Not-Art Digital Images: An Artist's Perspective

Peter Voci

ABSTRACT

Working with the New York State Police and the Nassau County Medical Examiners Office, a forensic anthropologist, a forensic medical photographer and an imaging systems artist attempted to reconstruct a face from the skull of a young woman. Facial feature components selected from police identification kits were digitized and manipulated to match control points and overlaid onto a digitized version of the skull. In this way a series of images was created that were called 'not-art' even though an artistic aspect was present.

AN UNIDENTIFIED WOMAN

In the summer of 1989, a motorist stopped his car along the side of the Meadowbrook Parkway on Long Island, New York, to relieve himself. As he went into the wooded area he discovered the remains of a young woman. The New York State Police were called in and an investigation began. An apparent drug overdose victim without identification, she was assumed to have been left at this site by her friends, the last people who saw her alive. The Nassau County Medical Examiners Office determined that she had been dead for some time before being found. Her body was in an advanced stage of decomposition, making the task of identification difficult. She did not correspond to any known missing person. The traces of drugs that were found in sample body tissue seemed to rule out any foul play. Fingerprints were obtained by a hydration process used by the forensic staff, but no matching prints were on record. Dental records might have been used to make a positive identification if someone similar to her had been reported missing, but since that was not the case it was impossible to know which dentist to consult. (Such a search would theoretically be possible if all dental X rays ever taken were digitized and stored, later to be recalled by a pattern recognition program. Such a system, although practical, does not currently exist.)

A forensic sculptor may be called in to try to define facial structure on an existing skull. Cork tabs of various thicknesses (determined according to tissue depths at particular facial locations) are glued to the skull; a modeling compound is then used to fill the gaps between the tabs, and a smooth top coat is added to complete the reconstruction. This technique, however, has a low success rate when used in the identification process. The sculptor starts with average tissue depths obtained from medical reference guides that record ranges in studied corpses. Since even slight changes alter the overall final composition, much guesswork is automatically included in this procedure. One needs only to recall the changes evident in a person one has not seen in 10 years, especially if a dramatic weight change or disease has occurred. The adult skull may have changed little, while the outward appearance has undergone a dramatic transformation. Moreover, forensic sculpture entails the subjective component of the sculptor as an artist, which may result in stylization of the resultant image.

THE IMAGING PROJECT DEVELOPS

Walter Poppe, a forensic medical photographer and a graduate student in my computer graphic class at the New York Institute of Technology, was instrumental in bringing together a research group that included himself, Spencer Turkel, the forensic anthropologist working on the case, and myself, an imaging systems artist. We met initially to discuss the possibility of using a digital imaging system to identify this woman from the remains. My task was to develop the approach and construct an image that the police would use in asking the public for its help. (This is not unlike what a sketch artist would provide from information supplied by eyewitnesses.) We were working with the same information that was given to a forensic sculptor, but in a different medium. We wondered, of course, just how sound the results would be. We would never find out unless we carried out the project.

Television commercials advertise computer imaging systems that make cosmetic surgery seem simple and easy. There are certainly legitimate prosthetic surgeons and reconstruction specialists using imaging technology in the medical profession, and their research efforts are bringing shattered lives back together again. Law enforcement agencies too use digital imaging technology to assist in the search for missing persons and fugitives. We realized that much research was still needed to make accurate conclusions, since we were just beginning to see the possibilities. Because we had many questions, we felt a slight apprehension, similar to that of a painter facing a blank canvas. Somehow this is a personal acknowledgment of the official start of a work.

THE PROCEDURE

Our approach was straightforward: we concentrated on building the facial tissue and components part by part on the skull, which acted as the visual armature for this additive technique. We set out to duplicate what the forensic sculptor does; however, our method would allow us to have a constant reference to the underlying structure because of the display characteristics of the medium. Besides the fact that we were working with transparent layers, another important difference with employing computer graphics was that we had

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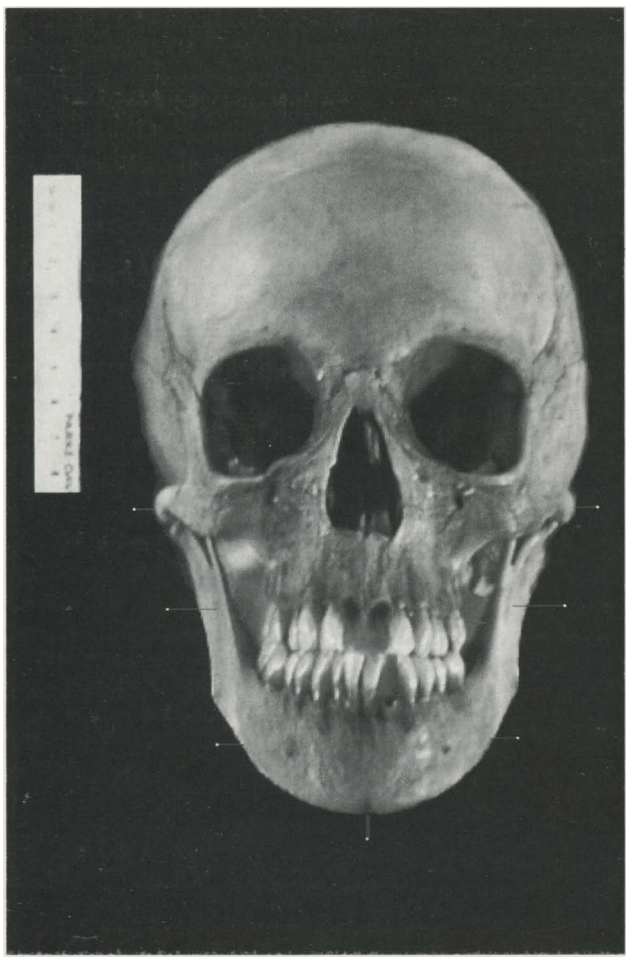

Fig. 1. Frontal digitized skull with the tissue depth reference points and facial outline. Copyright 1989 Peter Voci. Reproduced by permission.

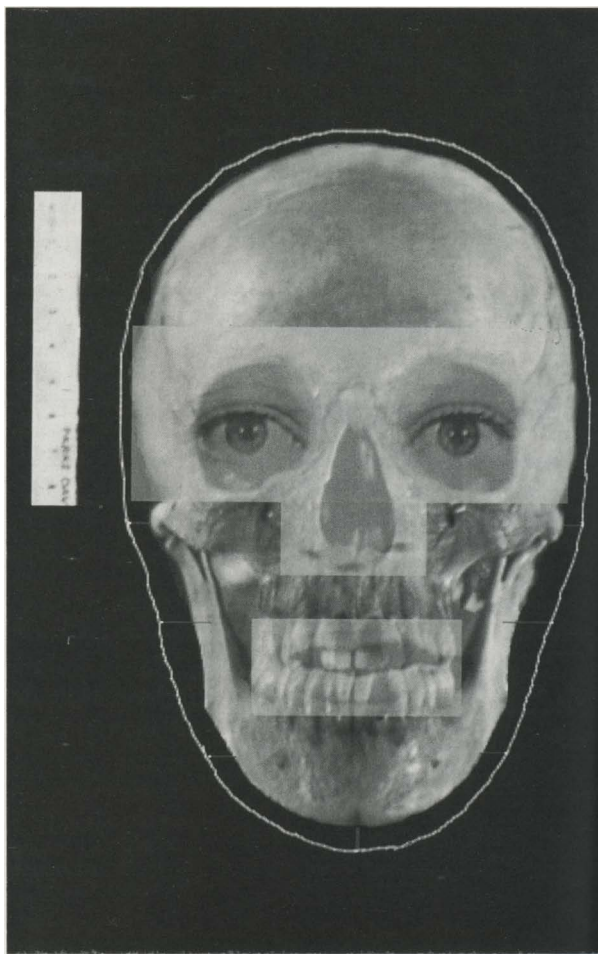

Fig. 2. A partial superimposition of the facial features, in scale, to match control points. Copyright 1989 Peter Voci. Reproduced by permission.

greater global manipulation control of an interactive nature.

The first step was to digitize the skull in a frontal elevation, then to determine the best tissue depth measurement points (Fig. 1). The information in *The Human Skeleton in Forensic Medicine* by Krogman and Iscan [1] gave us the basic facial outline. Additional reference points allowed us to place markers on the image of the skull to facilitate the subsequent layering of the eyes, nose and lips. These components were digitized from the identification kits that were supplied by the police department. To match the individual facial features to the reference points on the skull, image processing software was used. For example, we located and marked the reference points for the eyes. There was no exact match in size or distance apart in the kit, so we used the closest match, but then we reshaped, resized and overlaid the restructured parts in proper placement. The results of these techniques were as close as we could come to a visual description of a specific facial arrangement. The same steps were used to place the other facial components, and before long the whole became greater than the sum of its parts (Fig. 2). An unusual point was reached in this process. There on the screen was a synthesized portrait that had evolved with a cohesion of form that forced us to stop and analyze what seemed to have developed almost automatically. What had been expected to look similar to a police artist's sketch took on a distinctly unique appearance. This was the not-art image crafted to a likeness of a living personage based on skeletal remains.

To complete the image, a skin patch was digitized and recopied to create the opaque facial surface (Fig. 3). Hair was added and color glazes were included throughout in order to better model the image, which took on a portraiture quality. Instead of a black-and-white sketch, we had a color portrait (Fig. 4.).

We Had Our Doubts

With the image completed, we had more questions than when we started. What if different facial features were chosen and fitted to the same skull? Would the results differ to such a degree that the whole project was merely an exercise in randomness? After all, one can simply change one's facial expression and almost change into another character. Use of a computer may have complicated things in a way—it may have allowed us to forget about the subjective burden placed on the forensic sculptor. The computer, like the camera, somehow implants an unmeasured amount of the objective by the very nature of the built-in methodical descriptions that these devices provide.

We also needed to examine the human factors. Was the given forensic information accurate to begin with? Would the image, if distributed, and if it gave a misleading impression, hinder rather than help the prospect of discovering the identity of this person? The general public, after all, would be asked to recognize a particular face. This image, as a portrait, was not as

vague as police sketches, which in fact allow greater latitude by providing fewer visual cues. In addition, if we told the public that a computer had been used in the creation of this image, its credibility might be too firmly fixed, because of the tendency to believe in technological method. If a figurative pencil drawing is shown to someone, a typical question may be, Who is this supposed to be? However, if a photograph of the same subject is shown, the question is then much more direct: Who is this? The photograph and the subject become one and the same on an emotional level.

We needed to devise a test to prove that this technique was worth further commitment. One suggestion was to work from an X ray of the skull of a living person without ever seeing the face during the reconstruction experiment. Only after an image was finished would we compare the result to a photograph of the model. This test would of course have to be repeated a number of times with different models to confirm previous results. Another avenue to explore was that of three-dimensional computer graphics. The Smithsonian Institution in Washington, D.C., has a collection of plaster death masks along with a collection of matching skulls. If a three-dimensional database were created of the measurements of each mask and matching skull, we could extract the differences between them. With a large enough number of models, perhaps a face-generating program could be developed to display a facial match for any new digitized skull. An automated process such as this might help in a wide variety of cases where the leads are few.

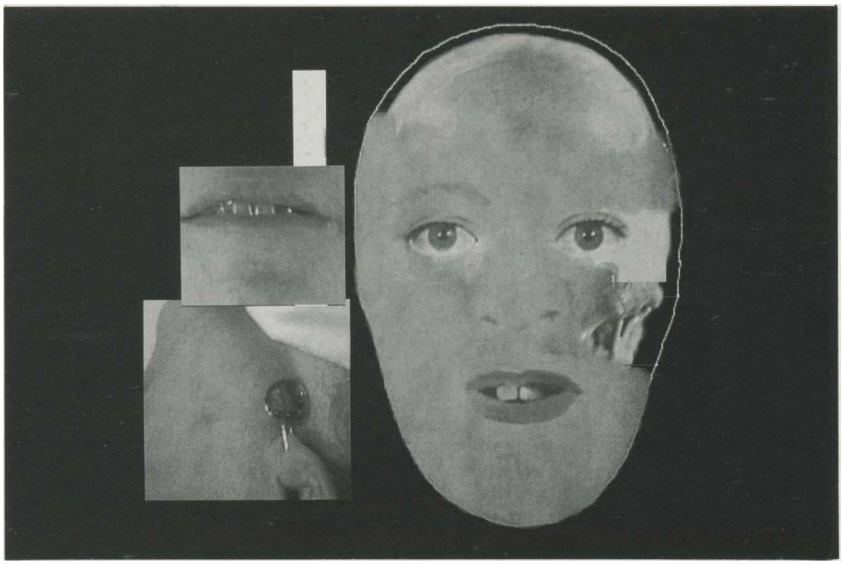

Fig. 3. Digitized skin patch references, with recopying in progress, to create the opaque facial surface. Copyright 1989 Peter Voci. Reproduced by permission.

Fig. 4. The image as a portrait.

Art and Craft

Throughout each step of this project, it was necessary for us to be particularly aware of the distinction between art and craft. Although artistic skills were employed in the development of these images, there was an unexpressed understanding from the start to adhere to a rigorous 'not-art' approach. Purely aesthetic concerns had to be suppressed. The antithesis of design seemed to be required, since each facial component had only one possible location on the array of reference points.

Naturally we wondered just how scientific our methods were. Even though our target image appeared to be remote and almost transparent, paradoxically it was relatively close to the structure of the skull itself. This was similar to the pure contour drawing exercise introduced by Kimon Nicolaides in *The Natural Way to Draw* [2] and reinforced by Betty Edwards in *Drawing on the Right Side of the Brain* [3]. Here one tries to capture the image of a model without looking at the sketch pad until the drawing is completed. One would not always expect an accurate rendering as the result of this method. In fact, the drawing may say more about the person who made it than about the subject.

It is an accomplishment just to render a model accurately, even with continuous study; it is certainly a much greater challenge to construct an accurate facial rendering from only the skeletal structure. Here the artist cannot express his or her own experiences but must work within the parameters of the craftsperson as imaging specialist. Future identification work, whether based on digital information, optical methods or even some genetic data, may develop to a point where conclusions can be arrived at with a high degree of probability. Practical applications would soon follow.

One of Us

As questions kept arising, we documented our work with a series of notes, slides and thermal prints. Investigators from the New York State Police Department visited my laboratory to view the superimposition process and see the final image. The investigators asked whether the image could be altered in

several ways. Their information and reference materials from the discovery site required subtle but important changes. Using digital technology allows modifications without much difficulty in most cases. Some of the suggested modifications included altering the hairline as well as the hair style and color. We also made a version of the image showing this person in poor health as a result of drug-taking.

As we continued to redefine the image, we felt hopeful of a good result. At one point an investigator on another case thought he recognized the image as that of a certain missing person with a conviction record. After a fingerprint check, however, it was determined that she was not the dead woman.

This woman is, unfortunately, still unidentified. She may of course be identified in the future. If and when that comes about, perhaps we will know how valid our efforts have been. Until that time, we will look at this image as an icon, a not-art digital image that symbolically might represent any one of us.

References

1. Wilton Marion Krogman and Mehmet Yasar Iscan, *The Human Skeleton in Forensic Medicine*, 2nd Ed. (Springfield, IL: Charles C. Thomas, 1986).

2. Kimon Nicolaides, *The Natural Way to Draw* (Boston, MA: Houghton Mifflin, 1941).

3. Betty Edwards, *Drawing on the Right Side of the Brain* (Los Angeles, CA: J. P. Tarcher, 1979).