scan: 150 µm reconstructed voxel size • ROI scan: 8 µm reconstructed voxel size
	Museum registration: EO.1952.53.1 Description: Pin Dimensions: 20.4 x 1.4 x 1.1 cm	• Wood	• Overview scan: 114 µm reconstructed voxel size • ROI scan: 4 µm reconstructed voxel size
	Museum registration: EO.1957.53.14 Description: Sculpture Dimensions: 27.3 x 8.3 x 9.1 cm	• Wood	• Overview scan: 156 µm reconstructed voxel size • ROI scan: 10 µm reconstructed voxel size
	Museum registration: EO.1961.31.8 Description: Power object Dimensions: 12.3 x 6.4 x 2.6 cm	• Wood	• Overview scan: 71 µm reconstructed voxel size • ROI scan: 8 µm reconstructed voxel size
	Museum registration: EO.1980.2.1758 Description: Tobacco box Dimensions: 40.4 x 7 x 7 cm	• Wood	• Overview scan: 175 µm reconstructed voxel size • ROI scan: 4 µm reconstructed voxel size

Lulua culture

Object photo	Description	Materials	X-ray μCT scans
	Museum registration: EO.0.0.15404 Description: Mask Dimensions: 57.9 x 29.7 x 18.5 cm	• Wood: *Ricinodendron heudelotii* • Pigment	• Overview scan: (tiled) 121 μm reconstructed voxel size • ROI scan: 3.5 μm reconstructed voxel size
	Museum registration: EO.0.0.43862 Description: Sculpture Dimensions: 30.8 x 7 x 7.5 cm	• Wood	• Overview scan: 170 μm reconstructed voxel size • ROI scan: 8 μm reconstructed voxel size
	Museum registration: EO.0.0.43896 Description: Sculpture Dimensions: 16.5 x 6 x 6.2 cm	• Wood	• Overview scan: 101 μm reconstructed voxel size • ROI scan: 4.5 μm reconstructed voxel size

Mangbetu culture

Object photo	Description	Materials	X-ray μCT scans
	Museum registration: EO.0.0.9579 Description: Bow Dimensions: 94 x 8.5 x 3 cm	• Wood • Fur	• Overview scan: none made • ROI scan: 7 μm reconstructed voxel size

Object photo	Description	Materials	X-ray µCT scans
	Museum registration: EO.1954.2.5 Description: Box Dimensions: 48.9 x 9.9 x 11.2 cm	• Wood	• Overview scan: (tiled) 150 µm reconstructed voxel size • ROI scan: 10 µm reconstructed voxel size

Mboma culture			
Object photo	Description	Materials	X-ray µCT scans
	Museum registration: EO.1953.74.3262 Description: Sculpture Dimensions: 15 x 5 x 4.8 cm	• Wood	• Overview scan: 90 µm reconstructed voxel size • ROI scan: 5.5 µm reconstructed voxel size

Mbuun culture			
Object photo	Description	Materials	X-ray µCT scans
	Museum registration: EO.1980.2.426 Description: Cup Dimensions: 12 x 9 x 8.4 cm	• Wood	• Overview scan: 80 µm reconstructed voxel size • ROI scan: 5 µm reconstructed voxel size

Meje culture

Object photo	Description	Materials	X-ray µCT scans
	Museum registration: EO.0.0.7538-2 Description: Knife Dimensions: 30.9 x 4.8 x 6 cm	• Wood • Metal	• Overview scan: None made • ROI scan: 7 µm reconstructed voxel size

Ndengese culture

Object photo	Description	Materials	X-ray µCT scans
	Museum registration: EO.1980.2.921 Description: Sculpture Dimensions: 54 x 9 x 7.6 cm	• Wood	• Overview scan: (tiled) 157 µm reconstructed voxel size • ROI scan: 9 µm reconstructed voxel size

Ngbaka culture

Object photo	Description	Materials	X-ray µCT scans
	Museum registration: MO.0.0.9458 Description: Harp Dimensions: 90 x 26 x 37 cm	• Wood • Leather • Plant fibre • Beads	• Overview scan: (tiled) 115 µm reconstructed voxel size • ROI scan: 5 µm reconstructed voxel size

Ngbandi culture

Object photo	Description	Materials	X-ray µCT scans
	Museum registration: EO.0.0.17831 Description: Amulet Dimensions: 22 x 7.8 x 3.5 cm	• Wood • Metal • Leather	• Overview scan: 120 µm reconstructed voxel size • ROI scan head: 9 µm reconstructed voxel size • ROI scan bead: 10 µm reconstructed voxel size
	Museum registration: EO.1948.29.2 Description: Cup Dimensions: 27.8 x 9.5 x 18 cm	• Wood • Metal	• Overview scan: (tiled) 166 µm reconstructed voxel size • ROI scan: 9.5 µm reconstructed voxel size

Ngende culture

Object photo	Description	Materials	X-ray µCT scans
	Museum registration: EO.0.0.26582 Description: Cup Dimensions: 30.5 x 12.5 x 12.5 cm	• Wood • Metal	• Overview scan: 175 µm reconstructed voxel size • ROI scan head: 14 µm reconstructed voxel size

Nsapo culture

Object photo	Description	Materials	X-ray µCT scans
	Museum registration: EO.1980.2.429 Description: Pipe Dimensions: 6.7 x 24.7 x 10.2 cm	• Wood • Metal	• Overview scan: 135 µm reconstruct- ed voxel size • ROI scan: 9 µm reconstructed voxel size

Pende culture

Object photo	Description	Materials	X-ray µCT scans
	Museum registration: EO.1948.40.13 Description: Mask Dimensions: 33.4 x 19 x 14.5 cm	• Wood	• Overview scan: 173 µm reconstruct- ed voxel size • ROI scan: 12 µm reconstruct- ed voxel size
	Museum registration: EO.1980.2.1991 Description: Mask Dimensions: 27.3 x 9 x 5.8 cm	• Wood	• Overview scan: 151 µm reconstruct- ed voxel size • ROI scan: 9 µm reconstructed voxel size
	Museum registration: EO.1980.2.2664 Description: Sculpture of mother and child Dimensions: 50 x 15.7 x 15 cm	• Wood: • Pigment	• Overview scan: (tiled) 110 µm reconstructed voxel size • ROI scan: 10 µm reconstruct- ed voxel size

Object photo	Description	Materials	X-ray µCT scans
	Museum registration: SJ.1975 Description: Mask Dimensions: 52 x 26 x 16 cm	• Wood: *Alstonia sp.* • Pigment • Plant fibre	• Overview scan: (tiled) 108 µm reconstructed voxel size • ROI scan: 6 µm reconstructed voxel size

Punu culture			
Object photo	Description	Materials	X-ray µCT scans
	Museum registration: EO.0.0.22003 Description: Fan Dimensions: 31.8 x 18.2 x 2.9 cm	• Wood • Leather • Metal	• Overview scan: 170 µm reconstructed voxel size • ROI scan: 4 µm reconstructed voxel size

Songye culture			
Object photo	Description	Materials	X-ray µCT scans
	Museum registration: EO.0.0.2104 Description: Chair Dimensions: 43 x 22.6 x 18.4 cm	• Wood • Shell	• Overview scan: (tiled) 151 µm reconstructed voxel size • ROI scan: 18 µm reconstructed voxel size
	Museum registration: EO.1959.23.3 Description: Shield Dimensions: 24.3 x 9.2 x 5.2 cm	• Wood:	• Overview scan: 98 µm reconstructed voxel size • ROI scan: 7 µm reconstructed voxel size

Object photo	Description	Materials	X-ray µCT scans
	Museum registration: EO.1951.10.1 Description: Power object Dimensions: 88 x 37 x 41 cm	• Wood: • Shell • Metal • Teeth • Feathers • Plant fibres	• Overview scan: (tiled) 127 µm reconstructed voxel size • ROI scan: 19 µm reconstructed voxel size
	Museum registration: EO.1960.37.1 Description: Sculpture Dimensions: 29.9 x 8.3 x 9.3 cm	• Wood	• Overview scan: 165 µm reconstructed voxel size • ROI scan: 10 µm reconstructed voxel size
	Museum registration: EO.1971.36.7 Description: Shoe Dimensions: 14 × 9.9 × 26.9 cm	• Wood • Metal	• Overview scan: 150 µm reconstructed voxel size • ROI scan: 4.7 µm reconstructed voxel size
	Museum registration: EO.1980.2.501 Description: Power object Dimensions: 46.2 x 12.2 x 15 cm	• Wood • Textile • Beads • Metal	• Overview scan: 145 µm reconstructed voxel size • ROI scan: 13 µm reconstructed voxel size
	Museum registration: EO.1980.2.2867 Description: Power object Dimensions: 22.5 x 4.8 x 7.2 cm	• Wood: *Cynometra hankei* • Metal • Teeth	• Overview scan: 125 µm reconstructed voxel size • ROI scan: 8 µm reconstructed voxel size

Suku culture

Object photo	Description	Materials	X-ray µCT scans
	Museum registration: EO.1953.74.2849 Description: Power object Dimensions: 15.2 x 4.5 x 3.4 cm	• Wood • Pigment	• Overview scan: 84 µm reconstructed voxel size • ROI scan: 6 µm reconstructed voxel size
	Museum registration: EO.1953.74.4158 Description: Mask Dimensions: 130 × 60 × 38 cm (fragment scanned)	• Wood • Plant fibre • Fur • Pigment	• Overview scan: none made • ROI scan: 3 µm reconstructed voxel size
	Museum registration: SJ.1465 Description: Sculpture Dimensions: 41.5 x 19 x 54.5 cm	• Wood: • Pigment • Metal	• Overview scan: 98 µm reconstructed voxel size • ROI scan: 7 µm reconstructed voxel size

Tabwa culture

Object photo	Description	Materials	X-ray µCT scans
	Museum registration: EO.0.0.31952 Description: Comb Dimensions:18.8 x 4.9 x 2.6 cm	• Wood	• Overview scan: 105 µm reconstructed voxel size • ROI scan: 5 µm reconstructed voxel size

Teke culture

Object photo	Description	Materials	X-ray µCT scans
	Museum registration: EO.0.0.7235 Description: Power object Dimensions: 11.5 x 3 x 2.7 cm	• Wood • Textile	• Overview scan: 71 µm reconstructed voxel size • ROI scan: 5 µm reconstructed voxel size
	Museum registration: EO.0.0.18795 Description: Power object Dimensions: 20.5 x 3.4 x 6 cm	• Wood	• Overview scan: 90 µm reconstructed voxel size • ROI scan: 4 µm reconstructed voxel size
	Museum registration: EO.0.0.29054 Description: Power object Dimensions: 25.6 x 7.4 x 8 cm	• Wood • Feathers • Earth	• Overview scan: 135 µm reconstructed voxel size • ROI scan: 5.5 µm reconstructed voxel size
	Museum registration: EO.1953.74.1793 Description: Power object Dimensions: 31.7 x 6.6 x 8.5 cm	• Wood	• Overview scan: 174 µm reconstructed voxel size • ROI scan: 8 µm reconstructed voxel size

Tetela culture

Object photo	Description	Materials	X-ray µCT scans
	Museum registration: EO.0.0.14359 Description: Bowl Dimensions: 13.8 × 8.9 × 17.6 cm	• Wood	• Overview scan: 101 µm reconstructed voxel size • ROI scan: 7.5 µm reconstructed voxel size

Vili culture

Object photo	Description	Materials	X-ray µCT scans
	Museum registration: EO.1967.63.322 Description: Sculpture Dimensions: 18.5 × 3 × 4.8 cm	• Wood	• Overview scan: 100 µm reconstructed voxel size • ROI scan: 4 µm reconstructed voxel size

Woyo culture

Object photo	Description	Materials	X-ray µCT scans
	Museum registration: EO.1951.50.30 Description: Lid Dimensions: 17.6 x 8.6 x 8.6 cm	• Wood	• Overview scan: 70 µm reconstructed voxel size • ROI scan: 6 µm reconstructed voxel size

Object photo	Description	Materials	X-ray µCT scans
	Museum registration: EO.1964.43.1 Description: Cimpaba Dimensions: 42 x 9 x 2.5 cm	• Wood	• Overview scan: (tiled) 90 µm reconstructed voxel size • ROI scan: 4.5 µm reconstructed voxel size
	Museum registration: MO.0.0.34821 Description: Bell Dimensions: 28.6 x 9.5 x 8 cm	• Wood	• Overview scan: 160 µm reconstructed voxel size • ROI scan: 11 µm reconstructed voxel size
	Museum registration: MO.0.0.35047 Description: Bell Dimensions: 22.4 x 8.2 x 6 cm	• Wood	• Overview scan: 150 µm reconstructed voxel size • ROI scan: 7 µm reconstructed voxel size

Yaka culture

Object photo	Description	Materials	X-ray µCT scans
	Museum registration: EO.0.0.23319-1 Description: Mask Dimensions: 18.5 × 3 × 4.8 cm	• Wood: *Alstonia sp.* • Pigment	• Overview scan: 121 µm reconstructed voxel size • ROI scan: 9 µm reconstructed voxel size
	Museum registration: EO.0.0.24970 Description: Mask Dimensions: 69 × 30 × 26 cm	• Wood • Pigment • Plant fibre • Textile	• Overview scan: (tiled) 112 µm reconstructed voxel size • ROI scan: 5 µm reconstructed voxel size

Object photo	Description	Materials	X-ray µCT scans
	Museum registration: EO.0.0.32836 Description: Mask Dimensions: 70 x 55 x 35 cm	• Wood • Pigment • Plant fibre	• Overview scan: (tiled) 120 µm reconstructed voxel size • ROI scan: 9 µm reconstructed voxel size
	Museum registration: EO.1953.74.1641 Description: Power object Dimensions: 27.3 x 7.2 x 5.2 cm	• Wood	• Overview scan: 145 µm reconstructed voxel size • ROI scan: 7 µm reconstructed voxel size
	Museum registration: EO.1953.74.2105 Description: Post Dimensions: 30 x 27 x 24 cm	• Wood • Plant fibre • Pigment	• Overview scan: 150 µm reconstructed voxel size • ROI scan: 7 µm reconstructed voxel size
	Museum registration: EO.1955.32.1 Description: Power object Dimensions: 32 x 11 x 10 cm	• Wood • Metal	• Overview scan: 125 µm reconstructed voxel size • ROI scan: 7.5 µm reconstructed voxel size
	Museum registration: EO.1956.55.8 Description: Sculpture Dimensions: 11.2 x 2.6 x 2.5 cm	• Wood	• Overview scan: 62 µm reconstructed voxel size • ROI scan: 3.5 µm reconstructed voxel size
	Museum registration: MO.0.0.2493 Description: Slit drum Dimensions: 46.5 x 10.4 x 14 cm	• Wood • Plant fibre	• Overview scan: 145 µm reconstructed voxel size • ROI scan: 8 µm reconstructed voxel size

Object photo	Description	Materials	X-ray µCT scans
	Museum registration: MO.0.0.2504 Description: Slit drum Dimensions: 41.8 x 6.9 x 7 cm	• Wood: *Markhamia tomentosa*	• Overview scan: 130 µm reconstructed voxel size • ROI scan: 6 µm reconstructed voxel size

Yela culture	

Object photo	Description	Materials	X-ray µCT scans
	Museum registration: EO.1951.4.10 Description: Sculpture Dimensions: 26.3 x 9.5 x 7.5 cm	• Wood	• Overview scan: 148 µm reconstructed voxel size • ROI scan: 10.5 µm reconstructed voxel size

Yombe culture	

Object photo	Description	Materials	X-ray µCT scans
	Museum registration: EO.0.0.1040-1 Description: Funerary sculpture Dimensions: 48 x 17.5 x 16.5 cm	• Wood: *Ricinodendron heudelotii*	• Overview scan: 110 µm reconstructed voxel size • ROI scan: 8.5 µm reconstructed voxel size
	Museum registration: EO.0.0.16665 Description: Sculpture Dimensions: 25.5 x 9.5 x 8 cm	• Wood • Metal • Glass	• Overview scan: 140 µm reconstructed voxel size • ROI scan: 9 µm reconstructed voxel size

Object photo	Description	Materials	X-ray µCT scans
	Museum registration: EO.0.0.43677 Description: Power object Dimensions: 33.3 x 8.2 x 11.2 cm	• Wood • Pigment • Glass • Resin	• Overview scan: 130 µm reconstructed voxel size • ROI scan: 7 µm reconstructed voxel size
	Museum registration: MO.1954.27.1 Description: Rattle Dimensions: 40.5 x 14.8 x 14.4 cm	• Wood • Plant fibre • Fruit	• Overview scan: 176 µm reconstructed voxel size • ROI scan: 12 µm reconstructed voxel size
	Museum registration: MO.1958.16.2 Description: Bell Dimensions: 20.1 x 12.1 x 11 cm	• Wood: *Crossopteryx febrifuga* • Plant fibre	• Overview scan: 118 µm reconstructed voxel size • ROI scan: 8 µm reconstructed voxel size

Yoruba culture

Object photo	Description	Materials	X-ray µCT scans
	Museum registration: EO.1998.24.1 Description: Mask Dimensions: 47 x 18 x 36 cm	• Wood: *Ricinodendron heudelotii*	• Overview scan: (tiled) 111 µm reconstructed voxel size • ROI scan: 7 µm reconstructed voxel size

Zande culture

Object photo	Description	Materials	X-ray µCT scans
	Museum registration: EO.0.0.4451 Description: Filter Dimensions: 35.2 x 13.2 x 29 cm	• Wood	• Overview scan: 150 µm reconstructed voxel size • ROI scan: 8.5 µm reconstructed voxel size
	Museum registration: EO.0.0.10924 Description: Pipe Dimensions: 11 x 46.5 x 4 cm	• Wood:	• Overview scan: 156 µm reconstructed voxel size • ROI scan: 7 µm reconstructed voxel size
	Museum registration: MO.0.0.13352 Description: Xylophone Dimensions: 51.8 x 8.7 x 2 cm	• Wood: *Pterocarpus soyauxii*	• Overview scan: 167µm reconstructed voxel size • ROI scan: 8 µm reconstructed voxel size
	Museum registration: MO.1980.2.516 Description: Harp Dimensions: 35.4 x 5 x 28 cm	• Wood	• Overview scan: 155 µm reconstructed voxel size • ROI scan: 4 µm reconstructed voxel size

Unknown culture

Object photo	Description	Materials	X-ray µCT scans
	Museum registration: EO.0.0.3659 Description: Power object Dimensions: 23 x 49 x 19 cm	• Wood: *Canarium schweinfurthii* • Metal • Glass	• Overview scan: 150 µm reconstructed voxel size • ROI scan: 6.8 µm reconstructed voxel size
	Museum registration: EO.0.0.22709 Description: Head rest Dimensions: 13.8 x 14 x 5.6 cm	• Wood • Beads • Pigment	• Overview scan: 90 µm reconstructed voxel size • ROI scan: 14 µm reconstructed voxel size
	Museum registration: EO.0.0.22717 Description: Head rest Dimensions: 14.3 x 14 x 6 cm	• Wood • Pigment • Metal	• Overview scan: µm reconstructed voxel size • ROI scan: µm reconstructed voxel size
	Museum registration: EO.0.0.31454 Description: Silence disc Dimensions: 10.5 x 10.5 x 0.8 cm	• Wood • Pigment	• Overview scan: 62 µm reconstructed voxel size • ROI scan: 11 µm reconstructed voxel size
	Museum registration: EO.0.0.39806 Description: Knife Dimensions: 33 x 5 x 5.8 cm	• Wood: *Balanites aegyptiaca* • Metal • Beads	• Overview scan: 130 µm reconstructed voxel size • ROI scan: 5 µm reconstructed voxel size

Object photo	Description	Materials	X-ray µCT scans
	Museum registration: EO.0.0.43336 Description: Sculpture Dimensions: 29 x 10.5 x 12.5 cm	• Wood:	• Overview scan: 164 µm reconstructed voxel size • ROI scan: 12µm reconstructed voxel size
	Museum registration: EO.1949.6.1 Description: Sculpture Dimensions: 9.5 x 2.1 x 2.1 cm	• Wood: *Diospyros sp.*	• Overview scan: 54 µm reconstructed voxel size • ROI scan: 4 µm reconstructed voxel size
	Museum registration: EO.1952.28.1 Description: Cane Dimensions: 26.2 x 3.6 x 3.6 cm	• Wood:	• Overview scan: 145 µm reconstructed voxel size • ROI scan: 5 µm reconstructed voxel size
	Museum registration: EO.1955.80.3 Description: Pestle Dimensions: 28.8 x 9.2 x 9.4 cm	• Wood: • Metal	• Overview scan: 154 µm reconstructed voxel size • ROI scan: 6 µm reconstructed voxel size
	Museum registration: EO.1955.128.4 Description: Power object Dimensions: 14 x cm	• Wood • Glass • Pigment	• Overview scan: 80 µm reconstructed voxel size • ROI scan: 4.5 µm reconstructed voxel size
	Museum registration: EO.1955.132.1 Description: Power object Dimensions: 21 x cm	• Wood • Glass	• Overview scan: 121 µm reconstructed voxel size • ROI scan: 10 µm reconstructed voxel size

Object photo	Description	Materials	X-ray µCT scans
	Museum registration: EO.1956.88.22 Description: Lid Dimensions: 9.3 x 19.6 x 19.6 cm	• Wood	• Overview scan: 80 µm reconstructed voxel size • ROI scan: 4 µm reconstructed voxel size
	Museum registration: EO.1959.48.347 Description: Bow Dimensions: cm	• Wood	• Overview scan: none made • ROI scan: 7 µm reconstructed voxel size
	Museum registration: EO.1967.63.430 Description: Power object Dimensions: 31.5 x 12 x 12 cm	• Wood • Textile • Shells • Plant fibre	• Overview scan: 167 µm reconstructed voxel size • ROI scan: 9 µm reconstructed voxel size
	Museum registration: EO.1979.1.287 Description: Toy Dimensions: 8.5 x 104 x 7.3 cm	• Wood: *Bombax brevicuspe* • Metal • Pigment • Plant fibre	• Overview scan: (tiled) 90 µm reconstructed voxel size • ROI scan: 4.5 µm reconstructed voxel size
	Museum registration: MO.1998.16.144 Description: Slit drum Dimensions: 32 x 78 x 94 cm	• Wood • Glass	• Overview scan: 121 µm reconstructed voxel size • ROI scan: 10 µm reconstructed voxel size
	Museum registration: SJ.1197 Description: Ciborium Dimensions: 31.5 x 18 x 19 cm	• Wood	• Overview scan: 170 µm reconstructed voxel size • ROI scan: 6 µm reconstructed voxel size

Object photo	Description	Materials	X-ray µCT scans
	Museum registration: SJ.4234 Description: Adze Dimensions: 26.5 x 18.7 x 3.7 cm	• Wood	• Overview scan: 100 µm reconstructed voxel size • ROI scan: 4 µm reconstructed voxel size