



Forensic Anthropology Population Data

Shrunken head (*tsantsa*): A complete forensic analysis procedureP. Charlier^{a,b,*}, I. Huynh-Charlier^c, L. Brun^d, C. Hervé^b, G. Lorin de la Grandmaison^a^a Department of Forensic Pathology and Medicine, University Hospital R. Poincaré (AP-HP, UVSQ), 92380 Garches, France^b Department of Medical Ethics, University of Paris 5, 45 Saints-Pères street, 75006 Paris, France^c Department of Radiology, CHU Pitié Salpêtrière (AP-HP), boulevard de l'hôpital, 75013 Paris, France^d Department of Pathology, University Hospital, Parakou, Benin

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ABSTRACT

Based on the analysis of shrunken heads referred to our forensic laboratory for anthropological expertise, and data from both anthropological and medical literature, we propose a complete forensic procedure for the analysis of such pieces.

A list of 14 original morphological criteria has been developed, based on the global aspect, color, physical deformation, anatomical details, and eventual associated material (wood, vegetal fibers, sand, charcoals, etc.).

Such criteria have been tested on a control sample of 20 *tsantsa* (i.e. shrunken heads from the Jivaro or Shuar tribes of South America). Further complementary analyses are described such as CT-scan and microscopic examination.

Such expertise is more and more asked to forensic anthropologists and practitioners in a context of global repatriation of human artifacts to native communities.

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1. Introduction

A consequence of the multiplication of human remains repatriation to natives [1–3] is the huge increase of scientific analyses dealing with such anthropological artifacts (for example the *Toi Moko* or isolated mummified heads from New Zealand) generally asked to forensic departments [4]. Our laboratory was indeed involved in the examination of artifacts from Natural History Museums (Rouen and Lille), the National Natural History Museum (Paris), the Museum of the Quay Branly (Paris), and from private curators. *Tsantsas*, i.e. shrunken head processed by the Jivaro tribe, living southeastern Ecuador and northern Peru, are a non-negligible part of such human artifacts conserved in anthropological and ethnological institutions; they may be involved in such repatriation processes in a short term.

For instance, the forensic practitioner does not have any synthesis paper giving a simple and complete methodology for the authenticity procedure, but general ones or case reports [5–9]. This

is the aim of this article, based on the analysis of shrunken heads referred to our department for authenticity expertise, and further items examined only for scientific purposes and comparison data.

2. Current fabrication process

Limits in the description of shrunken head production are the fact that all data are second-hands ones dated from the 17th to the mid-20th centuries, some of them being contradictory. Anyway, a global sequence can be determined: *Tsantsas* were made from men, women, and children. At the end of a victorious raid, just after death of the enemies, their heads were removed from the rest of the body (beheading being as close to the trunk as possible). Tropical environment obliged a quick initial process in order to prevent decomposition and putrefaction alterations:

“A part was made in the hair down the center of the back of the head. Using this part as a guide, a knife was used to cut down the bone from the crown of the head to the base of the neck. At the bottom where the cut ended, the corners of the skin were turned back on each side and peeled away from the bony structure of the skull” [5]. Muscles and flesh were then entirely cut away, in order to remove in one piece the head and face-skin with the hair intact. This piece was turned inside out, scraped, and cleaned of all

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adhering connective tissues. After having sewn shut eyelids from the inside using fine vegetal fibers, the head and face-skin was turned right-side out.

While waiting the further steps of preparation, the head-skin was deposited in cold river water, sometimes mixed with juice, vine or astringent botanical substance. Then the head-skin was put in boiling water 30 min to 2 h, in order to extract much of the fat and grease. Then the head was taken out, cooled and dried. While still warm and pliable, the skin was turned inside-out, then the inner surface was scraped with a knife, and still adherent pieces of flesh and fat, were cleaned off.

Further operations were carried out in order to preserve the features of the face: the posterior incision (back of the head) mended; flexible vine loosely sewn into the skin at the base of the neck (to provide a permanent opening through which heated shrinking agents will be introduced in the following steps, and removed by cutting at the end of the process). Nostrils were sometimes plugged with cotton and/or pitch. Lips were also sealed with both symbolic and practical significance: (1) trapping the avenging spirit of the slain individual; (2) keeping it from exiting through the mouth; (3) maintaining the human *look* of the head by keeping prominent facial features in their proper place by preventing hot sand poured into the head not to spill out while the head was turned and manipulated [5].

Then, small rounded stones (heated in fire) and hot sand were inserted into the head, in order to sizzle and hiss skin at its contact. “The somewhat laterally compressed or slightly squashed form of the *tsantsas* suggests that they were held in the palm of the slayer’s hand, with his thumb and index fingers at the temples for support as the face was molded” [5].

The blackish color of some *tsantsas* may be due to hot stones used to *iron* the outer skin of the face, or rubbing with charcoal in order to prevent “the avenging spirit from seeing out” [5]. Smoking over a fire of the *tsantsas* was also carried out in order to provide some resistance against insects.

In order to facilitate a wearing of the shrunken head around the neck of the Jivaro warrior during celebration feasts, one or two small holes in the top of the *tsantsas* were made with a sharp wooden needle (such artifacts being removed later during further feast).

Complete realization of the process generally occurred within 2 or 3 days, giving a final head measuring about one-fourth of its original size (i.e. the equivalent of an adult fist). Skin took the appearance of tanned leather, but cracks may arise due to

important dehydration during the long-term conservation in occidental climate.

3. Authenticity process

Three successive steps of shrunken head authenticity procedure may be separated:

1. morphological analysis and search for any of the 14 criteria (may be sufficient in a majority of cases);
2. hair microscopic examination (optional);
3. skin DNA analysis (optional).

3.1. Basic examination

Based on our experience of such artifacts examination, a list of 14 morphological specificities of true *tsantsas* can be summed up (Table 1 and Figs. 1–4). Such criteria were all based on the macroscopic examination of heads, analyzing their global aspect, color, physical deformation, anatomical details, and eventual associated material (wood, vegetal fibers, sand, charcoals, etc.). They have been chosen as easy visible, objective, and reproducible. In order to test their specificity, they all have been screened on a control sample of 20 authentic *tsantsas* displayed or deposited in French public institutions (Table 2). Their percentage of presence (Table 1) was: 65% (1 criteria: long suspension cord overhanging from the top of the head, or related hole), 70% (1 criteria: wooden pegs/vegetal fibers retained in the lips, or related holes), 90% (1 criteria: both eyes sewing shut from the inside), and 100% (all other 11 criteria).

A global part of these criteria can be seen directly in a quick macroscopic preliminary examination. The introduction of a fiberscope into the head cavity and/or the realization of a CT-scan (Fig. 5) can be useful, in order to search for any sand deposit, or any bony remnant, for example. Examination of the skin and all surface particularities may be facilitated by the use of a dissecting microscope.

3.2. Microscope examination

Hair microscopic examination may be useful for distinguish human and other animals ones, human medulla being physiologically less than one third width of shaft, amorphous and mostly not

Table 1

List of all 14 diagnosis criteria for the authentication of *tsantsas*, with their percentage of presence in our sample of 20 pieces.

Criteria	Percentage of observation in our sample (n = 20)
1 Dark or black or brown skin color due to impregnation with charcoal dust during shrinking	100% (n = 20)
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)	70% (n = 14)
3 Loop of wooden vine or fiber sewn into the neck (if absent or removed post-production, traces of suturing and/or sawing are present)	100% (n = 20)
4 Important thickness and leathery texture of the edge of the neck opening	100% (n = 20)
5 Oval shape of the neck in cross-section and/or lateral compression of the head	100% (n = 20)
6 From behind, neck and head tissues sewn together with fiber stitches	100% (n = 20)
7 Conserved anatomical details of the ear (with possibility of a earlobe hole, filled or not by a wooden tube or peg)	100% (n = 20)
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	90% (n = 18)
9 Profusion of hairs in the nostrils	100% (n = 20)
10 Long dark hairs (or hairs which have been cut years after the shrinking process)	100% (n = 20)
11 Long suspension cord overhanging from the top of the head (or related hole)	65% (n = 13)
12 No facial painting or artistic/ethnic scar	100% (n = 20)
13 No remaining skull fragment	100% (n = 20)
14 Complete filling of internal head cavities by sand and/or charcoals	100% (n = 20)

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