

Graphic Skull-Based Reconstruction of Faces

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1 Rules for drawing the facial features based on the skull

These **simplified rules** apply for normal-weight people, of whose skull a **photo in frontal view** exists ([1], [2], [3]). For overly thick or thin people, the rules must be adjusted accordingly.

1. The **scalp** stretches at a constant distance to the outer contour of the skull, only in the area of the chin, it is only half as thick as usual.
2. The **ears** start with the top edge at the level of the *suture* on the outer eye socket (at the *Processus Frontosphenoidalis* between *Os Zygomaticum* and *Os Frontale*) and end below in the area of the *temporo-mandibular* joint. Their distance from the head is again the thickness of the scalp.
3. The **eyebrow** follow the bead of the bone just above the eye socket, the indentations of the eyebrow.
4. The **eyes** start at the centers of the outer and inner curve of the eye socket and have an almond shape. The center of the pupil is located right in the middle of the eye socket, the pupil itself has the diameter of the width of the shape of the eyes. The **upper eyelids** arch above the eye shape with a thickness that corresponds to the radius of the pupil.
5. The **nose** is limited laterally by the width of the nasal opening of the skull. The **nostrils** are located just below the bottom of the nose opening. The **nose wings** extend the nose edge around the nostrils.
6. The **mouth** is drawn as follows: start the **corners** of the mouth at the last visible *molar* tooth. The **lip closure** follows the shape of the bite. Upper and lower edge of the **lips** follow the teeth as they grow out of the jaw bone.
7. Between the front incisors the **upper lip** has a notch, whose width is determined by the tip of the upper jaw bone and the distance between the front incisors.
8. **Scars** and **bumps** on the skull can indicate folds and growths on the skin.

The facial features of the deceased can be presented by means of these rules. But they do not give evidence of hair, even less on hairstyle, beard cut or even jewelry.

2 Application of the Rules

This section shows how to apply the rules step by step. First we choose the appropriate **frontal view** of the skull:



Figure 1: Skull from a medical book

Next we reduce the colors to **16 Grey Scales** to make it easier to draw and remove colors:

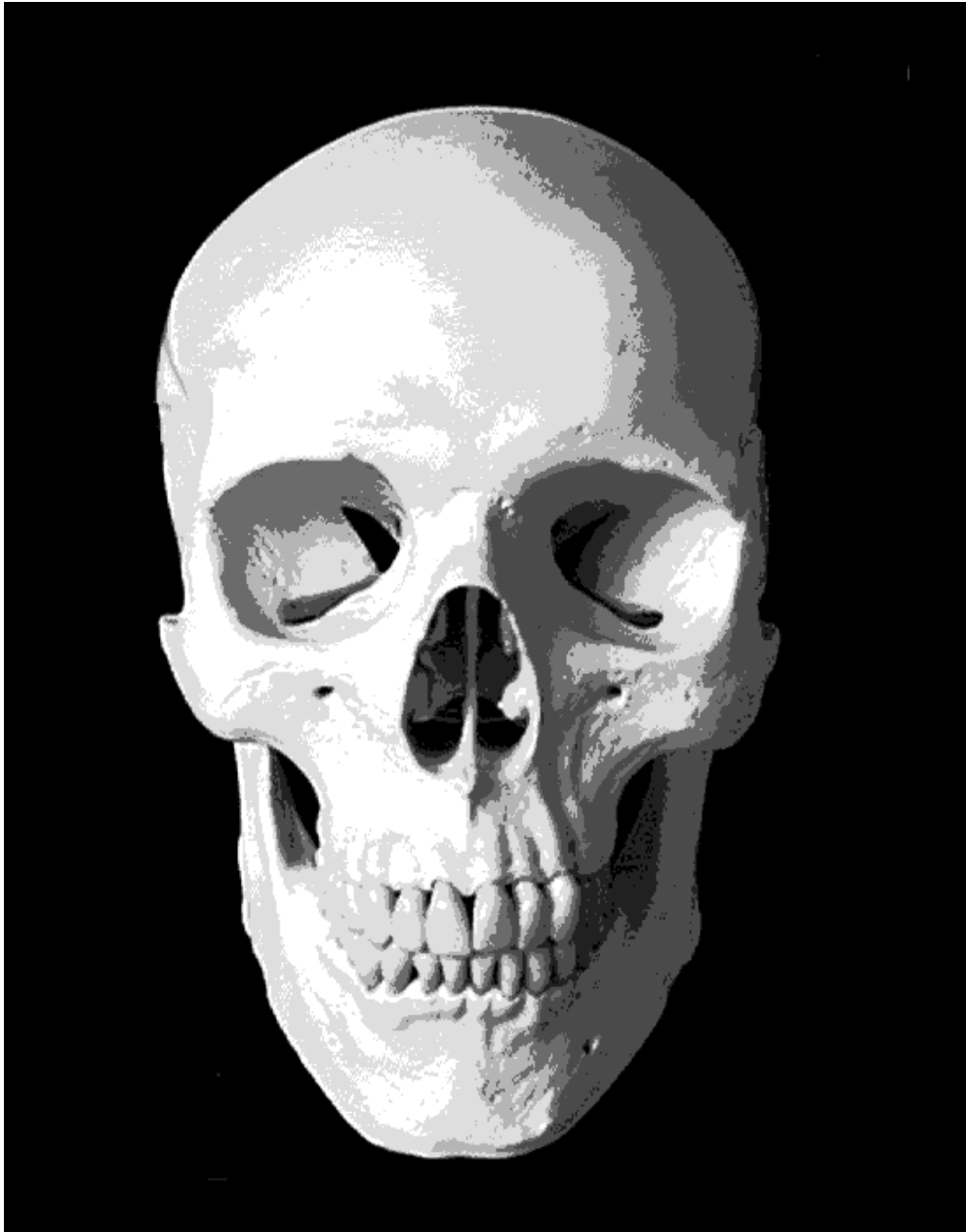


Figure 2: Image of skull with reduced colors.

According to **Rule 1** we draw the scalp (red line) and the skin around the chin (orange line):



Figure 3: Contour lines of the head.

The ears are drawn by applying **Rule 2**:



Figure 4: Drawing the ears.

The eyebrows follow according to **Rule 3**:



Figure 5: The eyebrows.

We insert the eyes according to **Rule 4**:

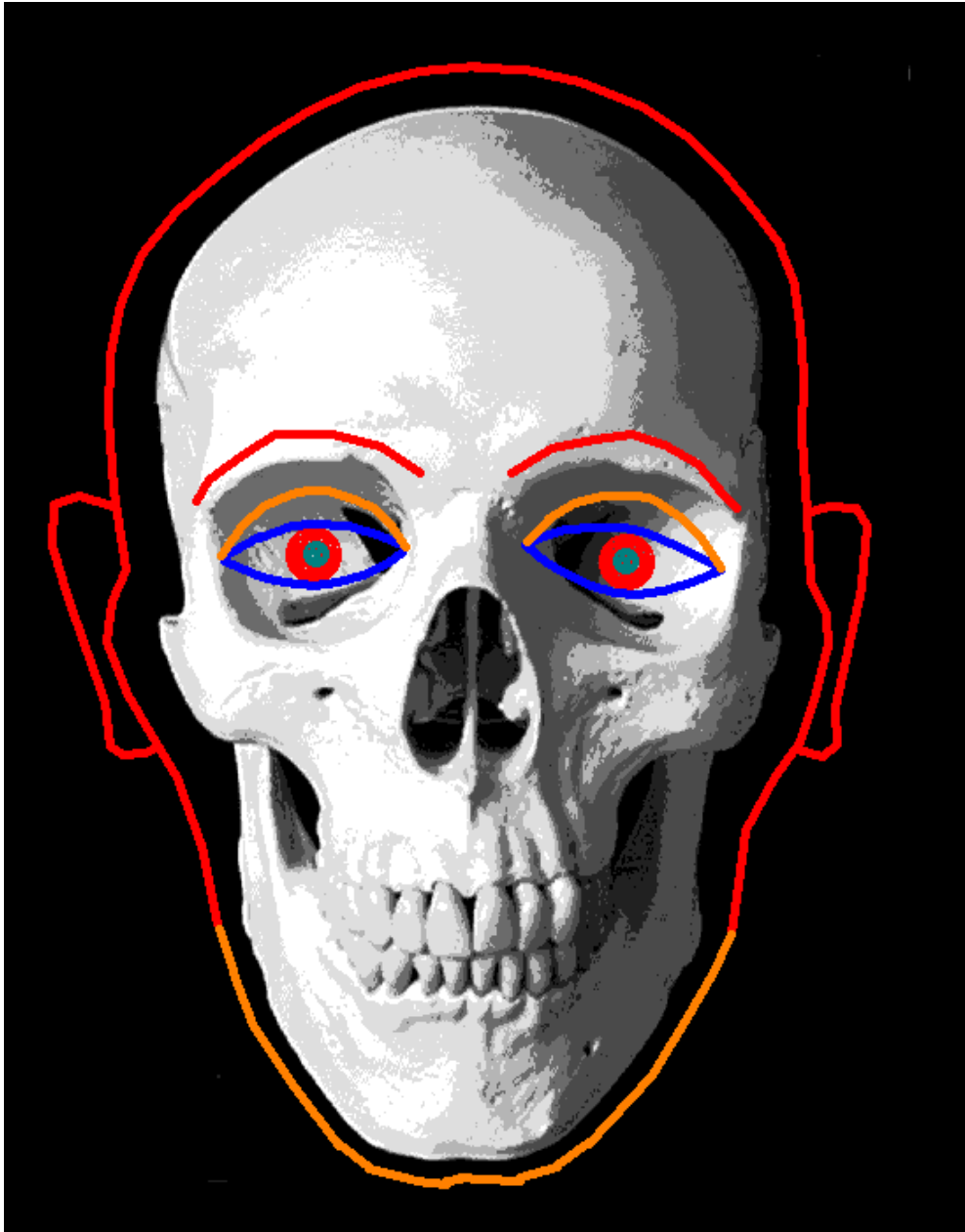


Figure 6: Drawing the eyes.

The contours of the nose follow the nose hole according to **Rule 5**:

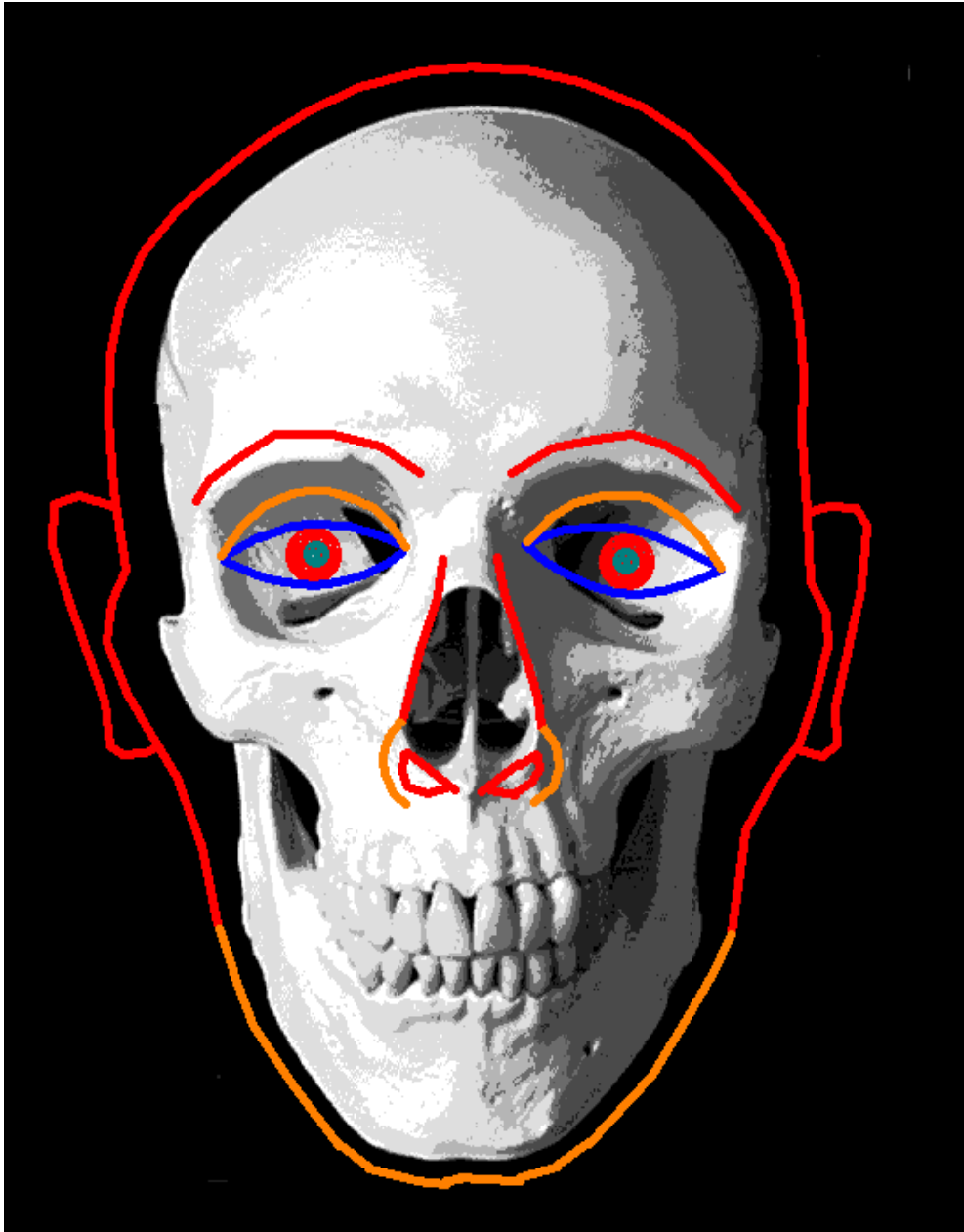


Figure 7: The nose.

Rule 6 gives us hints how to draw the mouth:

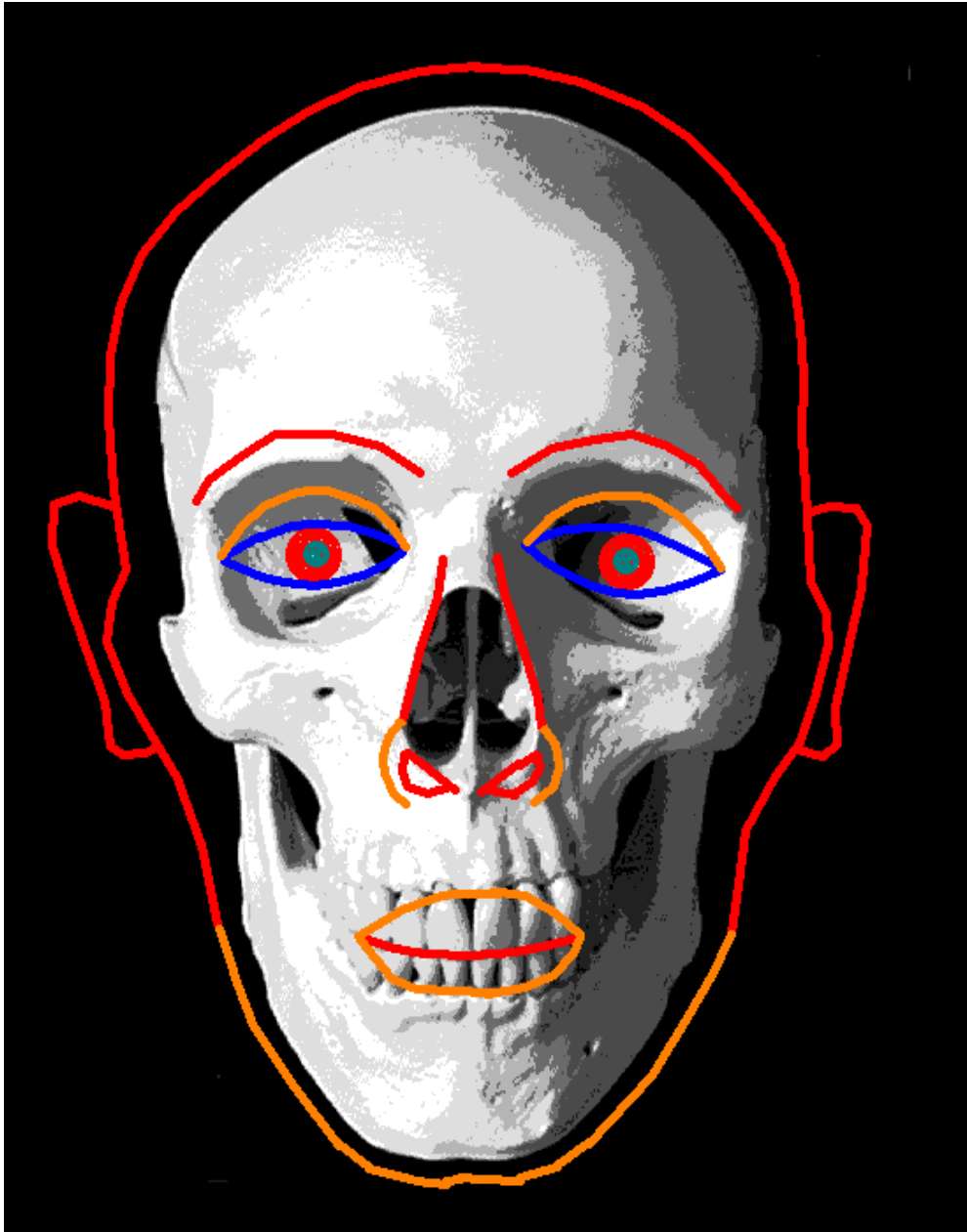


Figure 8: Drawing the mouth.

The shape of the upper lip is given by **Rule 7**:

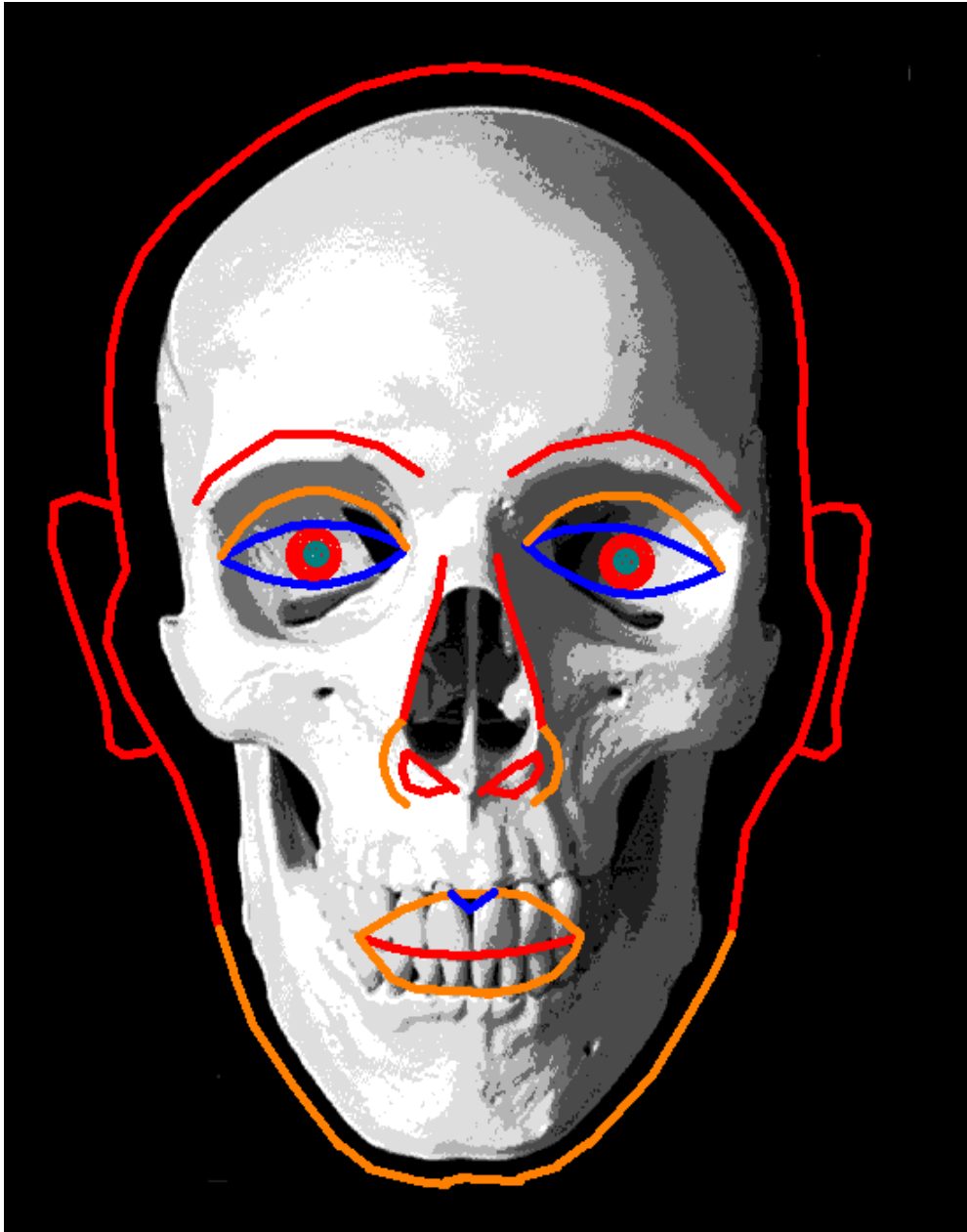


Figure 9: Shaping the upper lip.

Facial features like scars or folds are added according to **Rule 8** (dark green lines). With this, the raw reconstruction of the face is finished:

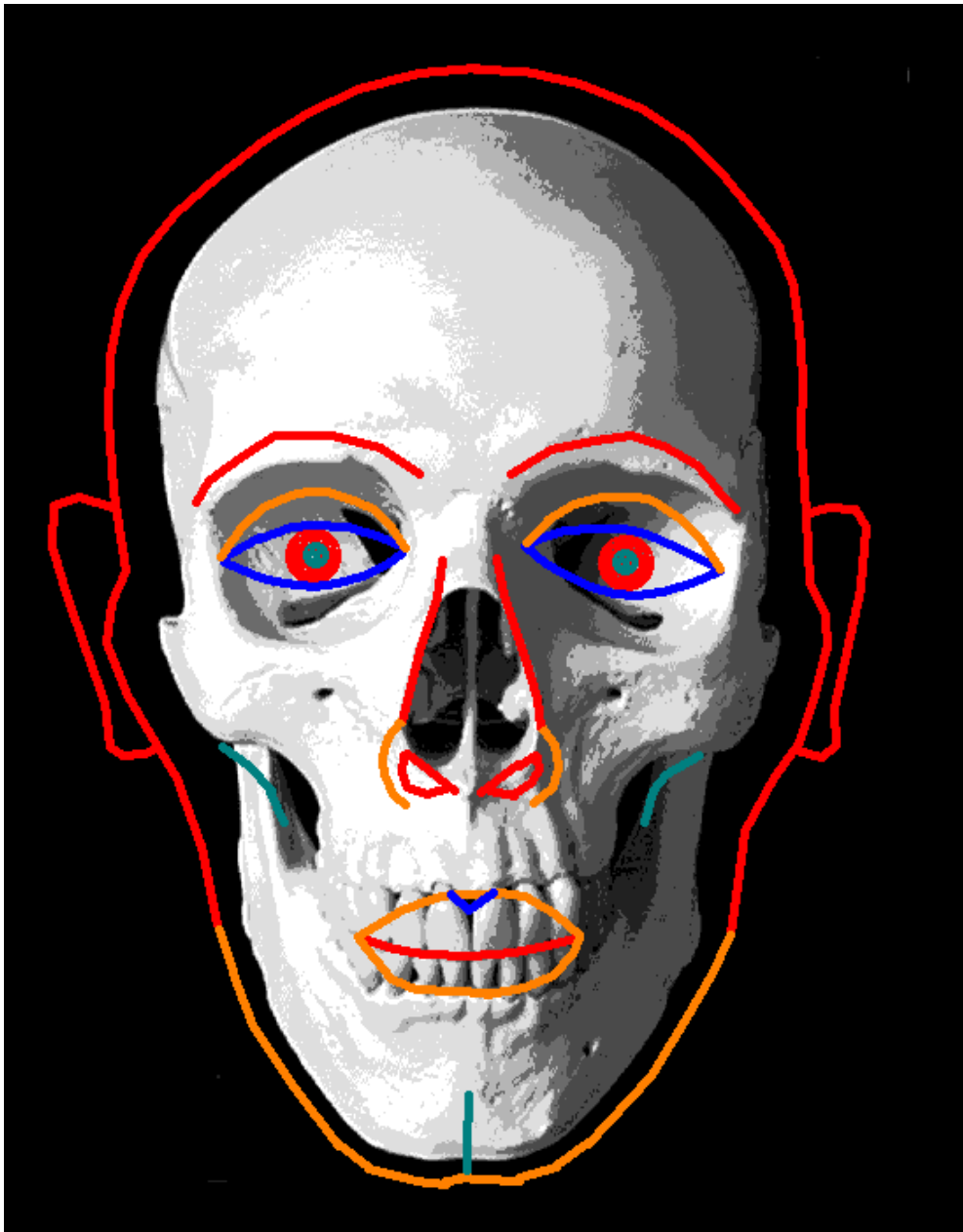


Figure 10: Adding folds and scars.

To get a better view, all the black and grey colors are removed:

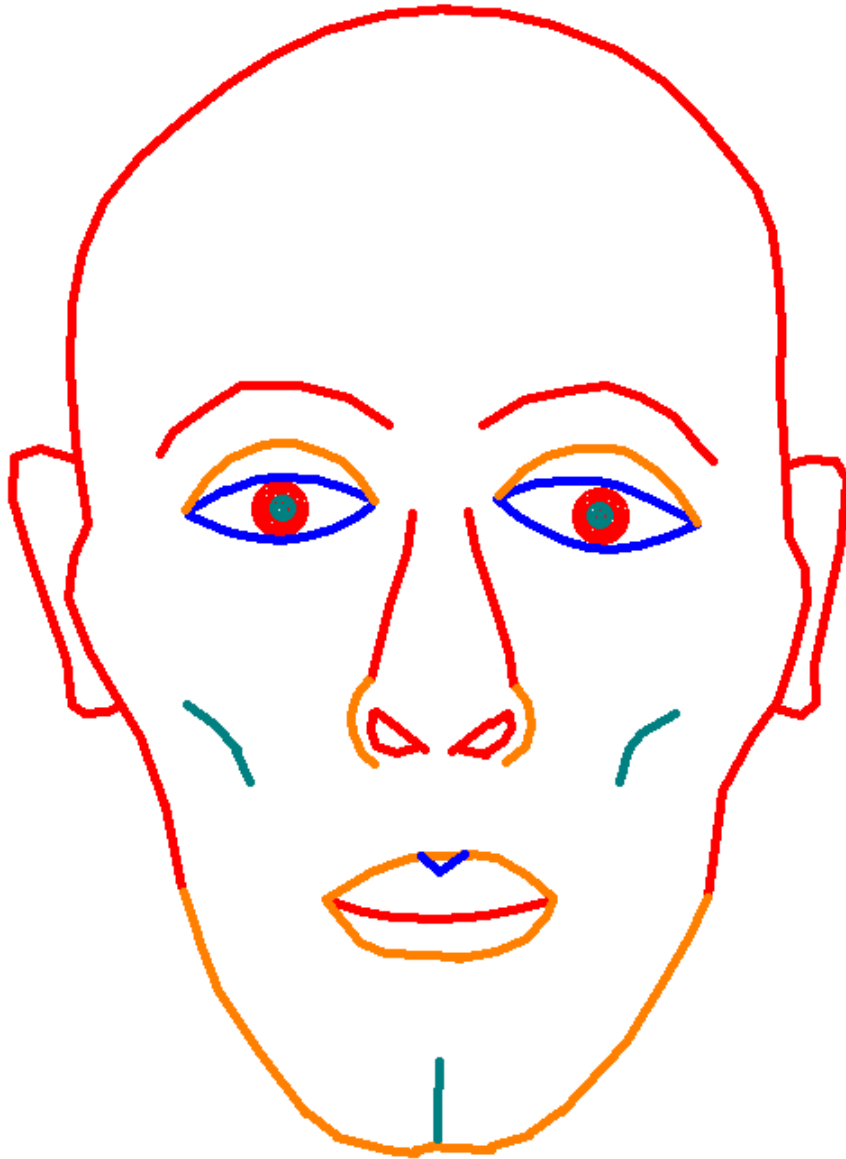


Figure 11: The raw portrait.

Corrections are made if necessary. Here around the eyes and the lips:

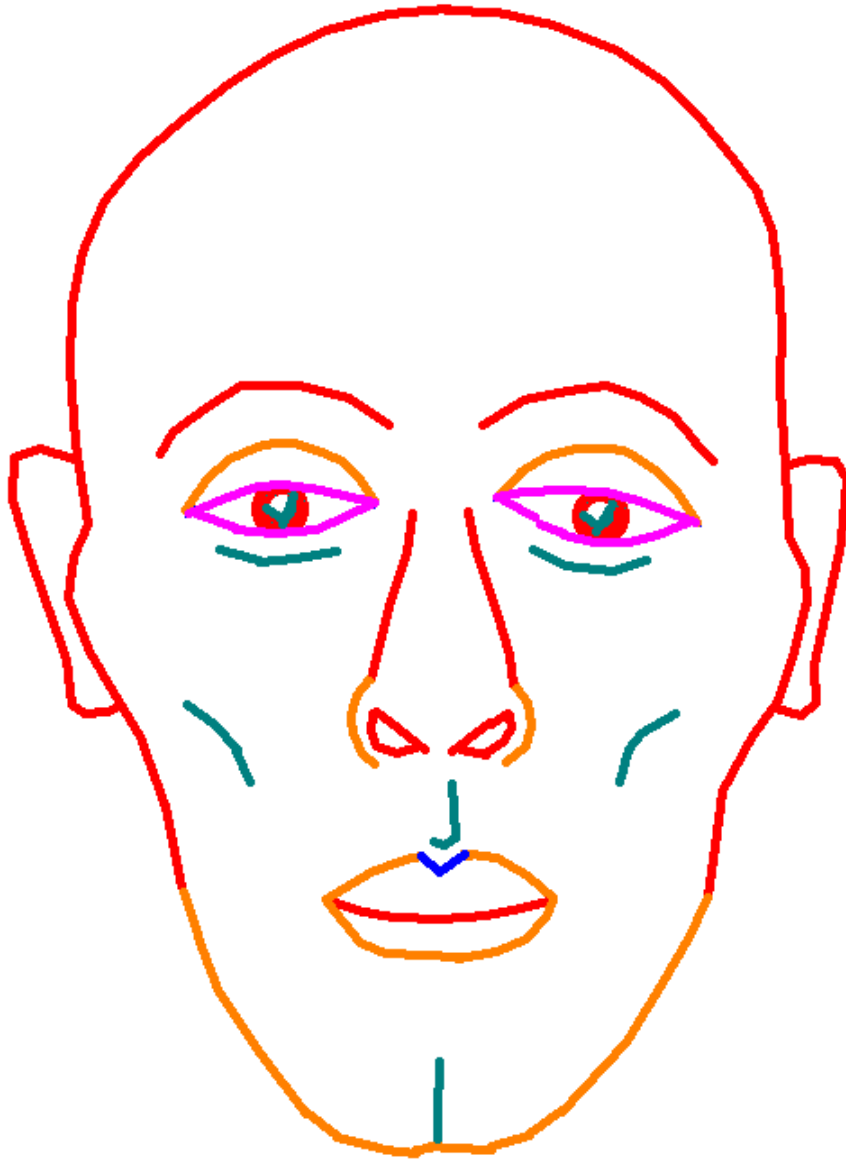


Figure 12: Corrections.

All colors are reduced to black, so we have finally the face reconstructed exclusively upon the features of the skull.

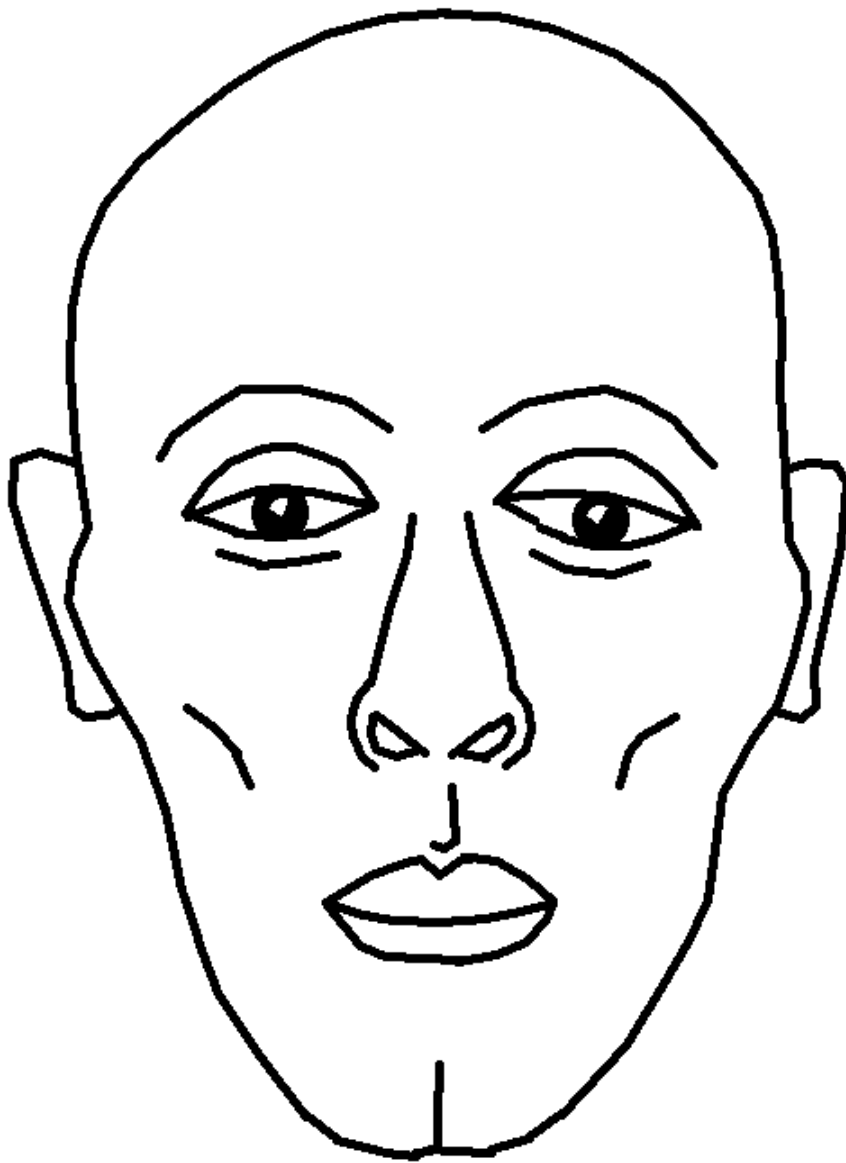


Figure 13: Finished portrait.

Accessories are based on other information or pure speculation like in our example here with the haircut:



Figure 14: Enhancing the picture.

If the additional information is correct, this would be a recognizable portrait of the dead person:



Figure 15: Final display.

3 Sources

References

- [1] Michail Michailowitsch Gerassimow: Ich suchte Gesichter. Schädel erhalten ihr Antlitz zurück. C. Bertelsmann Verlag, Gütersloh 1968.
- [2] 2D_facial_reconstruction.jpg,
Internet 2013
- [3] Lisa G. Bailey: Tissue Depth Guide for Facial Approximation, www.askaforensicartist.com,
Internet 2013