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# A computerized solution for the epigraphic survey in Egyptian Temples

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**Abstract**

Defined as "an auxiliary science to History that studied the inscriptions on enduring substances", the epigraphy calls for very varied methods and disciplines. These all imply a preliminary operation : the survey and the copy of the decors engraved or painted on walls, columns, etc. This stage is essential to understand and to reconstitute the ancient monuments, because cartouche friezes and ritual episodes give information on the date of the temple or on the nature of the activities that took place in the temple. Nowadays, epigraphic surveys are still for the most part done in a traditional handmade fashion, while computer-aided epigraphic surveying is only used for simple tasks, such as drawing the contour of hieroglyphic signs on scanned photographs. The epigraphy of a monument consists of scenes (low-relief) and texts. In the two cases, the hieroglyphic signs engraved are constituted of complex segments and curves, which must be accurately surveyed and recorded. Each hieroglyphic sign has not only a single geometrical shape, but also a morphology proper to a given alphabet and a precise sense. The present survey lays particularly emphasis on the graphic form of the sign and relegates its interpretation to an ulterior analysis. On the contrary the method proposed here gathers data about the meaning and the geometrical shape of each sign. This will finally lead to statistical studies on the hieroglyphs' form, to automatic translations of the texts and to the search for missing elements, based on geometrical as well as grammatical criteria. Our epigraphic survey solution is only adapted to the treatment of plane surfaces, therefore we have carried out a process for the development of conical surfaces, so as to be able to survey the inscriptions of the columns as well. The purpose of this paper is then to present the computer tools developed to draw and to record the shape and the meaning of the hieroglyphic inscriptions of walls and columns of temples such as the Karnak Temple in Egypt.

*Keywords :* Photogrammetry, Archaeology, Cultural Heritage, Surveying, Acquisition, Modelling.

## 1. Introduction

The achievement of epigraphic survey is a very important work in the today's archaeology, particularly in Egyptology because all the monuments contain numerous texts and scenes engraved on their architectural elements. It is a matter of urgency to do such surveys, because the inscriptions have been deteriorating at great speed for a few years and there is a risk to lose completely the decors with their important significations, which help us to understand the life in the Pharaohs' time.

The main problem at the present time is that the traditional methods carried out to survey the inscriptions are very long to do. For example the must prestigious, full and rigorous of these methods is the creation of facsimiles of the wall to survey, with photographs as background or simply with a transparent paper placed on the wall (Fig. 1). This work includes numerous controls during the drawing process and consequently this method takes time, because it requires the collaboration between different competent and experienced drawers. Moreover, the time used to implement the drawings is in a close relationship with the quality of the result.

An other inconvenience of the methods currently performed is the fact that the produced results are only visual representations, and not exploitable models. The description is also in the form of lines and curves : it is not an object that could be used later for various studies.

Fig. 1. Epigraphic survey on transparent paper (from [Parisel C., Stratégie informatique : programme relevé, GRCAO's internal research paper 17 p. (2002)]).

An other inconvenience of the methods currently performed is the fact that the produced results are only visual representations, and not exploitable models. The description is also in the form of lines and curves : it is not an object that could be used later for various studies.

Unfortunately the computerized methods proposed to the archaeologists to survey the epigraphy are rarely really adapted to their needs : they don't represent the relief of the signs, they take few care of the damages of the inscriptions (insertion of pre-recorded hieroglyphic

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signs that are not modifiable), they are not actually reliable, etc. Thus most archaeologists and epigraphists keep the traditional methods for their works, because they think that the complicated interpreting process required for an accurate epigraphic survey of a monument can't be made by means of a computer.

*Proposition*

The idea is then to propose an original computerized method, which tries to mitigate the problems set by the use of traditional epigraphic survey solutions, while considering the needs of the epigraphists and while offering them the possibility to control many specific things during the computerized survey process (the computer doesn't achieve all alone). A particular attention has been focused on the fact that the epigraphy of a monument is indissociable of its architectural support. The drawings are then recordable with all the information that are necessary to understand their real meaning (i.e. the architectural and archaeological context). The register format has been normalized so as to finally be able exploit the records (statistics, reconstitution of structures, etc.).

Our method is based on photogrammetric procedures, because of their numerous advantages for archaeological works :

- By definition, the photogrammetry is a non-destructive process (no contacts with the object to survey) that will not generate more damages on the elements to survey.
- The field works become easier and faster (saving of time and freeing of the site access) : photographic campaign and survey of a few control points only.
- The exploitation of the data is made entirely with computer tools in the office : this allow to avoid the difficulties of the field (heat, tourism, …) and to obtain most durable and exploitable numerical files of the surveyed objects, iconography, epigraphy...
- An analysis can be done at any time later on (for example, if the object is destroyed and should be rebuilt).
- The survey of inscriptions engraved on curved (columns) and not accessible (ceiling) surfaces is possible.
- Experience shows, that if the features are recorded conventionally during an excavation, different people have to draw. This will result in different and inhomogeneous drawings. If photogrammetry is consequently applied during the whole excavation, the documentation will be standardized.

As proof we can quote some application fields of the photogrammetry in archaeology : prospecting and landscape archaeology, excavation (examples given by Platzer and Waldhäusl [6,10]), recording upstanding remains, recording of caves, mining and cave paintings and recording of finds (examples in [1]).

Here, the goal is to turn to advantage the possibilities given by the use of photogrammetry, for the development of computer tools intend for the epigraphists and the archaeologists themselves (that is to say that the simplicity of use was primordial for us and has guided the choices that have been made). So our epigraphic survey method is exploitable in a graphical software, in this case AutoCAD© because it is widely in use in archaeology. We have achieve two main groups of tools (written in the programming language AutoLISP) : some for the drawing and the recording of the engravings of a wall for example, and some for the treatment of a conical surface so as to be able to do its epigraphic survey too (in reusing the same tools as those developed for the survey of plane surfaces).

These research and developments have been done by the *Computer Aided Design Research Group GRCAO, University of Montreal*, in collaboration with the *Photogrammetry and Geomatics Group MAP-PAGE, INSA Strasbourg*, for the photogrammetric part. It has been carried out within a larger project called *«Computer modelling as a means of reflection in archaeology : a new approach to epigraphic and architectural survey applied to the Karnak Temple »*. The GRCAO was in charge of this project through the *Karnak Hypostyle Hall Project (KHHP) of the University of Memphis*, and the collaboration contract signed by the two institutions put all data and material linked to the project at the GRCAO's disposal.

*Structuring*

The first part of this paper deals with the approach chosen for the drawing and the recording of the hieroglyphic signs of a plane surface. Three aspects have to be considered : the Bezier curves and their drawbacks, the strategy carried to draw the engravings and the bonding of stones, and the mode of record and of insertion of the signs after a first layout.

The second part concerns the adaptation of the method carried out for the epigraphic survey of plane surfaces to conical and cylindrical elements. This requires two steps: the three-dimensional reconstitution of a column and the development of its surface for the two-dimensional surveying of the epigraphy.

## 2. Drawing and recording of the inscriptions of a plane surface

The hieroglyphic signs have been drawn by means of Bezier curves, which control polygons are grouped and recorded so as to be able to redraw the signs automatically several times at different places and scales, and for other exploitations.

### *2.1. The Bezier curves and their drawbacks*

We have tested several types of bi-dimensional curves to represent the epigraphy of a plane element in a way that stays as faithful as possible to the original drawing. One of the most important choice criterion has been the simplicity of construction and of modification for the user.

We have also fixed other criteria for the curves construction function that we needed :

- real time display of the curves' movements that we make with the cursor

- possibility to have an inflexion point between two summits, without constraints
- possibility to provide a tangency or a dependency between two consecutive summits
- possibility to insert new curves and segments if necessary
- possibility to transform later a segment into a curve or inversely
- possibility to introduce, during the edition, a constraint between two curves or to relax it
- writing to memory of the result the most compact as possible

Considering these requirements, we have chosen the Bezier curves because they fulfilled the most of those.

A Bezier curve is constructed on the base of two points (**A** & **B**) and of an additional point (**C**) that allows to trace the tangent to the curve going through the points (**A**) and (**B**). The construction method is based on a recurrence principle : from the segments binding the points (**A**, **C**, **B**) — called control polygon of the curve — we choose any ratio between 0 and 1, which is applied on the length of [**AC**] to obtain the point (**X1**). The same ratio is applied on [**CB**] to obtain the point (**X2**). Next, we repeat the same operation on [**X1X2**] to obtain the first point of the curve (**pm1**), and so on to obtain all the points of the curve (Fig. 2).

Then it is enough to change the ratio **n/nb**, for **n** varying from 1 to **nb** (where **nb** is the number of iterations chosen), to obtain a curve of **nb+1** points.

This type of curve is well adapted to our needs (as we will see in the next chapter), but they have an important disadvantage if we wish to draw them in perspective and to visualize them in a front view (for the publication of the drawings).

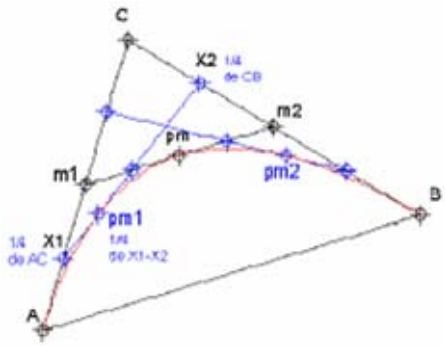



Fig. 2. Drawing of a Bezier curve (from [Parisel C., Stratégie informatique : programme relevé, GRCAO's internal research paper 17 p. (2002)]).

In fact : - if we consider a photograph of a wall that have not been taken perpendicularly to the wall (i.e. an oblique shot),

- if we draw on this photo the Bezier curve of a sign engraved on the wall,

- and if we put back the drawing of this curve in a front view ("righting" of the drawing),

- then we will establish that the obtained curve is not the same that the curve, which we could draw for the same sign directly on a photo taken from the front of the wall.

Thus, to do a rigorous survey of the hieroglyphic signs, we have been obliged to develop procedures for the orthorectification of the original photographs. That is to say that we create new pictures from the initial shots, as if they were all taken from the front of the architectural elements to survey (Fig. 3).

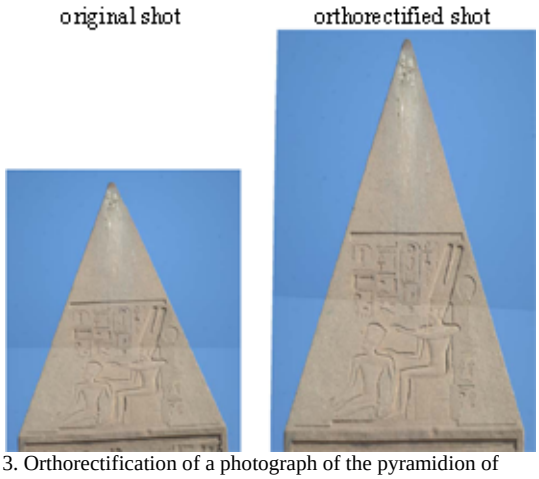



Fig. 3. Orthorectification of a photograph of the pyramidion of an obelisk (from [Parisel C., Rapport de travail sur la construction des orthophotos de surface à partir de photos en format BMP, GRCAO's internal research paper 17 p. (2004)]).

Therefore we can draw the hieroglyphic inscriptions by means of Bezier curves on the orthorectified photographs, so as to obtain an accurate drawing "in front view" of the signs (whereas it would have been false if we have traced the signs on the original photographs and if we have put them back in a front view afterwards).

*2.2. The drawing of the inscriptions and of the bonding of stones*

The hieroglyphic signs are then drawn as curves groups.

The construction of a curve is interactive :

- first we click on the two extreme points (**A** & **B**) of the control polygon,
- then we place the third (**C**) in controlling in real time (i.e. simultaneously with the cursor's shifting) the movements of the curve, so as to adapt it to the photo's sign in the best possible way.

We have then specified two options for the drawing of a second curve :

- to create a curve or a segment (i.e. the points **A**, **B** & **C** are aligned),
- to create it tangentially to the first curve or to the next that will be drawn.

When the drawing of a sign is completed, the different curves are automatically joined so as to make a single curve from them, and the same is made with the control polygons. The global curve can still be modified : the cursor is moved form point to point on the global control polygon (form the first point clicked on during the construction), and the joints are broken when a curve to adjust is chosen.

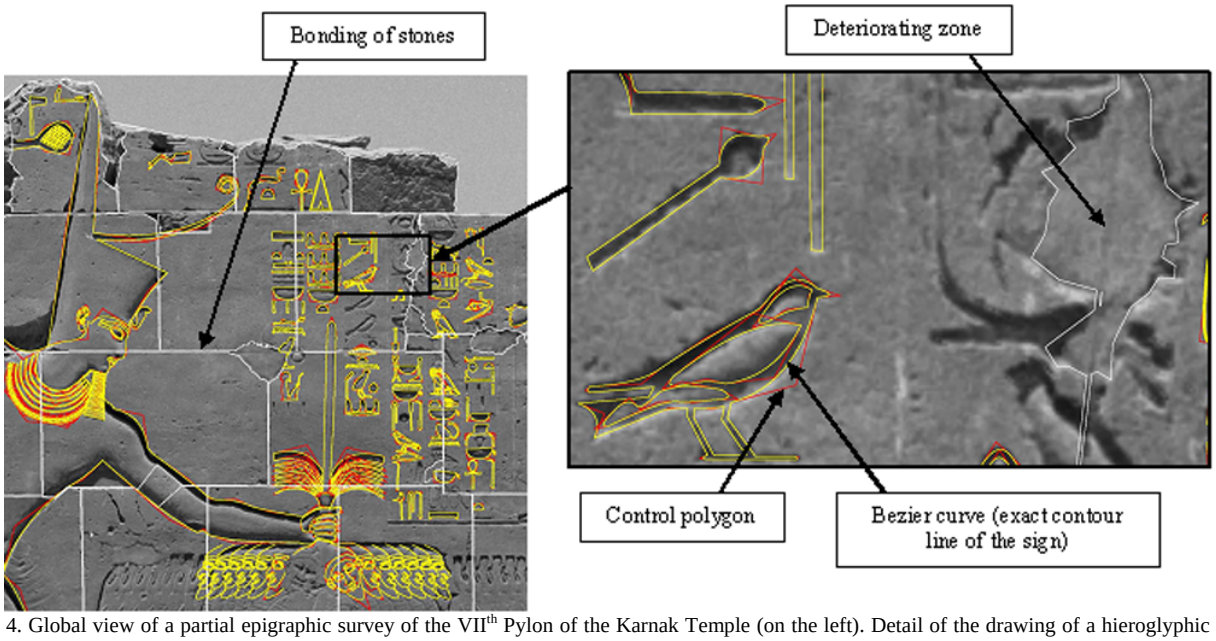



Fig. 4. Global view of a partial epigraphic survey of the VII[th] Pylon of the Karnak Temple (on the left). Detail of the drawing of a hieroglyphic sign and of a stone deterioration (on the right).

Then again some choices are available :

- to create a tangency or to relax it (with the previous or the next curve),
- to transform the curve into a segment or inversely,
- to divide the curve into two curves individually modifiable (for a more accurate drawing of the part of the sign).

This process ends with the re-joining of the curves and of the control polygons, to obtain two individuals entities necessary for the future recording of the drawing.

The survey of the bonding of stones consists simply on the drawing of several segments more or less long, to represent the stones and their deteriorations at best. The segments of each stone are then joined for the recording too.

This is illustrated in Fig. 4.

*2.3. The mode of record and of insertion of the signs after a first layout*

When a complete hieroglyphic sign has been drawn, it is recorded so as to be reusable for future exploitations or simply to implement the database of the signs surveyed on the wall (all are registered). The record process comprises several phases.

To begin with, it is essential to precise that the only thing that will be recorded is the control polygon of the curve, because it is not memory consuming (few points) and because the curve can easily be redrawn from its control polygon (then it is not necessary to record the curve itself with its numerous points).

Knowing that and to be able to record the sign, the first step is the identification of the control polygons of a sign (the same sign can be made up of several curves with their control polygons, as the bird in Fig. 4). We distinguish the control polygons that determine a group of Bezier curves — we call them CTL — and the simple polygons — we call them POL — that consist of a set of segments (these are very rare). The control polygons can be closed and fit into each other. The biggest that form the exterior contour has the number 1, and in order of successive inclusion, the number 2, 3 or more.

Finally, we keep some three-dimensional characteristics in telling if the considered part of the sign is a dug zone — indicated by **-** —, an embossed zone — indicated by **+** — or an engraving that is at the same level — indicated by **0** — (Fig. 5).

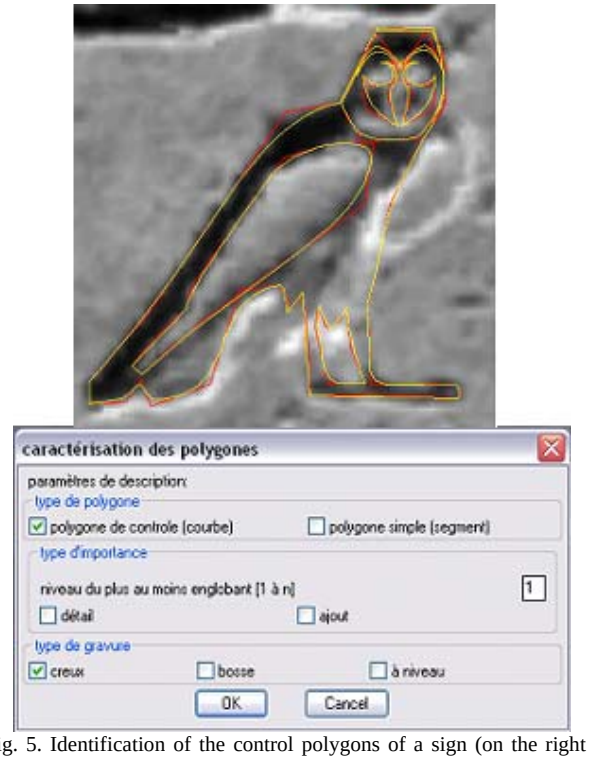



Fig. 5. Identification of the control polygons of a sign (on the right : dialog box created in AutoCAD© for the characterisation of the polygons).

The "pseudo-3D" characteristics will be used later for a symbolic "2D½" representation of the hieroglyphic sign, which consists in the layout of "strong lines" to simulate the sun shadow on the engraving (the sun direction can be chosen by the user). It allows better to see if it is a dug or an embossed hieroglyph (Fig. 6).

Fig. 6. Sign with strong lines simulating the sun shadow on the sign (the sun is here in the South-East). We can establish that the hieroglyph is dug.

The second step of the recording process is the grouping of the control polygons that constitute the sign. So we make a single geometrical entity with the different parts of the sign and we can give now some information about the meaning of the hieroglyph : name of the phonogram or of the ideogram, grammatical signification, phonetics, etc. The group has then a proper identity with a designation, a signification, a geometrical description and all the enquiries that the user think useful to add.

For the pursuit of the process, two choices are given to the user : to record the hieroglyphic sign as a "standard sign" or to record it simply with its original position on the picture (to implement the database of the signs surveyed on the wall). In the two cases, the information about the group representing the sign are registered in a text file. We have chosen this type of recording so as to be usable later in various software (transportable format).

The "standard signs" are intended to save time during the epigraphic survey process. In fact, a hieroglyph can be found several times on the same wall, with just a few morphological differences (Fig. 7). So the insertion of modifiable "standard signs" will made it unnecessary to draw the same sign several times over : when we see on the wall's photograph a hieroglyph that have already been recorded as a "standard sign", we insert the corresponding record at the right place and we make small modifications so as to adapt the standard to the particular case in the best possible way.

Fig. 7. Two variants of the same sign that differ in morphology (from [Parisel C., Stratégie informatique : programme relevé, GRCAO's internal research paper 17 p. (2002)]).

The insertion is done from a rectangle framing the sign (i.e. going through the extreme points — top, bottom, left, right — of the biggest control polygon). This rectangle is recorded in the text file at the same time that the other characteristics of the sign. In general, the "standard sign" is recorded for a reading from left to right, but the hieroglyphic texts can be written in several directions. So, at the moment of the insertion, the user can choose the direction (left to right or right to left) in which he wants to insert the sign. The result of the recording process is then a text file, that can be of two types depending on whether the drawing is recorded as a "standard sign" or as a simple sign with its position on the photograph (Fig. 8 & Fig. 9).

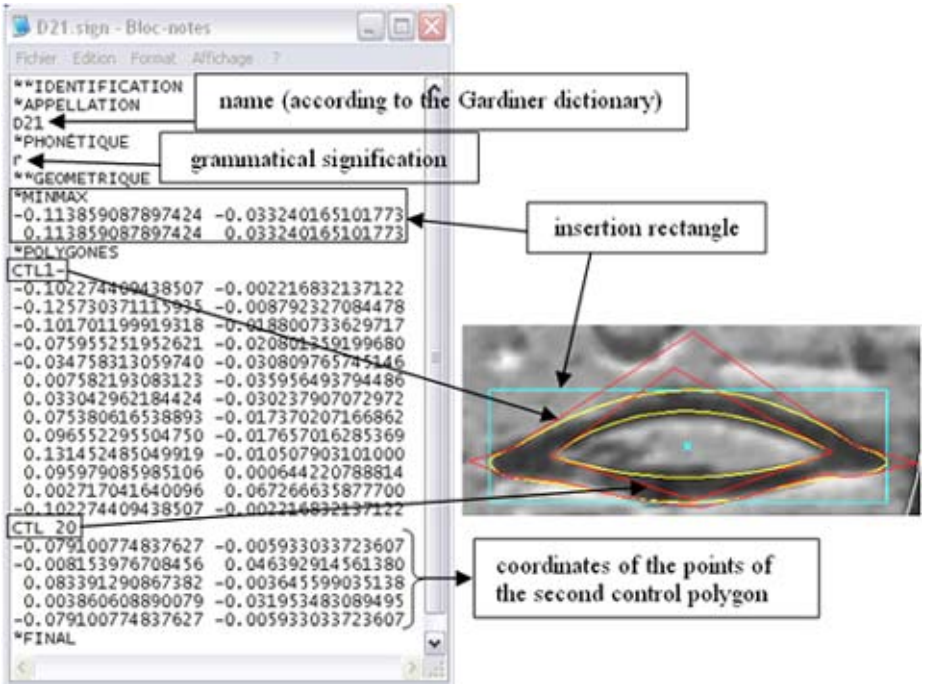



Fig. 8. Record file of a "standard sign" constituted of two control polygons and the corresponding drawing.

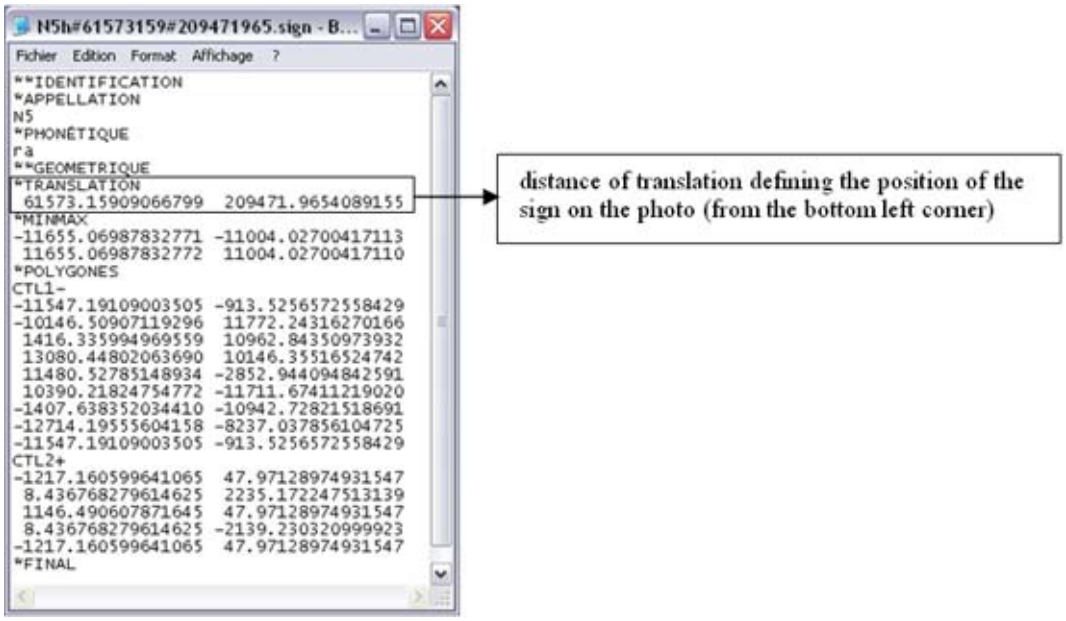



Fig. 9. Record file of a "standard sign" constituted of two control polygons and the corresponding drawing.

Afterwards, the record file of the "standard sign" is search in the "standard signs" database, in order to insert the sign at a particular place and at a desired scale on the photograph. Then we click on the extreme points of the sign to draw, so as to define the edges on the insertion rectangle, and the "standard sign" recorded is automatically retraced at the right place inside this rectangle. Small modifications could now be required to adapt the "standard sign" at the particular case in the best possible way. These modifications are possible thanks to the tools created before (described in the previous part).
The insertion of a "standard sign" is illustrated in Fig. 10.

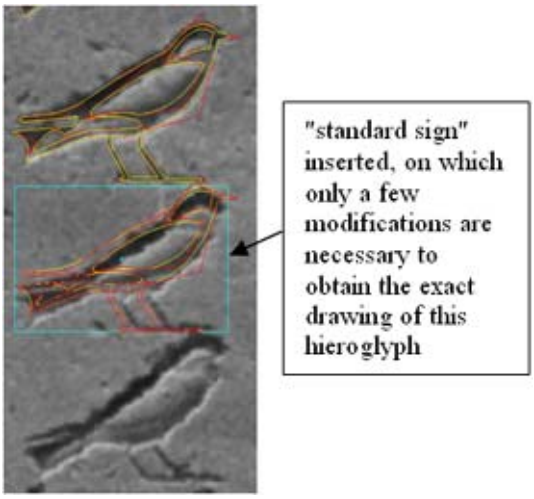



Fig. 10. Example of the insertion of a "standard sign" (we can see here that this insertion procedure is necessary, because it is not rare that the same hieroglyph appears several times in the same scene).

Thanks to the standard signs, it is also possible to take care of the stone deteriorations that affect the engravings. The process is explained in Fig. 11.
Likewise, the degraded parts of a sign can be recorded and this can be useful for the search of missing elements (blocks) of a wall for example (or for its reconstruction). So the missing block will be sought on geometrical criteria (global shape of the block), on material criteria, but also with the help of the inscriptions that figure on it.
If we see a part of a hieroglyph on the edge of a stone, we can thus confront it with the different records that we have at disposal, and this can guide us for the replacement of the stone to its true location (Fig. 12).

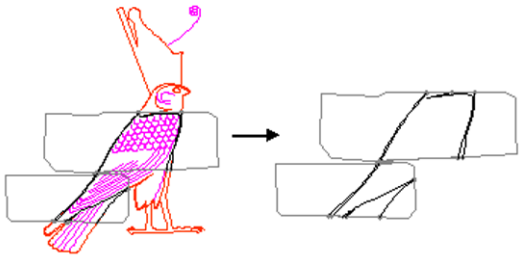
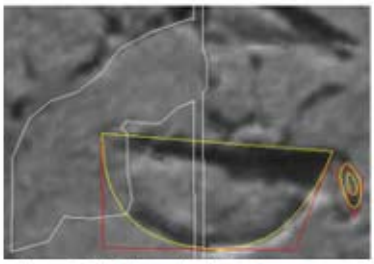
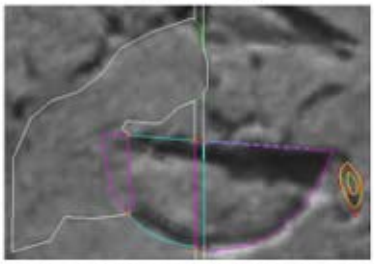


Fig. 12. Restitution according to the position of the intersections between the bonding of stones and the Bezier curves (from [5]).

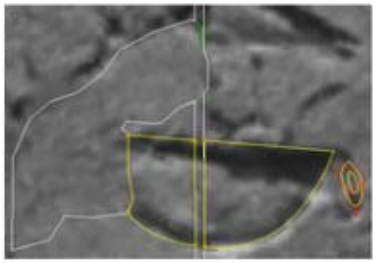
To conclude, this part of the paper has presented the method of computerized epigraphic survey carried out to draw and to record the hieroglyphic signs of planar architectural elements. This method is relatively easy to perform for archaeologists and epigraphists thanks to the very detailed menus created in the software AutoCAD©. Numerous choices are constantly available during the survey process, every operation can be undone if necessary, to keep a big utilization flexibility. Each surveyed sign is recorded in a database in the form of a text file, which can later be use for other exploitations : studies on the hieroglyphs' form, automatic translations of the texts, search for missing elements, etc.
This method has been carried out for the survey of plane surfaces, so a process for the development of conical surfaces has been fulfilled to be able to survey the inscriptions of columns as well.



**1.** insertion of the "standard sign" corresponding to the part of the hieroglyph that appear on the wall



**2.** division of the entire sign according to the stone degradations



**3.** subtraction of the degraded parts from the "standard sign" inserted.
Also : obtaining of the real representation of the hieroglyphic sign

Fig. 11. The taking into account of the stone degradations.

## 3. Epigraphic survey of conical surfaces

The epigraphic survey of the columns of temples is essential too, because columns often bear cartouche friezes and ritual episodes that give information on the date of the temple or on the nature of the activities that took place in its hypostyle hall. Thus this part of the article will set out the method carried out to survey a scene engraved on a non-plane surface, always based on photogrammetric techniques and with the goal to reuse the tools presented before for the drawing and the recording of the inscriptions. To begin with, the column must be modelled from the photographs that have been taken of it (the shots are the only initial data of the survey, as for the walls). After that, the obtained "virtual cone" must be developed in the form of a plane surface so as to be able to make its epigraphic survey with the same tools as before.

### *3.1. The three-dimensional reconstitution of a column*

The only data required to create a 3D model of a column's part are eight photographs covering its entire surface and some control information (points) to be located on these photographs. The photos must have a relatively high overlap between themselves. A minimum of six homologous points between two consecutive overlapping photographs are required, and three more common points between three overlapping photographs. As before and to remain in the same software, we have done this in the graphical software AutoCAD©. The photographs with the points can be seen in Fig. 13. For a better visualization, we have drawn polylines that connect the different homologous points between the shots.

From these initial data, the planar coordinates of the points on the photographs are integrated into photogrammetric formulae to obtain their 3D coordinates.

We have also developed computer tools for an automatic computing of the 3D coordinates of the column's points. Then thanks to these 3D points we are able to draw a vectorial model of the column, which will represent the theoretical column's surface.

As it seems that the theoretical surface of Egyptian columns is a cone (with a very acute angle at the summit), to obtain the vectorial view of the column, we have drawn a 3D polyline based on the points describing this cone geometrically. The parameters of the cone have been calculated by a mathematical algorithm, which carries out the surface matching of a cone (Shakarji [9]).

These parameters are :

- the director numbers of the axis of the cone
- one axis point
- the summit angle
- the distance between the axis point chosen and a generatrix of the cone

A solution is found through an iterative modification of the cone's parameters. The calculation ends when the average distance between the cone's points and the calculated surface stops decreasing.

It is worth noting that to determine the best cone approaching the points can lead to a cone, whose axis is not necessarily vertical. Indeed, the column might have suffered a slight subsidence or inclination in time.

The drawing in Fig. 14 represents the calculated 3D points and the 3D polyline describing the best cone based on these points.

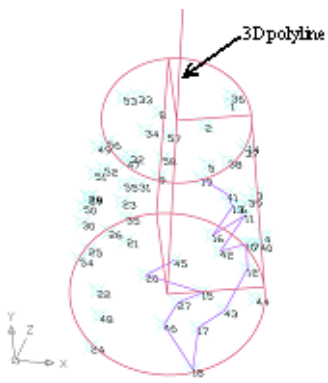



Fig. 14. Theoretical cone drawn from the calculated 3D points.

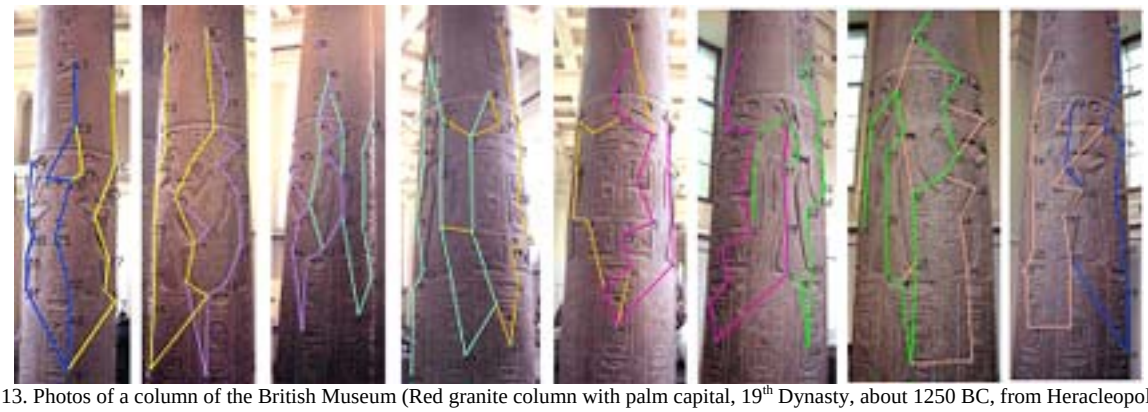


Fig. 13. Photos of a column of the British Museum (Red granite column with palm capital, 19th Dynasty, about 1250 BC, from Heracleopolis), with the homologous points chosen and the polylines joining these points.

For a better 3D visualization, we have also drawn on this layout one of the polylines joining the homologous points between two shots.

This model of the column is a "virtual model" (independent of any coordinates' system), which can be scaled down to proportion by measuring a length on the real column, or replaced in the 3D space while measuring just three points in the field.

Thanks to this vectorial representation of the column, we are now able to develop the obtained 3D polyline on a plane, so as to survey the hieroglyphic signs on a two-dimensional surface.

*3.2. The development of the column surface for the two-dimensional surveying of the epigraphy*

As mentioned above, the best cone approximating the points can be at an angle. So, the first step of the development is to make the previously obtained cone vertical, for the simplicity and the accuracy of the development's calculation.

A change of reference has been carried out so as to move the summit of the original cone to the zero point (of the AutoCAD© drawing) and to put the axis in a perfect vertical position.

The transition from one coordinates' system to the other is possible through three non-coplanar homologous points in each system. We choose these three points at random among the seven points of the previous 3D polyline. Knowing that the summit must be translated to the point (0, 0, 0), the coordinates of the two other needed points are easy to deduct. Afterwards, all the cone's points have been transferred from one system to the other and replaced exactly « on » the theoretical surface of the new vertical cone by means of an orthogonal projection.

We have thus been able to develop the vertical cone, that is to say the points of the 3D polyline have been put on a same plane. The points of the vertical cone (previously projected on the theoretical surface) have also been located on the development. This is illustrated in Fig. 15.

To be able to draw the hieroglyphic inscriptions, it is now necessary to orthorectify the original photographs of the column and to insert these pictures in the development (the principle and the aim are the same as for Fig. 3).

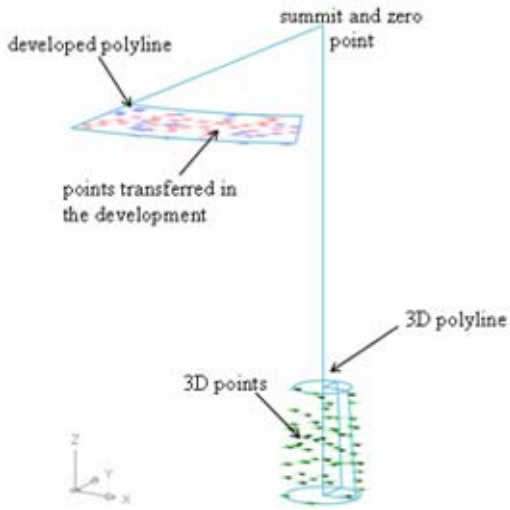



Fig. 15. Development of the cone.

To put the shots in the development, these must be transformed into orthophotographs. The epigraphy will thus be surveyed on this "front view" of the column.

The orthorectification process has two phases :

- the first consists in drawing, on the original shot, the edges of the column's shaft (generatrix), and in obtaining their equivalent on the development, so as to finally have the limits of the orthophotograph to be produced,
- the second carries out the transfer of the colour values of the pixels from the original photograph to the development.

We have thus created a new picture by assembling these pixels inside the previously drawn limits.

The result is shown in Fig. 16 for one of the shots.

After orthorectifying all the shots, a single photomontage is made, on which we have drawn the hieroglyphic inscriptions.

The montage of the orthophotographs is not easy to realize, because the exact positions of the different pictures must be strictly respected, and their scales likewise. Moreover, there are differences in light exposure from one original shot to the other (see Fig. 13), which requires image processing to obtain a homogeneous picture of the entire surface of the column's shaft. This problem can be avoided by taking the photographs in good light exposure conditions.

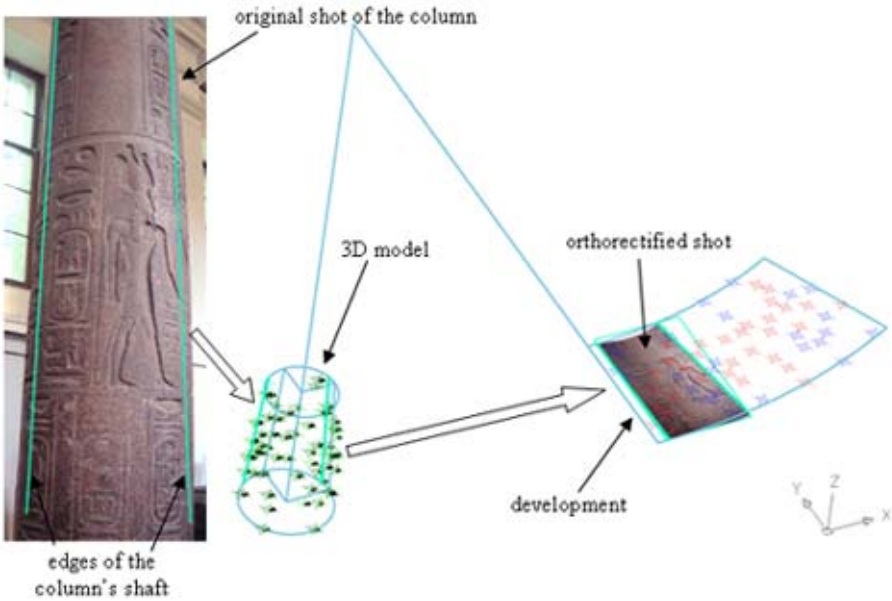


Fig. 16. Orthorectification process of one photo of the column (inserted afterwards in the developed cone).

Despite all this, once the photomontage is done, we obtain a "photograph" of the developed surface of the column's shaft. This picture represents a plane surface, on which the hieroglyphs can be drawn (Fig. 17).

Fig. 17. Montage of the orthorectified photographs with the layout of some hieroglyphic signs.

We have made the drawings of the hieroglyphic signs on this picture by reusing the tools described in the first chapter of this paper.

All the procedures are the same : the signs are traced, recorded, inserted, etc. exactly the same way as the inscriptions of the wall before. As the column's surface is now "planar", the "standard signs" already recorded, whereas the survey of a wall for example, can be inserted directly on this picture. The adaptation of the pre-recorded signs may require a small rotation to fit exactly with the inscriptions of the column, what is very easy to do. The question of light exposure during the photographic campaign is quite central for the quality of the epigraphic survey that will be carried out on the shots. It is required that the sunbeams reach the wall or the column sideways, in order to emphasize shadow areas. Ideally, it would be desirable if the photographs are taken early in the morning and late in the afternoon, whereas the sun lights up the wall with two distinct angles. This allows to have the same texts with different shade zones (see 2.3. and Fig. 7) and to compare later the interpretations that can be made of them. Actually, according to the hour of the day, either the vertical lines or the horizontal lines of the epigraphic signs are pronounced.

In case of a wall that is systematically in the shadow during a certain period of the year (because it is hidden by an other architectural element for instance), it is of course necessary to go on the field during the period of the year, when the sun highlights these areas usually shaded. To avoid this wait, some tricks are available, like the use of mirrors, positioned in strategic places, which reflect the light on the wall from different angles. To take the shots with a good flash is obviously an other way to obtain a better picture of the architectural element.

To sum up, if it is preferable to take the shots at strategic moments of the day or of the year, the working of these photographs to obtain a digital 3D model can be done at any time, what free the user from the temporal constraints mentioned above. Moreover, the progresses of image processing software allow to improve the quality of the digital shots at any time. Nothing is really definitive at the moment of the photographic campaign (at a lighting level) and image treatments are always possible, what adds to the simplicity of use of our method. On the other hand, the geometric arrangement of the shots has a great importance on the field and cannot be changed later. It is then significant to watch over to take a minimum of three photographs of each plane archaeological element (for the conical elements, the procedure is explained in 3.1.): one shot taken from the left, one in front of the wall and one from the right, with a relatively high overlap between themselves.

## 4. Conclusions and Extensions

This paper presents a computerized epigraphic survey solution for all the planar, but also conical and cylindrical, architectural elements of the Egyptian temples. This solution is of course adaptable to the survey of other types of temples (Greek for example). The simplicity and the flexibility of use makes it accessible for the epigraphists, and more widely for the archaeologists, who want to use computerized methods to carry out their epigraphic surveys. An advantage is to save time for other works that the survey itself, that is to say to have more time to interpret the texts engraved in the temples for instance. Moreover, various exploitations (reconstitution, palaeography, …) are possible thanks to the fact that all the signs drawn are recorded in an universal format. The publication of the texts can still be made in paper form, but can now be in numerical form too, what offers other possibilities for the data exchanges for example.

The different types of exploitations have not really been tested for the moment, but it is an aim in the prospect of the carrying out of this work.

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