A Reconstitution of the Face of the French Bayard Knight (1473?-1524) Based on DNA Analyses and on Informatics Study of his Official Portrait

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Abstract : We report here results concerning the reconstitution of the face of Bayard (1473?-1524), a famous French knight. This reconstitution was based on six main characteristics of his cranium : (brachygnathy, elevated height of the mandibular corpus, non protruding and squared osseous chin, lepteny, long nose with a bump, and deviation to the right of the nose point), on results of DNA studies (concerning skin, eyes and hair colours and his susceptibility to baldness), and on informatics treatment of his official (of Gariel) portrait.

Keywords: Bayard Knight, Reconstitution of His Face, Anatomic Characteristics of His Face, DNA Studies, Informatics Treatment of His Portrait, Facegen Programme

1. Introduction

The Bayard knight (1473?-1524) is well-known in French history as "Le chevalier sans peur et sans reproche". He is unanimously considered as the last true knight in shining armour, the last flower of the late Middle Ages, and the epitome of chivalry before the modern world took over [1].

Bayard's cranium as at present kept in the Dauphiné Museum of Grenoble. We have reconstituted the whole Bayard cranium from his upper, lateral and posterior parts, his mandible and most of his osseous facial part. Detailed examination of the reconstituted cranium establishes that it is the skull of a Caucasian male, aged from 45 to 50 years. There are six main characteristics of the Bayard cranium [2] : brachygnathy ; elevated height of the mandibular corpus ; a non protruding and squared osseous chin ; lepteny ; a long nose with a bump ; a deviation to the right of the nose joint. All these six characteristics are effectively observed on the face of the official Bayard drawing.

In the present study we found by DNA study the skin, eyes and hair colours of Bayard and his genetic susceptibility to baldness. We complete the reconstitution of the Bayard face by a detailed informatics study based on his portrait.

2. Material and Methods

The genomic DNA used is that extracted (about 100 µg in total) from the first molar located at the left side of the mandible (the tooth number 36), which permits previously the study of the mitochondrial DNA and the Y-chromosome profile of the Bayard knight [3].

For the genetic basis of the skin colour , we have studied [4] the F374L polymorphism of the Membrane Associated Protein (MATP) gene. Regarding to the 374F variant, which predispose to a white colour of the skin, individuals tested can be genotyped as FF homozygous (two doses of the F allele) or FL heterozygous (one dose of the F allele).

For the genetic basis of the eye colour, we have studied [5] the rs12913832 polymorphism located 21.1 kb upstream of the OCA2 first exon, in intron 86 of the HEC domain of the RLD2 (HERC2) gene. Regarding for the C variant, which predispose to a blue or green colour of the eye, by contrast TT carriers had a 80 % probability of being brown eyed.

For the genetic basis of the hair colour (and that of the skin and the eyes) is generally used the kit IrisPlex [6], which is based on the determination of alleles at twenty-four genes. We concentrate here only on the study of the rs16891982 variant of the SLC45A2 gene.

For androgenic alopecia, we have studied [7] the rs1160312 polymorphism A/G located in the proximity to the AR (androgen receptor) located on chromosome twenty. The rs1160312 [A] allele is associated with an increased risk of androgenic alopecia in the Twins UK cohort, and in men in Icelandic and Dutch cohorts.

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The three-colours portraits used for the reconstruction of Bayard's face is an accurate reproduction – scanned from a Xerox Multifunction Prontes.pdf – of the portrait of Gariel, located in the Dauphinois Museum of Grenoble (France). It is stuck up on a cardboard with a gilded border (dimensions : 40 cm x 27.5 cm). The key indicates "Le Chevalier Bayart", and the signature "JMD". **Figure 1** shows this reproduction.

This drawing was treated by an ameliorated version [**8**] of the FaceGen programme.

3. Results
3.1. DNA studies.
Our first assay on the genomic DNA of Bayard establishes that he is homozygous FF for the F374L polymorphism of the MATP gene ; so not only he had the F allele, but he also contains double dose of that allele for the white skin. Consequently the skin colour (and that of the face) must be pale.

Our second assay establishes that this genomic DNA is homozygous TT for the rs12913832 polymorphism of the HERC2 gene. So Bayard had 80 % probability of being brown (or dark) eyed.

Our third assay on the rs16891982 establishes that the genomic DNA of Bayard is homozygote GG. Consequently he had certainly not brown hair, contrarily with the commonly observed association between black eyes and brown hair.

The Bayard genomic DNA is homozygous AA for the rs1160312 polymorphism. That establishes that Bayard had the susceptibility gene to male-pattern baldness.

3.2 : Studies on the reconstruction of the face.
3.2.1. A first reconstruction.
The drawing was first digtalised ; in black and white, to avoid interference effects with the skin colour of the face (**Figure 2**). On the digitalised face are taken the eleven classical positions points : 1 and 2 : centers of the eyes ; 3 and 4 : two external points of the zygomatic archs ; 5 and 6 : external borders of the nostrils ; 7 and 8 : corners of the lips ; 9 and 10 : the two external points of the chin ; 11 : the most inferior point of the chin border (**Figure 3**).

Figure 4, which summarizes qualitative results obtained by the FaceGen programme of this first reconstruction, shows numerous abnormalities :
- The race is not given ;
- The asymmetry of the face is very important ;
- It results a caricatural aspect of the face (in shape), even monstrous in texture ;

- The age is very young (in shape), and of about 42 years in texture ;
- The gender is masculine (in shape), but feminine in texture.

Figure 5 gives the first reconstructed image of the face. It is effectively monstrous ; only the right hemi-face is correctly represented. This monstrous aspect is mainly resulting from asymmetry of the left hemi-face compared to the right one, and also for the non-alignment of the bridge axis of the nose with that of the lower part of the face. Eyes are blue.

Lepteny and the shape of the chin are in accordance to that we can see on the cranium.

3.2.2. A normalized face.
To compensate the asymmetry, seven supplementary points are taken on the digitalised face (**Figure 6**) : one at the basis of the nose ; another in the middle part of its bridge ; another one at its top ; one at the partition of the nose ; two in the superior and the inferior parts in the middle of the lips ; one at the point of the chin. To obtain a better balance of the right hemi-face, two supplementary points are also taken : one at the right corner of the eyelid of the right eye, and another at the external limit of the mandible, located at the horizontal level of the right corner of the lip.

It is possible to normalize the reconstruction face, as function of that it was already known concerning the Bayard knight. **Figure 7** shows the new FaceGen values, modified (by moving cursors values) :
- The race is European ;
- Assymetry is in the standard ;
- The caricature is typical ;
- Age is of about 50 years ;
- Gender is male.

The normalized aspect of the face according to these corrections is more accurate (**Figure 8**) , but the length of the face is somehow reduced. One interest of representation is that it shows a clear deviation of the nose point towards the left [**2**].

Figure 9 shows the ¾ right profile of the normalized face ; the aspect of the chin, brachygnathy and the elevated height of the mandible are well accurate. **Figure 10** shows the right profile of the normalized face, where the bump of the nose is clearly visible.

3.2.3 A biologized face.
Concerning the biologization of the face, we understand the incorporation in the normalized face of the new datas established here by DNA analysis : the pale colour of the skin ; the dark colour of the

eyes ; and the chestnut colour of the hairs (and of the wig, because of baldness).

Figure 11 shows a first version of the biologized face based on the previous normalized one. The chin form is straight, as the slight deviation the nose point (but the nose is somehow shortened) ; lepteny is respected, but the face is not so long (as its normalized shape). Skin is pale and eyes are dark. Because of baldness, hairs are not represented. A chestnut wig covering this first biologized face is represented in **Figure 12.**

We propose finally a second, and definitive version of a more elongated biologized face ; in this version, the nose (rectified in orientation), is also longer than that of the first version. **Figure 13** shows such a face, elongated and with a rectified nose. Its biologized form appears on **Figure 14**, where the skin is pale and the eyes are brown. **Figure 15** shows the chestnut wig covering the face.

4. Discussion and conclusions

Our results concerning the colour of the skin from DNA studies establish that the face of the Bayard knight was pale. That confirms the observations of the first Bayard biographs : Jacques de Mailles (the author of the "Loyal Serviteur") said that "he was pale" ; Symphorien Champier (Bayard's cousin) said that he was "of white skin" ; Aymard du Rivail said that he had "…a pale face".

We establish that Bayard was dark eyed. That confirms the S. Champier that said that he had "the eyes brown and bright".

Our results show that Bayard hairs were not brown. We have not any descriptions of the first biographs on this subject. The painting said "d'Huriage" [**9**] represents Bayard with brown hairs, but it can be with a wig ; he is also again represented in the two other paintings said "de Bauregard" and "de la Mure".

We think that Bayard was with blond hairs when he was young, and that his hairs were chestnut with age. In the Gariel portrait, the hair appears as blond (with white locks). Claude Expilly, who published in 1650 an history of the knight Bayard [**10**], said that "he had a wig of chestnut hair, of the hair colour that he had naturally".

We establish that Bayard had an increased susceptibility for baldness, that is likely because he is frequently represented with a wig on his paintings.

We have previously shown that the six main characteristics of the Bayard cranium are effectively observed on the face of the Gariel portrait [**2**]. We relate in the present article the several successive informatics studies undertaken with the goal to obtain a better reconstitution of the Bayard face based on this drawing.

The main difficulty encountered is due to the fact that the face of the Gariel portrait is represented on a ¾ right profile position, that causes in our first reconstruction a noteworthy exaggeration of the natural asymmetry of the face. This feature was corrected by taking several median supplementary points of analysis, and two other lateral points to equilibrate the right hemiface. A second facial reconstruction, "the normalized face", was then obtained, by modification (by moving the cursors of the analysis for the corresponding features) the datas concerning the reality of the Bayard appearance about his race, the normal asymmetry of his face, his age and his male gender.

Our third facial reconstruction, "the biologized face", was realized by incorporating in the normalized one our results of DNA analyses concerning the colours of the face and eyes of Bayard, and also his baldness that caused the wearable of a wig of the same colour than that of his original hairs. Because the nose is too shortened in our first version of the biologized face, we finally propose a second version of the biologized face (figure 15), where the nose and also the face are longer. We think that this second biologized version (depicted on figures 14 and 15) constitutes the better we obtain representing the reconstitution of the Bayard face.

References

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Figure 1 : The Gariel drawing of Bayard
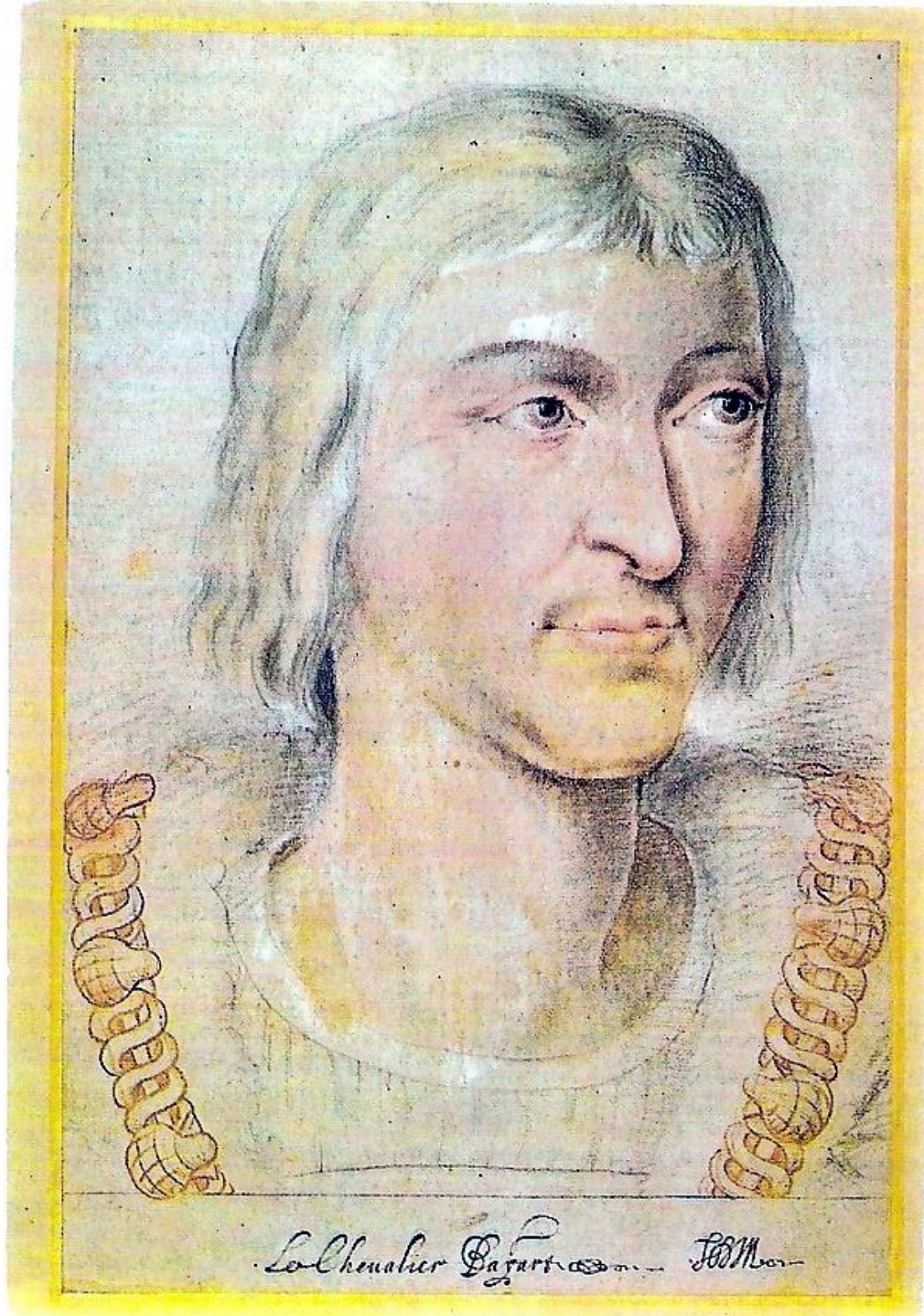
Figure 2 : Digitilisation (in black and white) of the drawing.

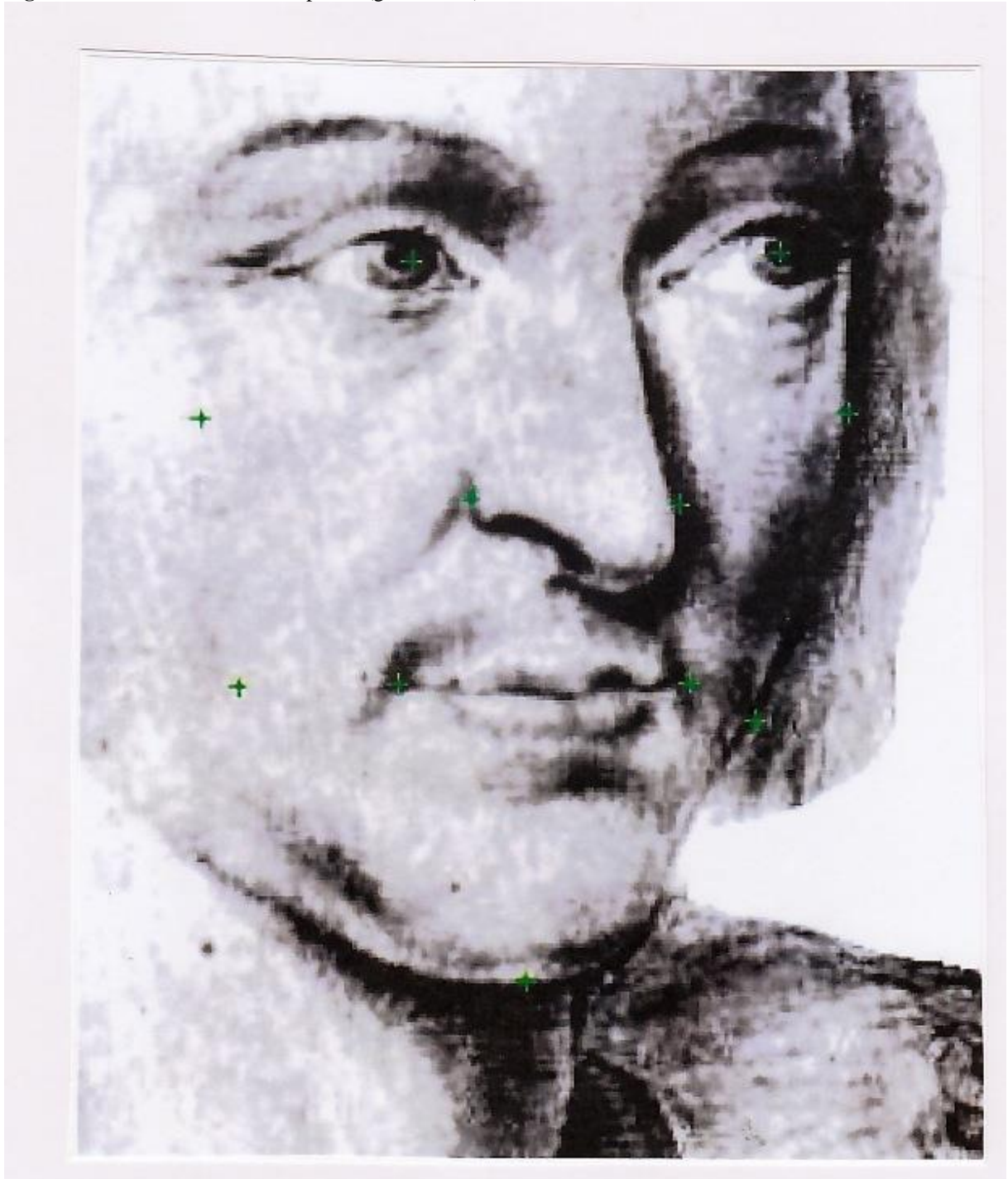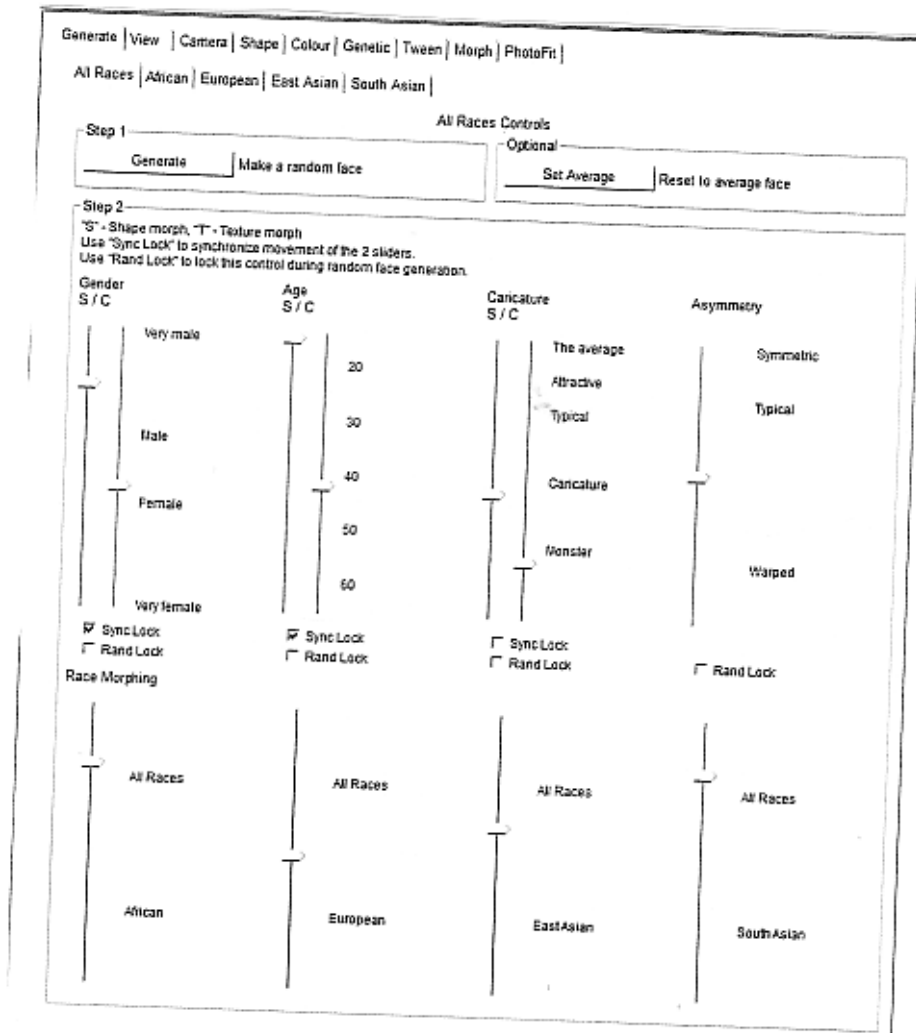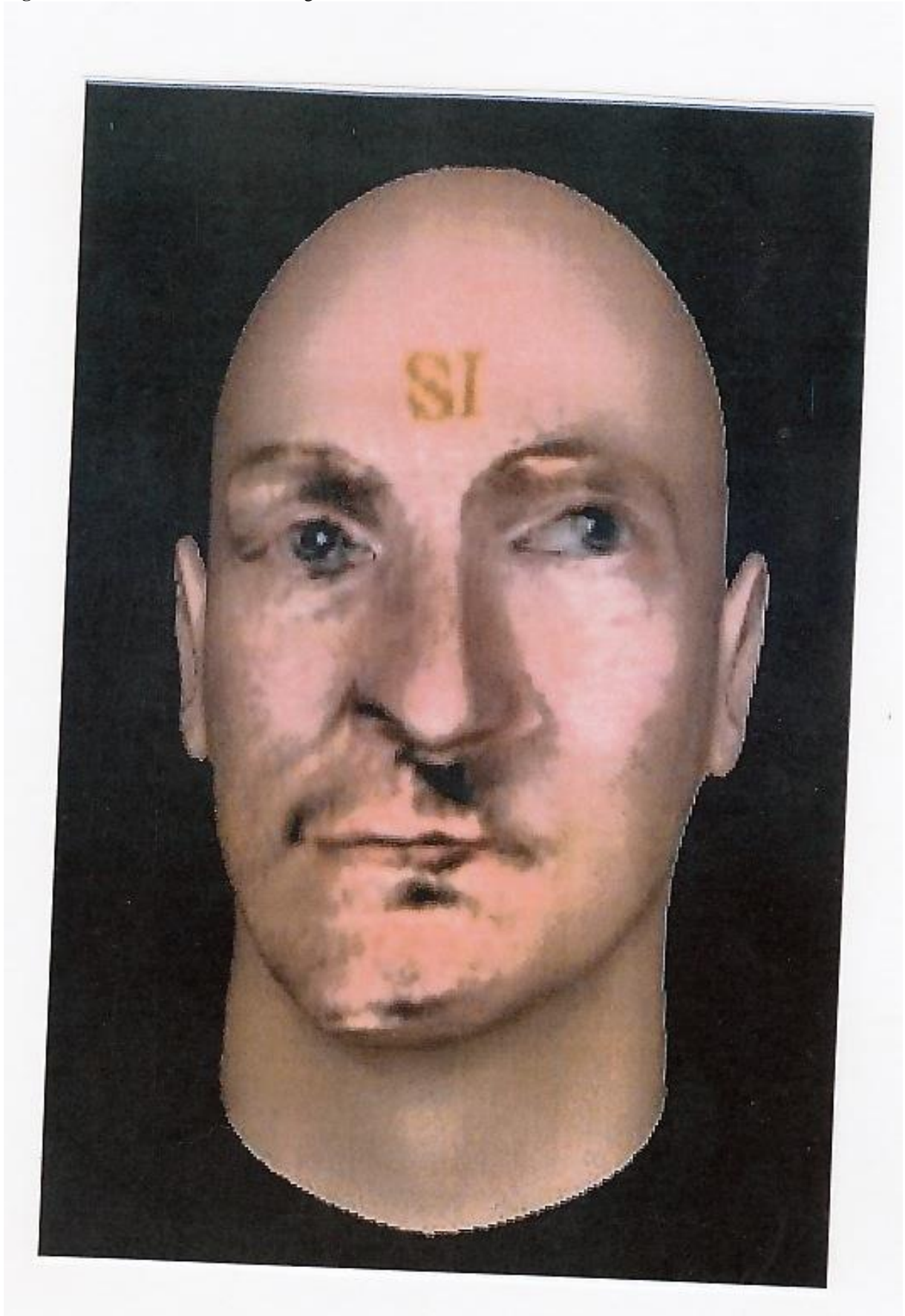**Figure 3** : Positions of the eleven points (green cross).

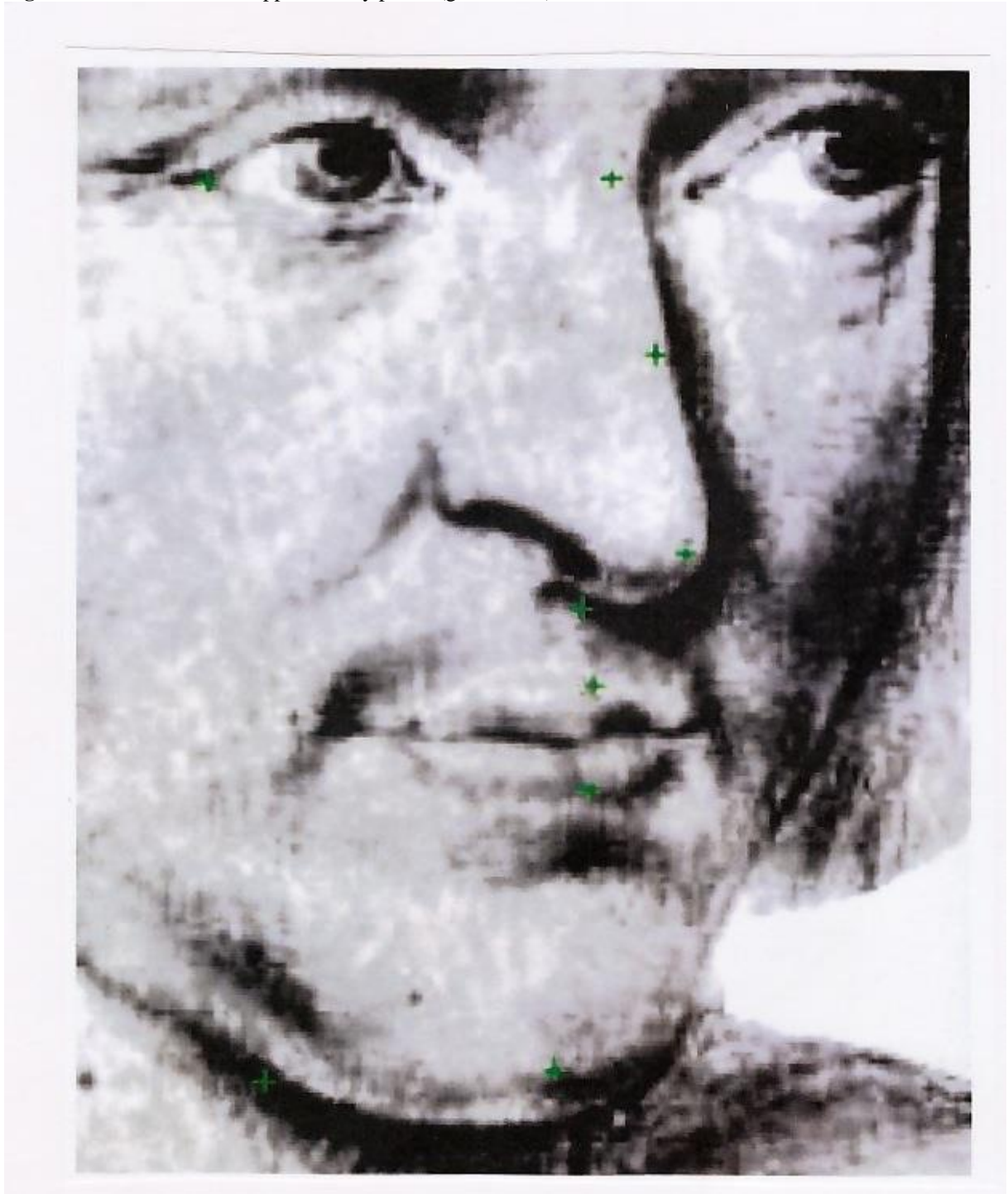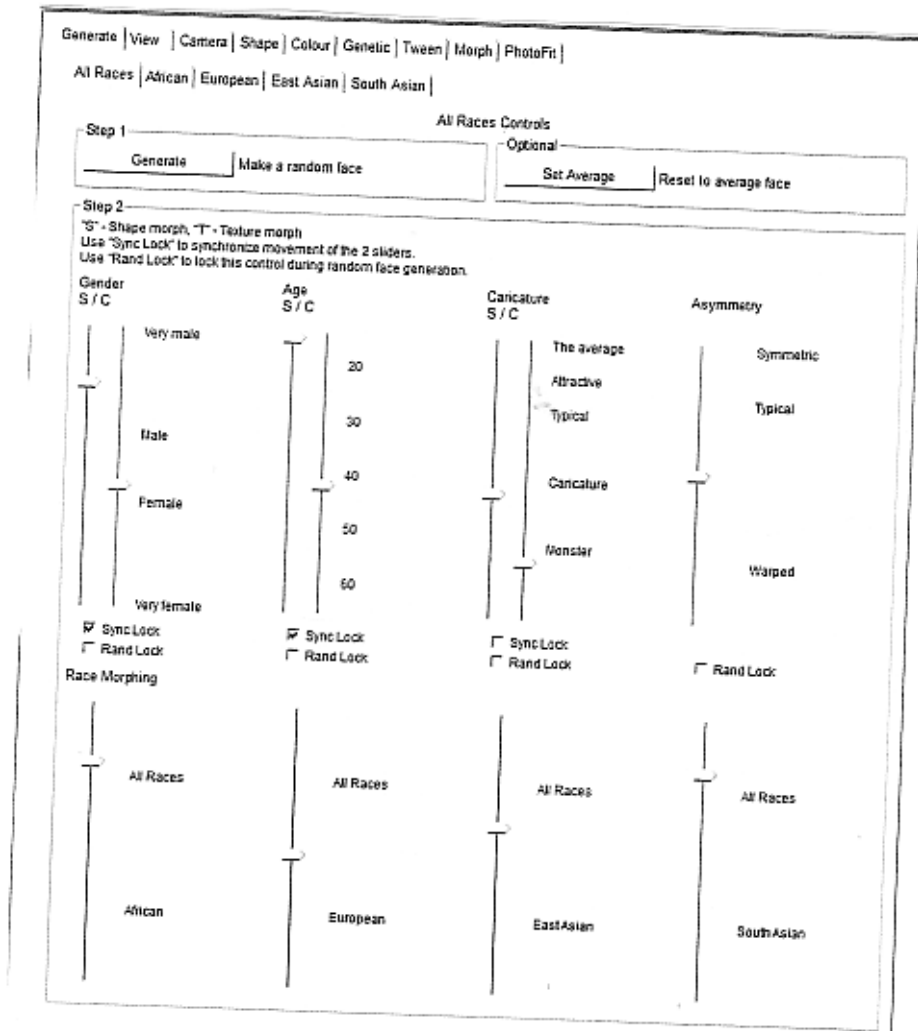**Figure 4** : Qualitative results obtained for the first reconstruction.

Figure 5 : The first reconstructed image of the face.

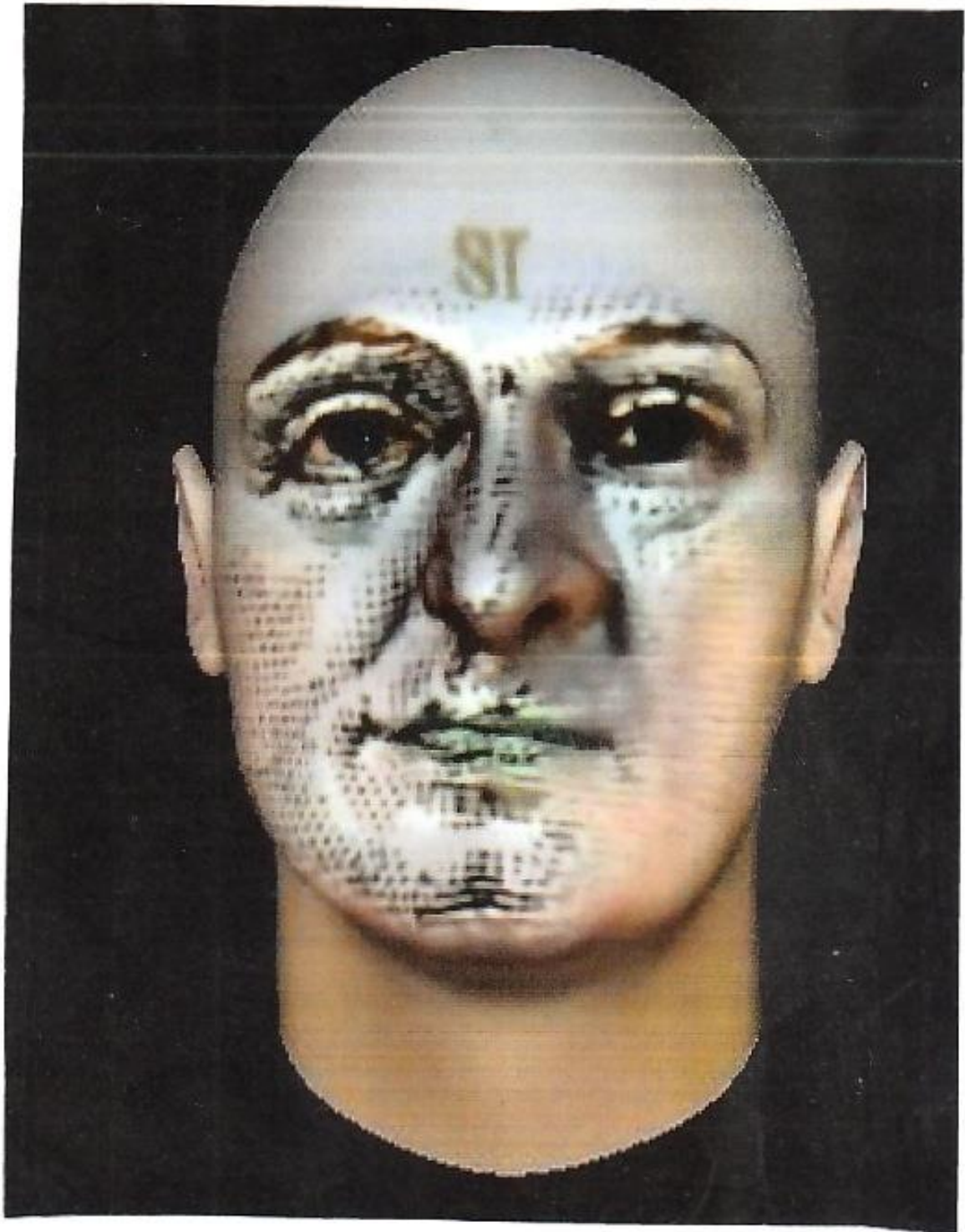**Figure 6** : Positions of the supplementary points (green cross).

Figure 7 : Modified values (race, asymmetry, caricature, age and gender) of the qualitative values of the FaceGen first results.
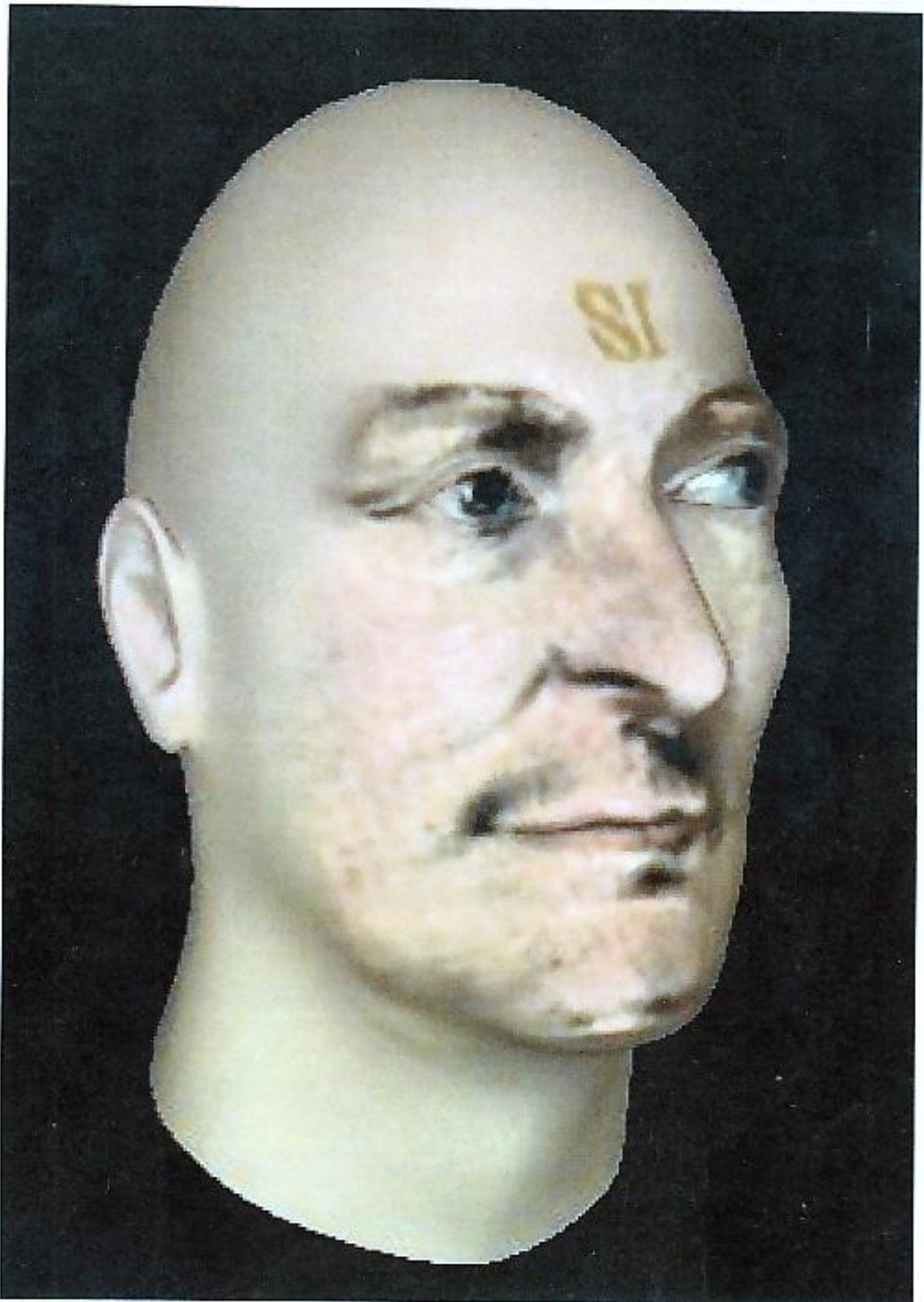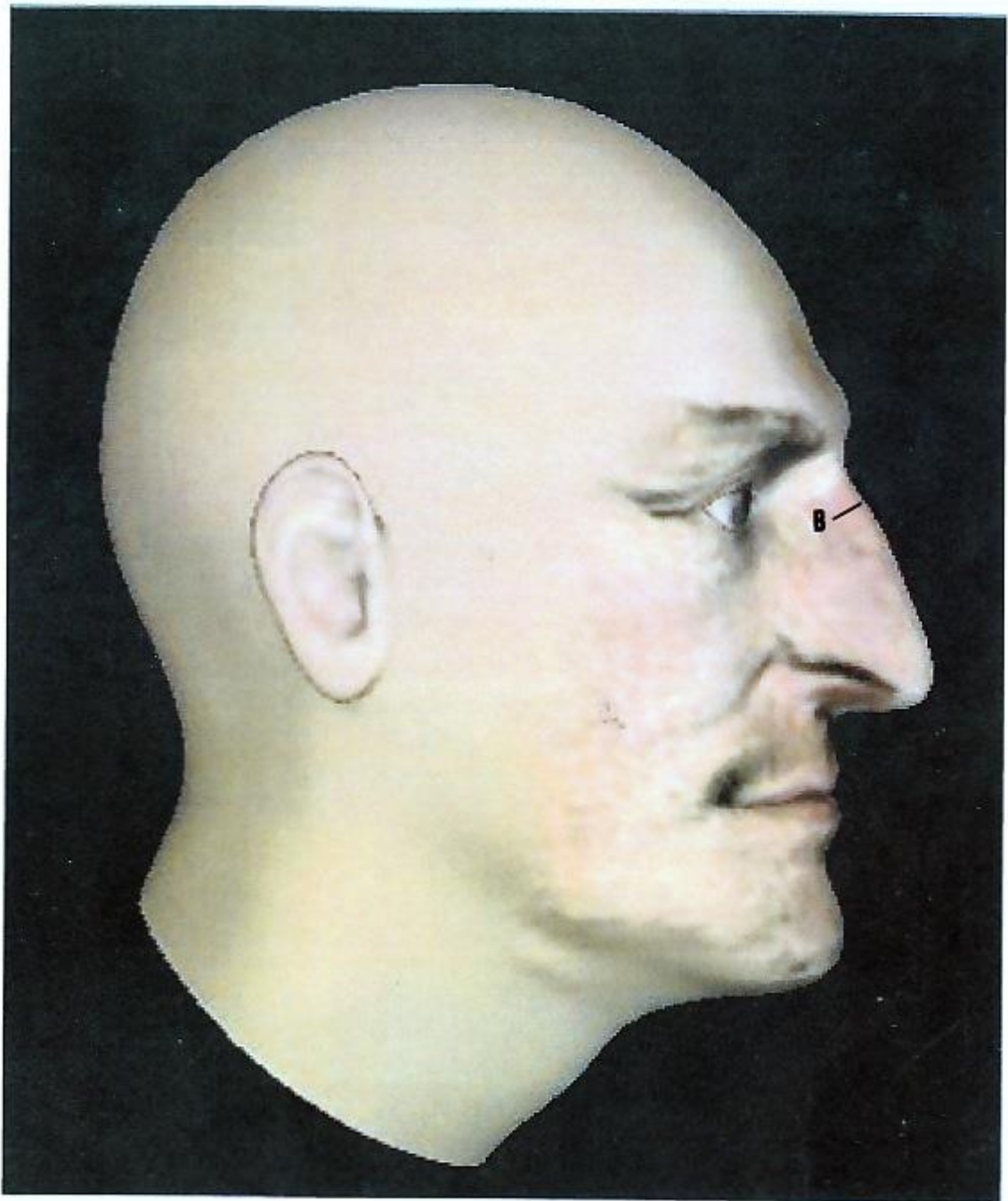
Figure 8 : The normalized reconstructed image of the face.

Figure 9 : A ¾ right profile of the normalized face.

Figure 10 : The right profile of the normalized face (B : the nasal bump).
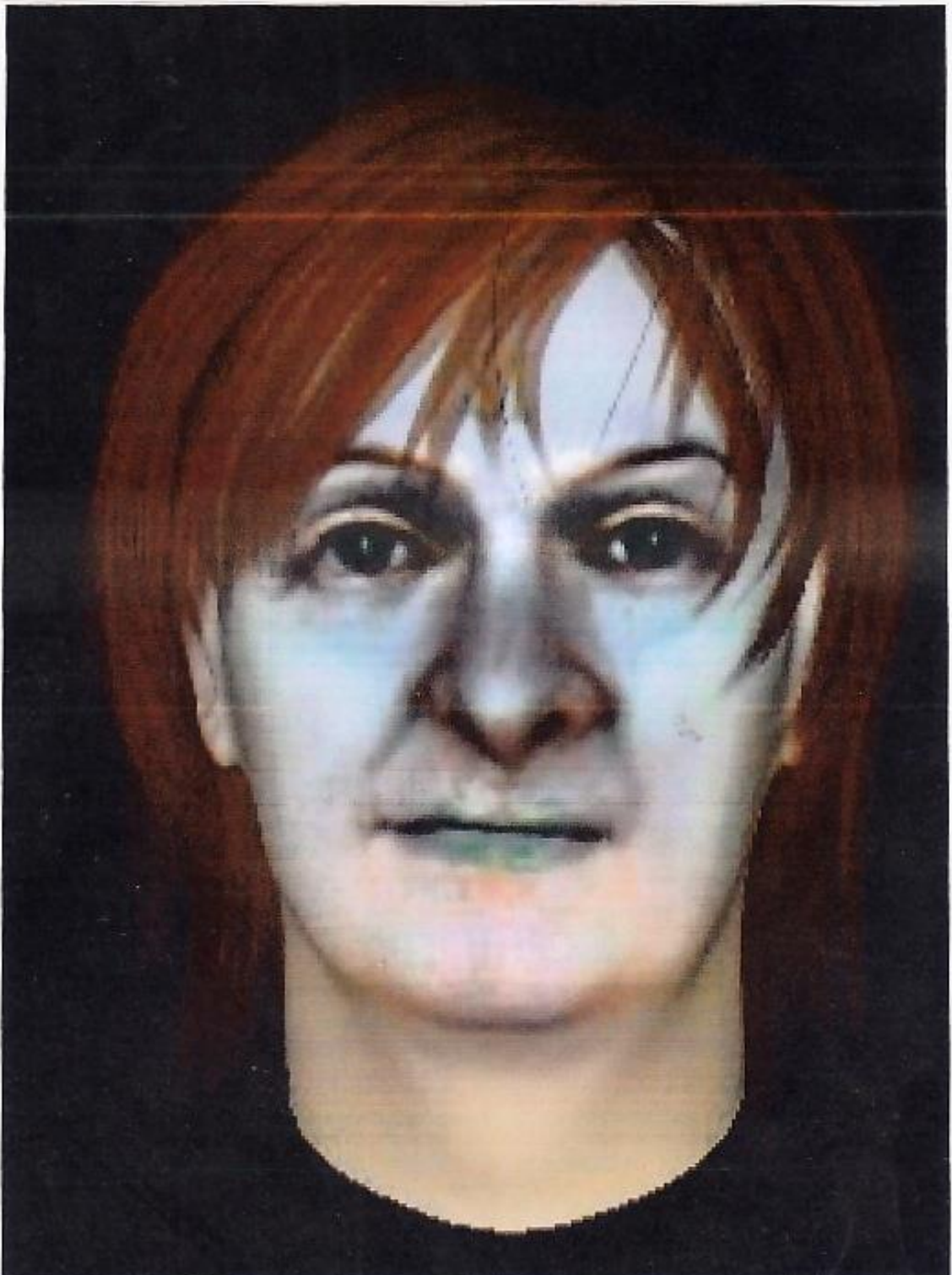
Figure 11 : The first version of the biologized face (P : the pale skin ; N : dark eye ; B : frontal border, limit of the hairs). The upper arrow point indicates the deviation to the left of the nose extremity ; the second arrow point indicates the position of drainpipe in the middle position, under the superior lip.

Figure 12 : Coverage by a chestnut wig of this first version of the biologized face.

Figure 13 : The second version of the biologized face (1 and 2 indicates the rectified orientation of the nose.
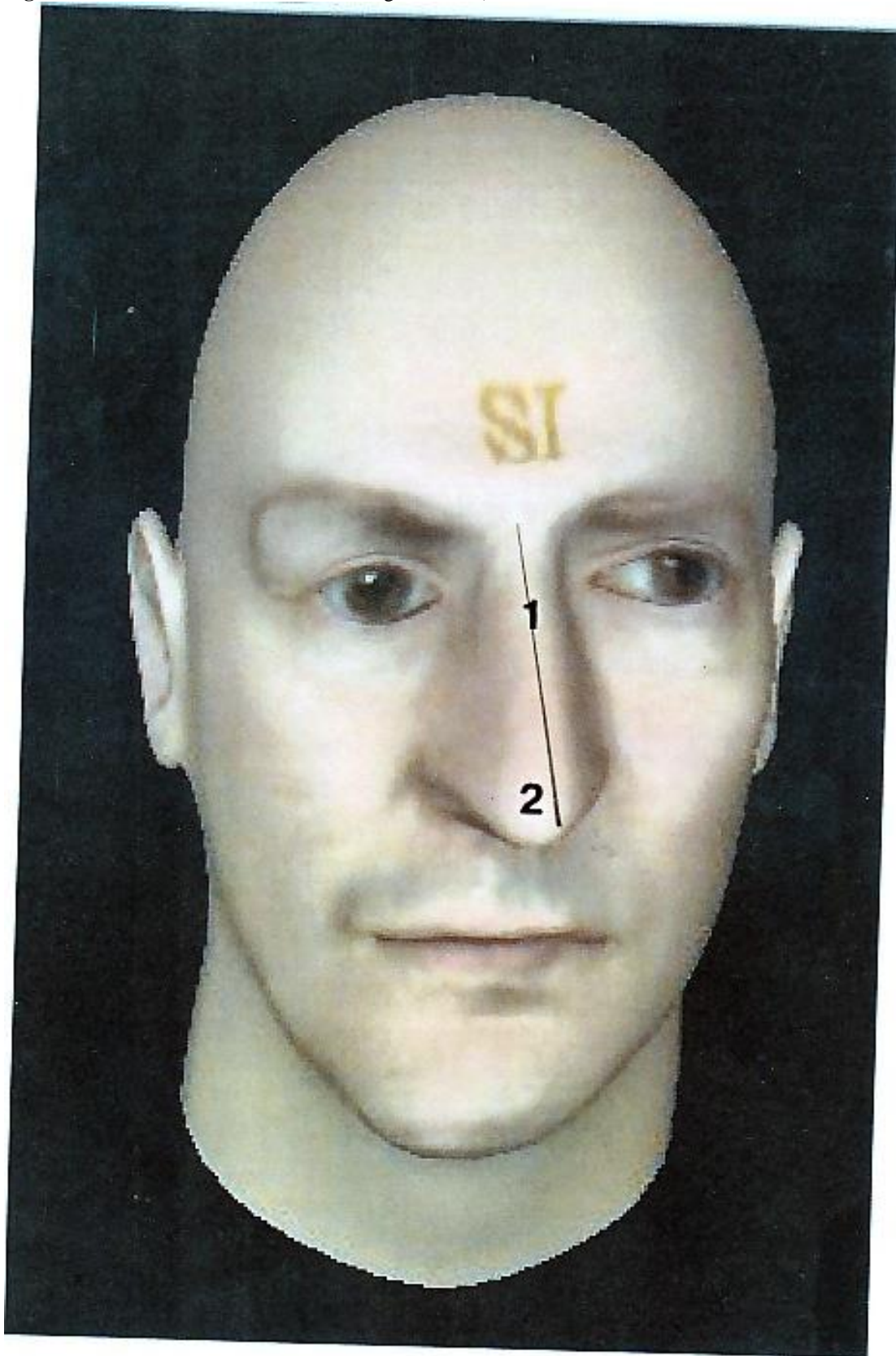
Figure 14 : The complete version of this second version, with skin and eyes colours

Figure 15 : Coverage by a chestnut wig of that version.