

Quadruple Flutes of Teotihuacan

Subjects: [Archaeology](#)

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Teotihuacan

musical instruments

sonic artefacts

aerophones

1. Quadruple Flute Organology

The Teotihuacan quadruple flutes are among the most elaborate ceramic fipple flute instruments documented for Mesoamerica. The extant finds, apart from three partly preserved quadruples most frequently broken mouthpieces [\[1\]\[2\]\[3\]\[4\]](#) [1](#) and a series of miniature representations in the form of ceramic plaques [\[1\]\[3\]\[5\]\[6\]\[7\]\[8\]](#) [2](#) were excavated predominantly close to the civic-religious centre of the site. The finds point to a standardized production of these flutes in terms of morphology and, in terms of size, to the employment of a family of larger (“alto”) and smaller (“soprano”) instruments.

In organological terms, the multiple flutes are composed of a mouthpiece and four long tubular resonators equipped with a number of fingerholes and/or tone holes (**Figure 1a**). The typical mouthpiece is characterized by two blow holes and two bifurcated airducts with four exit slits (**Figure 1b**). The four apertures are in general much longer than wider, equipped with convex side walls (presenting no frames) and slightly curved edges (**Figure 2a**). Inside the pipes a curved or bended ramp can be observed, extending from the exit slits of the airducts to the bottom of the pipe (**Figure 2b**). Cross sections of a virtual flute model provide visual possibilities demonstrating these partly non-visible organological features of the instruments (**Figure 3**). The configuration of the airduct–aperture assemblage is particularly unique when compared with more conventional forms applied in the ceramic fipple flute organology from Mesoamerica, presenting single airducts and apertures of rectangular, trapezoid, circular or oval shapes. Notably, the particular configuration is also not found in the multiple flutes from other pre-Columbian cultures, and thus represents a distinctive feature exclusively related to the Teotihuacan quadruple flutes.

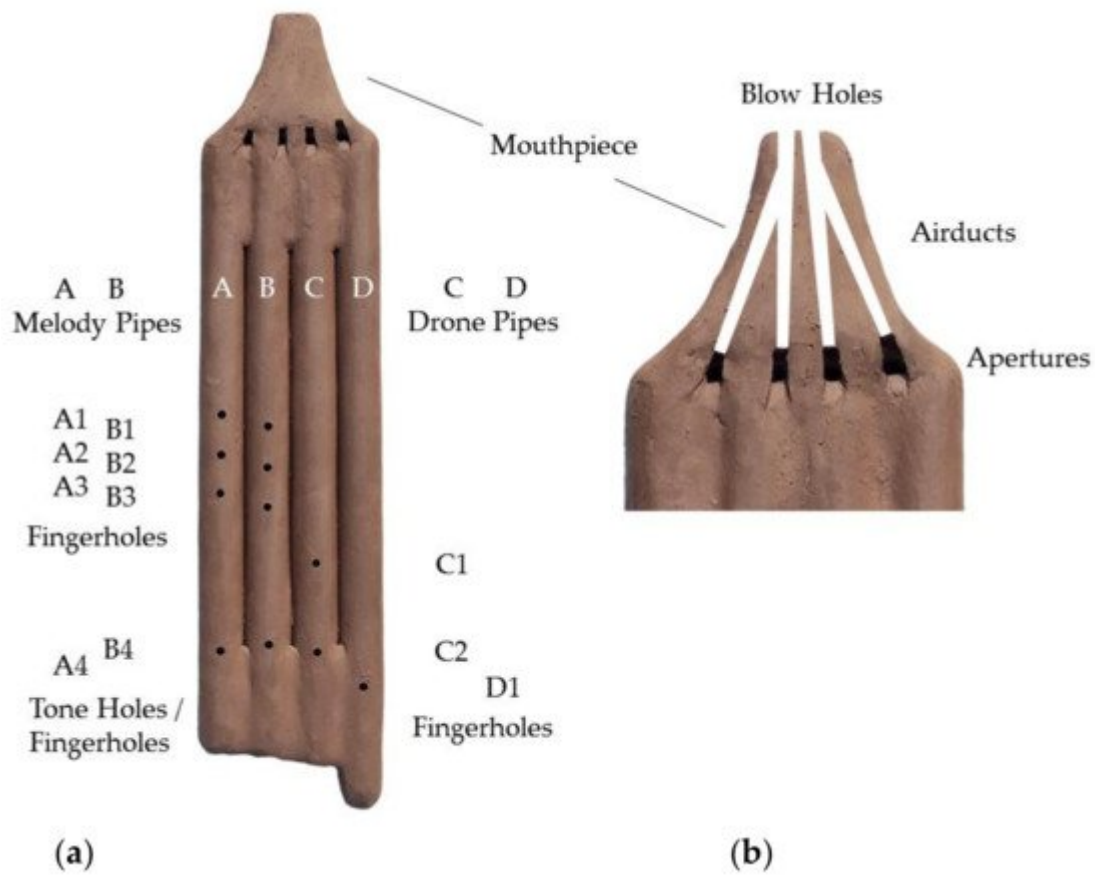


Figure 1. (a) The organological components of a Teotihuacan quadruple flute (experimental model); (b) mouthpiece configuration with two bifurcated airducts. Photos by Adje Both.

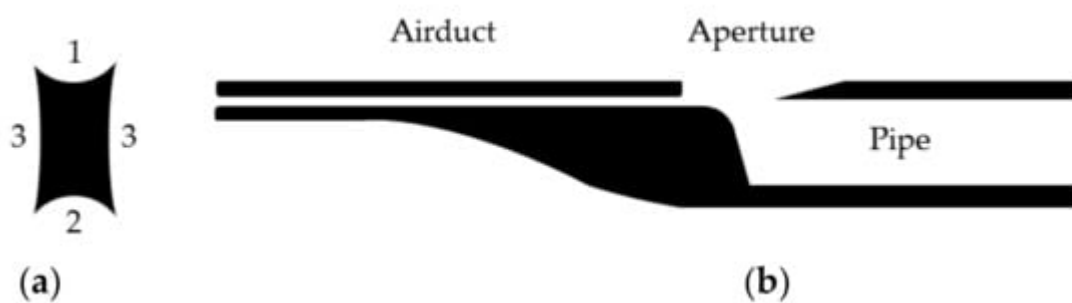


Figure 2. (a) Characteristic form of the Teotihuacan quadruple flute apertures: (1) top side of the airduct at exit; (2) edge; (3) side walls; (b) cross section of the Teotihuacan airduct–aperture assemblage with curved ramp. Drawings by Adje Both.

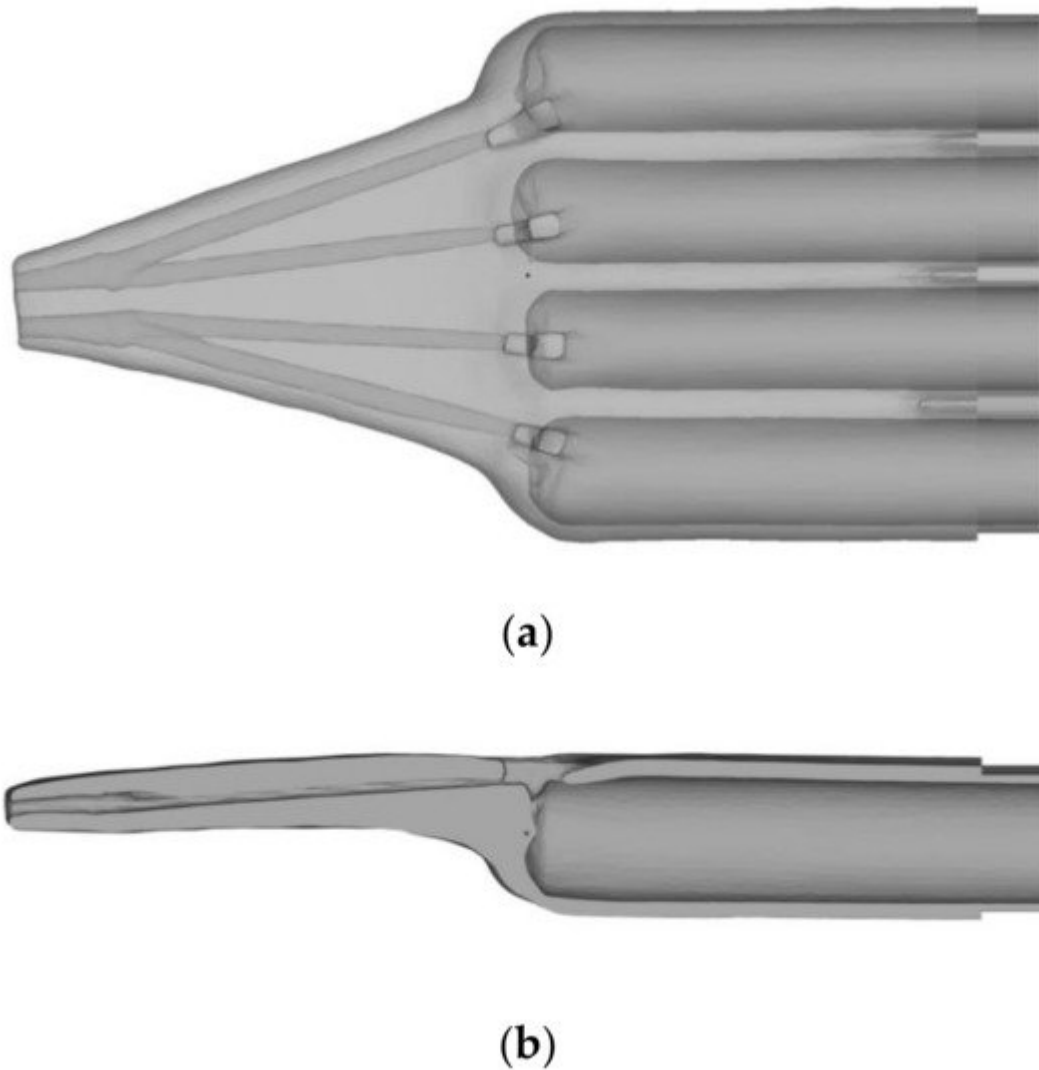


Figure 3. Virtual flute model, created by Jared Katz (2021): (a) top view showing the airduct-aperture assemblage; (b) cross section of the mouthpiece. Sections created by Stephen Knowles.

The two rightmost pipes of the instruments, which are likely to represent the “melody” pipes or “chanters” (identified as pipes A and B, for reference, see **Figure 1**), are always equipped with three more-or-less equidistant fingerholes placed in the central part (A1; A2; A3; B1; B2; B3) and a tone hole placed in the lower part of the pipes (A4; B4). As a general principle, the fingerhole groups in the central part are not aligned in parallel but slightly shifted, with the fingerholes of pipe A placed three-to-five millimetres higher than those of pipe B (always measured from the centre of each fingerhole). The tone holes in pipes A and B are also not aligned in parallel, but shifted in the opposite direction, with the hole of pipe A placed slightly lower than the one of pipe B. In acoustical terms, the tonal deviation as a result of the shifted position of the fingerholes is thus counterbalanced, but due to small measurement deviations in terms of the distances between the respective edges and the holes and their diameter, the pipes are hardly to be played in unison, resulting in the production of beats with various degrees of roughness ^[9] (p. 529). The two leftmost or “drone” pipes (C and D, see **Figure 1**) are equipped with one or two fingerholes each (C1; C2; D1), placed in the lower part for adjusting the drone frequencies. It should be mentioned, however, that the organological identification of the pipes and the holes with respect to their usage must be carried out cautiously

and that the definitions given above are preliminary. According to the way the instrument is supported and the fingering technique applied, pipes C and D can also be turned into melody pipes with a limited tonal range, and the tone holes of pipes A and B could also be used as fingerholes.

While pipes A–C are usually of the same length, pipe D is somewhat longer, thus producing tones in a lower frequency range than the other pipes. This particular feature is frequently seen in the quadruple flute miniatures from Teotihuacan mentioned above. In the sound artefacts, pipe D is also special in the sense that it is sometimes equipped with a much larger aperture than the apertures related to pipes A–C, and the ramp may be bended instead of being curved. Pipes A–C are usually half-stopped by slightly dented walls or an attached disk with a central opening, while pipe D could also present a conical constriction at the distal end. These elements serve to ensure that the pitch of the instrument is lower than if the pipes were open. As the distal end of pipe D has not been preserved in any of the extant sound artefacts from Teotihuacan, its exact configuration is unknown.

Some of the above described organological features are also observed in a series of roughly contemporary or slightly later multiple flutes from the Gulf Coast and the Maya Area, in particular the triple flute from Tenenexpan, Veracruz ^[10], the triple flutes from Jaina, Campeche, and Copan, Honduras ^[11] and the quadruples from Jaina, Campeche, and Baking Pot, Belize ^[1], suggesting mutual interchanges and certain continuities in terms of instrument design and musical knowledge. The comparison with these instruments is of particular help to get a better picture of the Teotihuacan quadruple flute organology, as not all parts of the extant finds from Teotihuacan are preserved. It should be noted that the triple and other multiple flutes from Mesoamerica are of equal importance than the quadruples, especially as the rightmost chanter of the triple flutes has been simply duplicated in the quadruple flutes (probably, as a reference to the West Mexican double pipes with groups of three fingerholes), while the longer configuration of the leftmost drone pipe was always maintained.

2. The Three Best-Preserved Teotihuacan Quadruple Flutes

Only three sonic artefacts are known, which are preserved partly intact. The first, larger instrument has been excavated in Burial 30 of Zacuala Palace, forming part of the main temple of the compound (**Figure 4a**) ^[1] (p. 70–73, Figure 3), ^[3] (p. 207, Lám. CVIII), ^[12] (p. 347, Cat. 165), ^[13] (p. 48–49, Figure 28), ^[14] (p. 131, Figure 10). For a better distinction, this flute is called the Zacuala quadruple. The flute was subject of at least three restoration/reconstruction attempts roughly carried out between 1959–1965 by Carlos Sigüenza, the second before 2005 and the last over 2005–2008 under the direction of Felipe Solís. Its current measurements are 74.5 cm in length, 13.2 in width and 3.8 cm in height. According to our examination of the artefact, it is made from granular paste, with temper containing mica (or muscovite, a phyllosilicate mineral) and crumbled shell (pieces of the latter are observed at the partly fractured distal end of the mouthpiece). The finish presents an ochre–yellowish engobe applied on both sides of the pipes that has been partially polished along the shafts of the pipes (comparable to the ochre ground on the Teotihuacan red-on-ochre ware or ceramic Group 8 established by Séjourné ^[15]). The mouthpiece originally did not present any application of engobe, which is hardly detected today as, in the course of the second restoration/reconstruction attempt of the instrument, the natural surface colour of the fired clay had been adjusted to the colour of the pipes. Notably, the object is manufactured from the same paste and also has the

same finish as the Anahuacalli quadruples (see below). The feature of ware from granular paste with ochre–yellowish engobe is also shared with other Teotihuacan instruments, such the ceramic horn in the form of a marine shell from Tetitla, Burial 32 5 (p. 518–520)].

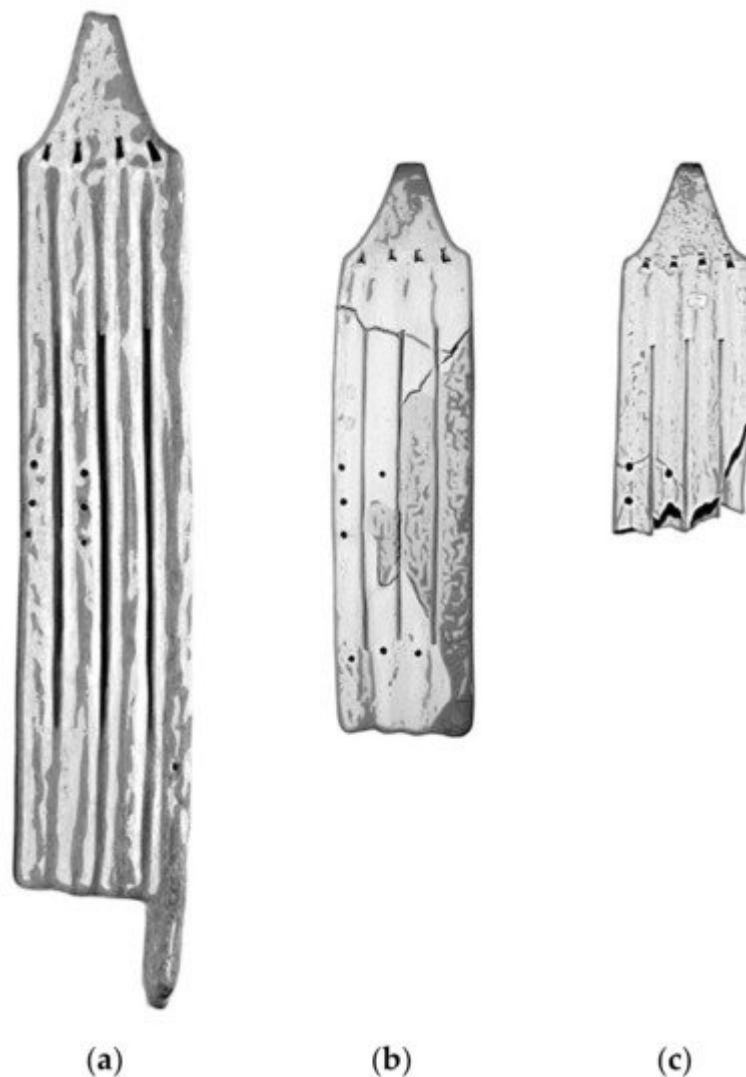


Figure 4. Quadruple flute finds from Teotihuacan, actual condition of the fragmented, restored and partly reconstructed artefacts: **(a)** Zacuala Palace (Museo Nacional de Antropología, Mexico City, Inv. 10-223540), actual length: 74.5 cm; **(b)** Diego Rivera collection, “Anahuacalli-1” (Museo Anahuacalli, Mexico City, Inv. 51125), actual length: 43.0 cm; **(c)** fragment from the Diego Rivera collection, “Anahuacalli-2” (Museo Anahuacalli, Mexico City, Inv. 45540), length: 28 cm. Drawings by Adje Both.

The second, much smaller flute, called Anahuacalli-1, is from the Diego Rivera collection and has no archaeological background information, except that it is from Teotihuacan (**Figure 4b**). This instrument was fragmented and the subject of one restoration/reconstruction attempt carried out before 1955, when published for the first time ^[16] (p. 140). The actual measurements are 43.0 cm in length, 10.4 cm in width and 2.7 cm in height. Its current condition is poor, as some of the reconstructed sections have come apart and further damages have been incurred to the preserved original parts.

The third quadruple flute, called Anahuacalli-2, is from the same collection but preserved only in a larger fragment consisting of the mouthpiece and the upper part of the tubes, including some of the fingerholes of pipes A and B (**Figure 4c**). The latter instrument is virtually identical to the Anahuacalli-1 quadruple in terms of its morphology, size, organological details and wear marks of its preserved parts. In both instruments a dark discoloration in the distal end of the mouthpiece has been observed, apparently resulting from extensive playing. Additionally, greyish-black spots of an unidentified substance are dispersed on the surface of both mouthpieces. According to these features, it can be assumed that the Anahuacalli quadruples stem from the same archaeological context, most possibly a burial. The two latter instruments belong to the soprano size of the Teotihuacan quadruple flutes.

3. Previous Reconstruction Attempts and Current Playing Condition of the Finds

As mentioned before, the Zacuala quadruple was subject to at least three restoration/reconstruction attempts, which are not fully correct according to current research. Notably, the reconstructions resulted in differing total lengths of the sonic artefact, ranging between 63.5 cm in the first [3](#) and, after a prolongation of the length of pipe D, 74.5 cm in the last reconstruction. On the other hand, the width of 13.2 cm and the height of 3.8 cm were always maintained and correspond to the original size (the height equivalent to the maximum outer diameter of the pipes). From the preserved part of the original find only a sketch has been published (**Figure 5**). The sketch does not include several parts of the distal end of some of the pipes, one fragment still presenting a fingerhole/tone hole inserted erroneously on the inferior side of the instrument (in pipe A in the first reconstruction and in pipe C in the second reconstruction). In the first reconstruction, pipes A–C have been given the same length, with the length of pipe D only a few millimetres larger. For the second reconstruction, the length of pipe D has been enlarged, and for the last attempt even more. During the second reconstruction attempt also the diameter of some of the fingerholes, originally presenting between 4.5–5.5 mm, has been substantially modified, resulting in diameters between 2.9–5.5 mm. According to the pre-Columbian flute design, usually presenting only small deviations of the fingerhole diameters of not more than 0.5–1.0 mm in one and the same instrument, the present condition must be challenged. In addition, due to the lack of knowledge on comparative material, the fingerholes and tone holes of the unpreserved parts in pipe A (A4), B (B4), and C (C1; C2) were never included. The fingerhole/tone hole currently situated on the inferior side of pipe C, most probably corresponds to A4, and the corresponding fragment to pipe A. The Anahuacalli-1 quadruple also has not been restored fully and satisfyingly, especially in terms of the length of pipe D and the omission of some of the fingerholes of pipes B (B2; B3), C (C1) and D (D1).



Figure 5. Sketch of the Zacuala quadruple before restoration/reconstruction. Redrawn by Claudia Zeiig after [\[14\]](#) (p. 131, Figure 10).

4. Manufacture and Design of Playable Reproductions with Copied and Reconstructed Parts

As the original restored and reconstructed flutes are malfunctioning and the organological details of the actual restorations/reconstructions are challenged, in particular the lengths of the individual pipes, the diameter of the fingerholes/tone holes, their number and respective placement, a series of reproductions from clay was produced by the instrument maker Osvaldo Padr3n P3rez, corresponding to revised reconstructions of the instruments. For the actual reproduction process the following steps were followed:

- producing four tubes with flat pieces of clay wrapped around wooden bars;
- joining the four tubes by filling an amount of clay in between the tubes in the upper and lower section of the pipes and in between the tubes on the inferior side;
- cutting the four apertures in the tubes;
- producing the mouthpieces in two parts (a larger lower and a smaller upper section, the latter presenting the blow holes): the inferior side of the lower section with four flat sticks in the size of the airducts, then covered by the superior side of the lower section; the same repeated with the upper section;
- joining the lower section of the mouthpiece with the tubes by bringing the remaining sticks in line with the edges; carefully removing the sticks and testing the sound; for support adding clay at the joint of the inferior side of the mouthpiece and the four tubes;
- joining the upper section of the mouthpiece with the lower section; removing the sticks and testing the sound; eventually adjusting the position of the mouthpiece so that all airducts are aligned well with the apertures, especially the edges;
- bringing the form of the aperture into shape and testing the sound; eventually slightly adjusting the airduct-aperture configuration;
- perforating the fingerholes/tone holes with a reed tube by measuring the position of the fingerhole A2 and from there on deducting all other fingerholes/tone holes; then testing the sound; eventually slightly adjusting the individual size of the fingerholes/tone holes;
- finishing by smoothing the entire surface, eventually applying engobe and partially polishing the surface.

- drying and firing. With the respective preparation, construction and drying processes of the individual pieces, at least three work days of 4 to 5 h each are required for production, and then at least a couple of days for the drying process, before the instrument can be fired.

Notes

1. So far documented are approximately 40 fragmented mouthpieces from the Teotihuacan Mapping Project at the Research Laboratory of the Arizona State University, San Juan Teotihuacán (RL-ASU), for a selection see ^[1] (p. 74–76, Figure 5); finds from Atetelco, La Ventilla and other excavation sites at the Ceramoteca of the Zona de Monumentos Arqueológicos de Teotihuacán, San Martín Teotihuacán (C-ZMAT, Inv. 10-600289; 10-599898; Elem. 19897; 57888; further finds without inventory no.), for a selection see ^[1] (p. 71, 74–76, Figure 2); finds from Zacuala, Yayahuala and Tetitla, see ^[3] (p. 236, Figure 126), ^[4] (p. 106, Figure 83D,E); and two finds from Teopancazco, see ^[2] (p. 202, 205, Figures. 4.47–4.48). For a distribution map, based on the finds stored in the RL-ASU and the C-ZMAT, see ^[1] (p. 83, Figure 9).

2. The miniatures are produced with a flat inferior side and the superior side simulating the instrument in relief, frequently simulating the fingerholes, apertures, and decoration, see ^[1] (pp. 76–81: Figures 6–8); ^[3] (pp. 237–238, 240, Figures 127–129); ^[5] (p. 379, Figure 268); ^[6] (p. 13, Table 4); ^[7] (p. 46, Photo 129); ^[8] (p. 3, Photo 130). A series of finds is stored in the RL-ASU and the C-ZMAT; one further find in the Museo Nacional de Antropología, Mexico City (MNA), the latter without inventory number.

3. Samuel Martí gave the length of 53.5 cm for the first restoration/reconstruction ^[13] (pp. 48–49, Figure 28), but when bringing his top view photograph to scale (and taking into account the photographic distortion of the object resulting from the position of the photographer and the angle of her or his camera) it becomes clear that a typo occurred, as an instrument of 53.5 cm in length would present a width of not more than 10.8 cm. When bringing the photograph to the scale of 63.5 cm in length and recompute the photographic distortion, the width of 13.2 cm is matched.

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