

Experimental Approaches to Glyptic Art Using Artificial Neural Networks. An Investigation into the Ur III Iconological Context

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Abstract

A group of late third millennium Mesopotamian cylinder seals representations, commonly known as "presentation scenes", has been chosen for an experimental use of Artificial Neural Networks (ANN) on visual art products. The main aim is to highlight the semantic features which function as clues of the scenes' syntax and the mental order they were founded on. The tools employed are some non-linear mathematical models, that is the Auto Contractive Maps (AutoCM) algorithms quantifying and weighing distances and connections through the examined specimens. The Auto Contractive Maps analysis leads to the development of a general picture of the semantic relationships among the representations under study and gives the researcher the chance to exert an intense self-criticism concerning criteria he uses to segment and classify artifacts. The form in which the results are displayed are two: the Minimum Spanning Tree (MST) and the Maximally Regular Graph (MRG).

Keywords

Mesopotamian glyptic, Artificial Neural Networks, Auto Contractive Maps, Minimum Spanning Tree, Maximally Regular Graph

Any kind of scientific approach to the artefacts of ancient cultures is compelled to face up to the fundamental problem of mapping products and objects which spring from a complex open system such as that of a state organized society.

Scholars used to consider cylinder seals a homogeneous class of artefact, both as far as their physical features and the range of their potential uses were concerned (Cassin 1960; Porada 1993, 563; Winter 2001; Collon 2001, 22–23), and significantly, glyptic products are among the few artistic remains of Mesopotamian cultures that have been chosen by scholars for studies centred on the use of mathematical and processing data models (Kelly-Buccellati 1977; Rova 1994 and subsequent research).

1. The investigation (*Fig. 1*)

In studies on Mesopotamian glyptic, a scene in which a divine or human figure is represented receiving some other figures is usually considered to be a "presentation". Although the concept of "presentation" belongs entirely to modern scholars, and many scenes depicted in the glyptic production from the late Early Dynastic III to the Old Babylonian period have been included in this group, it is still very badly defined. Weak attempts to define it more in

detail first appeared only in very recent times (these topics have been dealt with in Di Ludovico 2005, 57–68).

The present research is an investigation of a corpus of 354 "presentation scenes" seals or sealings dating to the Third Dynasty of Ur period, an age in which themes referable to this group became the most commonly recurring subjects of cylinder seals (as stated, among others, by Frankfort 1939, 144–146; Collon 1987, 36). Each scene has been formalized in a pattern of 405 variables. The resulting data set records the degree of presence in the scenes of the features represented by each variable by the means of binary values (where "1" indicates the presence and "0" the absence of a certain feature), though the algorithms employed also work well with fuzzy units.

The logics from which the set of variables has been developed strictly concern the physical and iconographic aspects of both the seal and of the "presentation scenes" included in the corpus. The first problem to face was that of the cylindrical surface of a seal: the scene carved on it ends where it begins. This means that during the original planning and execution by the craftsman, but also in its daily perception (the seal was worn as a jewel or a talisman), the scene had to be thought of in its "negative" form, and in strict



BM104496



NBC 3401

Fig. 1. Above, cylinder seal BM 104496 (Collon 1982: n. 387) shows a typical Ur III “presentation scene”. From the standpoint of the adopted formalization strategy, the legend is in the “origin” of the scene, and the “receiver” (that can be detectable in each scene, and is thus called “Person 1”) is a sitting goddess: before her a goddess (or Person 2, since this character is the closest one to the receiver) standing hand in hand with a shaven man (or Person 3). Of this scene, for instance, the data set records the dress, headgear, hairstyle, position of arms and legs and other attributes of each character (1, 2 and 3). There are also two integrative motifs, both between Person 1 and Person 2, that is the moon sickle and the goose, respectively located in the upper part and the middle of the field. The specific kind of niched throne and dais of the receiver have also been recorded, as well as the shape (two lines in a frame) and content (the typical formula: “x, son of y”) of the legend. Below, the verso of NBC 3401 (Yale Bab. Coll.), an administrative document which shows the juxtaposition of different kinds of impressions of the same seal: impressions of the legend on the right and in the middle, impressions of the scene on the left.

relationship to its circular development. Despite this, a single modern laboratory impression showing the full representation is considered by art historians as the normal procedure to illustrate, describe and understand a cylinder seal. That kind of impression shows the positive of the figurative and epigraphic content of the seal's surface, but is not representative of that content's strict physical relationship with the object bearing it, nor of the original ways in which the impressions were made on administrative documents. For this reason, and according to the adoption of the structuralist-like viewpoint to consider each scene as a sentence, and every element represented in it as a phoneme (the reconstruction and understanding of the relevant language would be the ultimate object of this research), some choices were needed prior to the scenes' formalization. Some reference points had to be found on the surface of the cylinder which could be used to describe the reciprocal spatial relationships between each element singled out and formalized in the scene and all other elements. As well as the obvious top, middle and bottom of the field, two points that could serve this purpose were found: the character that plays the role of the receiver and the gap which connects, on the cylindrical surface, the beginning and the end of the representation. The latter has been named the "origin" of the scene by the author of this contribution (on this and other here mentioned problems, see Di Ludovico 2005, 72–78; 2008; Di Ludovico and Ramazzotti 2008, 268–269). In all "presentation scenes" the figure receiving the visit or the homage can be easily located, while the roles played by the other participants in these representations have long been questioned. Similarly, the "origin" of the scene is the unambiguous break on the cylindrical surface that divides the two ideal ends of the horizontally developing field on which the scene is displayed.

The characters of the scene and the various elements displayed in it (the "integrative motifs" and the legend) were contextually classified and segmented in variables depending on the genre to which they belong, their formal features and their relative positions. The presence/absence features recorded in the data set can thus be classified in at least four groups: those recording the total number for each type of element (figures, integrative motifs, etc.), those recording the specific elements, those recording some of their parts or attributes (dress, posture of arms and legs etc.), and those recording their relative spatial position.

2. Instruments

The theoretical and logical approach adopted for the present work is of a non-linear and systemic kind. The main problems faced here focus on the recognizing of structural relationships existing between the elements which can be singled out in the scenes (Di Ludovico 2005). The choice of adopting Artificial Neural Network models (although this research project's future developments will include a methodological comparison with linear mathematical models) is owed to the need to ignore interpretations consolidated in past literature, largely giving the scenes' characters well defined aprioristic roles, or based on a scholarly tradition that considered Ur III "presentation scenes" too similar to one another to deserve a true in-depth study (exceptions to this view remain limited). The radical "bottom-up" approach used here required the possibility of investigating and reconstructing the iconic-linguistic system underlying Ur III glyptic "presentation scenes" as much as possible, without attaching a specific *a priori* value to any of the known elements singled out in them. The ultimate purpose is the classification of "presentations" and the distinction of their main possible semantic segments. The administrative and cultural values of the different kinds of presentations and the segments of which they are part will be the object of the subsequent steps of this project (in the search for logical connections between the relationship "scene-cylinder" and the relationship "impressed scene-administrative document").

Distances and connections of the scenes formalized in the data-set were determined and quantified by a process based on an Auto Contractive Maps (AutoCM) Artificial Neural Network (ANN). Generally speaking, AutoCM processing consists of three layers networks (Fig. 2a): an input layer, a

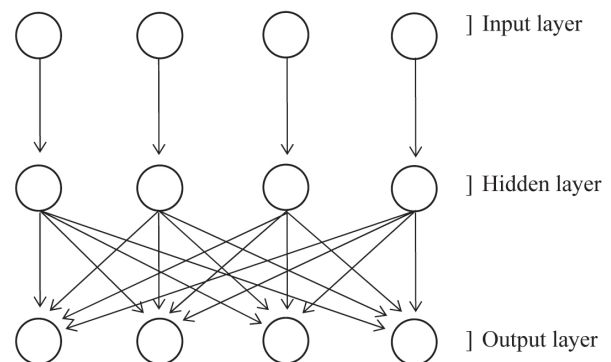


Fig. 2a. Structure of the Auto Contractive Map functioning (from Buscema et al. 2008, 9).

hidden layer (processing data), and an output layer. Every record of the data-set is a pattern of variables (see section 1.), whose number coincides with the number of nodes (N) of each of the AutoCM layers (the total number of nodes is thus 3N). The general structure of the algorithm can be represented by four fundamental steps: the transfer of the signal from the input to the hidden layer; the adjustment of the value of the connections between input and hidden layer; the transfer of the signal between hidden and output layer; and the adjustment of the value of the connections between hidden and output layer. Maximum gradient connections are found between the hidden and the output layers. The connections record the energy required for the transfer from one node to the other: the connections' adjustment in the learning phase is directed towards energy minimization, and is the result of the proper gradual evolution of the weights (the significant differences between the traditional and the AutoCM energy minimization equation clearly emerge from a direct comparison – Fig. 2b).

$$[1] \quad E = \text{Min} \left\{ \sum_i^N \sum_j^N u_i \cdot u_j \cdot \sigma_{i,j} \right\}$$

$$[2] \quad E = \text{Min} \left\{ \sum_i^N \sum_j^N \sum_k^N \sum_q^M u_i^q \cdot u_j^q \cdot u_k^q \cdot A_{i,j} \cdot A_{i,k} \right\};$$

$$\mathbf{A} = \left(1.0 - \frac{\mathbf{w}}{C} \right);$$

N = Number of Variables (Columns);

M = Number of Patterns (Rows).

Fig. 2b. Traditional [1] and AutoCM [2] equation for energy minimization (courtesy P. M. Buscema and Semeion).

In other terms, the AutoCM's algorithm draws a map of the less expensive set of logical relationships that keep together the data-set. On the one hand, it establishes logical and mathematical criteria of similarity on the basis of data-set content, on the other hand, according to such criteria it processes the distances between the data-set variables and calculates the value of each relationship. To reach this goal, AutoCM looks for an equilibrium based on internal evidence of the data-set (for the mentioned mathematical features and other technical details: Buscema, Petritoli, Pieri and Sacco 2008; for other scientifically grounded applications see, for example: Buscema, Grossi, Snowdon and Antuono 2008;

Buscema 1995; Buscema and Grossi 2007; Licastro *et al.* in press).

In this investigation, the data-set matrix has been transposed, so that the processing has been centred on the records. To sum up, the used data-set was made of 405 patterns and the Contractive Map was a net of 354 input and as many hidden and output nodes (3N = 1062). Consequently, a total number of 125670 Auto-CM connections are employed in this processing.

Results are graphically rendered in two forms: the Minimum Spanning Tree (MST) and the Maximally Regular Graph (MRG). The MST shows the whole minimum set of edges emerging from the AutoCM results; that is the less expensive (in terms of energy employed) set of edges which involves all vertices (each representing a “presentation scene” of the data-set, in this case). The MRG also shows edges expressing cycles whose relations are particularly strong and whose structures present many regularities. All edges are given a value expressing the degree of proximity/similarity (inversely proportional to the energy employed) of the vertices they connect. This means that MST and MRG do not only give a general picture of the way the “presentation scenes” may be arranged and classified according to their reciprocal logical resemblance, but also display the strength of each resemblance relationship.

3. Results

The visualization of the AutoCM synthesis in the form of the MST (Fig. 3a–b) shows a first possible arrangement of the formal and semantic relationships among the scenes. There are two scenes in the centroid position, both showing a male bearded god in a flounced robe in the role of the “receiver”; the god is turned towards a female deity that stands hand in hand with a male figure who raises his free hand before his face. Above, between the two gods, a moon sickle is depicted.

3.1. Branch A (Fig. 4)

A first notable big branch of the tree (here called “A”) includes the scenes usually called “royal presentations”. The “receiver” is here a male figure that for his dress, headgear and attributes can be interpreted as the representation of the king's role (Van Buren 1952; Winter 1986). The ‘crossroads’ of

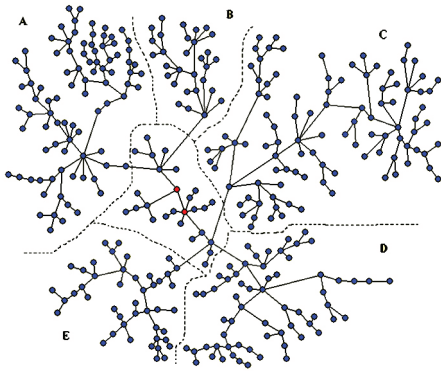


Fig. 3a. The Auto Contractive Map results in the form of the Minimum Spanning Tree.

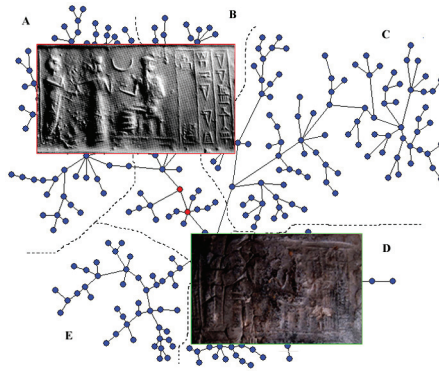


Fig. 3b. The two centroids of the Minimum Spanning Tree.

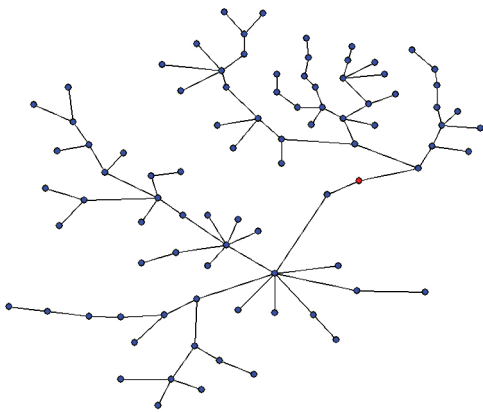


Fig. 4. Branch A isolated.



Fig. 5. Branch A centroid (VA 697; Moortgat 1940, N. 253).

this region of the tree is a seal showing the king's figure sitting before a goddess that stands hand in hand with a mantled shaven man (VA 697, Fig. 5). Above, in the field, no celestial symbols appear,

while the long legend, ending in the typical 'ir-zu' ('his servant') formula (Mayr and Owen 2004, 146), mentions the king Šu-Suen. Of the two branches connected to a scene of this kind ("royal presentation" showing the pair of figures hand in hand), a small one groups representations in which the "receiver" is standing instead of sitting. In these cases, he is often divine (Fig. 6a).

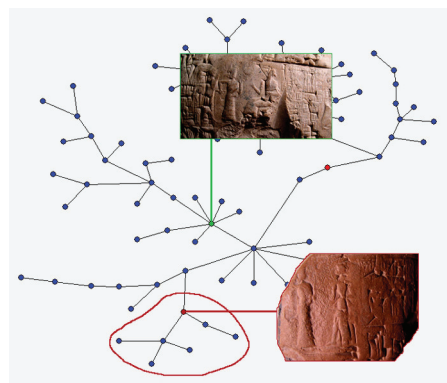


Fig. 6a. YBC 15835 (below), in the group of scenes with standing "receiver", and YBC 1178 (above, green).

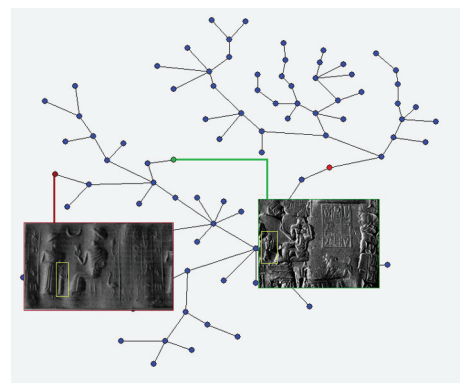


Fig. 6b. BM 102055 (left, dark red) and NBC 3271 (right, green).

At least two clearly defined groups of scenes are distributed in comparatively large clusters connected to the scene of VA 697. One is first represented by the impression on YBC 1178 (ŠS8): its remarkable feature is the presence of the well-known Ur III symbol of the sun disc inscribed in the moon sickle placed in the upper part of the field,

between the "receiver" and the goddess. The presence of the celestial integrative motif is constant in all the scenes which are placed along the clusters of the branch that lead off YBC 1178 towards the periphery of the tree. Besides the sun disc and the moon sickle, one can frequently observe the goose or the scorpion in the field, although rarely other kinds of animals. The legends consist of three or two lines, mostly expressing the patronymic and the qualification of the owner. Furthermore, some of these scenes suggest that the goddess with both hands raised placed between the shaven man and the "origin" has barely any influence on the semantic structure of the scene. Concerning the semantics of "presentation scenes" another notable piece of information one can infer is the role played by an infrequent figure of a goddess depicted on a smaller scale in the field. The goddess raises both hands and is placed between the "receiver" and the shaven man (Fig. 6b).

The second important group of scenes connected to YBC 1178 is introduced by two border scenes: those on NBC 11683 and NCBT 1341 (Fig. 7). In the comparatively small branch beginning with those specimens one can locate the complete set of "royal

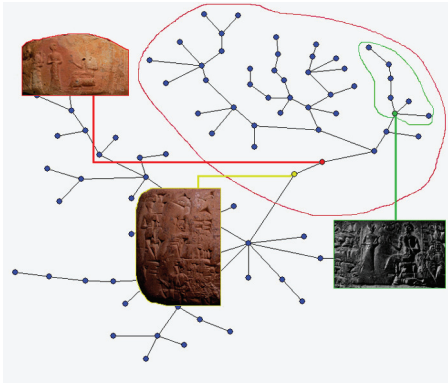


Fig. 7. NCBT 1341 (left, yellow),
NBC 5607 (right, green)
NBC 11683 (above, left, in red).

presentations” in which the isolated shaven man, his hands at his waist, faces the seated king.

If one isolates Branch A from the rest of the tree, its centroid corresponds to the impression of NBC 11683, and not in that of NCBT 1341, which could be considered, at first sight, the true border between two different syntactical structures of the “royal presentation”. The apparent main difference between the two impressions is the presence of the moon sickle in the centroid of Branch A.

Another interesting clue can be inferred from the little branch beginning with NBC 5607, which is directly connected to MLC 89. Here all “royal presentations” without the goddess with both hands raised and placed between the man and the “origin” are grouped (Fig. 7). This phenomenon may be a concrete confirmation of how important the general arrangement of the scene is in comparison to the main elements and characters represented in it.

3.2. Branch B (Fig. 8)

B is a smaller branch than A. The most represented compositional scheme of this branch is the hand-in-hand couple with the divine “receiver” (Fig. 9). The latter is always male and bearded, except for a



Fig. 9. Branch B centroids: NBC 8 (left) and NBC 690 (right).

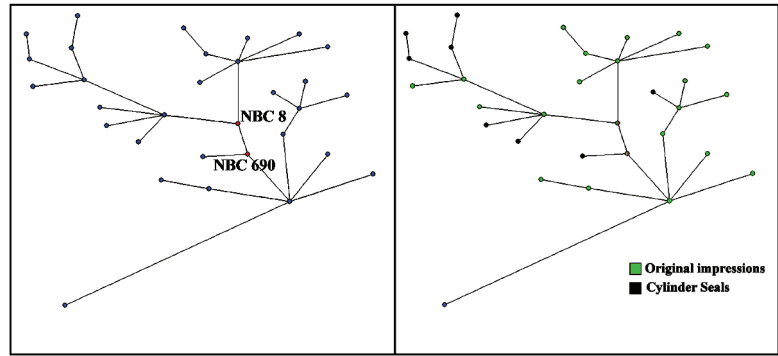


Fig. 8. Branch B isolated and the location in it of original impressions (right).

scene of an impression from Ur (U. 6950; Legrain 1951, n. 400). The legend is usually distributed over three framed lines and contains the name, patronymic and qualifications of the seal owner.

Scenes of Branch B are mostly known from impressions: 22 specimens out of 30 are original impressions, and the 8 cylinders are, significantly, all in peripheral locations. The double centroid can represent the two main groups of scenes of this small, but quite homogeneous branch: those without the celestial symbol, from NBC 8 towards the periphery, and those showing it, around NBC 690, in the lower part of the branch.

In general, Branch B looks very homogeneous and may confirm the foregoing observations about the figure of the female deity with both hands raised that occasionally is placed between the shaven mantled man and the “origin” of the scene.

3.3. Branch C (Fig. 10)

The quite large (101 specimens) Branch C finds its link with the centroid region in the scene of BM 102591 (Collon 1982, n. 373). The latter shows a female divine “receiver” in a flounced robe who sits before the hand-in-hand figures of the goddess

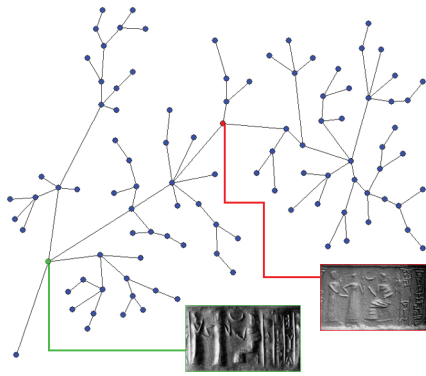


Fig. 10. Branch C isolated, with its centroid (Louvre A.199, right) and BM 102591 (left).

(in a pleated dress) and mantled shaven man. This compositional scheme is strongly represented and followed in almost all scenes of Branch C, which appears therefore extremely homogeneous.

The largest branch is the one first represented by a Louvre seal (AO 15416: Parrot 1954, n. 132; Fig. 11a–b). This scene, as well as the ones close to it in the tree, doesn't look very different, in its general arrangement, from the representation described immediately above. Only some rare distinctive features can be found, but they are the exception.

The presence in the scene of more than one integrative motif is correlated to a peripheral position. Along this part of Branch C one finds its centroid (MNB 1183; Delaporte 1923, pl. 75, n. 7) and a number of scenes which strongly resemble each other (Fig. 11a–b). A few small groups of “exceptions” based on a few distinguishing details can be located in small side clusters.

A second small branch begins with the scene of a seal preserved in the Pierpont Morgan Library (Porada 1948, n. 282) and consists of 19 specimens (Fig. 11a–b). Their main distinguishing feature is that most of them include two integrative motifs: the moon sickle on the top, between the seated goddess and the standing one, is constant and is very often associated with the goose, placed under it.

The third small cluster of this Branch shows quite a high density of original impressions; almost all scenes here depicted have one or two integrative motifs.

3.4. Branch D (Fig. 12a)

Branch D consists of 63 scenes. The clusters of this branch which are the nearest ones to the region of

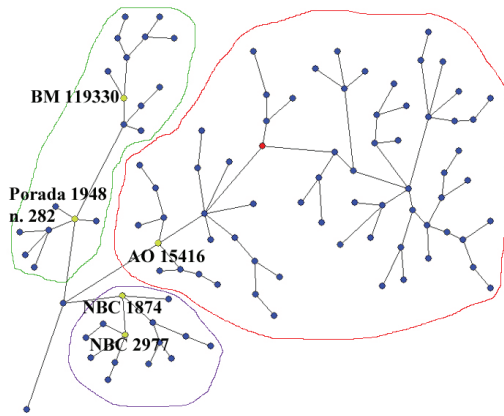


Fig. 11a-b. The three main subdivisions of Branch C.

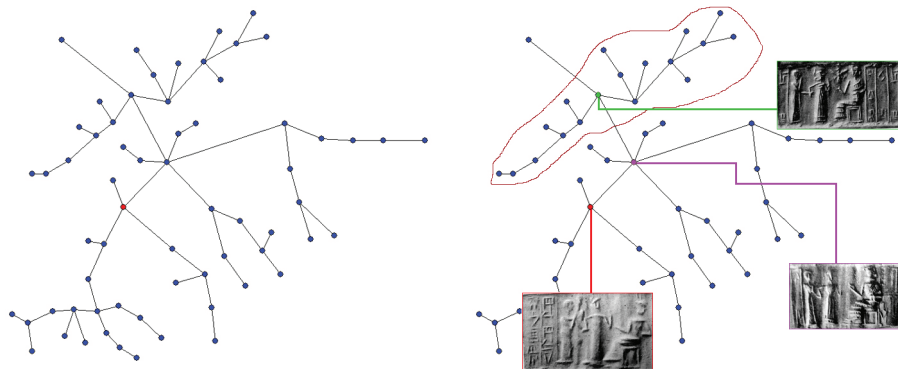
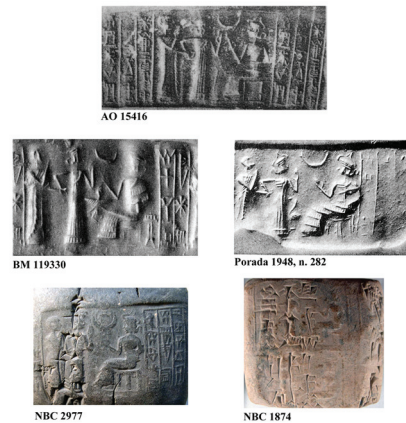


Fig. 12a-b. Branch D isolated and scenes which represent its main sub-groups (below, CBS 14334, on the left, and Parrot 1954, n. 109, on the right; above, VA 646).

the centroids of the tree are placed around the scene of a seal currently in Berlin (VA 646; Moortgat 1940, N. 270). The compositional scheme is the one with the seated goddess and the couple of the goddess and the shaven man standing hand-in-hand (*Fig. 12b*). The robes of the characters do not vary a great deal, except for that of the standing female deity, which can be either pleated or flounced. The inscription usually mentions the name, the patronymic and the professional qualification of the owner. The distinguishing feature of the first two lines of clusters seems to be the integrative motif of the lion-headed eagle.

The third line of clusters is quite large and starts with a scene from Telloh (Parrot 1954, n. 109). In general, most scenes grouped here seem completely devoid of integrative motifs and bear quite short legends; few exceptions are in seals which have been re-cut.

Worth mentioning are two little peripheral subgroups clustered in this part of Branch D. One contains scenes which mostly show only female characters: in these specimens the shaven man has been “replaced” by the figure of a woman having no evident divine attributes. The second one always shows a standing receiver, and appears as an interesting equivalent of the two clusters noticed in Branch A.

3.5. Branch E (*Fig. 13a–b*)

Forty-five scenes are grouped in Branch E and are based on the same schemes observed in the previous branch, but their typical traits are mostly the traces of secondary work interventions or the clues of an unfinished cut (*Fig. 13b*). The structural arrangement of the three characters represented in the scenes is quite homogeneous: a female deity is the “receiver”

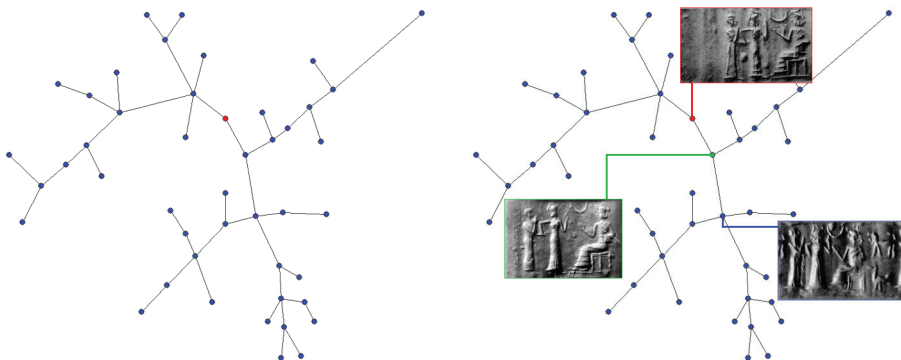


Fig. 13a-b. Branch E isolated and some scenes representative of its specimens (above, CBS 9102; below, BM 130707, on the right, Sb 1478, on the left).

and sits on a square-shaped throne which often shows a single or double niche on its side. Before her the couple of the goddess and the shaven man stand in the hand-in-hand pose. In the field, above and between the goddesses is the moon sickle. Very typical of whole Branch E is the absence of the legend, sometimes not yet cut, otherwise erased.

3.6. Maximally Regular Graph (*Fig. 14*)

The development by the AutoCM of the MRG leads to the confirmation of most of the impressions stated about the MST representation.

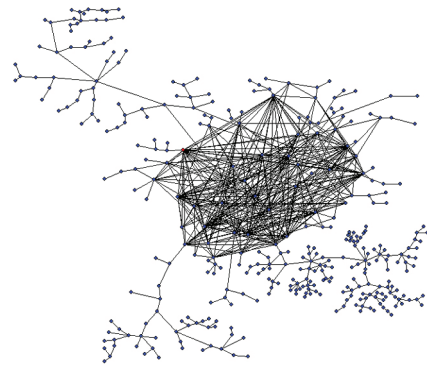


Fig. 14. The Maximally Regular Graph.

The main concentration of edges and cycles is in the central region of the graph and seems to involve a large number of specimens. Vertices of this region represent a fairly homogeneous group of “presentation scenes”, that is the most representative ones of Branch C and the connection of the region of the centroids with it and with Branch E (*Fig. 15*). These scenes may be the expression of a compositional pattern which had comparatively few specific implications from the viewpoint of role in the state machinery: they pertain to clusters which include a very small quantity of original administrative impressions.

The specimens collected in Branches A and B may, on the other hand, represent compositions which clearly signalled an active involvement of the owner in the administration or in other sectors of the state machinery.

4. Conclusion

In this contribution only a partial and summarizing report of the investigation outcomes has been displayed, since it briefly introduces the methods and logics underlying this research project. The AutoCM revealed a very useful and suitable tool for a systemic and overall investigation of the visual language of Ur III glyptic “presentation scenes”. It actually gave the opportunity to simulate an outline of an ancient communication system setting aside any tendency to rigid mechanistic readings of phenomena, and also to enable the critical re-examination of the interpretation parameters adopted by scholars themselves. Finally, the visualization of results using MST and MRG gave a reasonably clear global picture of the reciprocal relationships of the investigated specimens. The employment of such tools which consider as much as possible archaeological original finding contexts could represent a decisive step towards a new global and dynamic study of ancient cultures through their material products. Unfortunately, a very large number of accessible artefacts come from illicit excavations, and recent events in Mesopotamia have made the situation worse than ever.

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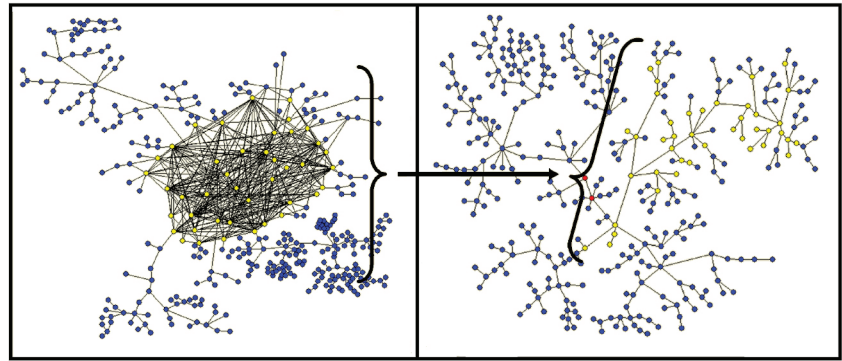


Fig. 15. MRG and MST – the positions of the most connected vertices.

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**Catalogue of the seals and seal impressions
used for this research**

- Amiet 1972
n. 1646, 1648, 1650, 1652, 1657, 1658, 1662, 1663, 1664,
1665, 1666, 1667, 1669, 1673, 1676, 1679, 1684, 1685,
1686, 1687, 1688, 1689, 1692, 1693, 1696, 1699, 1703.
- Bleibtreu (ed.) 1981
N. 42.
- Buchanan 1966
ns. 389, 421, 422, 424, 425, 441, 442, 446.
- Buchanan 1981
ns. 562, 567, 571, 572, 582, 584, 585, 589, 595, 599,
600, 604, 608, 614, 615, 618, 620, 626, 628, 629, 631,
636, 638, 639, 640, 643, 644, 645, 646, 647, 648, 649,
650, 651, 652, 653, 655, 660, 673.
- Collon 1982
ns. 331, 332, 334, 368, 369, 370, 371, 372, 373, 374,
377, 378, 382, 384, 385, 386, 387, 389, 390, 391, 394,
396, 397, 403, 406, 415, 429, 432, 433, 437, 438, 439,
440, 446, 447, 448, 450, 451, 452, 453, 454, 459, 463,
467, 469, 470, 471, 472.
- Delaporte 1920
Pl. 5, n. 7, 8, 9, 11, 14; pl. 6, n. 20.
- Delaporte 1923
Pl. 74, n. 19; pl. 75, n. 1, 4, 7, 9, 10, 15, 16, 17, 18, 20, 23,
26; pl. 76, n. 1, 2, 5.
- Frankfort 1955
ns. 709, 712, 768.
- al-Gailani Werr 1992
n. 86.
- Glock 1988
n. 53.
- Legrain 1925
ns. 231, 233, 234, 237, 242, 245, 246, 247, 249, 250,
251, 252, 253, 254, 255, 256, 261, 262, 263, 269, 277,
284, 287, 291, 313, 315, 316.
- Legrain 1951
ns. 321, 322, 323, 325, 327, 329, 330, 331, 333, 334,
335, 336, 337, 340, 341, 343, 344, 345, 346, 347, 348,
349, 352, 353, 355, 356, 360, 361, 362, 366, 367, 370,
376, 388, 399, 400, 428, 432.
- Keel-Leu and Teissier 2004
N. 96, 97, 98, 99, 101, 105.
- Kjaerum 1983
ns. 368, 369.
- Moorey and Gurney 1978
n. 27.
- Moortgat 1940
N. 252, 253, 254, 255, 256, 259, 260, 261, 262, 265,
268, 269, 270, 271, 272, 273, 279, 280.
- Moortgat-Correns 1968
N. 56, 57.
- von der Osten 1934
ns. 117, 122, 124, 126, 135, 136, 141, 143.
- von der Osten 1936
ns. 45, 46, 48.
- Parrot 1954
n. 104, 105, 106, 107, 108, 109, 110, 112, 113, 114, 115,
124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135,
136, 137, 139, 140, 144, 145, 146, 147, 164, 179, 186, 187,
188, 189, 212.
- Porada 1948
ns. 274, 275, 276, 277e, 282, 292e.
- Ravn 1960
ns. 28, 29, 30, 31.
- Van Buren 1940
n. 20.
- Van Buren 1942
n. 5.
- Vollenweider 1967
n. 34.
- Umma Tablets stored in the Yale Babylonian Collection
bearing impressions here examined (not including the ones
analysed from Buchanan 1981)
NBC 5123, MLC 89, NBC 2067, YBC 13292, NBC 1430,
NBC 5779, YBC 952, YBC 16720, NBC 3600, YBC 950,
NBC 3505, YBC 1636, NBC 3240, NBC 1838, NBC
3097, YBC 15880, MLC 1829, YBC 12967, YBC 1178,
MLC 91, MLC 2420, YBC 1705, NBC 1330, NBC 2977,
YBC 11243, YBC 1212, NBC 5200, NBC 1842, NBC
1874, YBC 9765, YBC 13793, NBC 3552, NBC 3073,
MLC 2317, YBC 1671, YBC 1180, MLC 2354, YBC 1571,
YBC 11244, NBC 11683, YBC 400, YBC 9771, NCBT
1341, NBC 2717, NBC 4108, YBC 1630, YBC 15835.