The earliest portrait of W.A. Mozart - A biometrical statistical analysis of the newly discovered Fruhstorfer Mozart from c1762

Martin Braun, August 2013

The painting is in oil on canvas, 49 x 37 cm, apparently still with its first frame, 62 x 50 cm. The portrait was sold in 2010 from a private home about 70 km from Salzburg in Austria, where it had been from 1922. Before that year the portrait was owned by the Austrian brewer family Fruhstorfer. The earlier provenance is not known. It is known, however, that in 1850 Rosina Fruhstorfer and her husband Siegmund Hoffmann became the owners of the pub Bergerbräu in the Linzergasse in Salzburg. This traditional Salzburg pub, which is documented from 1413, was in the neighborhood of W.A. Mozart's home. In 1777 W.A. Mozart was invited to the wedding of the brewer of the Bergerbräu.

Content

1) Photographs of the painting (Figs. 1-6)

Fig. 1 The painting "The Fruhstorfer Mozart" apparently with its first frame, 62 x 50 cm.

Fig. 2 The painting "The Fruhstorfer Mozart" without frame, 49 x 37 cm.

Fig. 3 The painting "The Fruhstorfer Mozart", head and shoulders.

Fig. 4 The painting "The Fruhstorfer Mozart", lower part.

Fig. 5 The painting "The Fruhstorfer Mozart", hand.

Fig. 6 The painting "The Fruhstorfer Mozart", face.

2) The status of scientific identification of faces in paintings

Scientific identification of faces in old paintings is still a young discipline. Until a few years ago one could even hear the opinion that the whole discipline was a false beginning. In arts we would be dealing with artifacts, not with images that mirror reality such as in photography. This view, however, is based on a serious category error. From the age of the Renaissance until the beginning of the age of photography, portrait painters worked under a condition of strictly limited freedom. They were commissioned to produce a facial image that would generally be recognized as faithful by anybody who had seen the depicted person. Only in a few exceptional cases could facial traits be arbitrarily altered. As a rule, they had to be reality-bound.

Due to the increasing importance of forensic face identification from digital photos, and due to the success of scientific face identification in much discussed cases of Shakespeare portraits and Mozart portraits, opinions have changed dramatically in recent years. Today researchers are funded even for the exploration of possible merits of software-based face identification in arts (1, 2).

3) The three Mozart portraits used for comparison

The Mozart portrait that would be the historically closest one is the so-called Lorenzoni Mozart (Fig. 7). It was commissioned by the father, Leopold Mozart, and is today attributed to the year 1763 and the painter Pietro Antonio Lorenzoni. However, it had to be excluded as a reference portrait for the present study due to grave painting errors. In 2006 a newly discovered boy portrait was found to be a partly altered copy of the Lorenzoni Mozart (3). At that time an investigation of the case had revealed the following painting errors in the Lorenzoni Mozart:

Quoted from the paper of 2006 (3):

"A close inspection of the Lorenzoni Mozart reveals that the painter made several technical mistakes that a skillful portrait painter would not make. First, the general impression is that we are dealing with a face that is adult-like. In particular, the proportions of the forehead and of the chin are typical for adults, but untypical for a child aged seven. If these parts are cut off, the face suddenly becomes child-like.

Another serious construction error lies in the treatment of the perspective. The frontal plane of the head looks pressed-in at its right side, because the right-side plane of the head is given too much space on the canvas. The horizontal distance between right eye and right ear is much too long.

Besides the two global errors there are also five major errors in face details:

1) The right side of the nose is considerably higher than its left side. Such an asymmetry never occurs in a healthy nose, and it does not occur in other Mozart portraits.

2) The lower part of the nose is bent toward the right. Also this asymmetry never occurs in a healthy nose, and it does not occur in other Mozart portraits.

3) The shadow on the left side of the nose is wrong in four respects: a) too dark, b) too sharp at its edges, c) too high up along the nose, d) straight line cuts across nose tip, instead of circling around it.

4) The left eye is focused on the observer, but the right eye is slightly turned lateral. This condition does not occur in other Mozart portraits.

5) The lower part of the right ear is highly unnatural and fully incompatible with other Mozart portraits."

Therefore, instead of the Lorenzoni, the chronologically next Mozart portrait that is universally regarded as authentic was used. It is the portrait painted by Saverio dalla Rosa in 1770. For additional comparisons also two portraits of the adult Mozart were used. These are the so-called Bologna Mozart from 1777, which is universally regarded as authentic, and the so-called Edlinger Mozart from 1790, which is today widely regarded as authentic both by the general public and by art historians in Berlin (4) and in Vienna (5).

4) Biometrical statistical analysis

A. Landmark test on non-identity

Face identification is largely determined by proportions and angles of landmark distances, such as length of nose. In the present case, one has to take into account that facial proportions in a six-year-old deviate sharply from those in a fourteen-years-old or in an adult. In the child, forehead and eyes are proportionally larger, whereas nose and chin are proportionally smaller (Fig. 8). Further, it must be taken into account that in the dalla Rosa the top of the forehead is covered by a wig. Considering these circumstances, the new face does not reveal one

significant landmark deviation from either of the two reference faces in Fig. 8. Thus, the landmark test on non-identity is negative, and identity of the subjects remains possible.

B. Feature test on non-identity

Most faces have a number of non-general features, such as a vertical indentation in the middle of the lower part of the chin. Comparison of such features between the Fruhstorfer and the dalla Rosa shows three differences. In the dalla Rosa the hanging cheeks with a skin fold under the chin (trait 1 in Figs. 9 and 12) are absent, possibly concealed by clothing. In the Fruhstorfer the elevation on the ridge of the nose and the horizontal indentation across the root of the nose (see Figs. 10-12) are absent. Because each of the three differences can be accounted for by the difference in age, also the feature test on non-identity is negative, and identity of the subjects still remains possible.

Excursus: Comment on the eye colors of W.A. Mozart

Heterochromia iridum is a condition where either the two eyes differ in color of the iris (complete heterochromia) or the color varies within an iris (sectoral heterochromia). From the large number of portraits of W.A. Mozart that we have today we can conclude that his eyes almost certainly had sectoral heterochromia. Each of the five portraits presented in this study clearly shows this condition (enlarge images up to 200 %, if necessary).

Lorenzoni (Fig. 7): right eye, gray-blue - left eye, gray-blue plus light-brown.

Fruhstorfer (Fig. 9): right eye, brown (upper part) plus gray (lower part) - left eye, brown (more centrally) plus gray (more peripherally).

Dalla Rosa (Fig. 10): right eye, gray - left eye, gray plus brown.

Bologna (Fig. 11): right eye, brown plus light-brown (or gray) - left eye, brown plus gray.

Edlinger (Fig. 12): right eye, light-gray-brown (centrally) plus gray (peripherally) - left eye, light-gray (centrally) plus gray (peripherally).

Additionally, it should be noted that in art history the eye colors in old portrait paintings are considered as notoriously unreliable for the following reasons.

- Both pigment layers and varnish can change chemically and physically with age resulting in color alterations.
- Dependence on illumination of the painted person.
- Dependence on curiosity of the artist to examine the eye colors closely.
- Dependence on illumination of the finished painting.

In conclusion, portraits of W.A. Mozart typically show multi-colored eyes, which would be consistent with the condition of sectoral heterochromia iridum. Differences in apparent eye-color combinations across Mozart portraits can easily be accounted for by circumstantial conditions.

C. Digital feature test on identity

Many faces have a number of digital features. These are features that are either obviously present or obviously absent. If two portraits, for which the non-identity tests have been negative, have a sufficient number of digital features in common, the probability of subject identity can be determined statistically. The following eight digital features appear in the Fruhstorfer and at least one of the reference portraits (Figs. 9-12):

1) Hanging cheeks with a skin fold under the chin.

2) Vertical indentation in the middle of the lower part of the chin.

3) Horizontal wrinkle line between mouth and tip of chin.

4) A nose tip with two tip-defining points.

5) Dark half-circles (suffused skin tissue) below the eyes.

6) Left eye more widely opened than right eye.

7) Fold of upper eyelid in parallel to and displaced from edge of eyelid.

8) Thinning-out in the lateral third of the right eyebrow.

Excursus: Comment on feature 6

The occurrence of this trait in a painted portrait is a fortunate one, because it provides additional evidence. The trait is not very rare, but painters tended to neglect it. In photos it had a prevalence of 9 %, but in paintings one of only 5 % (see below). The human brain is extremely sensitive in noting slight changes in the distance between lower and upper eyelid, because such changes are essential elements in emotional expression. For this reason, size differences between the two eyes of a portrait are easily detected. If artists wanted to do an extra favor to a customer with such a condition, they could give it a special treatment. In our case, the left eye is measurably more widely opened in the Fruhstorfer (Fig. 9) and in the dalla Rosa (Fig. 10). Interestingly, in the Bologna (Fig. 11) and in the Edlinger (Fig. 12) there is no measurable difference but an apparent one. In both paintings the artists made the left eye appear bigger by skillful manipulation of local brightness. The painter of the Bologna over-emphasized the brightness of the edge of the left eye's lower lid, whereas Edlinger made the

right eye appear smaller by over-emphasizing the shadow below the upper lid and by adding extra brightness to the reflection zones above and below the left eye. Tricks of this type protected artists against possible accusations of unfaithfulness on the one hand, and disrespectful realism on the other hand. If asked, they could reply: "The left eye looks bigger to me," in the first case, or "Both eyes are of the same size - you can measure them," in the second case.

Because the eight features are visible in almost all common light conditions of portrait painting, their frequency in the general population could be determined by feature counts in public portrait galleries.

A corpus of 132 adult Caucasian male portrait paintings was established by extracting naturalistic style portraits that were available in sufficient resolution from the internet archives of the Gemäldegalerie in Berlin, the National Gallery of Arts in Washington D.C., the National Gallery in London, and the Musée du Louvre in Paris.

A corresponding corpus of 108 portrait photographs was established by extracting, in order of listing, the results from Google picture searches that included the search term "portrait".

The count of feature frequencies, separately for paintings and photographs, revealed that in both databases trait 1 and 3 appeared in the same face more often than could be expected from their single frequencies. This observation is biologically plausible, because the probability of both traits is likely to increase with the amount of under-skin tissue in the lower jaw. Therefore, the co-occurrence of these two traits in a face had to be considered as a single new trait.

Similarly, the count of feature frequencies, separately for paintings and photographs, also revealed that in both databases trait 5 and 7 appeared in the same face more often than could be expected from their single frequencies. Also this observation is biologically plausible, because the probability of both traits may depend on qualities of under-skin tissue that are similar above and below the eye. Again, the co-occurrence of these two traits in a face had to be considered as a single new trait.

The feature frequencies were as follows:

1 and 3) Hanging cheeks with a skin fold under the chin AND horizontal wrinkle line between mouth and tip of chin: 8 % in paintings, 6 % in photographs.

2) Vertical indentation in the middle of the lower part of the chin: 46 % in paintings, 31 % in photographs.

4) A nose tip with two tip-defining points: 7 % in paintings, 7 % in photographs.

5 and 7) Dark half-circles (suffused skin tissue) below the eyes AND fold of upper eyelid in parallel to and displaced from edge of eyelid: 8 % in paintings, 9 % in photographs.

6) Left eye more widely opened than right eye: 5 % in paintings, 9 % in photographs.

8) Thinning-out in the lateral third of the right eyebrow: 2 % in paintings, 2 % in photographs.

Next, these six features or feature combinations were tested on correlations. Because all tests were negative and because there is also no biological rationale to assume any correlation, the six features have to be considered as stochastically independent. Thus, the frequency of their joint occurrence is computed by multiplication of the single frequencies. The results for the probability that two non-relatives have the six features in common are one in over 4,800,000 re the painting database, and one in over 4,700,000 re the photo database.

Further, it should be noted that the probability estimate would have been even stronger, if non-digital features such as the shape of the corners of the mouth had entered the calculation.

5) Reference images (Figs. 7-12)

Fig. 7 Five major painting errors in face details of the Lorenzoni Mozart (see text, section 3).

Fig. 8 Global comparisons with the dalla Rosa (1770) and the Edlinger (1790).
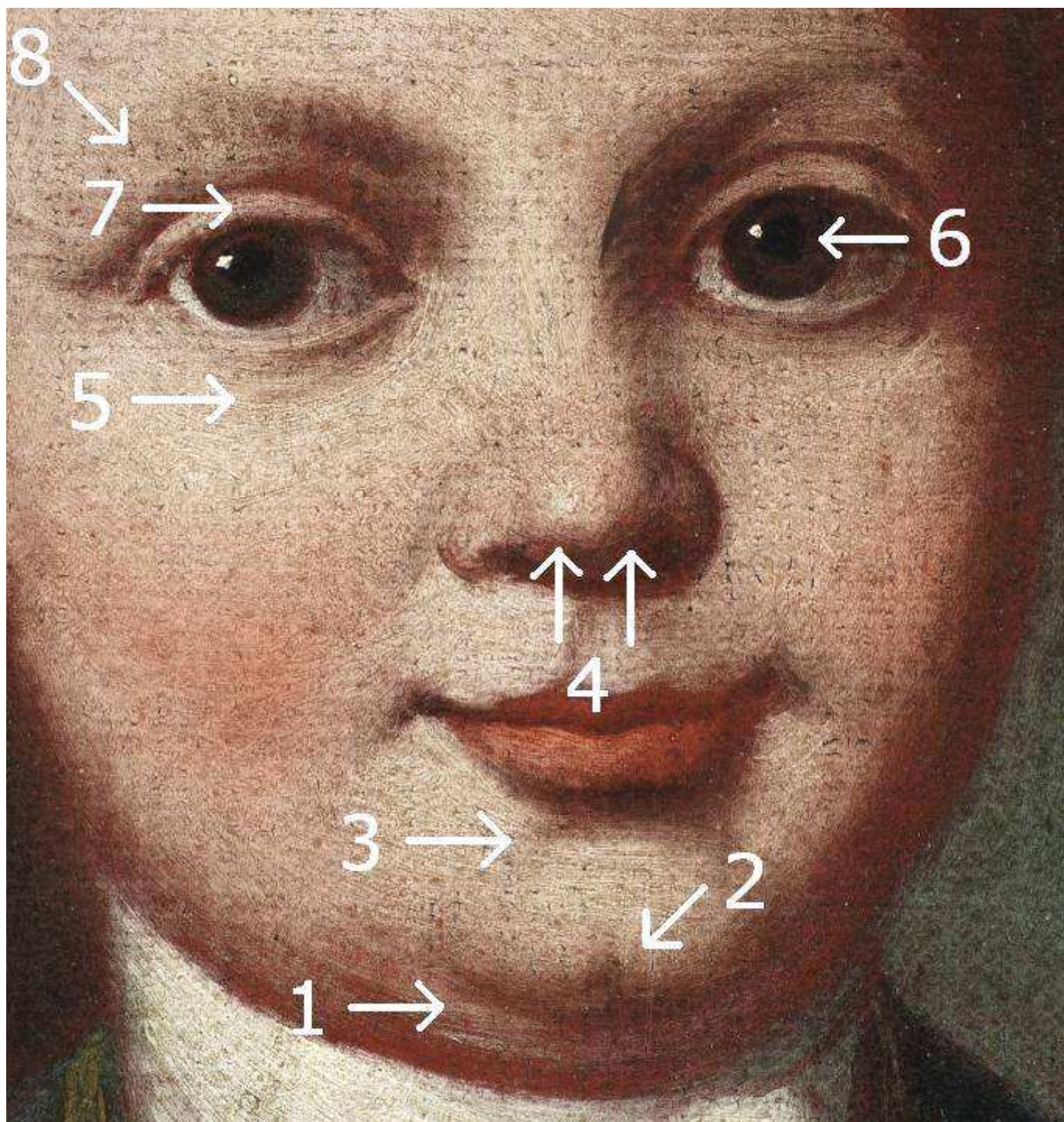
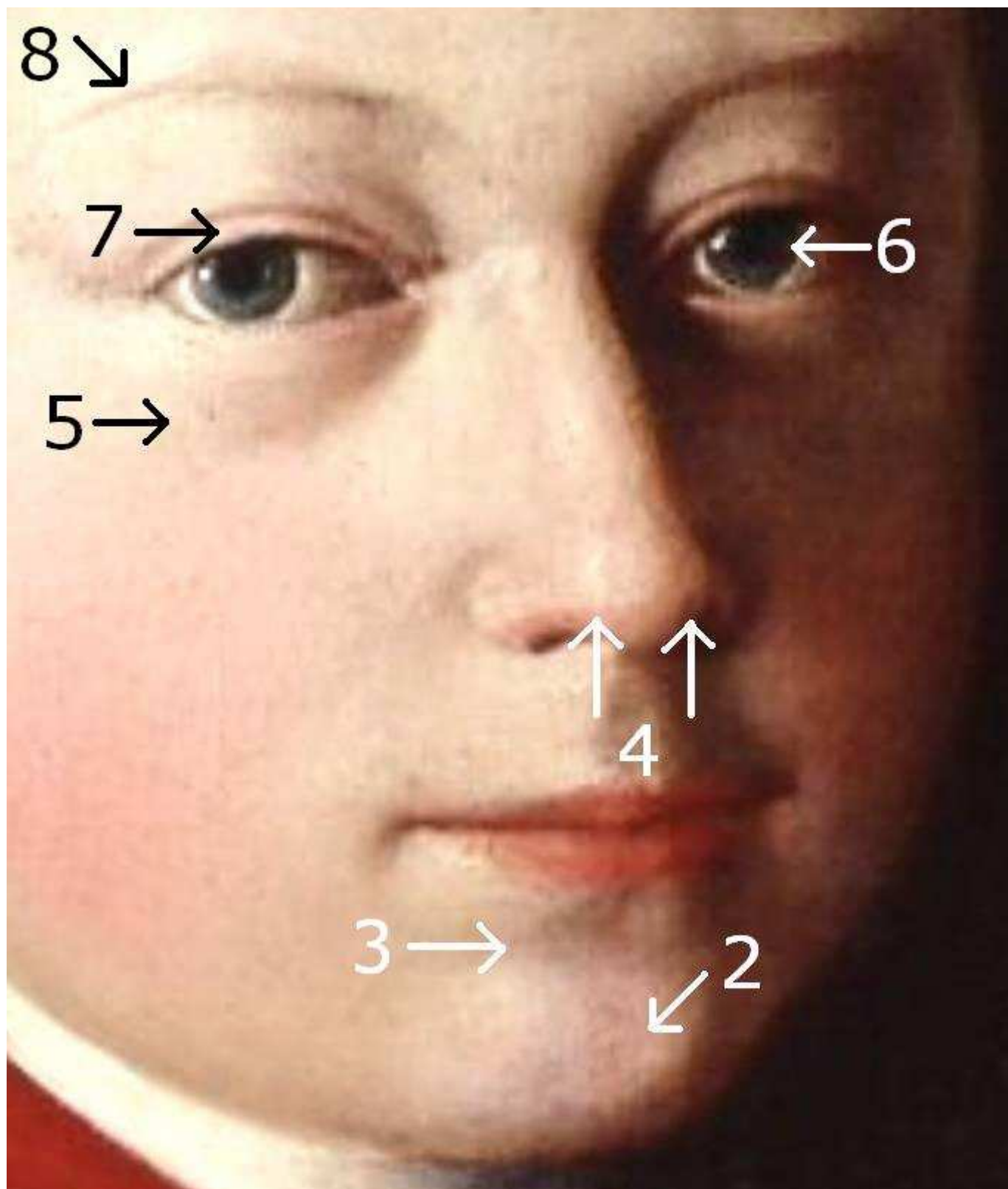**Fig. 9 The facial traits used in the present study in the Fruhstorfer Mozart (c1762).**

Fig. 10 The facial traits used in the present study in the dalla Rosa Mozart (1770).
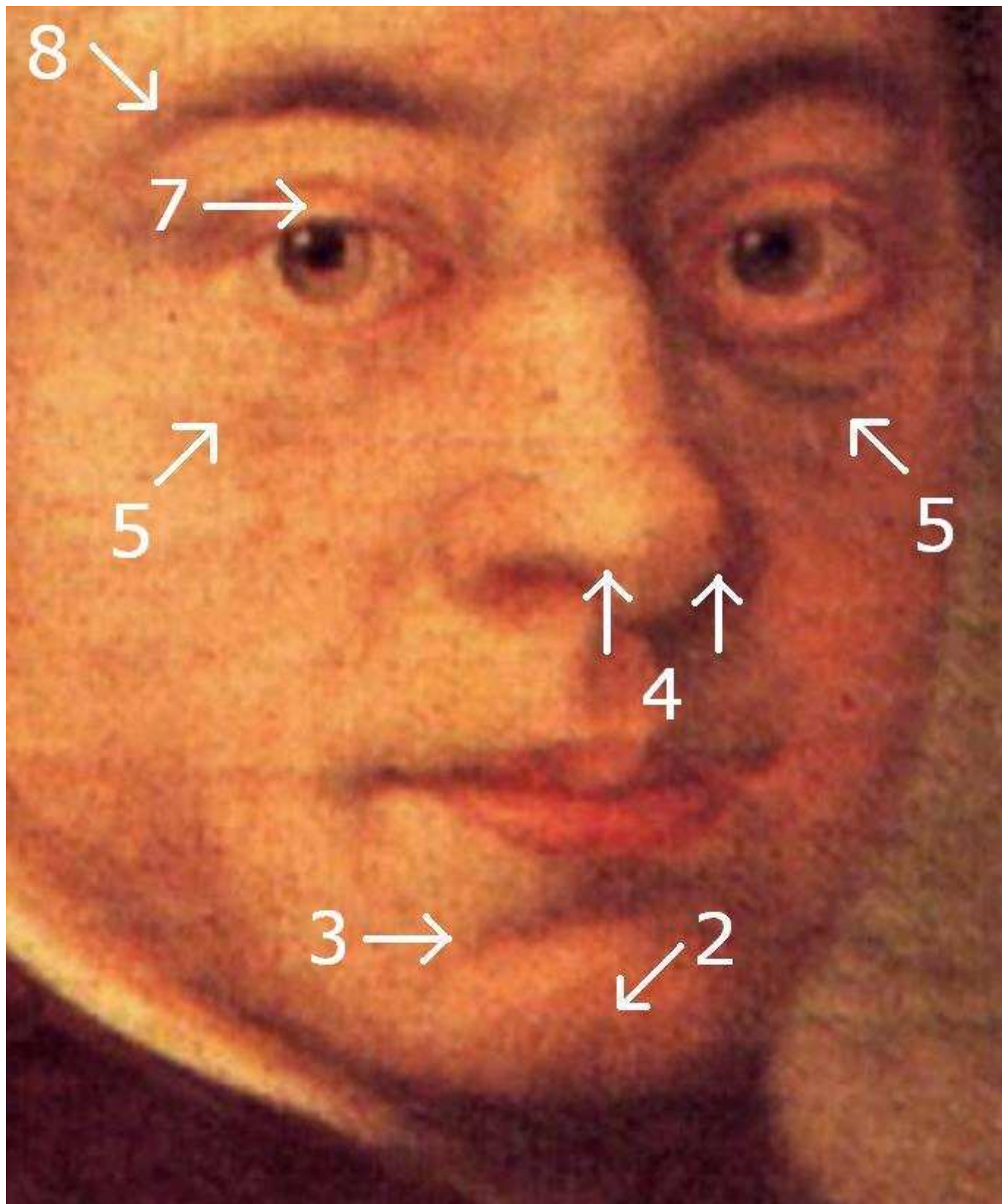
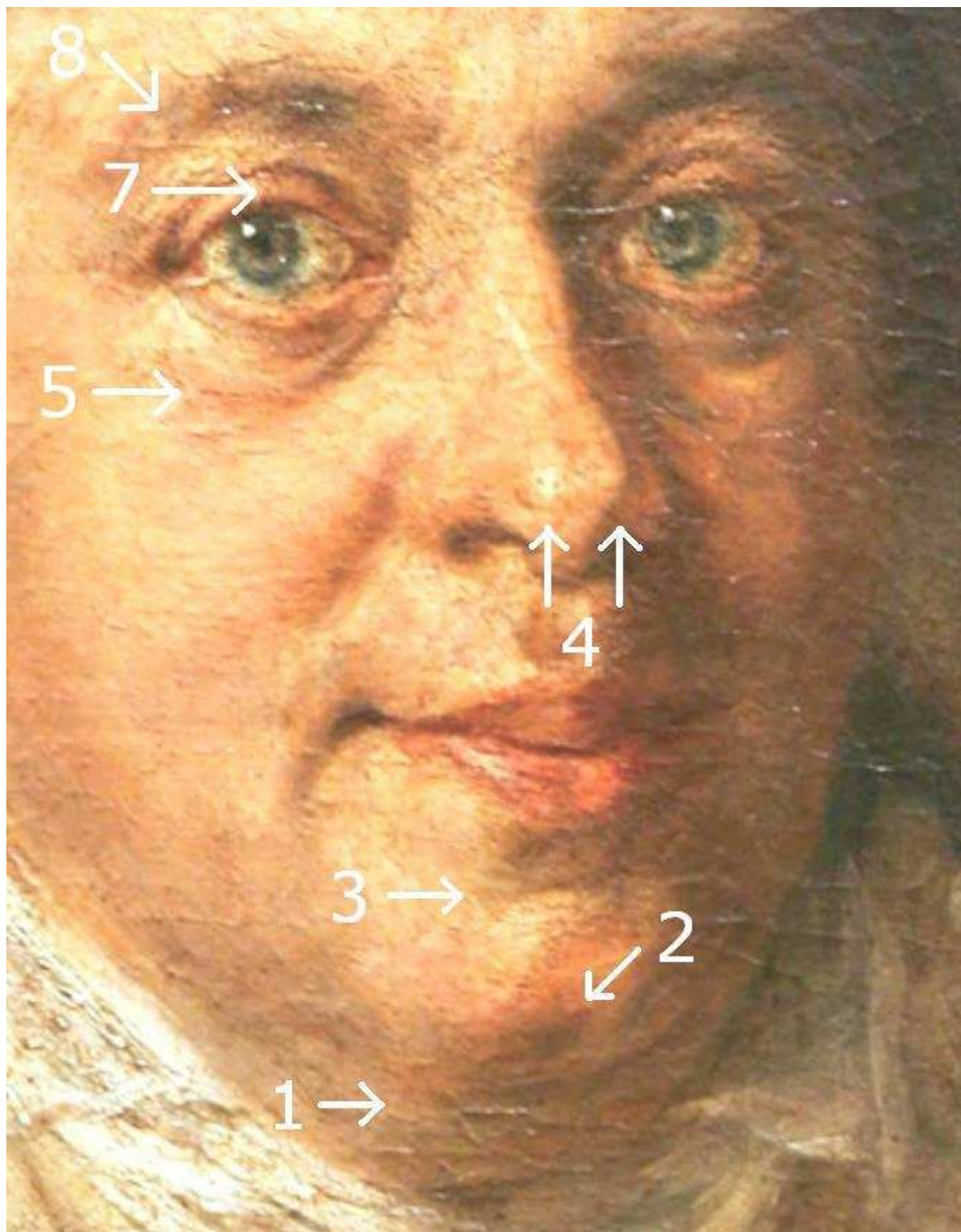**Fig. 11 The facial traits used in the present study in the Bologna Mozart (1777).**

Fig. 12 The facial traits used in the present study in the Edlinger Mozart (1790).

6) Where was it painted?

Inspection of the artist's brushwork revealed a fast but very skillful hand. This indicates a competence and experience that was more likely to be found in Munich or in Vienna than in Salzburg. In 1762 W.A. Mozart was for the first time presented as a miracle boy to the high nobility in Munich and in Vienna. At that time he was six years old, which would be consistent with the apparent age of the boy on the painting. Further, also the likelihood to find the depicted expensive clothing for a little boy and a sponsor for a high-quality portrait was clearly greater in Munich or in Vienna than in Salzburg.

Literature

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The author

Martin Braun is a neurobiologist and a composer. He is specialized on investigating music related auditory physiology. Since 1993 he has published original research on inner ear function, otoacoustic emissions, pitch processing in the auditory midbrain, neurophysiology of acoustical sensory consonance, precognitive absolute pitch, and the physiology of octave circularity of pitch. From 2000 he works for the independent research organization Neuroscience of Music near Karlstad in Sweden.
During the years 2005 and 2006 he carried out biometrical statistical analyses of several portrait paintings of W.A. Mozart, whose authenticity had been a matter of long-standing controversies. In the case of four portraits he found compelling evidence that they had to be regarded as authentic. These are the Edlinger Mozart (1790), the Hickel Mozart (c1785), the Delahaye Mozart (1772), and the Greuze Mozart (1763-64). Publication of the results caused further archival research elsewhere. In all cases, new archival findings since then have confirmed Braun's results, and the four portraits are today widely accepted as authentic.
Listing of the author's publications: http://www.neuroscience-of-music.se/publications.htm