SIMILARITIES ˙ BETWEEN SCULPTURES USING JACCARD'S COEFFICIENT IN THE STUDY OF AZTEC TLALTECUHTLI

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This paper is part of an appendix of a Ph.D. dissertation which was submitted in September 1989 (Baquedano, 1989). One chapter of the thesis argues that the Aztec earth deity (Tlaltecuhtli) was represented iconographically in two ways (Figs. 1 & 2). These representations were carved on the underbase of sculptures e.g. stone boxes, receptacles, chacmool sculptures (reclined personages), etc., all of which once set in position could not be seen again (they faced the earth they represented).
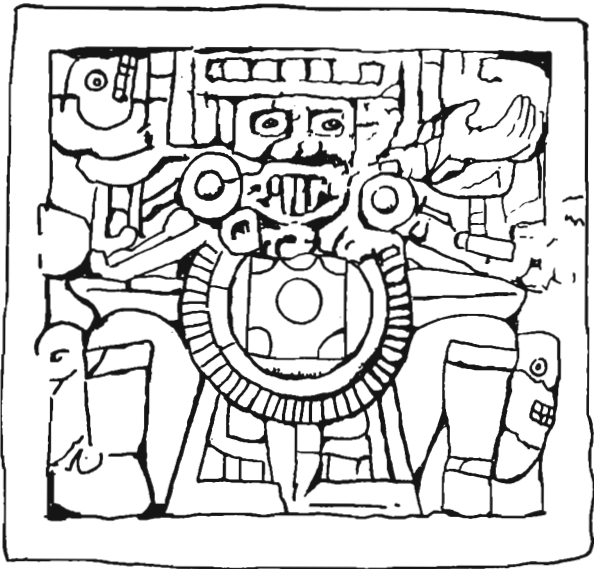

Fig. 1.   Underside of Stone of the "Death Monsters"   (height 67 cm, depth 62 cm, width 56 cm. Basalt) National Museum of Anthropology, Mexico City, no. 11-3277

Data

The sculptures come mostly from museum collections, twenty three from Mexican museums and fourteen from European and American museums. Only four sculptures come from controlled excavations (as opposed to chance discoveries). These last mentioned sculptures were found at or near the Great Temple of the
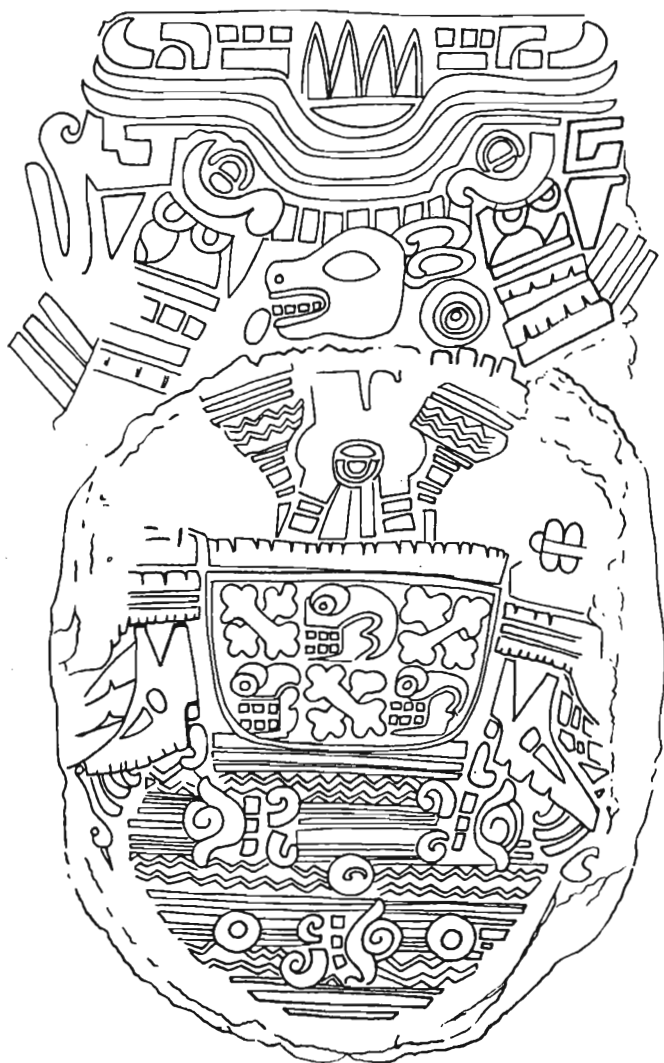
Fig. 2. **Underside of Pulque (wine) Vessel** (height 36.5 cm) Museum für Völkerkunde, Vienna, Ex-Collection Bilimek. Dark micaceous stone. This is one of the carvings depicting Tlaltecuhtli. The general symbolism is that of the earth and agriculture, but there are allusions to war and to warrior's death.

Aztecs, with the exception of one which was found in 1988 outside this area (Chivatito, in Mexico City). This latter sculpture was re-used in colonial times as a mill-wheel and it is likely that it was originally found in a ceremonial precinct. Most

carvings were discovered in downtown Mexico City (Zocalo) and not one comes from rural areas. This suggests that the cult of Tlaloc-Tlaltecuhtli was an elitist one rather than a folk one. Eight of the images from the present corpus were carved in greenstone, considered one of the most precious of Mesoamerican materials and used by members of the elite. The remaining images were in basalt.

The first step consisted in bringing together all the Tlaltecuhtli sculptures in the corpus, which consisted of thirty-six low relief sculptures and one in the round, thirty-seven in total. We then proceeded to list every single iconographic element present in each of the sculptures. These elements (variables) totalled 145. They are listed (following where possible standard Mesoamerican terminology) in Appendix 1. A list of the variables present on each sculpture (available on request) formed the data file for the computer operation.

Method

The statistical package iagraves (Tyers & Hodson, 1988; Duncan *et al.*, 1988) was used on a Dell 300 microcomputer. A matrix of similarity coefficients was calculated using the Jaccard coefficient, and analysed by single-link cluster analysis (slca). This combination was chosen in preference to the many other similarity coefficient and cluster techniques available, because it is simple to compute and understand, and because it has been found to be good at detecting simple divisions of datasets into a small number of distinct groups (e.g. grave assemblages into 'male' and 'female', see Duncan *et al.*, 1988, 2).

Results

The matrix of Jaccard coefficients between sculptures is shown in Table 1. It can be inspected visually to ascertain the degree of similarity between each pair of sculptures, but the main features of the matrix can be seen in the dendrogram produced by the single link cluster analysis programme (Table 2).

The inverse analysis (similarities between variables) produced a table too large to be published here, but is available on request at the cost of photocopying. It shows groups of consistently co-occuring, important iconographic elements, e.g. headbands and ankle decorations, square goggle-eyes, trilobal elements under the chin, the quincunx design and the trilobal chin decoration and so forth.

Discussion

The single link cluster analysis shows that there are two groups represented in the matrix:
a) the smaller group is a well defined one, which in this case is the 'Fertility group', represented by the sculptures depicting Tlaloc-Tlaltecuhtli. The sculptures that are similar in their attributes are numbers 1 and 3-8 (see Table 2).
b)The second group is the 'sacrifice' group (numbers 2, 9-37). The cluster analysis shows that they are more similar to each other than to the 'fertility group' but that they are less similar to each other than are the items within the fertility group. For example there is a variety in the way teeth are represented, sometimes shown as rows of knives. The tongue is often represented by a flint knife. The imagery in general is much more intricate.

18

Table 2. Matrix of Jaccard Coefficients between sculptures

	no.20	no1	no10	no11	no12	no13	no14	no15	no16	no17	no18	no19	no2	no21	no22	no23	no24	no25
no.20																		
no1	0.13																	
no10	0.24	0.07																
no11	0.36	0.20	0.42															
no12	0.33	0.14	0.25	0.23														
no13	0.42	0.25	0.41	0.41	0.22													
no14	0.30	0.15	0.10	0.45	0.53	0.44												
no15	0.42	0.16	0.23	0.37	0.12	0.44	0.30											
no16	0.28	0.12	0.09	0.10	0.05	0.17	0.15	0.23										
no17	0.26	0.07	0.36	0.47	0.20	0.33	0.36	0.38	0.11									
no18	0.43	0.37	0.05	0.13	0.06	0.08	0.08	0.07	0.25	0.09								
no19	0.10	0.13	0.06	0.39	0.21	0.14	0.08	0.07	0.21	0.37	0.22							
no2	0.13	0.24	0.29	0.08	0.03	0.30	0.36	0.28	0.20	0.11	0.10	0.10						
no21	0.61	0.12	0.27	0.06	0.03	0.09	0.07	0.09	0.16	0.07	0.36	0.13	0.18					
no22	0.55	0.16	0.48	0.40	0.26	0.29	0.37	0.04	0.19	0.41	0.18	0.43	0.09	0.14				
no23	0.49	0.19	0.17	0.48	0.24	0.29	0.35	0.33	0.21	0.42	0.23	0.48	0.14	0.17	0.77			
no24	0.22	0.19	0.15	0.41	0.20	0.28	0.31	0.27	0.19	0.28	0.07	0.41	0.17	0.17	0.64	0.70		
no25	0.41	0.11	0.18	0.21	0.12	0.15	0.19	0.32	0.09	0.33	0.11	0.32	0.13	0.08	0.24	0.34	0.30	
no26	0.37	0.21	0.26	0.32	0.13	0.38	0.20	0.24	0.10	0.45	0.09	0.26	0.10	0.09	0.32	0.39	0.35	0.27
no27	0.31	0.19	0.16	0.18	0.13	0.36	0.29	0.30	0.14	0.31	0.22	0.30	0.06	0.08	0.45	0.50	0.43	0.27
no28	0.32	0.12	0.21	0.53	0.14	0.11	0.17	0.34	0.14	0.22	0.06	0.21	0.07	0.10	0.27	0.31	0.29	0.24
no29	0.04	0.32	0.06	0.30	0.08	0.22	0.25	0.37	0.14	0.09	0.17	0.35	0.15	0.15	0.43	0.51	0.49	0.16
no3	0.44	0.44	0.28	0.38	0.24	0.36	0.08	0.13	0.20	0.38	0.09	0.08	0.07	0.07	0.05	0.07	0.08	0.10
no30	0.38	0.10	0.29	0.09	0.11	0.27	0.47	0.10	0.13	0.39	0.13	0.44	0.11	0.12	0.62	0.56	0.54	0.24
no31	0.29	0.19	0.28	0.37	0.28	0.11	0.47	0.32	0.13	0.47	0.10	0.44	0.11	0.08	0.48	0.52	0.50	0.28
no32	0.30	0.15	0.14	0.44	0.32	0.30	0.45	0.33	0.32	0.18	0.29	0.35	0.12	0.11	0.40	0.40	0.37	0.26
no33	0.38	0.09	0.24	0.14	0.34	0.20	0.16	0.25	0.17	0.46	0.17	0.26	0.15	0.27	0.32	0.30	0.28	0.14
no34	0.37	0.17	0.25	0.33	0.18	0.22	0.33	0.17	0.17	0.37	0.15	0.45	0.15	0.19	0.49	0.46	0.43	0.25
no35	0.30	0.16	0.23	0.23	0.31	0.19	0.36	0.28	0.21	0.30	0.21	0.40	0.11	0.16	0.35	0.50	0.43	0.27
no36	0.16	0.14	0.13	0.26	0.29	0.10	0.33	0.16	0.14	0.18	0.45	0.30	0.18	0.23	0.13	0.39	0.41	0.21
no37	0.08	0.07	0.06	0.13	0.06	0.11	0.12	0.17	0.09	0.09	0.03	0.19	0.11	0.30	0.11	0.17	0.35	0.08
no4	0.06	0.52	0.07	0.11	0.13	0.11	0.10	0.12	0.08	0.12	0.07	0.08	0.16	0.07	0.11	0.12	0.17	0.07
no5	0.08	0.52	0.06	0.11	0.11	0.11	0.10	0.10	0.18	0.07	0.03	0.08	0.12	0.12	0.13	0.11	0.10	0.07
no6	0.10	0.55	0.06	0.06	0.14	0.11	0.10	0.10	0.09	0.07	0.03	0.08	0.12	0.07	0.12	0.11	0.14	0.11
no7	0.09	0.53	0.06	0.06	0.13	0.11	0.10	0.10	0.11	0.07	0.03	0.09	0.13	0.08	0.13	0.12	0.11	0.08
no8	0.13	0.54	0.07	0.07	0.14	0.11	0.11	0.13	0.07	0.21	0.09	0.10	0.38	0.17	0.19	0.19	0.11	0.07
no9		0.28	0.11	0.11	0.11	0.32	0.18	0.13	0.07								0.11	0.08

Table 1. Matrix of Jaccard Coefficients between sculptures

n026	n027	n028	n029	n03	n030	n031	n032	n033	n034	n035	n036	n037	n04	n05	n06	n07	n08
0.43	0.46	0.14	0.04	0.08	0.56	0.47	0.28	0.31	0.55	0.50	0.27	0.03	0.81	0.88	0.81	0.73	0.13
0.42	0.28	0.08	0.44	0.13	0.56	0.23	0.58	0.28	0.31	0.16	0.13	0.07	0.92	0.70	0.91	0.15	
0.24	0.05	0.20	0.44	0.12	0.41	0.54	0.49	0.39	0.23	0.17	0.17	0.03	0.88	0.79	0.15		
0.14	0.32	0.28	0.26	0.09	0.50	0.53	0.32	0.33	0.14	0.18	0.14	0.03	0.84	0.19			
0.28	0.43	0.21	0.37	0.09	0.50	0.33	0.15	0.12	0.15	0.18	0.14	0.04	0.14				
0.36	0.28	0.04	0.29	0.13	0.35	0.17	0.11	0.13	0.14	0.17	0.12	0.16					
0.31	0.09	0.21	0.36	0.11	0.15	0.15	0.15	0.13	0.14	0.16	0.17						
0.15	0.31	0.18	0.35	0.07	0.10	0.16	0.12	0.16	0.15	0.16							
0.34	0.28	0.14	0.19	0.81	0.10	0.16	0.12	0.13	0.18								
0.28	0.20	0.10	0.07	0.77	0.12	0.16	0.13	0.04									
0.19	0.12	0.05	0.07	0.74	0.08	0.14	0.15										
0.14	0.07	0.06	0.07	0.71	0.09	0.16											
0.13	0.07	0.03	0.07	0.67													
0.18	0.07	0.05	0.07	0.18													
0.14	0.07	0.03	0.15														
0.14	0.08	0.19															
0.15	0.19																
0.22																	

From the above we conclude that there are indeed two groups within Tlaltecuhtli representations, one more directly associated with water (Tlaloc-Tlaltecuhtli) and the other group (with its variants) with sacrifice. It should be stressed that both groups in a certain way are related to the earth and to sacrifice, but there is much more consistency of iconographic depictions in Tlaloc-Tlaltecuhtli imagery.
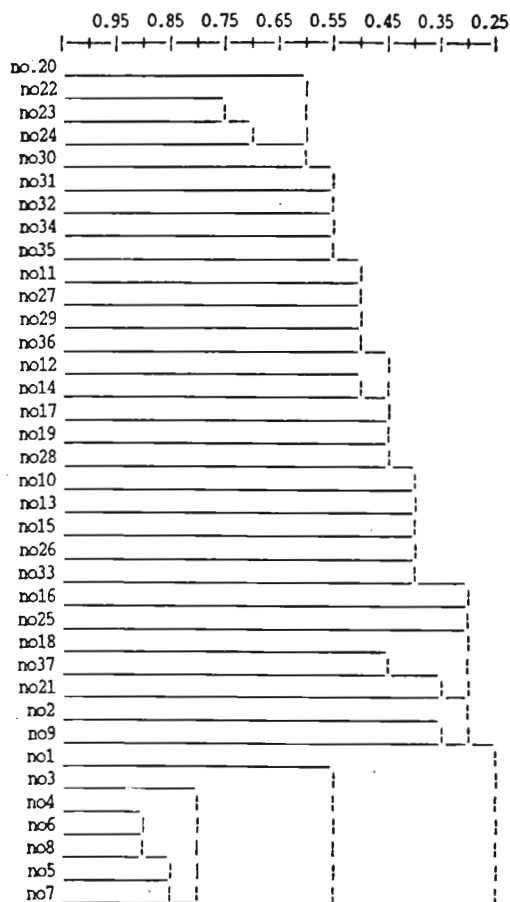
Table 2.   Dendrogram of single link cluster analysis of the sculptures based on the Jaccard Coefficient

References

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APPENDIX 1   ICONOGRAPHIC ELEMENTS CONSIDERED IN THE COMPUTER DATA FILE

sculpture: relief, free-standing, cuauhxicalli, chacmool stone, box, coiled serpent
posture: standing, seated, parturient position, cross-legged, dorsal
male/female, date/what date

frontal head
smoking mirror at back of head
tousled hair with insects
snakes protruding from hair
rectangular headband
amacalli (paper fan)
crenellated eyebrows
feathered eyes
round goggle-eyes
square goggle-eyes
fleshless mouth
human teeth
large teeth
naturalistic tongue
bared fangs
bigotera
circular ear-plugs
ear-plugs with bifurcated feathers
beaded necklace
necklace pendant
trilobal ornaments under chin
outstretched arms
bracelets
striated skin cuffs on limbs
striated skin cuffs with chalchihuitl
breasts
circular hatched band on abdomen
Tezcatlipoca

head thrown back
tousled hair
malinalli grass hair symbol
headdress covered with circles
headband/chalchihuitl
eyebrows
eye-sockets/human eyes
almond-shaped eyes
half circle goggle-eyes
concentric circles on cheeks
gaping mouth
knife teeth
tongue=single knife
snake tongue (e.g. Chacmool Tlaloc)
fanged mouth
bearded Tlaltecuhtli
circular ear-plugs with rectangular panels
necklace
necklace of hands and hearts
star-eye pendant
tuft of feathers on shoulder
decoration around elbow
striated cuffs
braided and striated skin cuffs
demon + skull ornaments on wrists
breasts + liquid streams flowing in pots
naked figure on chalchihuitl on abdomen
frontal midsection quincunx

circular disk around quincunx
belt with geometric design
profile skull belt buckle
protruding tongue from skull buckle
strip of jaguar skin on skull buckle
plain loincloth
loincloth with shells
loincloth with skulls + X-bones
chalchihuitl symbol
quincunx symbol
celestial band
demon faces on upper claws
claws + demon faces grasping skulls
bells near claws
demon faces on elbows
rope around leg
demon faces on knees
feathers/leaves at knee level
paper strips + circles at knee
paper strips + rows of circles
skirt +alternating skulls and X-bones
skirt with shell
wavy lines
wavy lines (waist level)
lower claws
water creatures
Itzpapalotl representation

feathers?leaves? at waist level
belt/rope to hold skull buckle
frontal skull belt buckle
floral decoration under skull buckle
braided leather strips
feathers on jaguar skin in loincloth
trapezoidal loincloth
atl tlachinolli symbols
ollin symbol
balls of sacrifice
claws
upper claws
claws grasping skulls
bells hanging from striated skin cuffs
demon faces of eye, eyebrow and fangs
outstretched legs
demon faces + skull ornaments on knees
rope around knee
paper strips+ v/triangular decorations
skirt with skull and X-bones
serpent skirt
trilobal wings and obsidian knives
wavy lines (head level)
ankle decoration
demon faces on lower claws
facial markings of octli deities
pairs of stone knives with demon faces