The Reconstruction of the Heads and Faces of three Ancient Egyptian Mummies

by

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Introduction

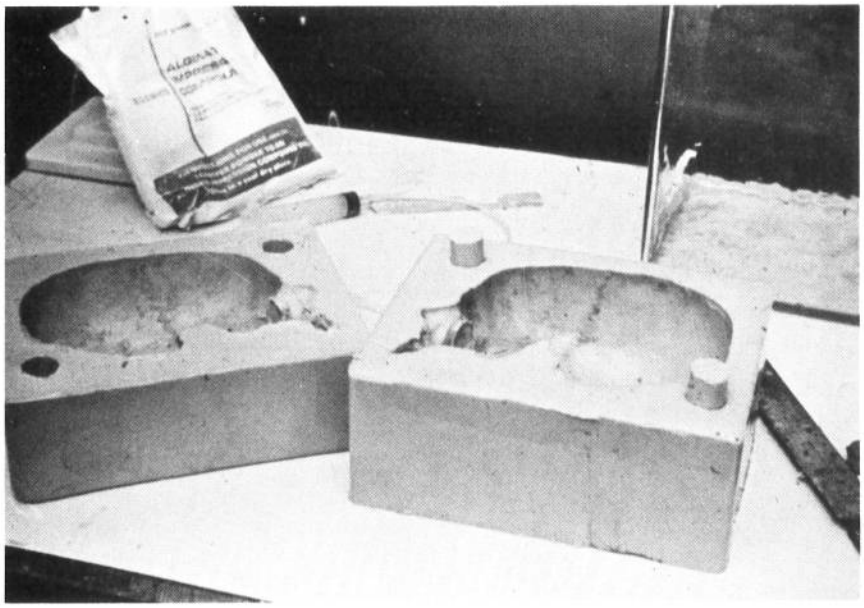
The size and shape of a human head is determined largely by the underlying bone structure, as are the facial features, the skull being the matrix upon which the head and face are built. Detailed examination of the skull can generally reveal the age and sex of the individual, and characteristics peculiar to race or ethnic group may also be apparent. The condition of the teeth provides valuable information. The configuration of muscle attachments provides evidence of size and strength, although in the face these are confined mainly to the base of the skull and the lower jaw. It is therefore possible, in principle, to reconstruct the major features of the human head with some degree of accuracy. However, a reconstruction can reveal only the type of face that *may* have existed, the position and general shape of the main features being accurate, but reconstructions of subtle details such as wrinkles and folds being inevitably speculative as there is no factual evidence as to their form or even their existence.

There have been a number of workers in this field, the most notable and often quoted being Kollmann and Büchly[1] who in 1898 published an account of their methods, and listed the thickness of the soft tissues of the head and face at twenty-three points. Table 4 of Kollmann and Büchly's work, in which their data for males are compounded with the earlier figures of His, provides maximum and minimum values for soft tissue thicknesses. It was upon these figures that the reconstruction of a head, thought to be that of Akhenaten, was initiated by Professor Harrison[2] with very positive results. Harrison's method was to mark the measurements off on anterior and lateral photographs of the skull and draw out a profile and anterior configuration. This method differs considerably from that of Kollmann and Büchly who made a three dimensional reconstruction. The three dimensional reconstruction is also the preferred method of both Gerasimov[3] and Krogman[4] when the remains are in an adequate state of preservation, and readily accessible. Because of its wide range of applications it was decided to adopt a similar approach for the reconstruction of the heads of three Egyptian mummies as part of the Manchester Museum Mummy Project.

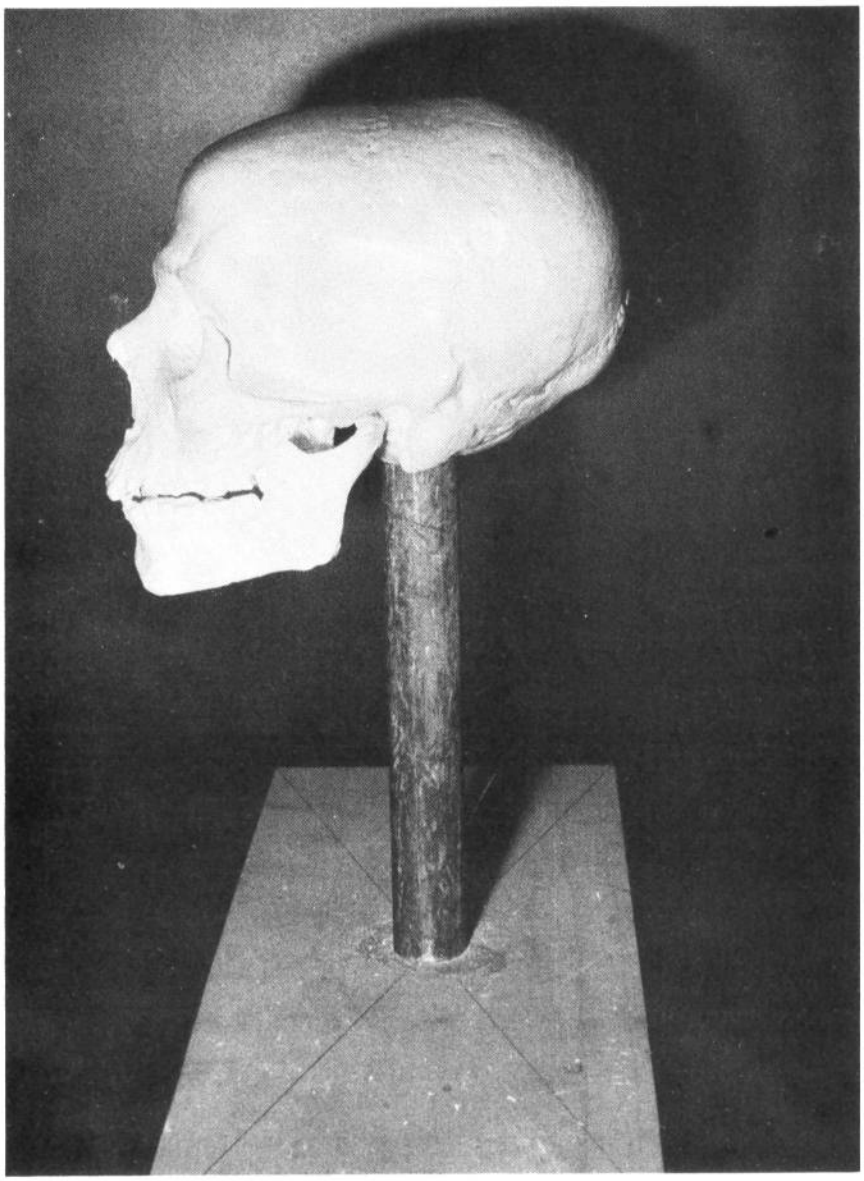
The objective was to produce drawings and paintings which would enable those who viewed the mummified remains to relate them more easily with living people as they may have appeared. The three dimensional 'busts' of the heads would serve as models upon which such illustrations could be based. It was considered essential that these illustrations be established as far as was possible upon scientific principles to eliminate 'artistic licence', thus ensuring a standardized procedure for all the heads, and enabling comparisons to be made between them.

The first two mummies chosen are in many ways unique. They were unwrapped by Dr Margaret Murray

(1) The skulls of the two brothers Khnum-Nakht (*right*) and Nekht-Ankh (*left*)



(2) The final appearance of the mould: the location lugs and sockets are clearly shown



(3) The completed cast of the skull of Khnum-Nakht mounted

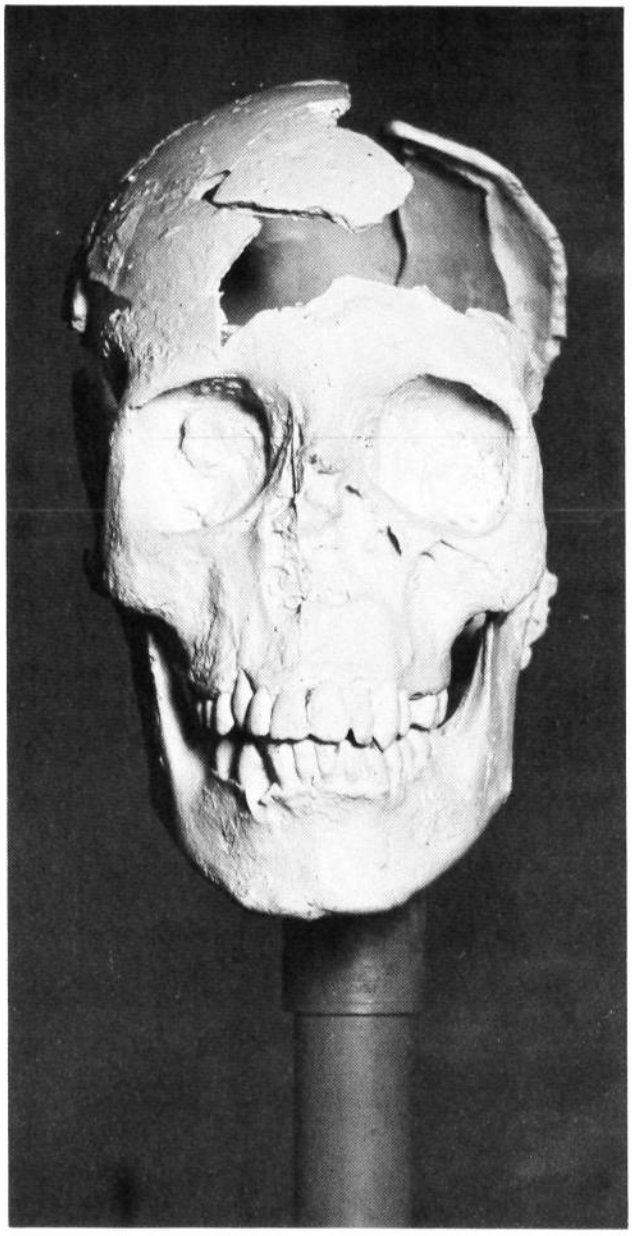
at Manchester Museum in 1907; all her findings were very carefully documented and a considerable amount of work has been done on them since.[5] It is known that they were buried together in the rock-tombs of Der-Rifeh and date from Dyn. XII. From the hieroglyphs on the coffins it appears that they were half-brothers, sharing a common mother, and all the evidence suggests that the younger of the two, Khnum-Nakht, had a negro father. He is estimated to have been between 40–45 years old at death, and to have suffered from osteo-arthritis which had seriously affected his back. The skull of Khnum-Nakht is in a perfect state of preservation; there are, however, no remains of any soft tissues. The skull is markedly prognathous, powerful in appearance and with a full set of teeth. The two upper left incisor teeth are fused together (geminated) and behind them lies an accessory incisor. The elder brother, Nekht-Ankh, is estimated to have been 60 years old at death. His skull is also in perfect condition, only the upper right incisor being absent. It is very much more delicate in appearance, the zygomatic arches being slender, the mastoid processes small, and the marking of muscle origins and insertions far less distinct than in the younger skull. It has been suggested that he may have been a eunuch, but this has not been substantiated (**1**).

The third mummy, that of a girl of about 13 years old which was also unwrapped in Manchester in 1975, presented many problems. Labelled '1770' for identification purposes, this mummy, unlike the previous two, was badly damaged; the skull, which had no preserved soft tissue, had been broken into some 30–40 pieces. Fortunately the majority of the bones which form the face were largely undamaged, although covered in a thick layer of mud and packing. The mandible was fractured to the left of the mid line and both mandibula heads were broken. The vault was totally shattered with many pieces missing.

Casting of the Skulls

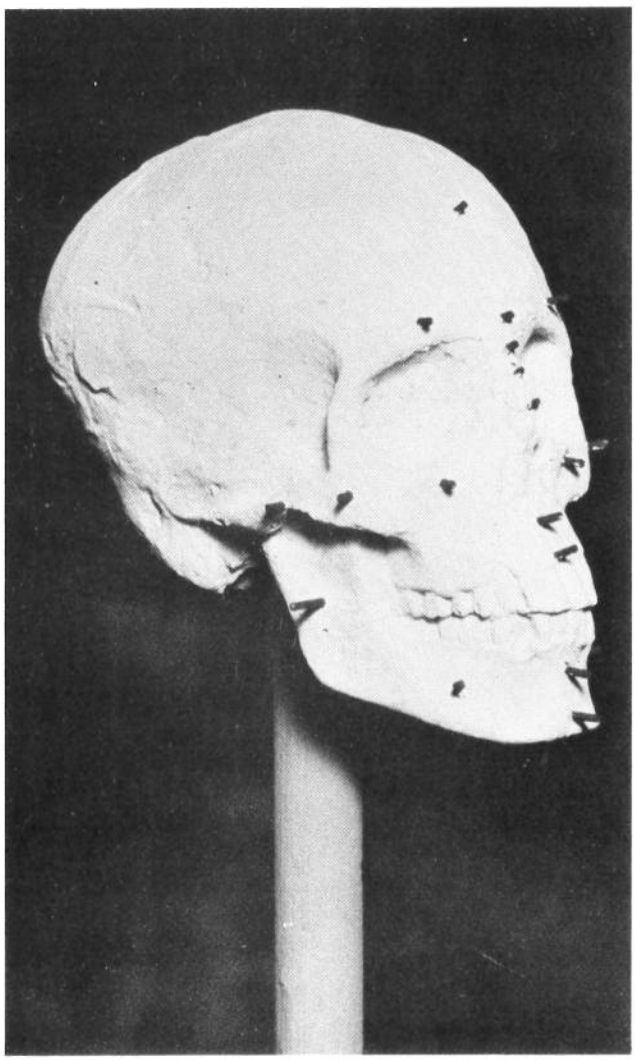
The conservation of specimens of such antiquity as the skulls of the two brothers was of prime importance. Therefore before any reconstruction work could be started it was necessary to make accurate casts of each, utilising techniques developed in the department for making casts of medical specimens. The skulls were first prepared by lightly filling in all areas which were likely to cause deep undercuts in the mould, for example: the eye sockets, the space between the zygoma and temporal bone, the external auditory meatus, the nasal cavity, the foramen magnum, plus all foramina and openings at the base of the skull. It was felt that these details should be sacrificed rather than risk damaging the skulls when removing them from the moulds.

Each skull was then placed on its side in a glass container supported on three plasticine prongs about one inch high. A thin plastic tube was taped to the side and down to the base of the glass container. A quantity of dental algenate was prepared, one part algenate powder to three parts water. This was poured into the container totally investing the skull up to the mid line. Two 1 in. × 2 in. corks were pushed 1 in. into the wet algenate at each corner of the tank and held in place. The setting time is approximately two minutes. When the algenate had set the corks were removed and a second mix was poured in filling the holes left by the corks and totally covering the rest of the skull to a depth of 2 in. When the second layer had set, air was forced into the plastic tube releasing the vacuum between the glass container and the mould and allowing the mould to slide gently out. The junction between the first and second layers of algenate was located and the two halves prised gently apart and the skull lifted out. Because of the flexible nature of an algenate mould and its total lack of adhesion it was possible to obtain a perfect 'split mould' without endangering the skull (**2**). The two halves of the mould were reunited, the lug and the socket, caused by the cork ensuring accurate relocation. The whole mould was then placed back in the glass tank, a small ½ in. opening was cut in the top with a scalpel through which plaster of Paris was poured until the mould was filled. Shortly after



(**4**) View of the skull of '1770' rebuilt in plastic

the plaster had set it was possible to remove a very accurate cast of the original skull. The lower jaw was cast as a separate item using the 'split mould' technique. A bridge of plasticine was fitted across the inside of the mandible with a short pillar in the middle, which protruded through the top of the mould. This provided an opening through which the mould could be filled with plaster after the removal of the mandible. Finally, the plaster mandible was fitted into position on the skull. A hole 1 in. diameter and some 3 in. deep was drilled into the plaster skull at the location of the foramen magnum, the whole then being set on to a stout wooden stand (**3**). As stated earlier the skull of the 13-year-old girl, '1770', was broken into many pieces a large number of which were missing; fortunately the majority of her teeth were present although some of them were not actually in place. An algenate mould was made of each separate piece of bone. In most cases the fragments had merely to be pressed lightly into a small dish of stiff algenate to provide a very satisfactory mould. The casting of the largest portion which included the maxilla, parts of the zygomatic bones, and a ridge of the frontal bone providing complete orbital cavities, was less simple. Being extremely fragile only a thin layer of algenate could be applied to the surface; when set, a layer of plaster was added to provide support for the very thin and flexible algenate mould. A quick curing plastic was used to make the casts (N.H.P. plastic), which were then assembled to form the replica skull (**4**). The missing areas were replaced with wax; this enabled a final cast of the whole skull to be made in plaster of Paris. This cast differed slightly from the previous two in that the lower jaw was in position. Not only did this save time it also provided a much more robust form upon which to do the final reconstruction.



(**5**) Plaster cast of the skull of '1770' showing the pegs inserted at specific points and of specific lengths

Reconstruction of Soft Tissue

The reconstruction of the soft tissues on the now prepared plaster skulls was started by first 'blocking-in' with soft modelling clay the head, neck and face, allowing the features to develop naturally. It is interesting to note how a skull will start to take on the character of a face at a very early stage. So delicate and fine are the muscles of the face that they leave very few marks on bones to indicate their origins or insertions. The nose is made up largely by cartilage, and fat also is an integral part of the soft tissue of the face. As the controlling factor in this reconstruction was to be tissue thickness there seemed little point in following anatomical structures too closely, the clay being pressed into place in blocks and modelled according to the dictates of the underlying skull.

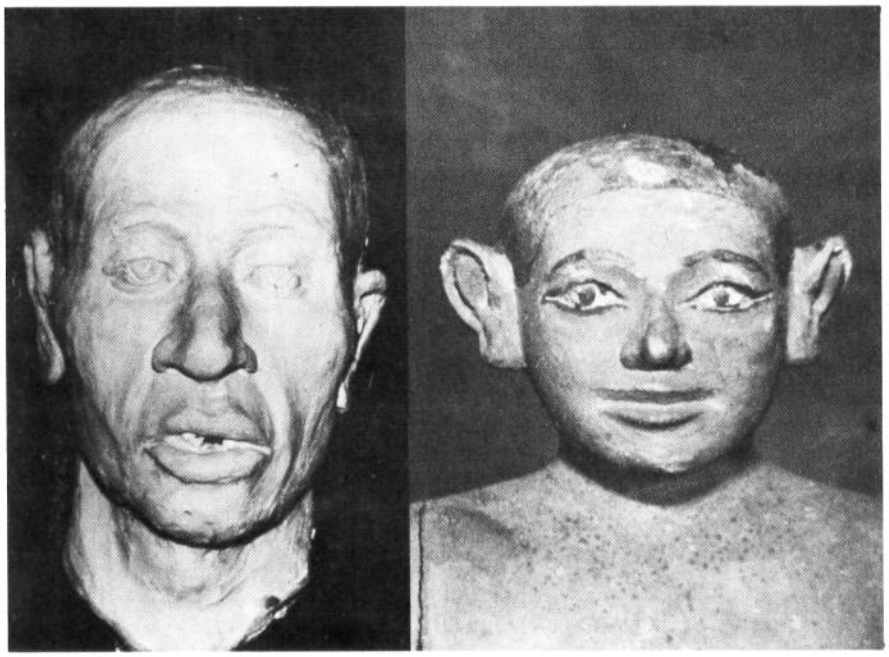
Measurements were made, the thickness of the clay being increased or decreased as necessary until it corresponded to the mean of the maximum and minimum thickness for soft tissue of the face at twenty-one specific points. These figures based upon Table 4 of Kollmann and Büchly's work are listed below:

Upper forehead	3.56 mm
Lower forehead	4.69
Nasal root	4.93
Mid nasal bone	3.25
Tip of nasal bone	2.12
Root of upper lip	11.57
Phittrum	9.48
Mental sulcus	10.05
Chin pad	10.22
Middle of masseter	17.52
At the angle of the mandible	10.46
Under the chin	6.08
Middle of eyebrow	3.65
Mid infraorbital	4.29
Front of mosseter	8.20
Root of zygomatic arch	6.74
Highest point of zygomatic arch	4.33
Highest point of malar	6.62
Nasal breadth at alae	35.65
Nasal depth from tip to root of lip	23.69
Height of upper lip	21.63

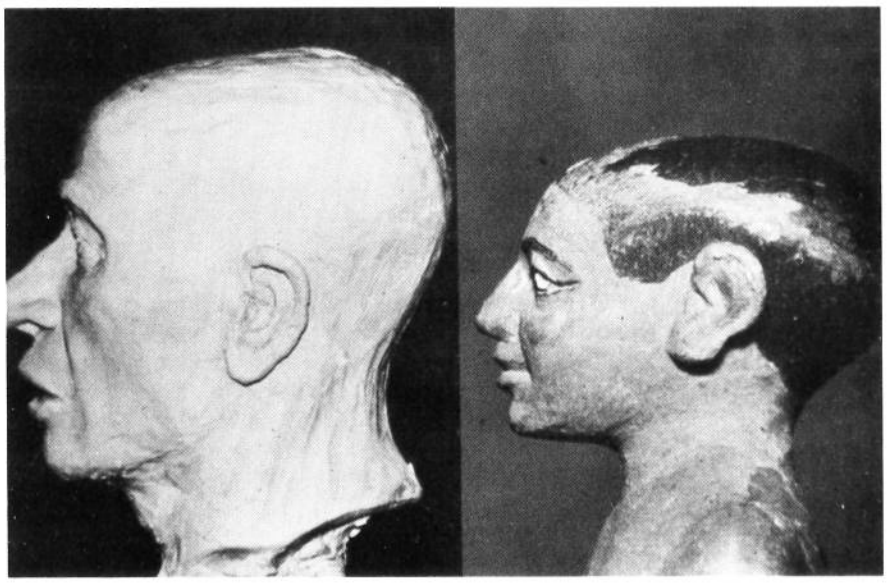
The measurements were taken by passing a thin steel probe through the clay at the specific points, the area was then reduced or increased in thickness to conform to

those listed. A slight variation to this system was adapted for the head of the girl '1770' in that pegs cut to the appropriate length were fixed in position on the plaster skull (**5**). The clay was then built up until it was of the correct thickness. This method was more accurate as it ensured that the measured thickness was in exactly the right place. Adjustments were made at the stage when the clay model was completed, which enabled minor ethnic considerations to be highlighted. These involved the eyes, which in ancient Egyptians were more almond shaped, and the tip of the nose. The measurements for the head of '1770' were based upon those in Table 3 from Kollmann and Büchly. However, considerable licence was allowed in order to avoid the somewhat cadaverous look of the two brothers, and also to try to capture the appearance so peculiar to young adolescents. It is questionable whether the second objective was, in fact, achieved.

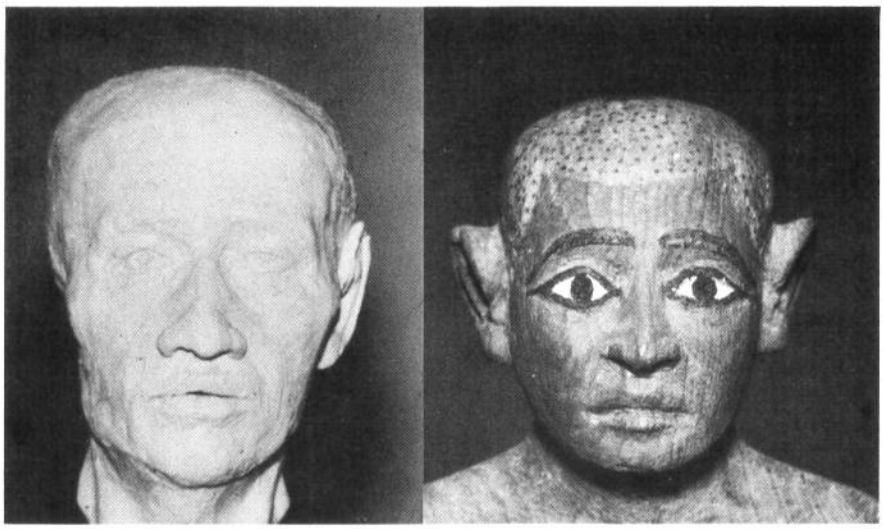
The size and shape of the nose, especially the profile, have not unnaturally been the cause of considerable discussion. The width of the nasal cavity can give a reasonable clue to the width of the nose, at a point across the wings, the bony opening being about three-fifths of the overall width (Krogmann). However, although a number of formulae have been suggested, all of which are approximations, the shape and form of the cartilaginous part will always remain a mystery. The anterior nasal spine and the nasal bone, if present, are the key points, for although they do not show us exactly what the shape was, they can give a good indication of the direction and the form that the nose must have taken. This, combined with a knowledge of ethnic group, age, and sex, gives enough information for speculation with a fair degree of accuracy. It does not allow, of course, for the unusual or the bizarre. The width of the mouth is generally recognized as being approximately equal to



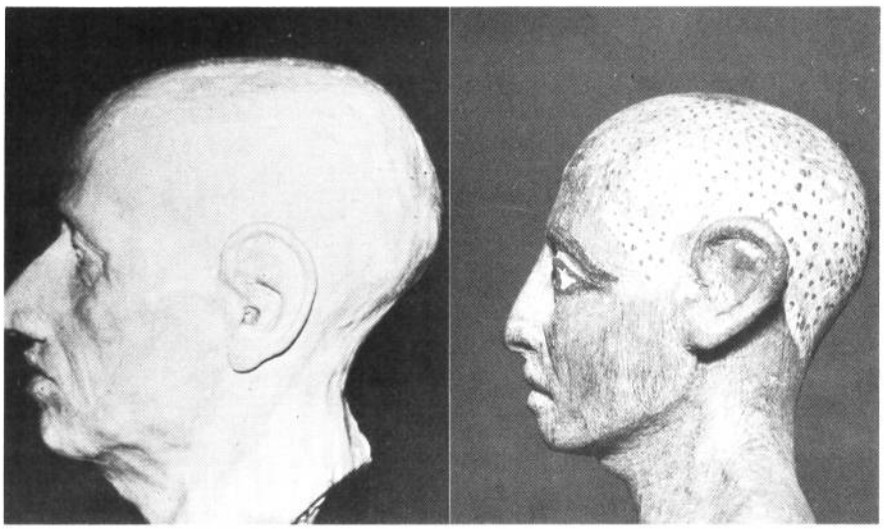
(**6**) Comparison of reconstruction with carved head of Khnum-Nakht



(**7**) Comparison of reconstruction with carved head of Khnum-Nakht



(8) Comparison of reconstruction with carved head of Nekht-Ankh



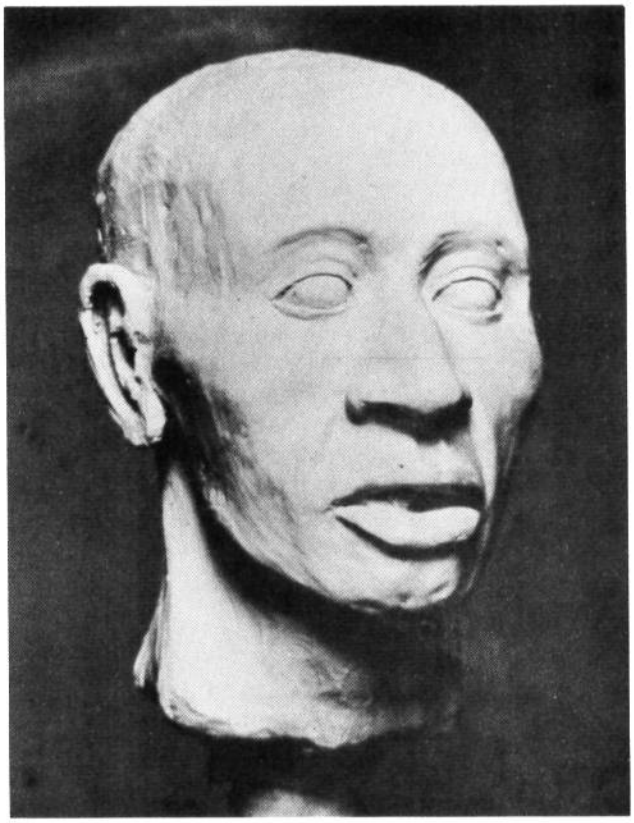
(9) Comparison of reconstruction with carved head of Nekht-Ankh

that of the inter-pupillary distance; again this does not accommodate the unusual forms that the mouth can sometimes take.

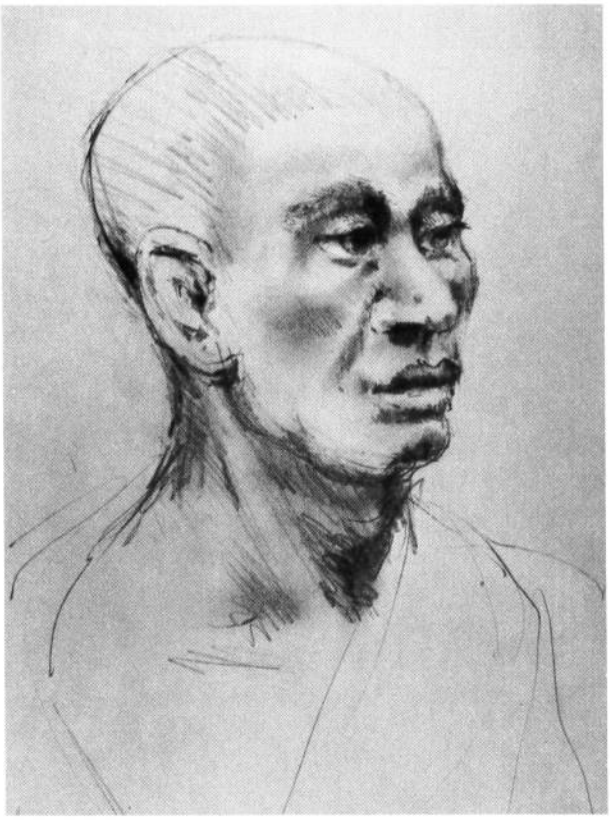
Information provided by the remains of '1770' was somewhat limited at the time of making the reconstruction. Both legs appeared to have been amputated, one above and one below the knee, but whether before or after death was not known. There was evidence to indicate some intestinal infection, and an irregularity in the formation of the bone in the region of the nose suggests the probability of nasal congestion, which may have given rise to a slightly adenoidal appearance.

Within the coffins of the two brothers were two small statuettes, 15.5 cm and 25.4 cm high, carved from wood. These represented the deceased as they had been when in full health. There was some apparent confusion as to the identity of these statuettes as the names written on their stands do not seem to correspond. So skilfully were they carved that it was decided to make some comparisons of the heads, which were some 3 cm. long, with the life-size reconstructions. As can be seen from the photographs (**6** and **7**), the head of the statuette of Khnum-Nakht is powerfully built, with full lips and broad nose, and compatible with the reconstruction which exhibits the similar features. The head of the second statuette Nekht-Ankh (**8** and **9**), is quite different, being more lightly formed, possessing a rather more delicate nose and a smaller mouth and chin. Again the similarity, although not striking, is unmistakable. It is unlikely that a very close resemblance between statuettes and reconstruction would occur accidentally as the difference in size is so great.

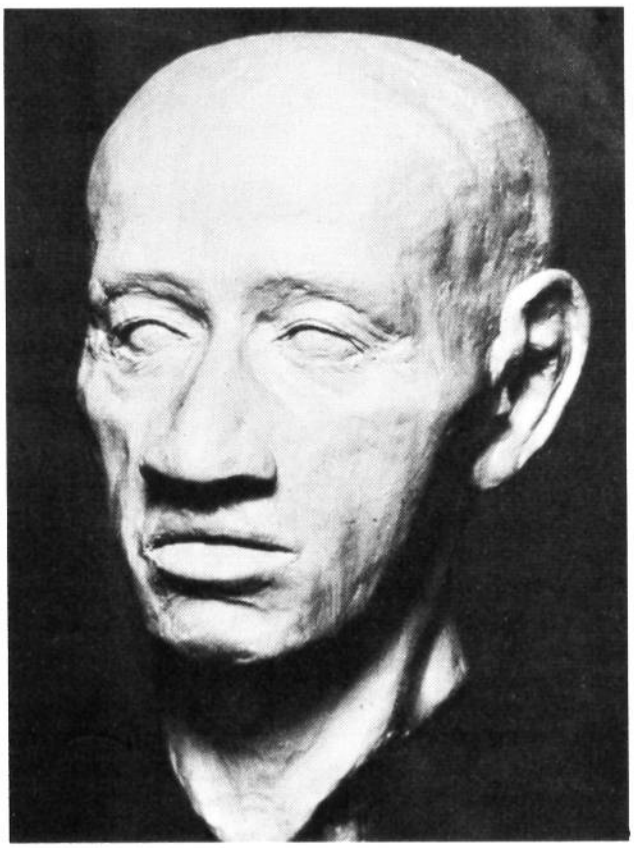
As stated earlier, the objective was to produce illustrations using the clay busts as models. A sketch of Khnum-Nakht (**10**) was made from the clay reconstruction (**11**). The somewhat cadaverous look has gone, caused in the first instance by the fact that the measurements upon which the reconstruction was based were taken from cadavers. Khnum-Nakht would appear to have been a man with strong features somewhat Negroid in appearance. He may well have had quite a handsome face. In this case, we do not know much about his hair, but it would be reasonable to assume that it was black, and that his skin was a swarthy olive colour. The illustration depicts Nekht-Ankh (**12**) as an older man, about sixty. We know that he had short grey hair as evidence



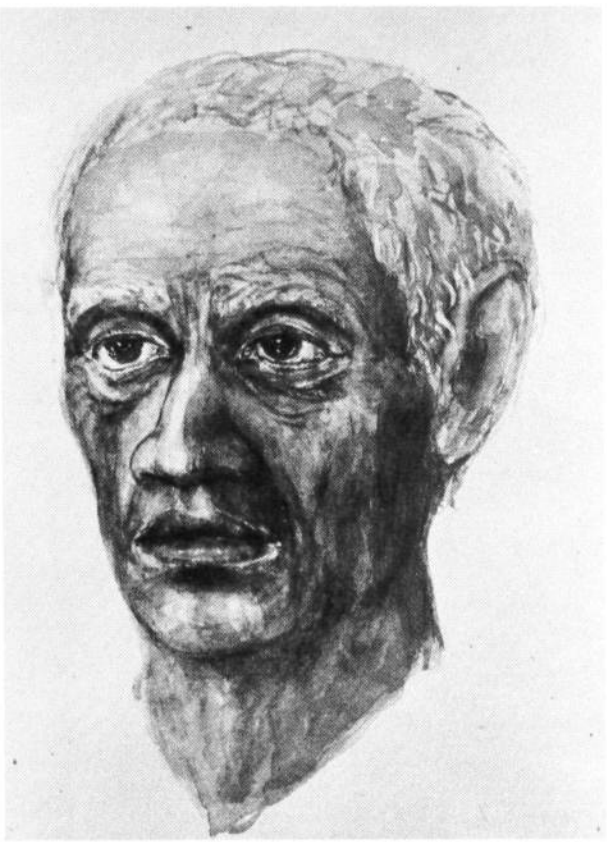
(10) Clay 'bust' of Khnum-Nakht



(11) Chalk drawing of Khnum-Nakht, based on clay reconstruction



(12) Clay 'bust' of Nekht-Ankh



(13) Painting of Nekht-Ankh based upon the clay reconstruction

(**14**) The final wax 'bust' of '1770' complete with hair, eyes and make-up

of this was found during the unwrapping (**13**). His appearance is less prepossessing than that of his half-brother, with a much weaker face and less well defined features.

The final reconstruction of '1770' (**14**) is in many ways more satisfactory because we have been able to give some form of identity to a handful of broken bones. This reconstruction was taken further than the previous two because of the rather special circumstances which prevailed at the time. A cast of the clay bust was made in wax, into which it was possible to fit glass eyes and eyelashes. Colour was added to the mouth and skin, together with a limited amount of make-up which would almost certainly have been worn by a girl of this age. The hair, which was added in the form of a wig, was for exhibition purposes only, and is not regarded as a part of the reconstruction work. The results in the case of '1770' were most unexpected and show a young girl, perhaps slightly adenoidal but not unattractive. The bony anamoly of the nose would not have been apparent in life so the contours of the face would hardly have been affected. Her mouth is full and a little fleshy, quite compatible with the skull which is somewhat prognathic. It was felt that to show a finely chiselled mouth as is sometimes seen in Ancient Egyptian paintings and drawings would be too positive a statement from such limited information.

Although the project produced acceptable and useful results, it was impossible to know just how accurate the reconstructed heads were. To check this a very limited study was done in a way that enabled comparisons to be made between an actual head and a reconstruction of the same head. This was achieved in the following manner. Three cadavers were selected from those due to be embalmed in the Department of Anatomy, University of Manchester Medical School, in preparation for anatomical dissection. Before embalming took place photographs were taken of both anterior and lateral views. These pictures were not seen by those involved in the reconstruction work. When the dissection had been completed by the medical students, as part of their studies, the three heads located by their serial numbers were made available for reconstruction. These remains, unlike those of the mummies, had a considerable amount of soft tissue, some of which had to be removed to expose the bone at the required points for the purpose of making measurements. It was, however, not possible to gain any helpful information from the soft tissue, as all the relevant structures had been removed or destroyed during dissection.

The specimens were far from perfect, and thus provided a good test for the method. The top of each skull had been removed, openings had been made to expose both frontal and maxillary sinuses, and in two the mandible had been divided. There were no original teeth present in any of the specimens. Because of the limitations in both time and resources only the anterior portions of the specimens were cast. Measured pegs were fitted into the casts in their prescribed positions and the clay built up as previously described. When completed, photographs were taken and compared with those made of the cadavers prior to embalming. Unfortunately, during the two years which intervened between the embalming and the reconstruction one set of pre-embalming photographs had been lost. Thus only two reconstructions could be properly assessed. The results are useful, demonstrating that the type of face that existed can be roughly reproduced. The reconstruction of the male specimen bore a strong likeness to the original head, although there were details of the nose that did not correspond exactly, and the somewhat fleshy fullness of the face, especially in the region of the lower jaw, was absent. In the female specimen the likeness was even more striking, although here again there was a slight inaccuracy in the nose. It should be stated that, although in both cases the nose did not correspond exactly with those of the original heads, they were approximately the right size and type. The thickness of soft tissue upon the human face can alter considerably during life, some losing and others gaining tissue for one reason or another. An individual will still be easily recognized in spite of these changes. Thus slight variations in a reconstruction are not necessarily critical.

It would be misleading to suggest that this method can recreate an accurate portrait from a skull. There are far too many variations in individual parts of the face that can never be known. However, it would be reasonable to claim that the type of face can be rebuilt to some extent. The size and general configuration can be regarded

as accurate and thus provide some idea of the appearance of the individual during life.

Acknowledgements

I should like to thank Mr John Hartshorn, Senior Medical Artist, who worked with me during the reconstruction of The Two Brothers and who produced the bust of Khnum-Nakht; Miss Shian Percy, Medical Artist, who gave so much help, especially with the reconstruction of '1770'; Mr Robert Mitchell and Mr Ronald Murray for recording photographically all the work and producing slides and prints of such fine quality. My thanks are due also to Dr R. W. G. Ollerenshaw and the staff of the University Department of Medical Illustration Manchester without whose support this work would not have been possible.

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