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# COMMENTARIES

## Counting Skulls: Comment on the Aztec Cannibalism Theory of Harner-Harris

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Harner (1977) and Harris (1977) propose a cultural materialist explanation for the large number of sacrifices carried out by the Aztecs by stating that these provided raw material for cannibalism. Cannibalism, in turn, was needed to provide the protein missing in Aztec diets. The magnitude of these sacrifices was given at 15,000 annually in Tenochtitlan and 250,000 in Central Mexico. Harner argues that the overwhelming majority of the victims were eaten. He describes the sacrificial ritual as follows:

> The corpse then was tumbled down the steps of the pyramid, where elderly attendants cut off the arms, legs and head. While the head went on the skull rack, at least three of his limbs were normally property of the captor. . . . He then hosted a feast in his quarters, of which the central dish was a stew of tomatoes, peppers and the limbs of the victim. [1977:120]

While others (Soustelle 1964:111; Ortiz de Montellano 1978; Duverger 1978:184-187, 200-203) agree that human sacrifice and cannibalism took place and while there is ample textual evidence (Sahagun 1951:3, 24, 47-48, 52-53; 1959:64-67; Duran 1967:23, 33, 64, 108), the extent and significance of the practice is controversial. The numbers used by Harner and Harris are much higher than any previously published, and have not been adequately documented in published sources. Arguments have been published that the consumption of even these large numbers of victims would not have contributed a significant percentage of the protein requirements of the Aztec elite (much less for the whole population), and that the timing of this consumption corresponded more with periods of thanksgiving than scarcity (Ortiz de Montellano 1978). In fact, the number of victims eaten was reduced by an unknown but significant amount, since all sacrifices to Tlaloc, the rain god, were buried intact and not eaten (Motolinia 1971:63, 66; Duran 1967:88; Lopez Austin 1980:366-367).

Even though the connection between the number of skulls on a skull rack (*tzompantli*) and the number of sacrifices or victims eaten is not proven, Harner uses the number of skulls as a key piece of evidence to support the contention that an extraordinary number of sacrifices, and thus feasts, took place. It is because of the importance placed on this datum by both Harner and Harris that it is worthwhile exploring both the validity of the number cited and an actual possible model of the *huey tzompantli* ("great skull rack") at Tenochtitlan. Harner states (1977:122) that there were 136,000 skulls on this *tzompantli* based on the following description by Andres de Tapia (1971:538), a Spanish conqueror: "Sixty or seventy very tall beams spaced a little less than a 'vara de medir' (.84 m) with rods from top to bottom. Each rod was drilled through five skulls" (author's translation). Tapia and a companion multiplied the number of rods by five to reach the total number. These data, if taken at face value, will give a result that is physically impossible, as shown below, and thus place the value of this testimony in doubt.

Uncritical reliance on "eyewitness" testimonies from a few conquerors is unwarranted and may be misleading because their motive at the time was to exaggerate the evil deeds of the Aztecs in order to justify the Conquest (Castile 1980; Ortiz de Montellano 1978). Missionaries, although biased against Aztec religion as a "work of the Devil," are on the whole more accurate sources of information and often give much more detailed descriptions. These will be used in an attempt to calculate what the possible capacity of the *huey tzompantli* might have actually been.

An elemental principle in reporting scientific data is that when experimental quantities are multiplied or divided, the number of significant figures in the result cannot exceed that in the

least precise measurement, in this case 60-70 poles. Tapia's result from his own data should only have one significant figure, that is, $1 \times 10^5$, not the six figures used by Harner, which gives an erroneous impression of precision. In addition, in this case a simple calculation will demonstrate the physical impossibility of the result proposed. The assumption of 70 poles arranged in seven rows of ten poles would result in 63 rods with five skulls each. Each plane would contain 315 skulls. Tapia does not describe the vertical spacing between the planes, but another description (Duran 1967:23) gives the spacing as .42 m. To accommodate $1.36 \times 10^5$ skulls with this spacing would require the vertical poles to be 181 m high, beyond the height of any known tree. According to a principle dating to the times of Galileo, a tree cannot be more than 100 m high (Judson 1980).

Duran 1967:23) provides a fuller description of the skull rack at Tenochtitlan. It can be used to derive a more realistic estimate of the number of skulls to be found there. The length of the *tzompantli*[1] was 30 "brazas"[2] (50.16 m), the width was 30 "pies" (8.4 m), the spacing between poles was 1 "braza" (1.67 m), and the vertical spacing between rods, ½ "vara" (0.42 m). Each connecting rod contained 20 skulls and the vertical poles were high as a "tall tree." No actual height is given, nor are we told how many poles there were. A calculation based upon the relationship between height and diameter of a tree (McMahon 1975:93)[3] will allow us to arrive at the probable number of skulls. The maximum number of poles of a given height that can fit in the area given by Duran can be obtained algebraically.[4] The number of skulls that could be held under these conditions are given in Table I for various pole heights. Duran's figure of 20 skulls/rod leads to a skull width of only 8.35 cm, which is too narrow. A more probable width, derived from anthropometric measurements of modern Nahoa Indians, is 14.9 cm (Faulhaber 1970:82). This leads to a density of 11 skulls per rod. Calculations using both these figures are given in Table I. It is interesting to note that the number of skulls stored rises to a maximum at a pole height of approximately 30 m. Increasing the pole height beyond this leads to diminishing results in capacity. This height seems a reasonable postulate as a maximum for *tzompantli* poles. It is in the range for those used in the "volador" dance from Veracruz, which is of Precolumbian origin.

One of the reviewers mentioned that there were several skull racks besides that one described here. Sahagun (1951:166-175) mentions five skull racks besides the "great" skull rack. These, however, seem to be quite small by comparison. Only one is described with any detail. The *Mixcoatl tzompantli* was described as two "estados" in height with seven or eight crossbars (Sahagun 1956:233). This would be approximately 3 m high, with the crossbars spaced about .4 m apart, in agreement with Duran's measurements. We are not told how many poles there were so the capacity cannot be calculated. It is clear, however, that these skull racks were used only in special occasions and would not add a significant number to that of the "great skull rack."

It seems reasonable to conclude that the principal skull rack at Tenochtitlan contained at the very most 60,000 skulls (at 11 per rod) and probably much less since it did not occupy the entire space described by Duran. Tapia's description, on which Harner relies, is patently in error when taken at face value and is also a gross overestimate of the number that a reasonable set of assumptions would produce.

## NOTES

[1] Duran states that the *tzompantli* was "placed in the center" of the space for which I give the dimensions. However, the calculations will be carried out as if it occupied the entire space to allow for a margin of error and to weigh the results conservatively in the direction of too many rather than too few skulls.

[2] The units of measure at this time were not standardized and some variation took place. It seems that units of volume such as "fanegas" varied considerably (Ortiz de Montellano 1978) but that linear measurements were more stable. Several sources (Real Academia Española 1970; Alonzo 1958) were in agreement on the length of the "braza" and "vara." In any case, the other assumptions that have to be made in the calculations reduce the number of significant figures in the answer to such a degree that minor variations in the conversion factors from Spanish to metric unit would not increase the error significantly.

[3] The relationship is diameter = k $(\text{height})^{3/2}$. K varies from tree to tree. Since we don't know what kind of tree was used, in this paper k is equal to .0050. This value is in the midrange of several possible trees, such as *Pinus ponderosa* (k = .0017), *Abies religiosa* (k =

TABLE I. TOTAL NUMBER OF SKULLS IN "TZOMPANTLI" FOR POLES OF VARIOUS HEIGHTS.

| Pole height, m | Diameter at base, m. | No. of rods | Skulls/plane (20/rod) | Skulls/plane (11/rod) | No. of planes | Total no. skulls × $10^3$* (20/rod) | Total no. skulls × $10^3$* (11/rod) |
|---|---|---|---|---|---|---|---|
| 15 | .29 | 4 × 25 = 100 | 2,000 | 1,100 | 36 | 72 | 40 |
| 31 | .86 | 4 × 19 = 76 | 1,520 | 836 | 74 | 112 | 62 |
| 45 | 1.5 | 3 × 15 = 45 | 900 | 495 | 107 | 96 | 53 |
| 61 | 2.4 | 2 × 12 = 24 | 480 | 264 | 145 | 70 | 38 |
| 92 | 4.3 | 2 × 8 = 16 | 320 | 176 | 219 | 70 | 38 |

* The accuracy to which these totals can be given is probably one and certainly not more than two significant figures.

.0061), *Taxodium distichum* (k = .0038) or *Cupressus lusitanica* (k = .0086) (Harlow and Harrar 1958:105-207).

[4] (Diameter) X + 1.67, Y = 50.16, and X = Y + 1 where X = number of poles and Y = number of spaces for the length, and (diameter) X + 1.67 Y = 8.40 and X = Y + 1 for the width of the platform.

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# Is Guatemalan Indian Society Really Changeless? A Rebuttal to Partridge

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In his review of *Revolt Against the Dead* (Brintnall 1979), my book about the social transformation of a Mayan Indian community in the northwestern (*not* central) highlands of Guatemala, William L. Partridge (*AA* 84:130-133, 1982) not only mislocates the place, but also misrepresents the argument and content of the study.

Partridge deals with three books, including my own, in a piece entitled "Community Studies in Latin America." He claims (pp. 130-131) that the books *report* that "contemporary com-