

A STUDY OF THE IDENTIFICATION AND AUTHENTICITY OF THREE TROPHY HEADS

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Abstract: Trophy heads are human heads that have been removed from the rest of the body at the time of death or later. They present varied elaborations, to a greater or lesser degree: Basically the skull can be preserved (skull trophy) or not (shrunk head). We present here a morphological study that allows us to study the authenticity and possible cultural background of three trophy-heads belonging to the Complutense University's patrimony (Madrid, Spain) and rediscovered by serendipity. The aim/goal of this paper is twofold. First, study and identify of these trophy heads. Second, to assess their authenticity.

We conclude that two out of the three heads are shrunk heads, suggesting that their objective/goal was different and that can be clearly distinguished from the false or commercial shrunk heads, that emerged mainly in the nineteenth century. Also, their morphological and ornamental characteristics indicate that one is authentic or ceremonial tsantsa and the other is commercial. The other head was a skull trophy with the ornamental decorative features compatible to a trophy head by the Mundurucu tribe.

Keywords: Anthropology, authenticity evaluation, ceremonial tsantsa, commercial shrunk head, ethnobotany.

INTRODUCTION

Throughout the history of mankind, the head and, by extension, the skull, have been considered "the see of the soul" (in the broad sense of the word), the place where the power and spirit or deities of the person live. Thus the origins of the cult of the skull go back, at least, to the Neolithic. This tradition was generally present during the Bronze Age in some peoples of Europe (Celts), in the Asian steppes and Oceania and also in pre-Columbian America [1, 2].

"Trophy heads", a term first used by Max Uhle [3], are human heads that have been removed from the rest of the human body at the time of death or later. In some cases, the skull is preserved and is called "trophy skull" [4] and in others not, as in "head shrinking", a term used for the first time in 1926 by Dyott [5].

The evidence documented so far allows us to infer that the changes observed in the method of

preparation in the production of "trophy heads" indicate that various human groups had specific ideas about how it should be made and, therefore, different ideas about its meaning and function [4, 6]. Probably the ritual for the preparation of a trophy head involved three stages with specific meanings: the decapitation, associated with the annihilation of the enemy's power; the offering of blood, destined to "feed" the deities and the "preparation" of the trophy as a sacred offering. These considerations and their derived aspects are of undoubted interest to various groups such as anthropologists, medical historians, forensics, anatomists or ethnobotanists.

Tribes distributed throughout the Amazon jungle and the Orinoco River, such as the Tupinambá, the Kokama (Kambebe or Omagua), the Mundurucu or Munduruku and the Parintintin were all great trophy skull hunters [7]. The Colima, Panche, Muisca, Caribe and Quimbaya tribes in Colombia or some other cultures of the pre-Inca civilization such as the Chavín,

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the Paracas, the Nazca, the Tiawanaku and the Aymara have also stood out in these practices [8].

On the other hand, shrunken heads are mummification phenomena unique to South America. Shrunken heads are typically made by Cuna and Cayman Indians, these being located along the Atrato River in northwestern Colombia, or by Amazonian Shuar indians (or Jíbaros). Ceremonial tsantsa are ritually shrunken heads from enemy victims of the Shuar, Achuar, Awajún (Aguaruna), Wampís (Huambisa), and Candoshi-Shapra cultures [9, 10]. First Tsantsa Shuar was identified in 1527 by the traveler and chronicler Miguel de Estate when he was exploring the Ecuadorian coast [11]. Present article designates these heads as “ceremonial tsantsa”. Since then and the interest of ethnologists and collectors increased progressively, becoming the object of commercial exchange, which favored the market for fake tsantsas. These are described as “commercial shrunken heads” and their manufacture intensified from 1872 in much of South and Central America, commonly by third world physicians, mortuary technicians, and taxidermists [10, 12] or by the very Shuars, who made them out from the heads of different jungle animals, especially sloths [13, 14].

Trophy heads, however, are relatively rare and a comprehensive review of the literature shows that trophy heads, now in museums, have been little studied so far. Although their study is of interest for several fields, there are still doubts for anthropologists and historians of medicine about the kind of knowledge obtained from these rituals that could have enriched the medical practice of these peoples [15]. Anatomists and ethnobotanists focus on the technical details of the preparation of reduced heads [5, 14, 16, 17] and forensics focus on their medical and legal value [18-20], increasingly important in a context of global repatriation of human artifacts to native communities since many trophy heads were recovered from looted sites many years ago or when field methods were different and documentation was less detailed [4].

The aim / objective of this article is twofold. First, the study and identification of three trophy heads found in the Julián de la Villa Anatomical Museum located in the Faculty of Medicine of the Complutense University of Madrid, Spain. A second objective is to assess its authenticity.

MATERIALS AND METHODS

Three allegedly trophy heads (Specimens 1, 2 and 3) belonging to the Historical-Artistic Heritage of

the Complutense University of Madrid were studied.

The cranial and cephalometric data were obtained with a sliding calliper and measuring tape. In specimen nº 1, posterior-anterior (PA), lateral and axial projections were made. In specimens nº 2 and 3 were made anterior-posterior (AP) and lateral projections only to confirm the absence of bone structures.

For the tests, some samples of hair from the inner surface of the neck region were taken from the specimens nº 2 and 3. The microscopic exam of the hair was done in a light microscope. The width of the bone of the human hair was studied according to Post and Daniels [21] and Robertson [22]. In order to avoid selection bias in the tested materials and results of this study, two independent reviewers performed the exams. Both agreed on the results we presented. We were unable to obtain permission for extracting the newspaper used to fill two shrunken heads. This would have allowed us to determine the date when it was made.

RESULTS

Measurements of the 3 specimens are shown in Tables 1 and 2. For specimens 2 and 3 morphological criteria to confirm the human origins of a shrunken head [12, 18] were evaluated in Table 3. Basic criteria to differentiate commercial and ceremonial tsantsa shrunken heads [12, 23] in our both specimens are shown in Table 4.

A description of the main characteristics from the three heads is reported below. Their preparation and decoration are the main points of support used to identify their origins.

Specimen nº 1

This is a full human head, damaged by poor

Table 2. Measured characteristics (cms) of the specimens nº 1 and 2 (shrunken head) described in our study

Parameters	Specimen nº 1	Specimen nº 2
Latero-lateral diameter	8.0	7.0
Occipital-frontal diameter	7.3	7.6
Head height (dewlap-head)	11.5	9.2
Inner corner eye angle	2.4	1.4
Outer corner eye angle	5.6	4.8
Height (dewlap-head)	11.5	9.2
Left ear height	3.2	2.8
Left ear width	2.1	1.9
Right ear height	3.0	2.9
Right ear width	1.8	1.8
Intercomisural distance	3.0	2.2
Latero-lateral neck opening	3.4	3.4
Anteroposterior neck opening	1.8	1.9

preservation (Fig. 1A and 1B). It maintains all the bones of the face and skull. Table 1 details the main craniometrical measurements of this piece.

The skin, less present in the occipital and upper areas and absent in the temporal parietal area is dry, damaged and shows some traces of hair. The orbits excel because they have been emptied and filled with a hard resinous substance. The long and thin pieces of a clamshell shaped material are incorporated to mimic the lid margin. This material is preserved in the left eye and has 3.1 cm in length. In the right eye it can only be seen one scratch. Both nostrils are closed with the same substance used for ocular or orbital modeling. The oral cavity has no teeth and there are two thick strands of rope coming out of it. It is a unique string whose ends were knotted tightly inside the mouth. The length of the

string protruding from the oral cavity is 84 cm. Two thick white cotton tassels are attached with pins on the pinna. Some 16 cm large garlands with tiny purple feathers hang from these tassels.

In AP, lateral and axial radiographies, a full cranial bone structure (Fig. 1C and 1D) was observed. The closing of cracks, vascular slits, sella turcica (turkish chair), paranasal sinues and other bone structures appear to be normal, with no significant signs of pathology or trauma. On the left eyelid, there are two structures of homogeneous density. There were no teeth.

Specimen n° 2

The specimen is a human type head (Fig. 2 and 3) well preserved, with no bone structures. An incision extending from the crown of the head along the dorsal

Table 1. Measured characteristics (cms) of the three specimens

Parameters	Specimen n° 1	Specimen n° 2	Specimen n° 3
Biparietal diameter	12.9		
Fronto-occipital diameter	14.6		
Latero-lateral diameter		8.0	7.0
Occipital-frontal diameter		7.3	7.6
Head height (dewlap-head)	14.9	11.5	9.2
Inner corner eye angle		2.4	1.4
Outer corner eye angle		5.6	4.8
Height (dewlap-head)		11.5	9.2
Left ear height		3.2	2.8
Left ear width		2.1	1.9
Right ear height		3.0	2.9
Right ear width		1.8	1.8
Intercomisural distance	3.9	3.0	2.2
Latero-lateral neck opening		3.4	3.4
Anteroposterior neck opening		1.8	1.9

Table 3. Morphological criteria used to authenticate our two shrunken head according to Charlier *et al.* (2012)

Criteria	Morphological Specificities	Specimen n°2	Specimen n°3
1	Dark or black or brown skin color due to impregnation with charcoal dust during shrinking	√	√
2	Wooden pegs or vegetal fibers retained in the lips (if absent or removed post-production, sets of vertically aligned corresponding holes are present just behind both the upper and lower lips)	√	No
3	Loop of wooden vine or fiber sewn into the neck (if absent or removed postproduction, traces of suturing and/or sawing are present)	√	√
4	Important thickness and leathery texture of the edge of the neck opening	√	√
5	Oval shape of the neck in cross-section and/or lateral compression of the head	√	√
6	From behind, neck and head tissues sewn together with fiber stitches	√	√
7	Conserved anatomical details of the ear (with possibility of a earlobe hole, filled or not by a wooden tube or peg)	√	√
8	Both eyes tightly closed (with possibility of sewing shut from the inside), skin in the surrounding cheek area being smooth with no facial down present	√	√
9	Profusion of hairs in the nostrils	√	√
10	Long dark hairs (or hairs which have been cut years after the shrinking process)	√	√
11	Long suspension cord overhanging from the top of the head (or related hole)	No	No
12	No facial painting or artistic/ethnic scar	√	√
13	No remaining skull fragment.	√	√
14	Complete filling of internal head cavities by sand and/or charcoals	No	No

surface of the neck is closed with some kind of cable (rope). Table 1 lists then main cephalometric measures of this shrunken head.

The skin is shiny and black. The eyes are closed. The eyelids have eyelashes. There is hair on the face and earlobes. Both ears are not perforated but maintain their cartilaginous helical shape. The nostrils are rounded and closed. The lips are punched in six different places

and a cable (rope) through these perforations seals the mouth. There is only one oval cross stitch cable (rope) in the neck area, which thickness and texture is similar to parchment paper. The base of the neck was presented flush, with minor buckling evident where the incision had been made. That incision was straight, consistent and smooth edge.

A lower oval opening shows that the shrunken head was filled with newspaper. There are no traces of visible face paint or tattoos. The interior of the shrunken head is hollow, rough and filled with newspaper. The head maintains its shape due to the stiffness of the skin. The hair was short, shiny black and firmly attached to the scalp. It was taken a sample of the hair and it was studied on a microscope. Hair bone was discontinuous

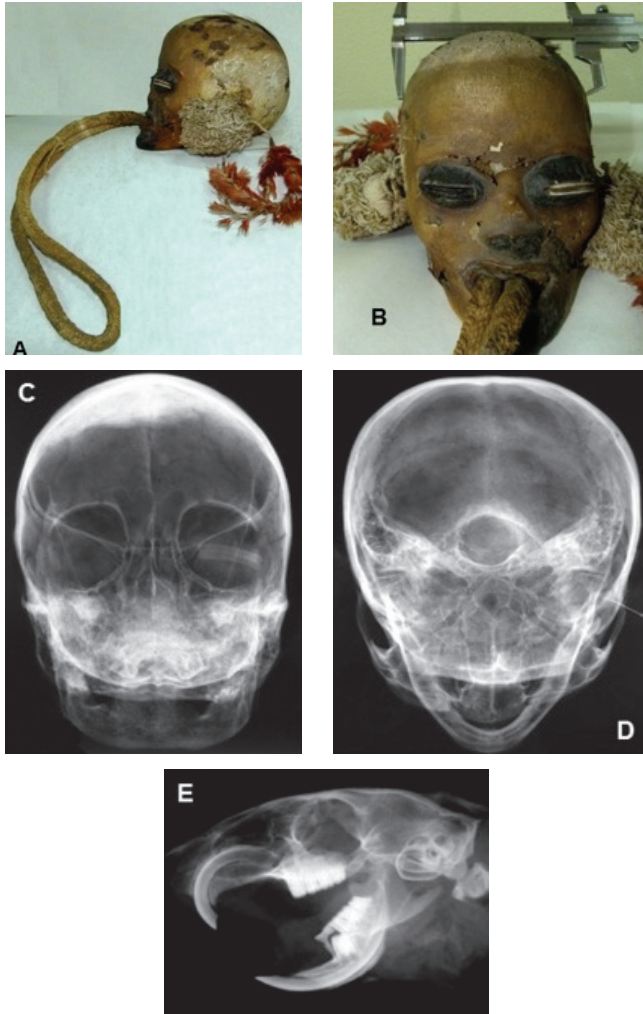


Figure 1. Specimen n° 1. **A:** Lateral view. The skin, less present at occipital and superior areas and absent at parietal-temporal areas, is dry and damaged and has some traces of hair. The orbits protrude as they have been emptied and filled with a hard resinous substance. Long and thin pieces of a shell-like material have been embedded to mimic the eyelid edge. **B:** Frontal view. The orbits have been emptied and filled with a hard resinous substance. Long and thin pieces of a shell-like material have been embedded to mimic the eyelid edge. This material is preserved in the left eye and has 3.1 cm length. In the right eye only a mark can be observed. **C:** Frontal radiograph. Bony structures have a normal appearance, with no significant signs of pathology or trauma. In the left eyelid, two structures of homogeneous density are observed. Dental pieces are absent. **D:** Axial radiograph. **E:** Lateral radiograph of head of Azara's agouti (*Dasyprocta azarae*), revealing teeth, modified from a radiograph by Oliveira *et al.* (24).



Figure 2. Specimen n° 2. **A:** Frontal view. **B:** Detail of the face. Human-like head. The hair is short and glossy black. The skin is shiny and black. The eyes are closed. The eyelids have lashes. Hair is present on the face. The nostrils are occluded. The lips are pierced at six different locations and a cord through the perforations seals the mouth. There are no traces of face painting or tattooing observable. **C:** Antero-posterior Radiograph. Absence of bony structures. Arrow: incision made for the elaboration of the shrunken head. See the deformation of the head.

and less than a third of the width of the shaft, amorphous, and mostly not continuous when present.

Radiological images confirm the absence of bone structures. In the AP, the deformation of the shrunk head and the incision for processing (Fig. 2C) is observed.

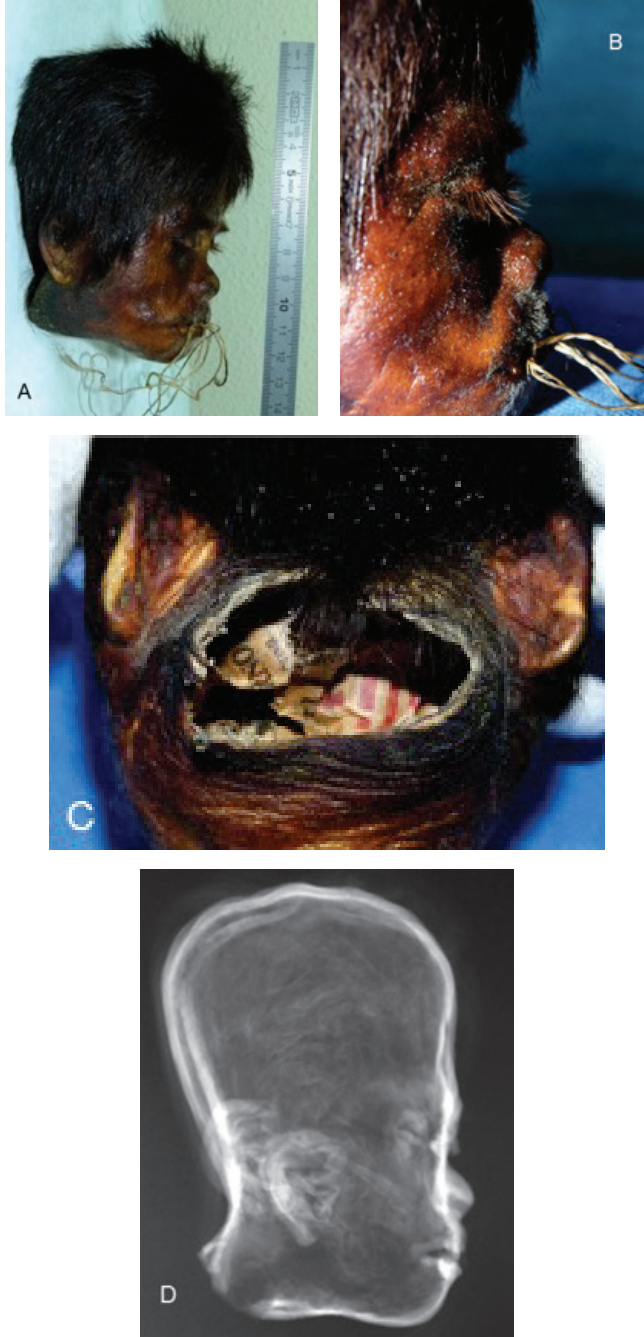


Figure 3. Specimen n° 2. **A:** Lateral view. **B:** Detail of the face. Human-like head. The eyes are closed. The eyelids have lashes. Hair is present on the face and earlobes. Ear is unpierced. The nostrils are occluded. **C:** Inferior view. Nape Area. See oval shape of the neck section and important thickness and leathery texture of the edge of the neck opening. **D:** Lateral Radiograph. Absence of bony structures. See the deformation of the head. Papillary and reticular layers of the dermis detached. Both ears are unpierced. Note the conservation of the Helical complex retained.

In the lateral radiography (Fig. 3D) a detachment in the papillary and reticular layer of the dermis was evident. The ears roughly occupying the middle third of the face and the helical complex was retained.

Specimen n° 3

This specimen is a human type head with indigenous appearance (Fig. 4 and 5).

There are no bone structures and it is well preserved. The eyes, with large eyelashes, are closed. The nostrils are rounded and closed. The mouth is open. There is a lot of hair in the face and nose. The skin is black. The earlobes are not perforated but maintain their cartilaginous helical shape. In the neck area there is an oval opening sewn with rope. A small seam with rope is observed on a side, possibly while breaking through that area. The rope appears to be similar to the one used in the neck. The skin is thicker in this area and its texture is similar to parchment paper. The base of the neck showed an irregular, rough and ragged incision. That incision was uneven edge, smooth on the anterior half and rough on the posterior half.

This shrunk head is filled with cardboard paper, it can also be observed through the mouth. Table 2 details the main cephalometric measurements of this trophy head.



Figure 4. Specimen n° 3. **A:** Frontal view. **B:** Detail of the face. Human-like head. The eyes are closed, with long eyelashes. The mouth is open. Plenty of hair is present on the face and nostrils. The skin is blackened. The earlobes are unpierced. **C:** Detail of sewing. **D:** AP Radiograph. Absence of bony structures. See the incision made for the elaboration of the shrunk head.

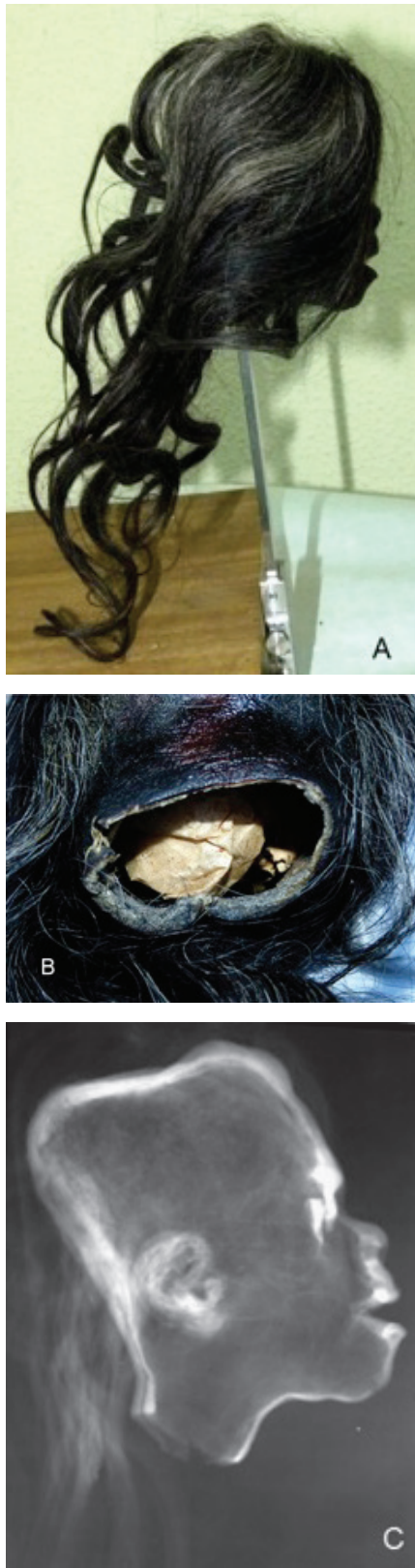


Figure 5. Specimen nº 3. **A:** Lateral view. Very long hair is present all over the head. **B:** Inferior view. Nape Area. See oval shape of the neck section and important thickness and leathery texture of the edge of the neck opening. **C:** Lateral Radiograph. Absence of bony structures See the deformation of the head. Note the conservation of the Helical complex retained.

A very long hair is present all over the head (Fig. 4). The hair was black and firmly attached to the scalp. A sample of the hair was studied on a microscope. Hair bone was, mostly, discontinuous when present, amorphous, and less than a third of the width of the shaft.

Radiological images confirm the absence of bone structures. The AP radiography (Fig. 4D) shows the posterior incision made during the preparation of the shrunken head extending from the neck to the front area. In the lateral radiography (Fig. 5C) a detachment in the papillary and reticular layer of the dermis was not evident. The ears roughly occupying the middle third of the face and the helical complex was retained.

DISCUSSION

“Trophy heads” are human heads that have been removed from the rest of the human body at the time of death or later. Various criteria can help their identification, such as decoration on trophy skulls or reduced heads, elaboration and preparation techniques, and more recently genetic analysis.

In our study material the decoration of the skull trophy is compatible to a trophy head by the Mundurucu people (specimen nº 1). The macroscopic and microscopic criteria confirmed the human origin of the two shrunken heads (specimen nº 2 and 3).

Trophy skull

The trophy skulls are identified by the handling or the decoration of natural orifices (eyes, ears, nose or lips) and/or by the location of the hole made in the head, where a piece of string is passed to carry the enemy's head hanging from their belts as a trophy. For example, in Peru the Chavín, the Nazca, the Paracas and the Tiawanaku make a small hole in the middle of the forehead. Other tribes, such as the Aymara or tribal areas from the northwest of Argentina and Bolivia, drilled a hole in the apex of the skull (8).

The Mundurucu or Mundurucu indians remove the eyes, place in a resin paste on the orbits and embed the tooth of an agouti (*Dasyprocta agouti*) to simulate the eyelids. In the teeth of the agouti (Fig. 1E), neither the crown nor the root can be distinguished because the enamel covers substantially the entire length of the tooth [24]. Besides, the Mundurucu decorate hair and ears with cotton cords embellished with red and black feathers of a black-billed toucan (*Ramphastos vitellinus*). This ornament is intentional since the red colour is one of the cultural elements of the

hunting totemists groups [25]. Its addition neutralizes permanently the possible harmful emanation that may arise from the head. Direct observation of specimen 1 – on which several steps from the described ritual can be

confirmed– allows us to conclude that it is an authentic Munduruku trophy head.

The first references of the Mundurukú Indians date from 1768. The missionaries and travelers spoke

Table 4. Criteria according to Houlton & Wilkinson (2018)

Criteria. T: ceremonial tsanta (C) C: Commercial shrunk head (Cm)	Specimen n°2 n°3	
1. T: Long narrow face, often presenting a ‘pinched’ impression at the temples, a forcibly upturned and spread nose, and intentionally distended lips, creating an elongated profile with a sloping brow and receding chin C: More convincingly proportioned face and an upright profile. Rounded to domed shaped scalp	C	no
2. T: Size approximately a fifth of a full scale head, equal to a clenched human fist C: Variable scale - of head size -	no	Cm
3. T: Vertical skull-removal incision located from posterior median of head to nape of the neck C: Variable skull-removal incision locations	C	C
4. T: Sutures are often wide and uneven – performed using a thick and inflexible flat bamboo needle with coarse chambira fibre C: Stitches are usually more precise, discrete and consistent – due to access to finer, sharper, metal needles and thinner suture threads	Nv	no
5. T: Sutures are typically made using ‘over and over’ stitches C: Sutures are typically made using ‘baseball’ stitches	no	Cm
6. T: Loop of flexible vine is sewn into the neck – if absent, traces of suturing can be evident C: No supporting vine at the neck structure	C	no
7. T: Eyelids are tightly drawn into the head and sutured shut C: Variable, but the eyelids are often carefully sutured to retain their visible form; often with the upper lid positioned over the lower lid	no	Cm
8. T: Three mouth perforations from chonta pin application – sometimes retained and lashed together with chambira (see note) C: No, or a variable number of perforations mark the mouth. If pins are present, they are not always chonta wood	C	3
9. T: The mouth pins are classically replaced with intricately woven string tassels applied to the mouth at a length equal to the scalp hair. Several horizontal red bands of achiote are painted, but these can fade over time C: Tassels are often not attached. If present, atypical colourants, materials and knots for securing them may be present	no	Cm
10.T: Skin browned using carbon staining C: Skin sometimes remains unstained, presenting as a grey or yellow colour	C	C
11.T: Vellus downy hair removed C: Vellus downy hair is sometimes maintained, or shaved/trimmed to a stubble	no	no
12.T: Skin is polished C: Skin can sometimes present a dull, rough texture	Cm	Cm
13.T: Skin tends to be dense and of considerable weight C: Skin can vary; it can sometimes be thin, fragile and very light in weight	C	C
14.T: Typically long scalp hair is present, with no facial hair C: Scalp hair can vary in length. Facial hair is often maintained	no	no
15.T: One or two perforations mark the crown, with one fitting a vegetable fibre string suspension cord (woven into a five-loop braid) that is secured within the head by a small wooden pin. The cord is long enough for adornment about a person’s neck C: Heads are not always perforated to fit a cord. If cords are fitted, they can be produced from a variety of different materials, woven differently, overly decorated, and of an inappropriate length for personal adornment around someone’s neck.	no	no
16.T: Piercings that would typically present at the earlobes were not always decorated. Toucan feather ear dangles and/or wooden tubes/pins are however common C: Headbands, necklaces and any ornamentation comprising beads, seeds, or portions of seeds are atypical to ceremonial tsantsa	Cm	Cm
	Nv	Nv
	Nv	Nv

3: this specimen has signs of three marks but without evident holes; Nv: not valuable.

of their “aggressive nature” and their interminable struggles with the neighboring towns and the Portuguese [26]. The Mundurucu indians, ancestral enemies of the Parintintin, inhabit along Madeira and Tocantins Rivers in Brazil. The Mundurucu were such a fierce and belligerent group. The Parintintin Indians assigned them the term munduruku or “giant ant” because their warfare techniques consisted in lining-up during combat like a compact group of ants. The Mundurucu Indians were famous for exposing the trophy heads near their huts. The Mundurucu cut off not only their enemies’ heads but also those of the warriors of the tribe who died when fighting far from the village. In this case, they transported the head of the deceased to his family home, hung it up and, after a ceremony in which the warriors vowed to avenge, buried it beneath the house ground [2].

The practice and ritual of *pariúá-te-ra* (trophy head) of the Mundurucu is well documented [26]. It lasted about three rainy seasons (three to five years). At the end, the heads of their enemies lost their spiritual power and were discarded.

Once the soft tissue, fat and brain were removed through the foramen magnum, the head skin and hair are left to dry. Then, it was dried several times in a container filled with vegetable oil and annatto (*Bixa Orellana*) and later, it was smoked and exposed to the sun for several days. The head was smeared with Andiroba oil (*Carapa guianensis*), inside cotton balls are filled and covered her mouth with resin. Several intertwined strands hung from the mouth and the thicker one served for the head’s owner to carry or tie it around his waist. The decoration was done as explained before. During the preparation of the trophy head, teeth were extracted and used to decorate a cotton belt that was used in a ritual called *pariúá-te-ra*. This ritual used to be held almost a year after obtaining the head. Our head also needs teeth.

At the end of the third season of rain a new party was celebrated where Mundurucu neighborhood groups were invited and enemy headhunting practice was staged.

While this ritual happened, the owner of the trophy head had a series of privileges, as he was honored and nurtured by his tribe. After the ritual, the warrior lost his privileges and returned to his normal life.

Shrunken heads

The findings of the anthropological and ethnological research have established decorative features, both morphological and ornamental, that

can be used to distinguish ceremonial tsantsa from commercial shrunken heads. Recently, some authors reported that only 9% of heads could be clearly assigned to ceremonial tsantsa, 56% were defined as commercial shrunken heads, and the remaining 35% as heads of ambiguous origin [12, 23].

According to criteria established in Table 3, only 20% of these diagnostics are absent. Long suspension cord overhanging from the top of the head or related hole (diagnostic criteria 11) was missing in specimens n° 2 and 3. To Charlier [18] this criteria was also the most absent. The sand filling was also absent from both specimens. It is easy to deduce that the sand was lost with time and had to be replaced by newspaper to maintain the shape of the shrunken heads.

In our study these macroscopic criteria are complemented by a microscopic hair analysis, compatible with human hair in both specimens of shrunken heads. The positivity of these macroscopic and microscopic criteria is sufficient to confirm the human origin of a shrunken head, making it unnecessary a DNA analysis [18].

Possible commercial origin of the shrunken head

Our second objective was to evaluate whether these tsantsas were ceremonial or commercial.

The technique for the preparation of shrunken heads is a well-documented variant of mummification. In 1885, Prieto was the first to knowingly become acquainted with the Shuar and their head shrinking methods [17]. Other authors have given detailed accounts of the methods employed by the Shuar in shrinking heads [5, 14, 17]. While the technique described preserves the facial features of the person, the Shuar had no desire to preserve their natural expression, often distorting the shrunken heads to deliberately ridicule their enemies. This also helps to distinguish the authentic shrunken heads from the false ones [13, 20, 23].

Besides, the technique used by the Shuar respects the initial length of the hair. In the shrunken heads, the beauty and abundance of the hair involves a “spiritual value”. The hair witchcraft is one of the oldest ritual practices of mankind. Perhaps, the relationship between head size and length of their hair was the reason why the Shuar reduced the former to increase the latter [16]. Therefore, specimen n° 2 meets 10 of the 16 criteria for the tsanta ceremonial heads. Specimen n° 3 meets 9 of the 16 criteria for the tsanta commercial heads. However, there have been

established other morphological characteristics such as those corresponding to the preservation of the neck (type of cut, neck ring) or to the ears [27].

Concerning the type of cut, in our both specimens the incision of the decapitation was made flush with base of the neck but they were of different quality. Therefore, the straight incision and the smooth edge at specimen n° 2 (Fig. 3C) indicate a case of tsantsa ceremonial [12] and uneven edge and smooth on the anterior half and rough on the posterior half at specimen n° 3, (Fig. 5B) are compatible traits of a commercial shrunken head [12].

The evidence of a supportive neck ring structure applied to the base of the neck was maintained in most ceremonial tsantsa (83%) and seldom in commercial heads (8%) – this would have been implemented to support the neck in an open position, allowing the processor access to the internal head to apply hot pebbles and later sand to promote desiccation. Common ceremonial evidence included small pinhole perforations or grooves lining the neck base [12].

In all ceremonial tsantsa, 91% ambiguous heads, and only 36% of commercial heads, the base of the neck was presented flush, with minor buckling evident in those specimens where the incision had been made close to where a neck ring was likely once applied [12].

In our specimen n° 2 the base of the neck was presented flush, with minor buckling evident while the base of the neck of the specimen n° 3 showed an irregular, rough and ragged incision. This trait indicates specimen n° 2 to be tsantsa ceremonial while specimen n° 3 is more probably commercial.

On the other hand, papillary and reticular dermis separation often occur in the evidently distorted ceremonial and ambiguous heads [23]. In our specimen n° 2 a detachment in the papillary and reticular layer of the dermis was evident while specimen n° 3 this is not evident. An inspection of the deeper dermal tissues, viewed in cross-section, could only be performed via CT [12]. Also durable hyaline fibrocartilage defines the complex helical structures of the ears and the cartilage is normally retained in shrunken heads, delivering relevant structural support [23]. Radiological study shows that in both specimens, n° 2 (Fig 3D) and 3 (Fig 5C), the reduced ears retain the distinctive helical complex.

In conclusion, the decoration of the skull trophy is compatible to a trophy head by the Mundurucu people. Also, the overall data, according to macroscopic and microscopic morphological criteria, confirm the

human origin of the two shrunken heads, these being one of tsantsa are ceremonial origin (specimen n° 2) and the other one commercial (specimen n° 3).

Conflict of interest

The authors declare that they have no conflict of interest.

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