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MiC MINISTERO DELLA CULTURA

Michelangelo: l'effigie in bronzo di Daniele da Volterra

ATTI DELLA GIORNATA DI STUDI DELLA MOSTRA

Firenze, Galleria dell'Accademia di Firenze,
15 febbraio-19 giugno 2022

a cura di

CECILIE HOLLBERG

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Firenze, Musei del Bargello
Rimini, Museo della città "Luigi Tonini"
Milano, Castello Sforzesco-Civiche Raccolte d'Arte Applicata
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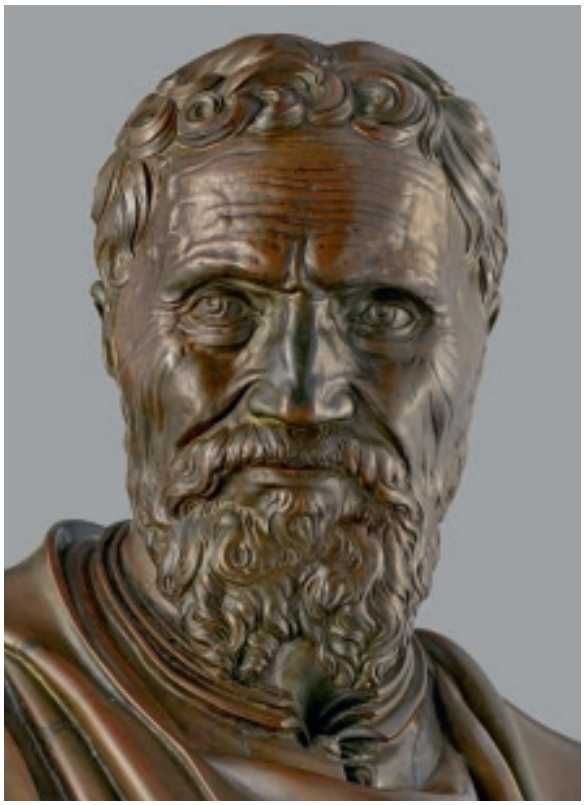

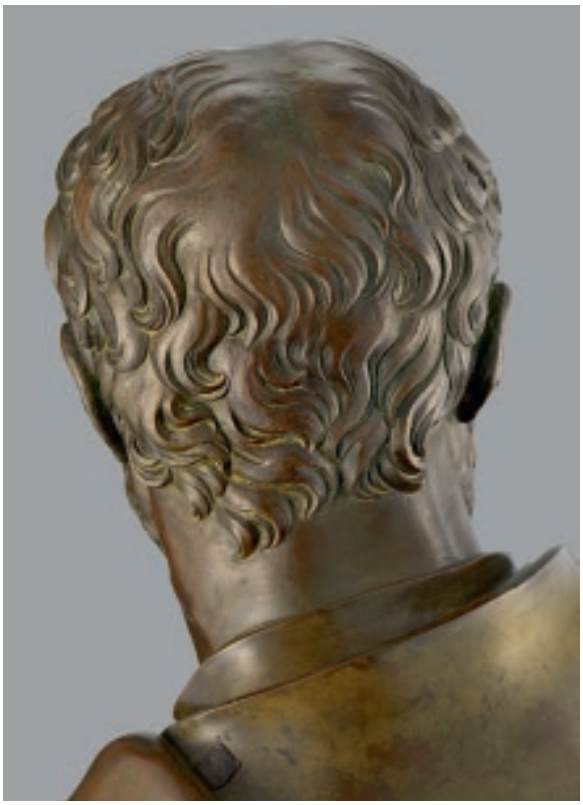

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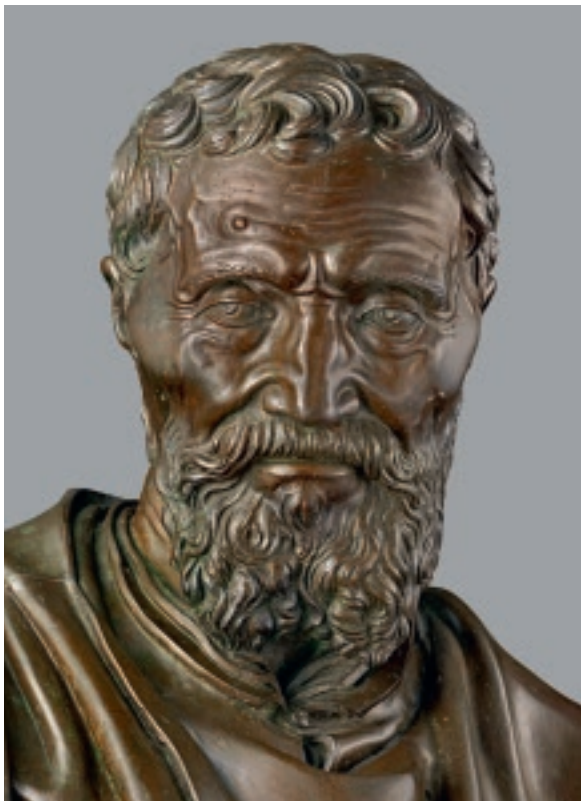

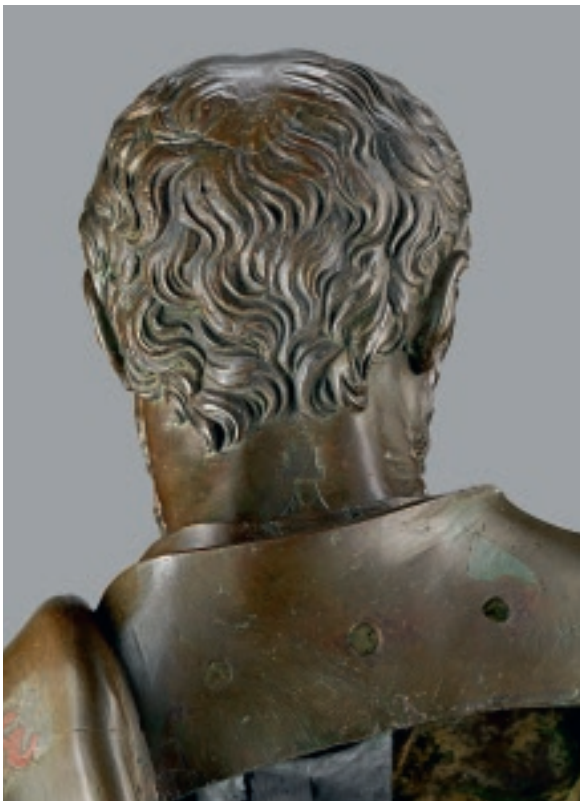

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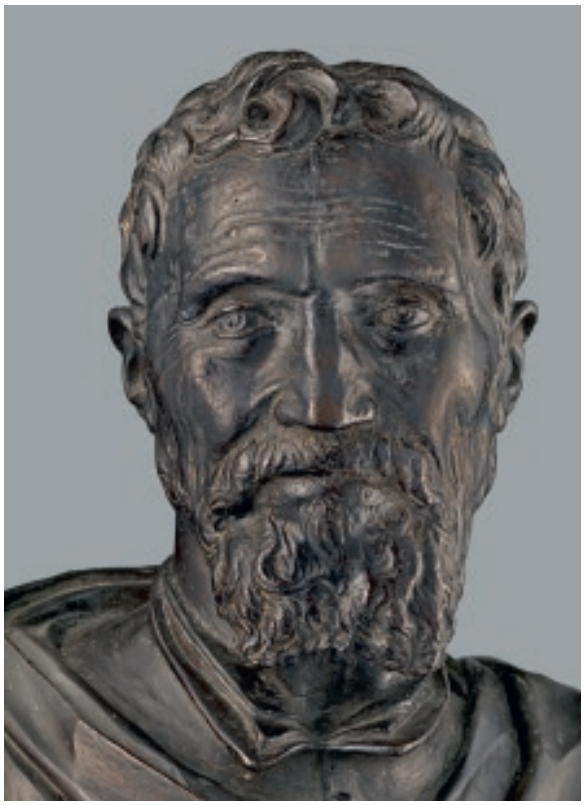

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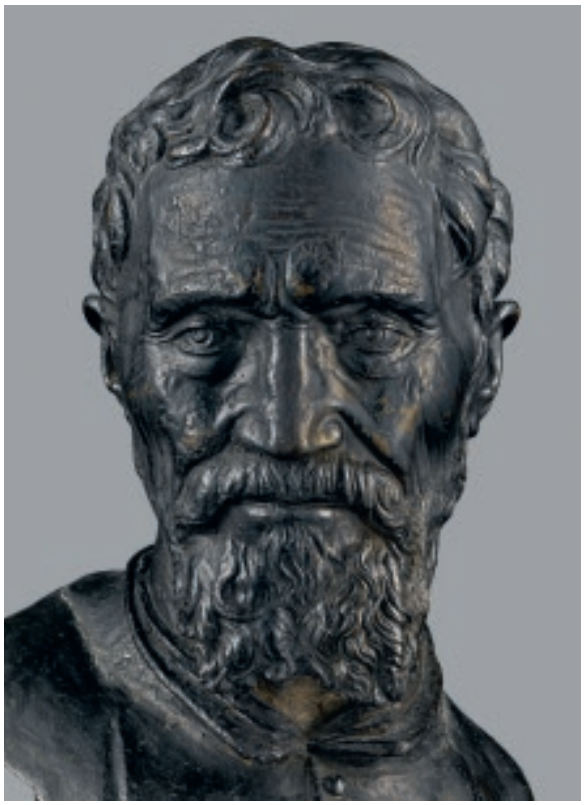

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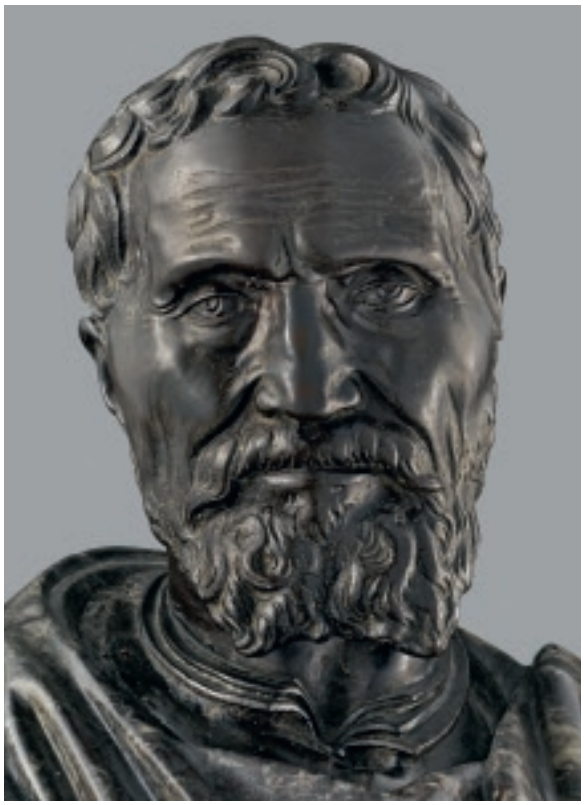

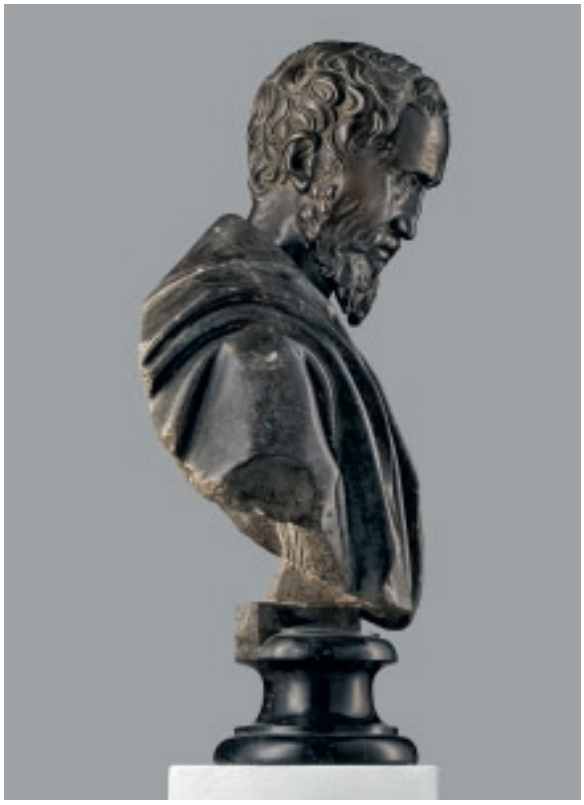

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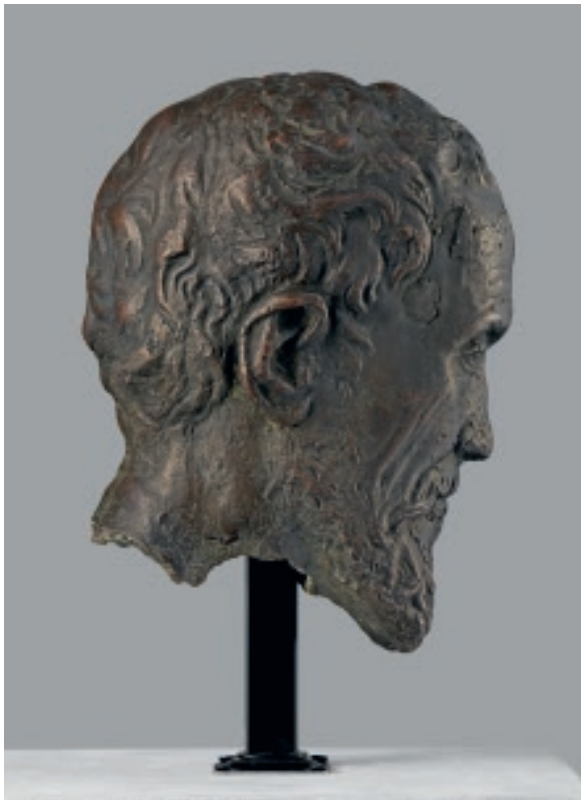

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Contributi tecnico-metodologici

Box of heads, cut alongside the symmetry line.

Analysis and Observation. Reading Material Evidence

ADAM LOWE

This is an essay about looking, objective science and creative actions. The mix of forensic analysis, digital recording of surface and shape, scientific investigation, material sampling, philological and archival research, intuition, and discussion of the evidence is resulting in a deeper understanding and consensus about the ten bronze busts of Michelangelo made by Daniele da Volterra. The modelling of the 'original' bust, in clay or wax (or a mix of materials), before the casting in bronze, must have happened in the time between Michelangelo's death on 18th February 1564 and Daniele da Volterra's death on April 4th 1566. Did the casting of all the busts take place at the same time? Did it happen in Rome? Can we determine the sequence of the casting from the evidence brought together at the Galleria dell'Accademia in Florence? Will a mixture of machine learning and close analysis help to add to the knowledge about this group of bronze casts?

Making the bust of Michelangelo must have been an intense experience for Daniele da Volterra. He was living and working in the space previously occupied by Michelangelo. He was probably working from a death mask of his close friend which he would have made himself soon after Michelangelo's death. A death mask differs from a life cast in significant ways. In both cases the eyes are shut and need to be modelled, but without pumping blood or muscle activity the lifeless flesh cannot resist the effects of gravity. In a parallel project carried out with Fundación Casa Ducal de Medinaceli and the Spanish Gallery at Bishop Auckland, Factum worked on the death mask and the sepulchre of Cardinal Tavera, both made by Alonso Berruguete. Luis Buñuel, when making the film *Tristana* (1970), commented that the face was the «fixed image of death». While Berruguete (who knew Michelangelo from his time in Italy) was making a funerary portrait from a death-mask, Ricciarelli was bringing his friend back as a portrait of a living figure.

If he was working from a deathmask, Daniele da Volterra, a painter, had to 'volumise' and reanimate the flesh, literally carrying out an 'anti-ageing' treatment to bring the lifeless form back into the realm of the living. Not only did he have to add 'fillers' but he had to create the volume of the skull, recreate the hair, form the beard and model the neck. All he had was his memory, the drawing he had made that is now in the Teylers Museum and the painting attributed to him in the Metropolitan Museum of Art. The drawing is dated between 1548 and 1553. The position of the head in the drawing is awkward, half-sitting, half-lying, as if the model is in bed, not comfortable and ill at ease. The drawing is significant in terms of its relationship to the busts. There is a close correspondence between the shape of the abstracted hair on the forehead in the drawing and in the modelling of the bust. In a death mask the hair is not recorded and would be formless and compressed in the production of the cast. In some of the bronze casts the hair and the beard have been modelled based on a literal translation of the drawing. The wrinkles around the eyes and creases on the glabella (between the eyebrows) are also literal transcriptions from image to form. There are other details that seem to have been added to some of the busts in a literal way from the drawing.

Recording the Bronze Casts

Factum Foundation recorded all ten busts between June 2021 and February 2022. An important part of the work was to keep constant both the methodology and the technical team doing the work. Even in objective metrological recording there is an element of subjectivity in the gathering and processing of data, although this is less significant in some systems than others. The 3D scans were all made with two different approaches to recording, the first with a structured light scanner (Breuckmann SmartScan-HE) and the second with a camera and 50mm lens. All the recording and processing was done by Voula Paraskevi Natsi and Pedro Miró.

Breuckmann SmartScan-HE

This system integrates two digital cameras mounted in the same rigid arm and a pattern projector. Calibration is performed by recording a patterned plate of know dimensions.

The non-contact structured-light scanning technology of the SmartScan enables fast data acquisition with a

1. Comparative detail from Louvre head: left, white light scan at 200µ; right: photogrammetry at about 100µ.

high level of detail. The SmartScan optical 3D scanner is regarded as an accurate measurement system that can collect high-density surface data with very good levels of accuracy. The system is ideal for object digitisation and feature inspection. Advancements in fringe projection technology have improved the scanning of glossy and dark surfaces which was important in the recording of these bronze busts. Each 'shot' taken with the SmartScan has a resolution of 140µ but, in the processing to generate an STL file, the data is automatically filtered to produce a cleaner scan, resulting in a resolution of about 200µ.

Photogrammetry

A Canon EOS 5DSR (54 mpx) camera was used with a Sigma F1.4 DG HSM Art 50mm focal length lens. The photogrammetry was carried out using a CANON 580EX II flash gun with the camera mounted on a Manfrotto tripod with a panoramic head attachment. Approximately 350 images were taken of each bust. Each image is a RAW format, 16BIT file. The resulting 3D model extracted from these images has about 10 million polygons. All processing is done with Reality Capture software. As photogrammetry uses a process of feature mapping between each image, the more photographs with the correct overlap, the better the results. We have produced 3D models with a resolution below 100µ but with the Michelangelo busts the relatively smooth dark glossy surface produces noise. To reduce the glare caused by the reflection off the surface we used cross-polarising filters.

The Relationship between Noise and Information

Any relatively uniform dark surface without significant changes in colour and with high levels of reflectivity will produce noisy data. Where the photograph is 'burnt out' there is no data and in an undulating surface with a uniform colour the software has trouble feature 'mapping' (i.e. identifying corresponding features in different images). While photogrammetry has a higher point cloud than the white light scanner, and so theoretically has a higher resolution, the amount of noise due to the uniformly dark glossy surface means that there are more artefacts and therefore less reliable information (fig. 1).

3D Printing

The material prints were all made with the same SLA printer at the same time (except for the bust from Bayonne that was recorded and printed later). Initial small prints were made in-house with a FormLab printer. The full-sized prints were made by Materialise in Leuven, Belgium using the Mammoth 3D printer with a layer thickness of 20µ and a wall thickness of 2mm to ensure that the shape does not distort. From the 3D model, the print is prepared by cutting the file into thin layers with specialised software. A structure is created to support overhangs and cavities. The process takes place in a large tank. A platform is covered with a layer of liquid polymer and a computer-controlled laser 'draws' the form by curing the light-sensitive polymer. The platform is then lowered and the next layer is drawn on top of the previous one. This is repeated until the model is finished. When the object is complete, it is raised out of the tank and the uncured liquid drains away. The stabilizing supports are removed manually after the model is taken from the machine and cleaned of excess resin.

Machine Learning and Masks

One of the most significant outcomes of 3D recording and rematerialisation that often passes unnoticed is that

with this technology we can separate form from colour. When the colour is removed, the differences between each model are easier to identify. It facilitates new approaches to study and analysis.

After meeting with Mario Micheli and Cecilie Hollberg, Voula Paraskevi Natsi manually placed points around defined features on the face. The resulting 'masks' appear like naïve drawings with lines or dots describing eyes, nose, mouth and ears – features for which we have names. Perception tends to focus on things we can name and isolate. On a face these elements never exist in isolation but are defined by a change in plane, material or colour. Identifying specific points in a render of a 3D set of coordinates on a computer screen is an imprecise science dependent on the judgement of a skilled digital artisan. The limitations of any screen-based interface are instantly apparent. While this procedure produced comparative measurements, it should be noted that the ability to pinpoint each marker manually is to some degree subjective, with an accuracy that needs to be understood in millimeters rather than microns.

The carefully selected spatial points were then analysed using geo-positioning software. The first level of this research focused on the 'masks' extracted from the front of the face. After the symposium it became clear that meaningful results required a full 3D comparison of corresponding points placed around each head.

Observing the 3D Prints

Observation alone clearly suggests specific groupings. A close study of the heads was undertaken in the workshops of Factum Arte in Madrid. The study of the bronze busts alongside the 3D prints (where the uniform colour is less distracting than variations in patina or the different protective coatings) happened in Florence under exhibition conditions. The difference between a coat of acrylic resin (normally Paraloid) and various mixes of wax may be subtle, but it is clearly visible and alters our perception of an object.

Finding the sequence in the production was the goal. Casting a bust in bronze involves many creative and practical decisions as the object is mediated from the original model, through all the stages involved in the lost-wax process. In theory, as each cast is made there is an entropic breakdown of the mould resulting in artefacts and softness in the cast. The reality is not so straightforward. Waxes taken from the mould always vary a bit and are retouched and remodelled to remove seams, bubbles and other faults. A retouched wax can be distorted by handling or in the investment process. Bronze contracts on cooling, both shrinking and deforming in subtle ways. The sprues and vents need chasing and removing after casting. The surface of the bronze can also be worked by skilled craftsmen to sharpen details and remove casting flaws.

Observing the Bronze casts

The process of bronze casting involves several stages that all have an impact and influence on the appearance of the final object:

Daniele da Volterra produced a bust of Michelangelo in clay or wax. This is the master from which a mould is made.

The production of a mould: this complex form would have required a piece mould.

The creation of a wax cast from the mould. After retouching, wax sprues and runners are fitted to the wax positive allowing the bronze to enter the mould and the air to escape during casting.

The encasement of the wax in grog and plaster and the burning out of the wax result in a secondary mould that will produce a positive cast in metal with a hollow core.

Preparing, heating and pouring of the bronze

The chasing of the bronze and removing if nails, sprues and other undesired artefacts of the process.

There was no fusion welding at the time. Any holes in the or flaws in the cast either had to be cut out and filled with a new piece of bronze or recast into the bronze using wax and clay. When chased these repairs are invisible to the eye but evident in an X ray.

When the compressing, chiseling and carving of the surface is complete, the bronze would have been heated and treated with patina. The patination gives the cast its final colour.

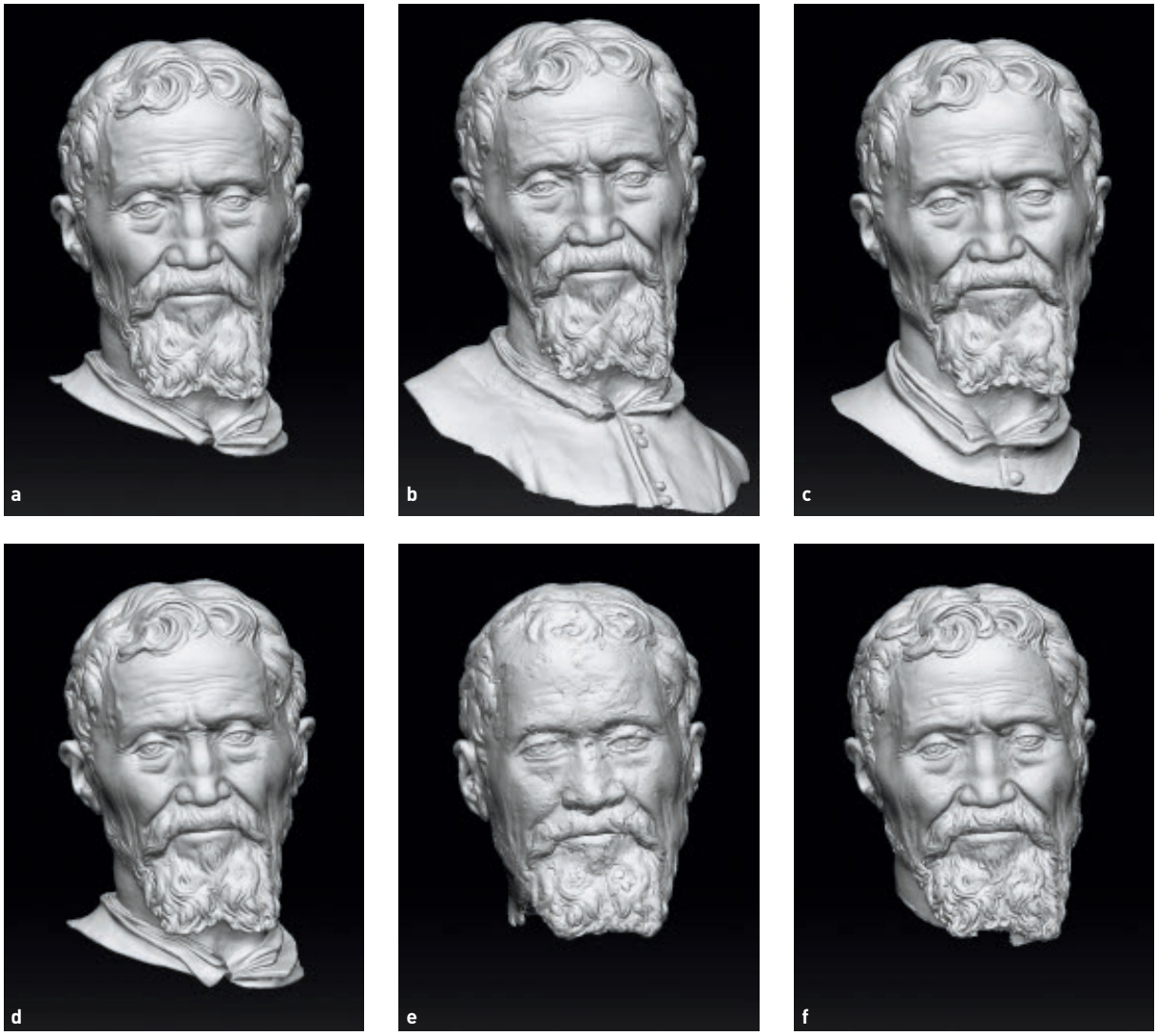
After studying the bronzes in the Galleria dell'Accademia and the 3D prints in Factum's workshop (in various sizes and divided in different ways) the following observations seem to be supported by the evidence. The bronze heads fall into two groups:

GROUP A: Louvre, Jacquemart-André, Casa Buonarroti and Bayonne. Two other busts belong belong to Group A; the damaged bust from Castello Sforzesco and the bust from the Ashmolean. Both finish at the neck.

GROUP B: Accademia, Bargello and Musei Capitolini (the first two seem to have stronger similarities than the third which is softer).

The bust from Rimini has qualities of both groups. When seen from the front it belongs with group B but the deformed and flattened back has the marking of the heads from Group A (fig. 2).

The heads of group A are characterised by appearing like the portrait of a real person rather than the sculpture of a great man. The bronze has a workmanlike character lacking evidence of significant tooling in the wax or chiseled finishing in bronze.

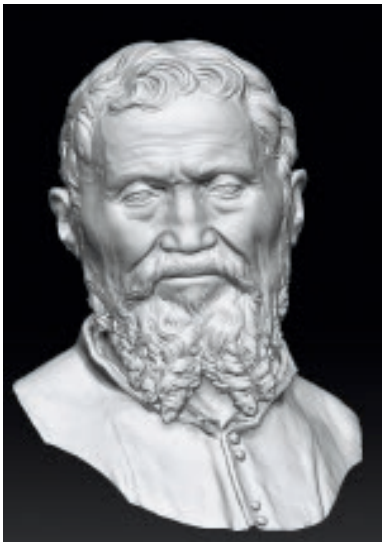


2. Group A, front: a. Louvre; b. Jacquemart-André; c. Casa Buonarroti; d. Bayonne; e. Castello Sforzesco; f. Ashmolean.

The position of the head on the neck creates a space between the beard and the throat. The clothes in each figure, when they exist, are essentially the same. The mouth is similar in each case, and the details of the beards show signs of being cast from the same mould. The veins on the temple are also from the same mould. The top of the head is less defined and lacks clear modelling of the hair. There is a horizontal line on the back of the head in the cast in the Louvre. A line can also be found on the Bayonne version, but it is not in the same place. If the lines were the result of a join in the piece mould, they would be in the same place. They may have formed as the wax is swilled round and tipped out of the mould. Any line that existed in the others has been smoothed over. Perhaps the most clearly revealing detail is the hair when it meets the nape. The similarities between the six casts from Group A in this area clearly indicate that they come from the same mould.

The Rimini bust has characteristics that place it between Group A and Group B (fig. 3). It appears that the wax has been heavily worked and changed and the distorted and flattened back of the head clearly shows signs of having been pressed against a flat surface, perhaps in transport.

In the working of the wax the moustache becomes rounder and more trimmed and the bottom lip fuller. The exaggerated fork and modelling of the hair on the beard mark it out from the other busts (in the other heads in Group B the parting in the beard is reduced). The coiffuring of the hair, clearly taken from the drawing, effectively remains consistent. The clothes are different from those in

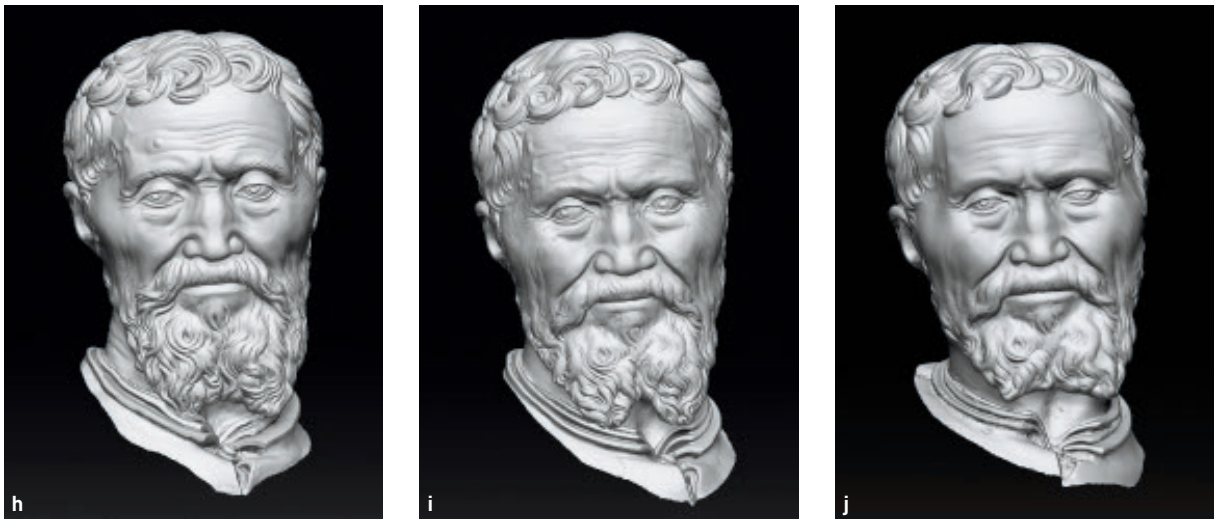


3. Rimini.

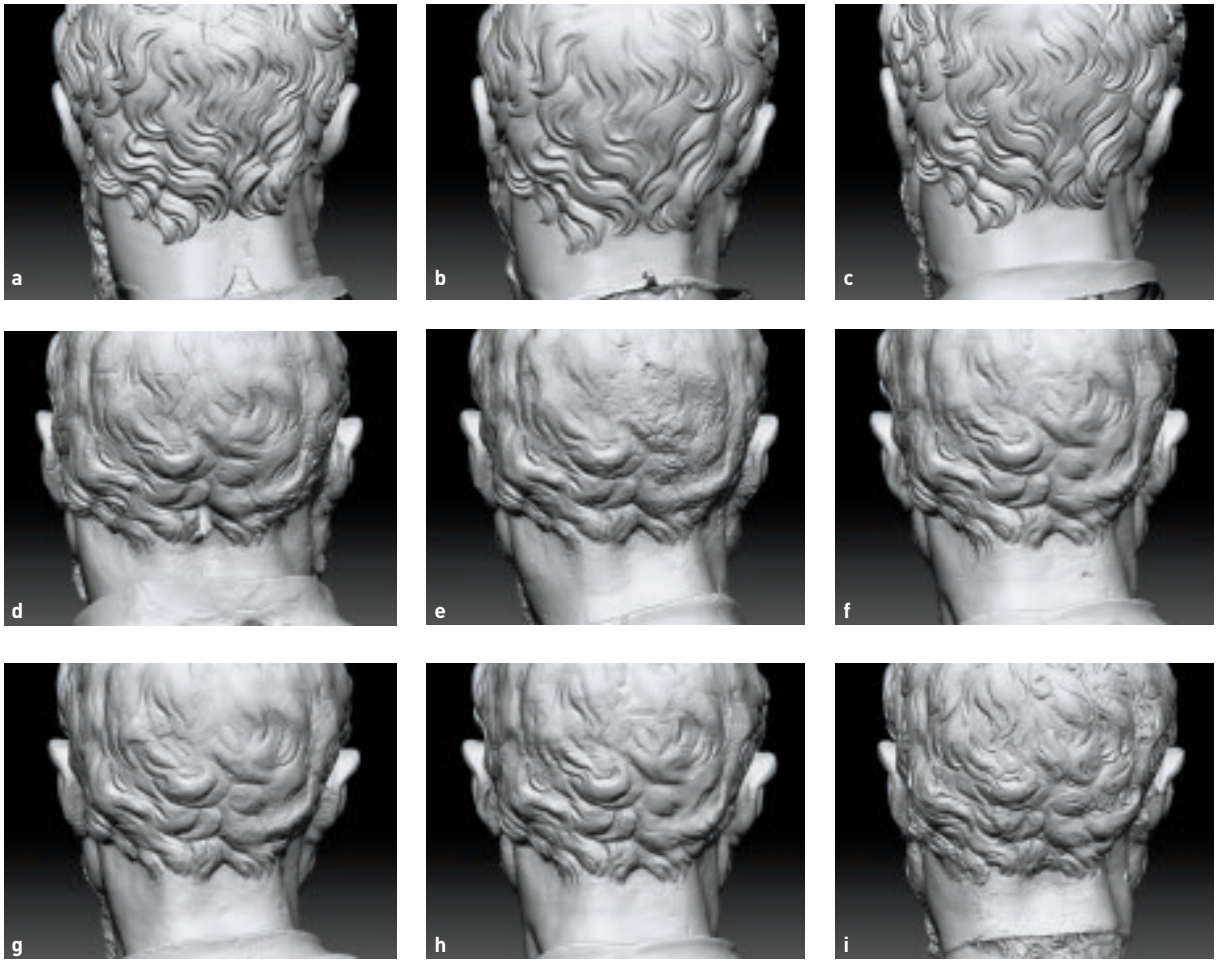
Group A and the head and beard are more tucked into the neck. It does appear as if someone was using the drawing as the reference rather than relying on their memory of Michelangelo's face.

By comparison, Group A lacks the detail, definition and refinement of Group B (fig. 4). The three casts in Group B are much more heavily worked into the wax and chased into the cast metal. When comparing the three different portraits, the one in the Musei Capitolini is a bit softer and less sharply defined. They have similarities that show they were made from the same mould and suggest that they were made in the same foundry, probably by the same person at the same time. The cast in the Accademia is the most clearly defined and the details, like the wart on the forehead, are evidently worked by hand with a small indent around the base of the growth making it feel more pronounced than the other sculptures in this group. In each case the hair on the nape finishes in three duck's tails of a nearly identical pattern. The hair on the top of the head in both groups is less worked and clearly shows signs of the casting process.

The bottom lip is fuller and relates to the Rimini cast. It appears to have been corrected to match the drawing. The similarity between this drawing of Michelangelo's head and the bronze busts in group B is explicit and of significance. A skilled sculptor has turned an informal cast into a formal bust. The change of clothes and extended upper body in the Accademia, Bargello and Musei Ca-



4. Group B, front: h. Accademia; i. Bargello; j. Musei Capitolini.



5. Back details: a. Accademia; b. Musei Capitolini; c. Bargello; d. Rimini; e. Casa Buonarroti; f. Louvre; g. Jacquemart-André; h. Bayonne; i. Ashmolean; j. Castello Sforzesco.

pitolini copies indicate they belong together. The Musei Capitolini body is a made of stone rather than bronze and significant attention has been placed on the scale and importance of the bust.

The face and the front view show considerably skilled retouching while the back of the Musei Capitolini, Bargello and Accademia heads shows very similar modelling in the wax before casting (fig. 5.a-c).

The squashed back of the Rimini head appears to be associated with Group A, with traces of some of the same markings and the same relationship between the ears and the head. Unlike on the other heads there are some striated marks from a tool (these are clearly visible on the neck). These have been made in the wax and show a softness that can be attributed to the lost-wax casting process rather than direct working on the bronze (fig. 5.d). When looking at the details in the hair the Bayonne bust clearly belongs with Group A. The similarities between the Louvre, Bayonne and Jacquemart-André are striking (fig. 5.f-h), while the Casa Buonarroti head shows some casting flaws (fig. 5.e). The Ashmolean cast has many similarities, but it has a more painterly treatment of the hair (fig. 5.i). If the

Ashmolean head was the source for the original cast that was then retouched and re-moulded, it would account for the slightly less defined and slightly rounder qualities of the other casts in the group.

The bust from Castello Sforzesco is in poor condition (fig. 5.j). It seems to come from the same mould as Group A which all seem to be derived from the Ashmolean head. The poor condition of the bust is hard to account for, but it was not uncommon to cast imperfect waxes which were meaningful for the artist to ensure their preservation. The condition of this cast is unlikely to be caused by a damaged mould. It seems more likely that it is an experiment by an un-skilled sculptor. Daniele da Volterra only turned to sculpting at the end of his life. He was a painter, a person transposing the three-dimensional world onto a flat plain, famous for painting the 'breeches' onto Michelangelo's *Last Judgement* for which he got the nickname 'Il Braghettone'. The historical casting specialist Andrew Lacey has observed, during his study and analysis of the Rothschild Bronzes, that the deterioration in the bronze cast was due to the wax or terracotta model having sat around for a long time, slowly getting worse for ware. Later (possibly decades later) it may have been decided that the best way to save the work would be to cast it in bronze thus capturing the decaying surface.

This really leaves the central question. Does Group A, counting Bayonne, Castello and Ashmolean, include the busts of Michelangelo that are referred to in Daniele's estate inventory as being in the studio in varying degrees of completion and finish?

The Ashmolean head has unchased sprues and vents on the back of the head. It is the only bust with this detail. The Ashmolean cast also has a great provenance entering the Museum after it has been in the collection of the artist and connoisseur Sir Thomas Lawrence. While this version is just the head and is clearly less presented than the others, it has the feeling of a modelled form from which a cast has been made. After this bronze was cast, there seems to be a little reworking and there is a slight softening of the surface in the other heads that bear a strong resemblance to this cast. The presence of pitch inside the cast might also suggest that it was done in a goldsmith's workshop rather than a bronze foundry of the type described by Vasari other contemporary writers. If the derivative casts were made from the more finished and chiselled busts in Group B they would have a more finished appearance and would not differ to the extent that they do from Group A.

From a letter of Diomede Leoni, 18 April, 1566:[1]

> With regard to the metal busts, Messer Daniello has cast them, but they are in such a state that they must be worked over with chisels and files, and I do not know if your Signory will like them. Do as you please. For my part I wish you had a good memorial of him and nothing less. That which I say, I do so from regard; Had Daniello been alive perhaps he would have known how to finish them, as to these people I do not know what they will do.[2]

Conclusion

Daniele da Volterra made an intimate portrait of his close friend, the great artist Michelangelo. The poor state is the thing that drew Diomede Leoni's attention. The bust now is Castello Sforza is certainly in very poor condition. The Ashmolean bust is informal, tactile and unfinished but its surface carries clear traces of the marks in the wax 'original'. The others in group A are similar but softer suggesting slight reworking of the wax and the creation of another mould. The Rimini bust is the transition, probably made at the same time as the three busts in Group B but using the same mould to produce the wax. The face is reworked but not the back of the head. The three finished busts in Group B are more finished and formal, presenting the public face of Michelangelo. They were made by a skilled sculptor and an experienced foundry.

Lost-wax bronze casting always contains of evidence that can both reveal and obscure. It is a complex process involving many material transformations. Entropy would not account for Group B becoming Group A, but skillful modeling of the wax or chiseling of the bronze could turn the wax model used to make the Sforza or Ashmolean heads into the Bargello or the Accademia busts. It is therefore possible to assert that Group A must pre-date group B. The character of the surface suggests the Ashmolean bust is the first satisfactory bronze cast from which the others were made.

1 Other sources attribute it to Giacomo Del Duca, one of Michelangelo's assistants. *Il carteggio indiretto di Michelangelo*, edited by P. Barocchi, K. Loach Bramanti, R. Ristori, 2 vols., Florence, 1988–95.

2 Ibid., II (1995), pp. 246–7: "Circa le testi d(e) mitallo, m. Daniello gli ha gettati, ma sono in modo che hormai se hanno da fare d(e) novo con ciselli et lime sì che non so se saranno a preposito per V. S. Fate voi. Io, per me, vorrei havesti il ritratto d(e)lla bona memoria d(e) Missere, non d(e) un altro. V. S. faze lei. Co(m)metta a qualcheduno che vi raguaglie meglio di me. Io, quel che dico, dico per amor che vi porto; et forse, essendo vivo, Daniello l'arebbe fatte condure a un modo che questi soi genti non so quel che faranno"; English translation by Mr. Heath Wilson, in a text by C.D.E. Fortnum, Bodleian Library, Oxford.

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