



**Citation:** F. Tononi (2020) Aesthetic Response to the Unfinished: Empathy, Imagination and Imitation Learning. *Aisthesis* 13(1): 135-153. doi: 10.13128/Aisthesis-10737

**Copyright:** © 2020 F. Tononi. This is an open access, peer-reviewed article published by Firenze University Press (<http://www.fupress.com/aisthesis>) and distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

**Data Availability Statement:** All relevant data are within the paper and its Supporting Information files.

**Competing Interests:** The authors have declared that no competing interests exist.

## Aesthetic Response to the Unfinished: Empathy, Imagination and Imitation Learning<sup>1</sup>

FABIO TONONI

The Warburg Institute, University of London, School of Advanced Study  
E-mail: [tononifabio@gmail.com](mailto:tononifabio@gmail.com)

**Abstract.** This contribution proposes how beholders may internally process unfinished works of art. It does so by considering five of Michelangelo Buonarroti's interrupted sculptures and pointing out their empathic and imaginative potential. The beholder focused on the surface, I propose, is inclined to mentally simulate the artist's gesture that drafted the sculptures through the visible graphic signs of the chisels. This inner simulation takes place within the activation of various brain networks, located in the brain's motor system. Renaissance authors associated the observation of the unfinished to learning and, as this article shows, this assumption seems to find confirmation in recent neuroscientific studies on mirror neurons and imitation learning. In this way, the empathic engagement established between the beholder and the work of art observed – as well as the role played by embodied simulation and imagination in this kind of visual perception – clarifies how the incompleteness can also have that pedagogical function recognised by Giorgio Vasari and Benvenuto Cellini.

**Keywords.** Empathy, imagination, imitation learning, implied actions, unfinished.

---

### 1. INTRODUCTION

To investigate the power that unfinished works of art exercise on the beholder, it seems essential to explore the activity of the brain in relation to their observation. Cognitive neurosciences have made important contributions toward a better understanding of the functions of the human brain, with direct and significant resonances in the history of art and aesthetics. The encounter between art and neuroscience has allowed scholars to produce some original interpretations of works of art – particularly those that emphasise the representation of motions and emotions – and opened an authen-

---

<sup>1</sup> I would like to express my gratitude to Professor David Freedberg (Columbia University in the City of New York) and Professor Manos Tsakiris (Royal Holloway and The Warburg Institute, University of London) for their insightful suggestions for this text.

tically new field of research<sup>2</sup>. The first remarkable attempt in this direction was accomplished by David Freedberg with *The Power of Images* (1989). In this book, Freedberg recovered the discourse of the role of the observer in art and set it on new foundations, enlarging the boundaries determined by Ernst Gombrich (1960) years earlier. Freedberg's pathfinding work has since been carried forward and deepened, both by Freedberg alone (Freedberg [2008]; Freedberg [2010]) and by Freedberg in collaboration with prominent neuroscientists, such as Vittorio Gallese (Freedberg, Gallese [2007]) and Ulrich Kirk (Kirk, Freedberg [2015]).

In a similar, albeit not symmetrical, way, cognitive neurosciences have gained a great deal by operating with philosophical and artistic concepts and by playing a part in theoretical debates. In this way, cognitive neurosciences have remained involved in the general intellectual context, rather than enclosing themselves in a safely circumscribed, specialized field of expertise and practice. They contributed not only to shed light on the way we process reality but also on our engagement with the arts and images in general (Changeux [1994]; Zeki [1999]; Ramachandran [2003]; Gallese [2017])<sup>3</sup>.

The fusion of these two disciplines, art history and neuroscience, gave origin to a new interdisciplinary approach, which has its roots in the philosophical and aesthetic debate inaugurated by some of the most important philosophers, psychologists and art historians of the nineteenth and twentieth centuries, including Gustav Fechner (1876, 1998), Carl Lange (Lange, James [1922]), William James (James [1890]; Lange, James [1922]), Robert Vis-

cher (1873), Theodor Lipps (1903, 1903–1906), Aby Warburg (1999), Wilhelm Worringer (1907), Maurice Merleau-Ponty (1945, 1948), and Ernst Gombrich (1960).

Building on this tradition, the present study intends to cast light on the way beholders perceive the unfinished in the visual arts, particularly in sculpture. Under examination is a specific kind of unfinished, that is, the one that presents a rough surface and makes the signs of the tools used by the artist well visible. An emblematic example that deserves new attention in this sense is Michelangelo Buonarroti's unfinished output. By considering Giorgio Vasari's and Benvenuto Cellini's statements, which stress the pedagogical function of the unfinished, for its peculiarity to show the process of art creation, I intend to validate their hypotheses by focusing on specific neuroscientific research. Pertinent for this purpose is the focus on the activity of mirror neurons in relation to the contemplation of implied actions – such as the artist's gestures, no longer perceivable but that can be mentally traced through the signs left by the instruments employed by the artist on the block of marble. Mirror neurons are a specific category of visuomotor neurons that were first discovered in area F5 of the monkey premotor cortex, in 1992, by a team of neuroscientists composed of Giacomo Rizzolatti, Luciano Fadiga, Leonardo Fogassi and Vittorio Gallese. Subsequent neurophysiological experiments indicated that mirror neurons are also present in humans, precisely in the ventral premotor cortex (encompassing Brodmann's area 44) and posterior parietal cortex (Rizzolatti, Craighero [2004]; Rizzolatti, Sinigaglia [2008]). The functions of this class of neurons are essential for the understanding of the actions of others, such as 'reach out', 'grasp', and 'hold'. This is why the research on mirror neurons also contributed to the study of intersubjectivity, empathy and imitation learning.

Specific brain-body processes seem to be involved during the observation of graphic signs, that is, empathy, embodied simulation, imagination, memory and imitation learning. The activation of imagination, I posit, establishes an

<sup>2</sup> See, for instance, David Freedberg's (2011) new reading of Rogier van der Weyden's *Descent from the Cross* and Vittorio Gallese et al.'s (2018) fresh interpretation of Lucio Fontana's *Concetto spaziale* (1956) and Eugenie Paultre's *Senza titolo* (2016). For a brief outline of twentieth-century scholarly skepticism about the role of emotions and empathy in art perception, see Freedberg, Gallese (2007: 199, box 3).

<sup>3</sup> See also the recent collection of essays, most written by psychologists and neuroscientists, in Huston et al. (2015).

empathic relationship between the observer and the work of art observed through a process of simulation of the artist's gestures. In this sense, empathy and imagination would be at the origin not only of an aesthetic experience, capable of involving the brain as well as the body of the viewer, but also of a learning activity.

Although, at present, there are no published experiments testing the way in which beholders respond to certain types of the unfinished, there is empirical evidence indirectly suggesting that the observation of a graphic mark – such as a cut or brushstroke – could lead the beholder to imagine the artist's act of sculpting a material or applying painting on a two-dimensional support.

Even though the neuroaesthetic literature on Michelangelo's unfinished is limited and generic, there are studies that have attempted to address the problem of the perception of the unfinished in the visual arts. Semir Zeki was first to deal with Michelangelo's unfinished within the neuroaesthetic discipline. He did so by considering some examples of Michelangelo's interrupted production, which includes statues, reliefs, paintings and drawings. However, in *Inner Vision* (1999: 22-36), he confines himself to only mentioning a possible response of beholders to the unfinished generally understood – that is, the imagination of hidden forms – without providing any biological evidence in support of his claim or clarifying the kind of unfinished he is referring to<sup>4</sup>.

Zeki deepened the phenomenon of Michelangelo's unfinished in a second study (2002: 65-67), stressing once again its potential for the beholder in neurological terms. In this regard, while talking about the unfinished, he states, «what Michelangelo has done, without acknowledging it, is to leave it to the brain of the spectator to complete it» (Zeki [2002]: 66). Moreover, for Zeki, the observation of an unfinished work «engages the brain more intensely» (Zeki [2002]: 67) than one that has been

finished. Despite the goal of undertaking a cross-disciplinary approach, these statements are not followed by that scientific explanation asserted in the introduction, that «all human activity is dictated by the organization and laws of the brain: that therefore, there can be no real theory of art and aesthetics unless neurologically based» (Zeki, [2002]: 54)<sup>5</sup>.

In another article, Zeki (2004: 190) addresses the problem of Michelangelo's unfinished through a different perspective. He compares Michelangelo's *Rondanini Pietà*, an unfinished statue, with the incomplete triangle of Kanizsa. However, the main statements, including «in trying to make sense of the Kanizsa pattern that constitutes a Kanizsa triangle, the brain 'finishes it off'» and «in Michelangelo's *Rondanini Pietà*, the capacity to give multi interpretations is taken yet a step further», are not followed by an accurate and detailed neuroscientific explanation.

David Freedberg and Vittorio Gallese (2007: 197-198) interpret Michelangelo's unfinished works from a neuroscientific perspective, as well, although more clearly and precisely than Zeki. They focus on a specific aspect of the unfinished, that is, its potential to facilitate a motor response in the beholder. According to them, in the unfinished sculpture of the *Atlas Slave*, the «responses often take the form of a felt activation of the muscles that appear to be activated within the sculpture itself». This would explain why, they argue, «the sense of exertion ... is effectively conveyed to the spectator».

Finally, another attempt to investigate Michelangelo's unfinished in neuroaesthetics is provided by Vittorio Gallese and Cinzia di Dio (2012: 691). They see the unfinishedness of the *Slaves* as the key element that strengthens the bodily empathy of art viewers, who, according to the authors, are able «to experience the struggle of the prisoners to free themselves from the stone». Supported by empirical experiments, they propose this interpretation by stressing «the relevance of embodied simulation in art».

---

<sup>4</sup> Evidently, not all unfinished can have the same characteristics (for instance, the unfinished does not always have hidden forms) and not all typologies of the unfinished can elicit the same response in the beholders.

---

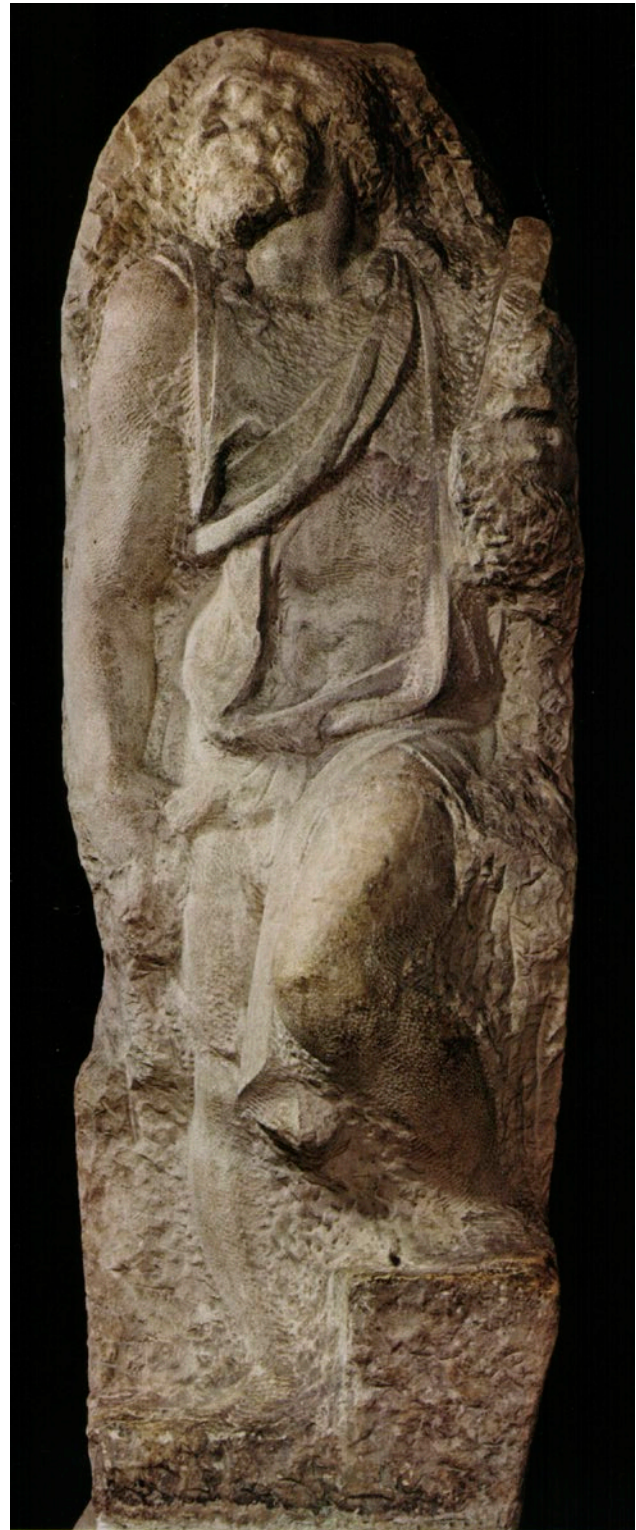
<sup>5</sup> For a detailed review of Zeki's neuroscientific interpretation of art creation and perception, see Ione (2003).

In this study, I intend to take a different angle from the ones previously explained. Considering the sub-personal and unconscious way in which most simulations work, as a form of direct perception, I focus on implied actions, perceivable and simulated through the signs left by the sculptor's instruments, thus revealing the imaginative and pedagogical potentials of the unfinished.

## 2. MICHELANGELO'S *NON FINITO* AND THE PROCESS OF IMAGE-MAKING

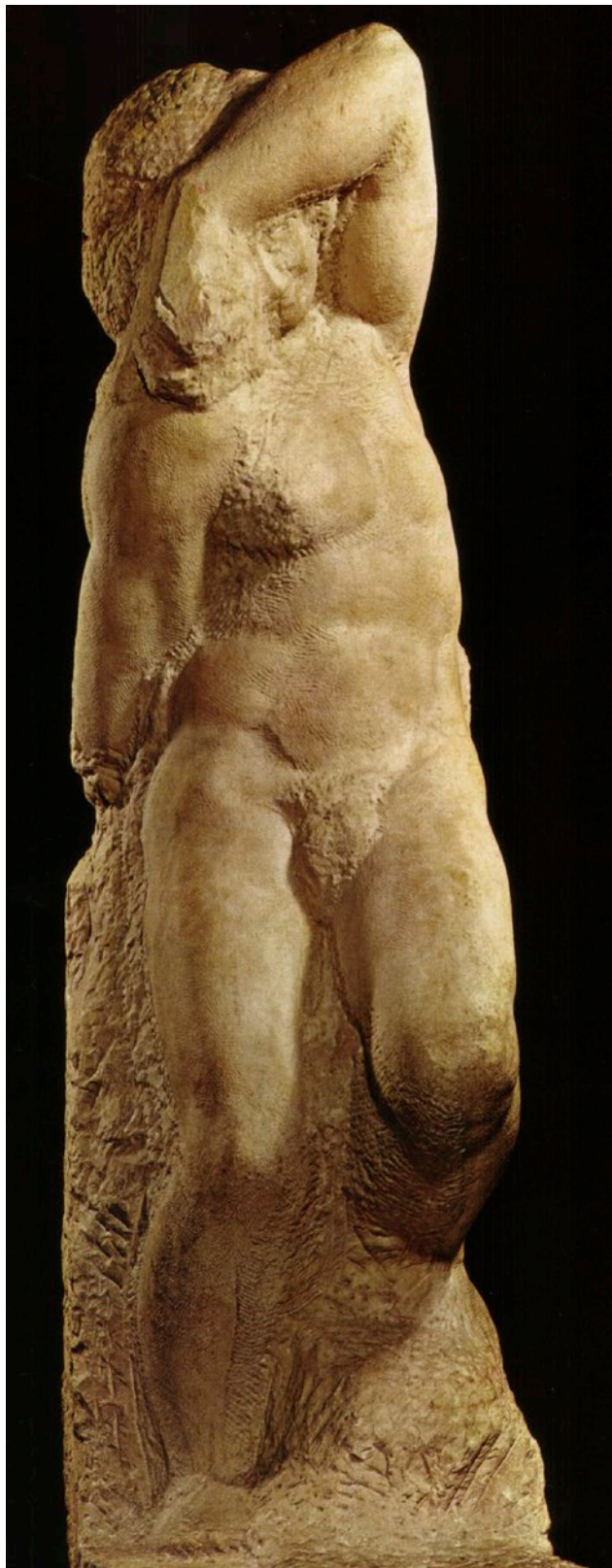
«Michelangelo's unfinished works manifest their incompleteness in a way that one cannot help noticing, no matter at what point one gazes, even if it does not always extend over the entire surfaces» (Gilbert [2003]: 57). With this sentence, Creighton Gilbert catches the issue of the perception of the unfinished that is present in many of Michelangelo's works of art, particularly sculptures. In this regard, Vasari wrote, «there are few finished statues to be seen out of all that he executed in the prime of his manhood, and that those completely finished were executed by him in his youth...the others, I say, were all left unfinished, and, moreover, they are many»<sup>6</sup>.

I address the problem of the aesthetic responses of beholders to the unfinished as a rough surface by focusing on five statues by Michelangelo Buonarroti, the solution of which, I argue, requires the application of neuroscientific findings. From Michelangelo's unfinished output, this essay concentrates on the interrupted statue of *St Matthew* (Figure 1) and the unfinished *Slaves* (Figures 2–5). The *Slaves* is a group of six statues realised for Pope Julius II's tomb in San Pietro in Vincoli in Rome. Two of them are finished – the *Dying Slave* and the *Rebellious Slave* – whereas the other four – the *Young Slave* (Figure 2), the *Bearded Slave* (Figure 3), the *Awakening Slave* (Figure 4) and the



**Figure 1.** Michelangelo Buonarroti, *St Matthew*, 1506, marble (216 cm), Florence, Galleria dell'Accademia. (Image in Public Domain)

<sup>6</sup> Vasari (1966: VI, 92): «delle sue statue se ne vede poche finite nella sua virilità, che le finite affatto sono state condotte da lui nella gioventù...l'altre, dico sono [re]state imperfette, e son molte maggiormente». Translated in Vasari (1912–1915: IX, 83).



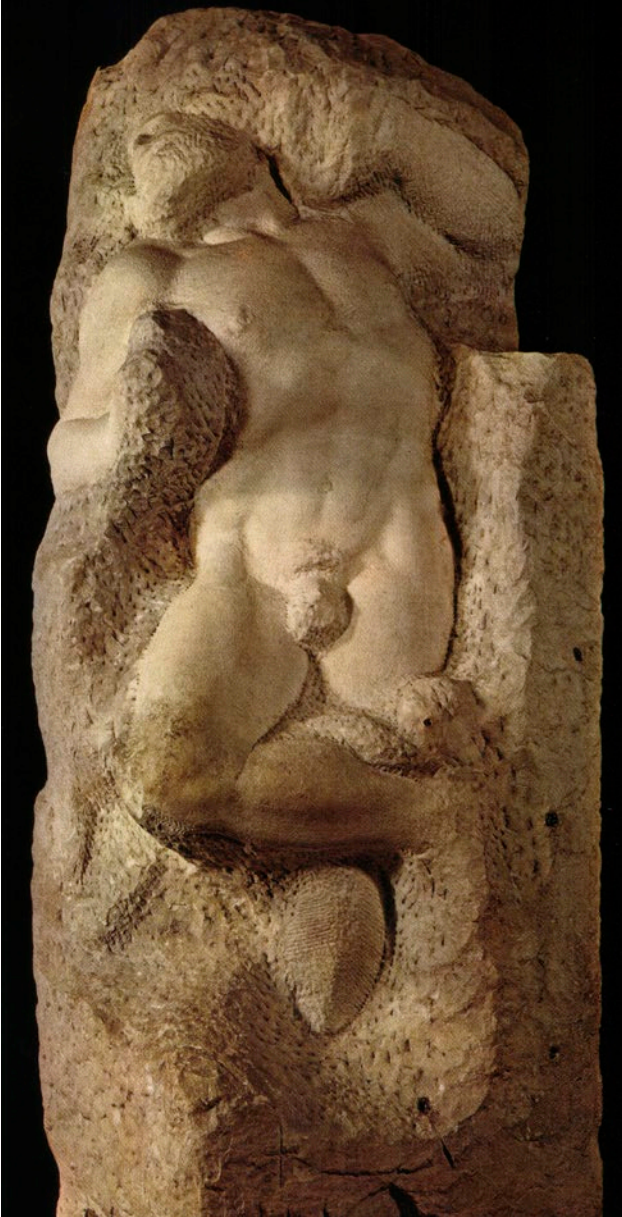
**Figure 2.** Michelangelo Buonarroti, *Young Slave*, c. 1525–1530, marble (256 cm), Florence, Galleria dell'Accademia. (Image in Public Domain)



**Figure 3.** Michelangelo Buonarroti, *Bearded Slave*, c. 1525–1530, marble (263 cm), Florence, Galleria dell'Accademia. (Image in Public Domain)

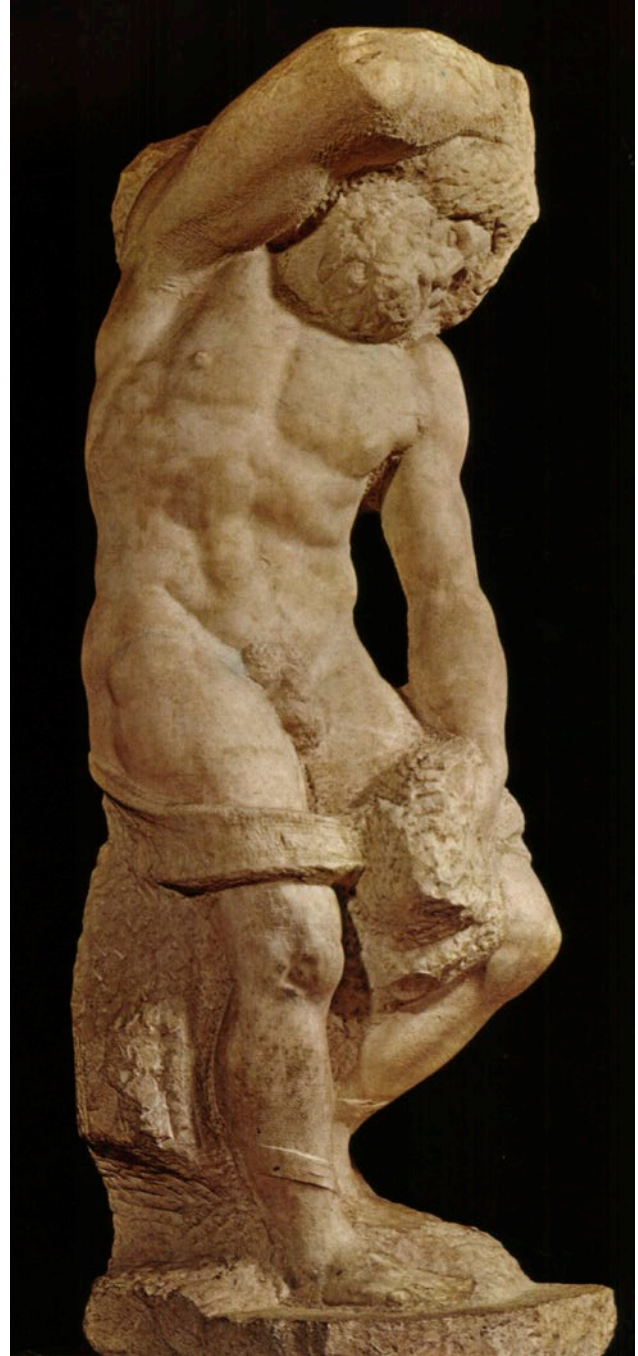
*Atlas Slave* (Figure 5) – are incomplete. Among these *Slaves*, I deal with the last four, which better express, along with the *St Matthew*, the concepts of empathy, embodied simulation, imagination, and imitation learning applied to sculpture.

As stipulated in the contract between Michelangelo and the consuls of the Arte della Lana, the



**Figure 4.** Michelangelo Buonarroti, *Awakening Slave*, c. 1525–1530, marble (267 cm), Florence, Galleria dell'Accademia. (Image in Public Domain)

statue of *St Matthew*, which Michelangelo realised in 1506, was part of a group of twelve sculptures, as the number of the Apostles, to be placed in the Florentine Cathedral of Santa Maria del Fiore (Buonarroti [2005]: 18-21). However, as a consequence of his acceptance to realise the tomb for Pope Julius II – as Michelangelo himself stated in a letter dated December 1523 to Giovan Francesco



**Figure 5.** Michelangelo Buonarroti, *Atlas Slave*, c. 1525–1530, marble (277 cm), Florence, Galleria dell'Accademia. (Image in Public Domain)

Fattucci (Buonarroti [1973]: III, 7) – he carved only this unfinished piece. As a result of this new commission, on 18 December 1505, the contract for the *St Matthew* was cancelled (Pope-Hennessy [1963]: catalogue, 12).

Describing the *St Matthew*, Vasari adopted the adjective «sketched» to refer to its unfinished state, stating that «sketched in this manner, it shows its perfection and teaches sculptors in what way figures can be carved out of marble without their coming out misshapen, always improving the figure by removing the marble judiciously and being able to change something, if there were any need»<sup>7</sup>. In this statement is condensed the idea according to which the unfinished allows the observer – in particular, the beginner sculptor – to acquire knowledge about the process and method undertaken by the artist in making the work and, consequently, to learn how to carve stones properly. In this respect, it is worth investigating how the problem concerning image-making and the perception of unfinished works of art are related<sup>8</sup>.

The group of *Slaves*, dated c. 1520–1530, shows many similarities to the sculpture of *St Matthew* previously mentioned. There are some clues that suggest they were part of the project for the tomb of Pope Julius II, dated 1505–1545, as a drawing that represents six well-defined figures seems to hint (Zöllner et al. [2007]: 491). The resizing of the monument – for which Michelangelo realised six projects – decided by the Pope himself, would have forced Michelangelo to exclude the *Slaves* and *Victories* in the final version of the tomb, probably both initially conceived for the ground level<sup>9</sup>.

These sculptures share a similar appearance: all present a rough surface as a result of the hits made by the artist with different types of chisels in



**Figure 6.** Michelangelo Buonarroti, *Awakening Slave*, detail, c. 1525–1530, marble (267 cm), Florence, Galleria dell'Accademia. (Image in Public Domain)

the act of shaping the figures. This aspect becomes clearer if we focus on a specific detail. Considering the bottom part of the *Awakening Slave* (Figure 6), for example, we notice that, at the centre, there are two rows of parallel lines, executed with a type of small chisel, which define the lower part of the figure's left leg; around it is a series of strokes, irregularly arranged, which suggest other forms, probably executed with a larger chisel; finally, the right leg is surrounded by small holes, likely made with a hand drill. The object of investigation of this study is exactly this sort of appearance, which is the consequence of the abandonment of works of art in mid-creation by the artist.

These sculptures not only share the same type of rough surface but also a similar level of unfinishedness: some parts of the figures' bodies are inside the stone, others are emerged but only sketched out, and still others are clearly visible and well detailed but with their surface rough. Because of their appearance, Vasari identifies a particular purpose for the unfinished *Slaves* when he states, «four Prisons sketched out, that can teach one how to carve figures out of marbles with a secure manner so not to ruin the stones»<sup>10</sup>.

<sup>10</sup> Vasari (1966: VI, 110): «quattro Prigioni bozzati, che possono insegnare a cavare de' marmi le figure con un modo sicuro da non istorpiare i sassi».

<sup>7</sup> Vasari (1966: VI, 22): «la quale statua così abbozzata mostra la sua perfezzione et insegna agli scultori in che maniera si cavano le figure de' marmi senza che venghino storpiate, per potere sempre guadagnare col giudizio levando del marmo et avervi da potersi ritrarre e mutare qualcosa, come accade se bisognassi». Unless noted otherwise, subsequent translations are my own.

<sup>8</sup> For more on the unfinished as a phenomenon that allows the viewer to see the method undertaken by the artist in creating the work of art, see Carabell (1997); and Bambach (2016).

<sup>9</sup> For Michelangelo's tomb of Pope Julius II, see Condivi (1553: 22-26); and Vasari (1966: VI, 26-30).

Vasari, therefore, in repeating what he says about the *St Matthew*, attributes a pedagogical potential to these sculptures, as they provide instructions to the observer on how to properly deal with marble. However, it is worth clarifying that this potential can be seen as a consequence of the unfinished state and not as the aim of the artist<sup>11</sup>.

We have seen that, for Vasari, it is important for a beginner sculptor to learn from Michelangelo's unfinished works because he adopted the best way to sculpt marble. In fact, his method gave the artist the possibility of applying modifications during the work in progress without damaging the block. At this point, a question arises: what did Michelangelo's method of image-making consist of? To answer this question, we first need to consider the concept of sculpture that Michelangelo had in mind. We find an important indication of Michelangelo's definition of sculpture in a letter that he wrote in 1547 to Benedetto Varchi: «For sculpture I mean what one does by force of taking away»<sup>12</sup>. As it is evident, Michelangelo did not intend sculpture as a process of addition, as it is in the case of clay, for instance. Quite the opposite, he meant sculpture as a process of subtraction. He expands this concept in one of his sonnets, in which he states, «not even the best of artists has any conception that a single marble block does not contain within its excess, and that is only attained by the hand that obeys the intellect»<sup>13</sup>. Michelangelo, in this passage, clearly expresses the idea that the image to be carved is already present inside the block of marble but is covered by the

superfluous. It is the task of the artist to remove the matter in excess and free the image.

Michelangelo's method of carving was celebrated by many of his contemporaries, Vasari being one of them. In another passage, addressed to beginner sculptors, he praises Michelangelo's method of carving, explaining how it works:

*You take a figure in wax or some other solid material, and lay it horizontally in a vessel of water, which water being by its nature flat and level at the surface, as you raise the said figure little by little from the level, so it comes about that the more salient parts are revealed, while the lower parts those, namely, on the under side of the figure remain hidden, until in the end it all comes into view. In the same manner must figures be carved out of marble with the chisel, first laying bare the more salient parts, and then little by little the lower parts; and this method may be seen to have been followed by Michelangelo in the above-mentioned Slaves*<sup>14</sup>.

Vasari here, using a metaphor, gives instructions about how to correctly create a sculpture. Basing his explanation on Michelangelo's unfinished *Slaves*, he states that the sculptor should start carving from the surface of the block of marble toward the depth. The result is that the first forms to emerge are almost finished, whereas the recessive parts are roughly sketched out or remain entirely embedded in the stone.

The method adopted by Michelangelo in sculpture, evident in his unfinished output, seems to have been very different from that practiced by

<sup>11</sup> Zeki's (1999: 51; 2002: 68) argument that Michelangelo left most of his artworks voluntarily unfinished, specifically to express philosophical concepts, must therefore be rejected. In addition, Gilbert's (2003) historical reconstruction contradicts Zeki's assumption. For a detailed review of the literature on the possible reasons why Michelangelo left the majority of his works unfinished, see Schulz (1975).

<sup>12</sup> Buonarroti (1973: IV, 266): «io intendo scultura quella che si fa per forza di levare».

<sup>13</sup> Buonarroti (1991: 302): «Non ha l'ottimo artista alcun concetto, ch' un marmo solo in sé non circoscriva col suo superchio; e solo a quello arriva la man che ubbidisce all'intelletto». Translated in *ibid*.

<sup>14</sup> Vasari (1966: VI, 110): «che se e' si pigliassi una figura di cera o d'altra materia dura, e si mettesi a diacere in una conca d'acqua, la quale acqua essendo per sua natura nella sua sommità piana e pari, alzando la detta figura a poco a poco del pari, così vengono a scoprirsi prima le parti più rilevate et a nascondersi i fondi, cioè le parti più basse della figura, tanto che nel fine ella così viene scoperta tutta. Nel medesimo modo si debbono cavare con lo scarpello le figure de' marmi, prima scoprendo le parti più rilevate, e di mano in mano le più basse, il quale modo si vede osservato da Michelagnolo ne' sopra detti prigionieri». Translation adapted from Vasari (1912–1915: IX, 106–107).



the majority of the artists of the time. As we know from Benvenuto Cellini – who recorded and recommended Michelangelo’s method in chapter six of his treatise *On Sculpture* (1568) – generally, artists worked from all sides at the same time to carve a block of marble, bringing out the whole figure at once. On the contrary, Michelangelo’s method consisted of completing one side at a time:

*When you are satisfied with your model you draw the principal views of your statue on to the stone, and mind it be well drawn, for if not you may miscut your block. The best method I ever saw was the one that Michelangelo used; when you have drawn on your principal view you begin to chisel it round as if you wanted to work a half relief, and thus gradually it comes to be cut out<sup>15</sup>.*

The method that Cellini describes in this passage is also evident in the statue of *St Matthew*, which was carved from the front of the block towards the back:

*I must not omit to say for the guidance of those who are unskilled in working marble, that they may strike boldly in with their subbia; for the more delicate subbia, provided it be not inserted straight into the stone, does not crack the marble, but just chips off as lightly as possible whatever may be necessary; while with the scarpello a tacca the rough edges may then be brought to an even plane, and you go over the work with it just as if you were making a drawing for the surface. And this truly is the right method, and the one which the great Michelangelo employed. Some have tried other ways, and thinking to have their work done quicker have sought to get their figure out by taking*

<sup>15</sup> Cellini (1971: 789): «E da poi che uno si sia satisfatto nel sopradetto modello, si debbe pigliare il carbone e disegnare la veduta principale della sua statua di sorte che la sia ben disegnata; perché chi non si risolvessi bene al disegno, talvolta si potria trovare ingannato da’ ferri. E il miglior modo che si sia mai visto è quello che ha usato il gran Michelagnolo: il qual modo si è, di poi che uno ha disegnato la veduta principale, si debba per quella banda cominciare a scoprire con la virtù de’ ferri come se uno volessi fare una figura di mezzo rilievo, e così a poco a poco si viene scoprendo». Translated in Cellini (1967: 136).

*a bit off first in one place and then in another, but it took them all the longer in the end, and wasn’t near so good<sup>16</sup>.*

As these written records make clear, the unfinished works of art allow the beholder to see the method undertaken by the artist (in this case, Michelangelo) in creating the work of art and, consequently, to understand and learn the proper process of image-making. Because the figures of these statues are half emerged from the blocks of marble and the signs of the chisels are well visible, the sculptures are perceived incomplete by the observer. I argue that the beholder who perceives works of art as unfinished is led to imagine the process of creation – namely, the gestures of the artist’s hands in the act of carving the block of marble – and to grasp the direction of the working process from the front to the back. In the following sections, I suggest how this may happen in the beholder’s brain-body system, after introducing the phenomenon of empathy, essential for an aesthetic response.

### 3. FROM THE SELF TO THE OTHER: EMPATHY IN AESTHETIC RESPONSE

The form of observation that Vasari and Cellini suggest to beginner sculptors can also occur at a pre-reflective level. Sight, indeed, can provide direct access to the object observed. It is in

<sup>16</sup> Cellini (1971: 790): «Non voglio mancare di non avvertire quelli che non sono pratici al marmo, per quel che la subbia si adopera, confrontando che quanto più si può si vadia in là con essa presso alla fine. Questo si è perché la detta sottilissima subbia non introna il marmo, ché non la ficcando per dritto nella pietra l’uomo spicca dal detto marmo tutto quello che e’ vuole gentilissimamente; e di poi con lo scarpello a una tacca si viene a unire, e con quella si inversa come se proprio uno avessi a disegnare. E questo è il vero modo che ha usato il gran Michelagnolo; perché questi altri che hanno voluto fare altrimenti, come sè dire cominciando a levare ora in un luogo e ora in un altro, ritondando la figura, pensando di far più presto, a questi tali è riuscito il far più tardo e manco bene». Translated in Cellini (1967: 136-137).

this sense that we discuss empathy, mainly a visual phenomenon that can occur when we relate to what we see.

The nineteenth-century German philosophy and art history describe empathy as a consequence of the absorption of the observer in the object observed<sup>17</sup>. In this process of absorption, a decisive role has been assigned to the self, whose distinction with the other would be, during active contemplation, minimised. Wilhelm Worringer (1907: 34), for instance, associated «the concept naturalism with the process of empathy». For Worringer, the observation of naturalistic figures causes a form of loss of self, with consequent absorption of the beholder into the work of art.

Behind Worringer's explanation of the process of empathy are the theories of Arthur Schopenhauer (1818/1819–1844) and Theodor Lipps (1903–1906). For Schopenhauer, «the person who is involved in this perception is no longer an individual, for in such perception the individual has lost himself»<sup>18</sup>. In this way, Schopenhauer argues that a beholder involved in a visual contemplation of either a living being or inanimate object loses himself entirely in the contemplated thing. Schopenhauer brings this concept to its extreme consequence by stating that «it is as though the object alone existed without anyone to perceive it, and thus we are no longer able to separate the perceiver from the perception, but the two have become one, since the entire consciousness is filled and occupied by a single image of perception»<sup>19</sup>. Schopenhauer

<sup>17</sup> For the debate about empathy in the nineteenth-century German philosophical tradition, see Lanzoni (2018: 21–97).

<sup>18</sup> Schopenhauer (1919: I, 246): «ist zugleich der in dieser Anschauung Begriffene nicht mehr Individuum: denn das Individuum hat sich eben in solche Anschauung verloren». Translated in Schopenhauer (1969: I, 179).

<sup>19</sup> Schopenhauer (1919: I, 245–246): «so, daß es ist, als ob der Gegenstand allein da wäre, ohne jemanden, der ihn wahrnimmt, und man also nicht mehr den Anschauenden von der Anschauung trennen kann, sondern Beide Eines geworden sind, indem das ganze Bewußtsein von einem einzigen anschaulichen Bilde gänzlich gefüllt und eingenommen ist». Translated in Schopenhauer (1969: I, 178–179).

penhauer's idea of contemplation was re-elaborated, years later, by Theodor Lipps, who posits that «in empathy, therefore, I am not the real I, but am inwardly liberated from the latter, i.e., I am liberated from everything which I am apart from contemplation of the form. I am only this ideal, this contemplating I»<sup>20</sup>.

However, the distinction between the self and the other in empathy, I argue, remains crucial. Precisely because it is the I that experiences the other, without the I – as stated by Schopenhauer, Lipps and Worringer – there would not be any experience. The loss of self would consequently dissolve the empathic experience. In other words, how can I experience something – in this case, the other – if my I is lost<sup>21</sup>?

After the phenomenological tradition that followed the aforementioned debate, the phenomenon of empathy has recently found new consideration in the fields of cognitive neurosciences, art history and neuroaesthetics with fundamental contributions by Antonio Damasio, Jean Decety, Vittorio Gallese and David Freedberg<sup>22</sup>. At the base of this renewed interest, there is, among other factors, the discovery of mirror neurons, which revolutionised the understanding of empathy, whether in life or art.

In dealing with emotions, Damasio (1994) proposes the “as-if” theory. Based on a neural account, he suggests that, during observation, the beholder feels the same sensation as the subject observed, *as if* (s)he were in the situation contemplated. Gallese's embodied simulation theory goes in a similar direction (Gallese [2005]; Gallese [2011]; Gallese [2017]; Gallese [2018]; Gal-

<sup>20</sup> Lipps (1903–1906: I, 247): «Ich bin also in der Einfühlung nicht dies reale Ich, sondern bin von diesem innerlich losgelöst, d.h. ich bin losgelöst von allem dem, was ich aufser der Betrachtung der Form bin. Ich bin nur dies ideelle, d. h. dies betrachtende Ich». Translated in Worringer (1907: 34).

<sup>21</sup> My argument here seems to find confirmation in neuroscientific research on intersubjectivity (Decety, Somerville [2003]), as shown in the subsequent passages.

<sup>22</sup> For the debate about empathy in the phenomenological tradition, see Zahavi (2010).

lese [2019]). Based on the discovery of mirror neurons, he argues that both the emotions and goal-directed movements observed are inwardly simulated by the beholder, so as to establish an empathic engagement between the self and the other. Decety and colleagues took a slightly different approach. Their work contributed to the study of empathy by showing that imagining one's own action, imagining another's action and imitating an action performed by a model all activate the same areas of the premotor cortex and posterior parietal lobe in the observer as in the observed (Decety et al. (1994); Decety, Grèzes [1999]).

Further empirical evidence indicates that, during external contemplation, the neural network associated with self-recognition overlaps with regions that contain mirror neurons, which, as we have previously seen, provide a link between the self and the other, enabling intersubjectivity and empathy (Decety, Sommerville [2003]; Sugiura et al. [2005]; Uddin et al. [2005]; Platek et al. [2006]). As a consequence, mirror neurons can function as bridges between the self and the other, indicating the pivotal role of the self in empathy.

Finally, Freedberg (2008, 2010, 2011, 2017) applies these empirical results, also in cooperation with Gallese (Freedberg, Gallese [2007]), to the study of the empathic responses to the representations of motions and emotions. In this way, he offers a solid contribution, from the humanities side, to the dialogue between art history and neuroscience.

#### 4. THE TRACE OF THE ARTIST AND THE BEHOLDER'S RESPONSE: IMPLIED ACTIONS, EMBODIED SIMULATION AND IMAGINATION

The phenomenon of empathy can make observation an effective learning activity in numerous contexts, including the observation of unfinished works of art. The neurological implications during the observation of graphic signs, such as those left by a chisel or manual drill, may corroborate this idea, even when the artist is not working on the statue at the time of direct observation. As we will

see, empirical data suggest that in observing certain traces left by an instrument, it is possible to mentally reconstruct the gesture of the hand that produced them through a process of embodied simulation and, I propose, imagination.

Three electroencephalography studies that focus on implied actions perception investigate the connection between the gestures of the artist's hands and the marks produced by those gestures (Umiltà et al. [2012]; Heimann et al. [2013]; Sbriscia-Fioretti et al. [2013]). In doing so, these experiments analyse the observers' brain response to graphic signs, such as letters, ideograms, scribbles, cuts and brushstrokes. The first study suggests that the observation of a letter of the Roman alphabet, Chinese ideogram or meaningless scribble – all handwritten – activates the viewers' motor representation of their hands (Heimann et al. [2013]), which means that an embodied simulation is taking place. A similar motor simulation of the artist's gesture is provoked during the observation of the cuts on canvas by Lucio Fontana (Umiltà et al. [2012]) and the brushstrokes on canvas by Franz Kline (Sbriscia-Fioretti et al. [2013]).

The data of the experiment on the perception of digital images of three abstract paintings by Fontana – showing, respectively, one, two and three cuts on a white canvas – suggest that the observation of the cuts activates the motor system of the beholder's brain, including mirror neurons, and, consequently, an embodied simulation takes place in the viewer – namely, the simulation of the artist's gesture in making those cuts (Figure 7). The gesture of Fontana is therefore (consciously or unconsciously) imagined, or retraced, through the visualization of the cuts, thus confirming the statement of Ugo Mulas, the photographer who immortalised the moment of creation: «Seeing a picture of holes, or a picture of cuts, it is easy to imagine Fontana making the cut with a blade or the holes with an awl»<sup>23</sup>. As the authors of the

<sup>23</sup> Mulas (1973): «Vedendo un quadro di buchi, o un quadro di tagli, è facile immaginare Fontana mentre fa il taglio con una lama o i buchi con un punteruolo».

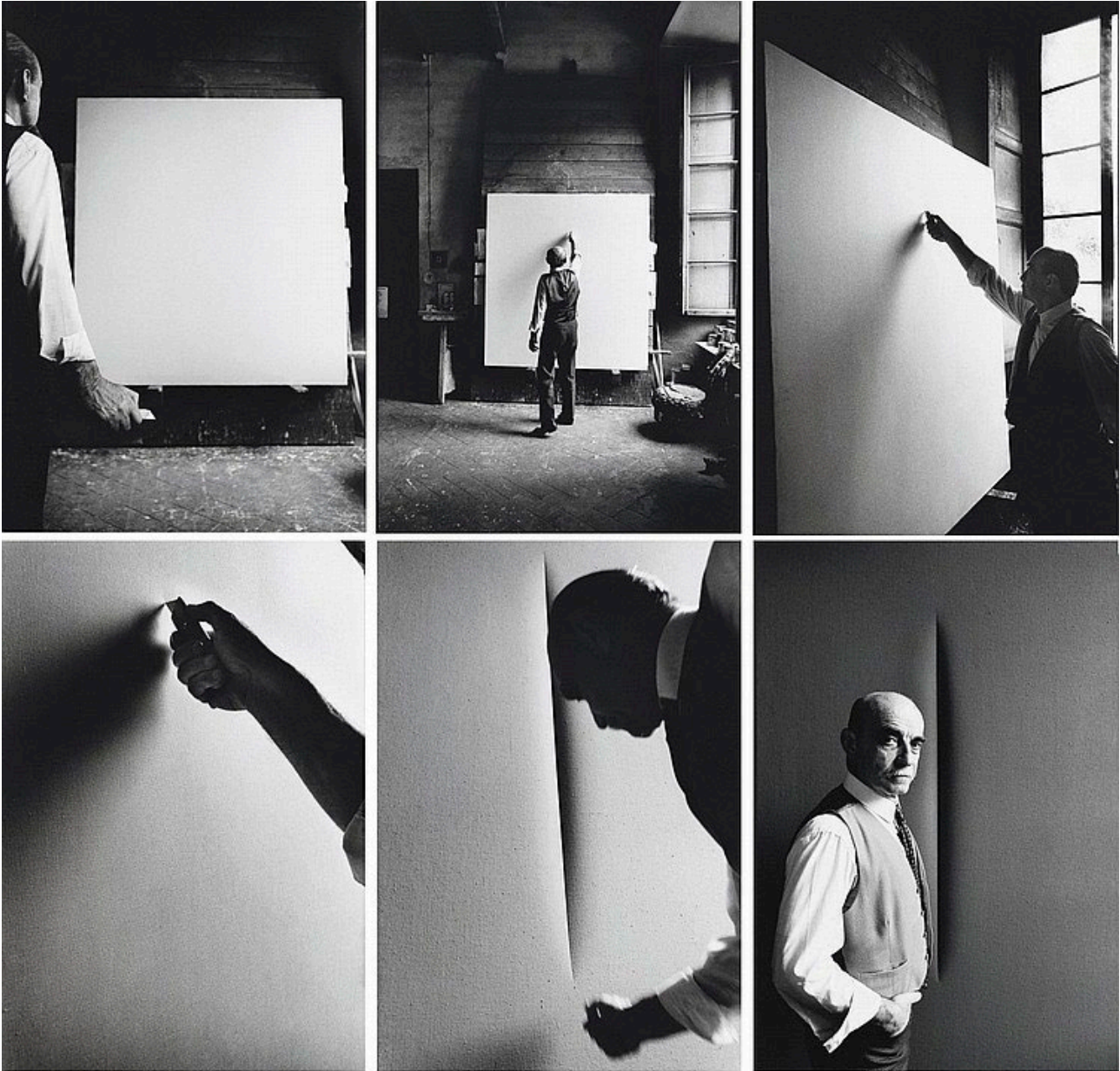


Figure 7. Ugo Mulas, *Lucio Fontana*, 1964. (© Ugo Mulas Estate)

study advance, this embodied simulation of the painter's gesture by the observer can be part of the aesthetic experience, based on the observation of these three works.

The last experiment, which focuses on the perception of digital images of three abstract black and white paintings by Kline – titled, respectively, *Suspended* (1953), *Painting number 2* (1954) and *Painting Number 7* (1952) – confirms the

results of the previous two, that is, to observe an abstract painting – or better, every brushwork of an abstract painting – also means to (consciously or unconsciously) simulate the gestures performed by the painter in creating the signs.

Given the similarities, in terms of dynamism, between the graphic signs investigated in the previously mentioned experiments and the visible traces of the creative gestures on Michelan-

gelo's sculptures, it is likely that the neuroscientific results obtained in those studies can be applied to the kind of unfinished we are examining. Indeed, the signs left by the chisel or manual drill on Michelangelo's sculptures that I have focused on can be inserted in the same category of the signs of the letters of the Roman alphabet, Chinese characters, scribbles, cuts and marked traces of brushstrokes analyzed in those experiments, inasmuch as the latter possess the same dynamic components of the network of crosshatching and the more-or-less regular dots visible on the surface of Michelangelo's statues. Therefore, we can advance the hypothesis that the observation of the signs of the tools in Michelangelo's *St Matthew* and four *Slaves* activates the motor system (including the mirror mechanism) of the viewer's brain, who, as a consequence, is facilitated to retrace – also at an unconscious level – in his or her brain-body system the artist's hands gestures. As a result, the beholder's attention (including an art-trained beholder) would be able to catch the information about the shape, direction and intensity of the hits of the chisels and thereby imitate Michelangelo's artistic method<sup>24</sup>. If my hypothesis is confirmed, the neuroaesthetic approach would validate the pedagogical potential that Vasari and Cellini attribute to Michelangelo's unfinished.

The embodied simulation of the implied movements of the maker, which occurs during the observation of different kinds of graphic signs – including chisel and manual drill marks – reveals, as I have proposed, the imaginative potential of the unfinished. Neuroscientific evidence suggests that the mirror neuron system (the same involved in graphic signs perception) may also contribute to the domain of imagination and that automatic imagination is a crucial mental function for visual perception and social behaviour. We possess the ability to mentally project events

and simulate outcomes, even at an unconscious or pre-reflective level. When we imagine actions done by either ourselves or others – like those executed by an artist in the act of carving a piece of marble, for instance – shared midline and frontoparietal structures are activated (Ruby, Decety [2001]). This has led neuroscientists to believe that imagination is a common domain between the cortical midline structures and mirror neuron system (Uddin et al. [2007]). In this regard, it has been observed that these brain networks might be involved in a number of imaginative processes linked with empathy (Decety, Sommerville [2003]; Ruby, Decety [2004]; Jackson et al. [2005]). Therefore, we can suppose that these inner reactions are the clue to an empathic engagement established between the observer and the unfinished work of art observed. In other words, the attention required for the mental reconstruction of the artist's gestures leads to a process of immersion by the observer in the work contemplated, which would activate mental-body faculties such as embodied simulation and imagination.

##### 5. THE ROLE OF MEMORY IN VISUAL PERCEPTION: A REMARK

In many circumstances, the activity of certain mental processes – such as prediction, mental simulation and imagination – cannot be detached by previously acquired knowledge. A number of studies demonstrate that previous experiences, memories and expertise play an important role in the intensity of activation of mirror mechanisms and the ensuing perceptual contents<sup>25</sup>. It follows that those who already possess some artistic skills – or generically understand the process of art creation – are potentially more advantaged than those who do not in learning new abilities through simple observation.

Consequently, the beholder's memory of a sculptor in the act of carving a block of marble,

<sup>24</sup> It is worth clarifying that knowing how to imitate a method does not mean being able to reproduce the style of the work in question. In other words, succeeding in approaching the block of marble as Michelangelo did does not necessarily follow that one can automatically contribute to sculpture as Michelangelo did.

<sup>25</sup> On the role of memory and experience in mirror neurons activity, see Gallese (2014); Ammaniti, Gallese (2014); Gallese (2016).

for instance, can be a determinant for imagining, or simulating in the embodied mind, those specific actions that were executed to produce those signs. The artistic skills possessed by a beholder, if any, may play a further role in this sense. In this case, (s)he will be more facilitated in improving his or her artistic competences while observing an incomplete work of art realised by a great master, as Vasari and Cellini advise.

## 6. OBSERVATION AND THE BIOLOGICAL BASES OF IMITATION LEARNING

«Observation is always for a purpose» (Gombrich [1960]: 103). With these words, Gombrich sought to draw attention to the importance of observation in the visual arts, both of the artist and the beholder. In this regard, he coined the concept of ‘the beholder’s share’, referring to the psychological mechanism underlying image observation. Also Pliny, in the *Natural History*, recognised the pivotal role of mind during observation: «it is the mind that is the real instrument of sight and of observation; the eyes act as a sort of vessel receiving and transmitting the visible portion of the consciousness» (XI.LIV.146)<sup>26</sup>.

We can advance that one of the purposes of observation is learning. Learning by keen observation (or by imitation through observation) has long been acknowledged as an important aspect of human learning strategy. As we will see, neuroscientific studies on the mirror neuron system show the existence of neural bases of learning by observation and imitation. Furthermore, it seems that this way of acquiring knowledge is very effective and efficient.

As previously mentioned, neuroscientific findings suggest that mirror neurons play a crucial role in observation, particularly during the observation of goal-directed actions, allowing observers to understand the actions of others or even their own

actions<sup>27</sup>. The fact that mirror neurons are activated during both action execution and action observation hints that they also play an important role during the imitation of the actions observed (Rizzolatti [2005]). Empirical evidence suggests that during imitation three cortical areas are involved, that is, the superior temporal sulcus and the two frontoparietal mirror neuron areas (Iacoboni et al. [2001]). This study finds confirmation in Molnar-Szakacs et al. (2005), whose experiment focuses on hand action observation and imitation. The data collected in this study show an activation of mirror neurons during both the observation and imitation of the action. Furthermore, a study conducted by Calvo-Merlino and colleagues (2005), on the role of expertise and motor repertoire of the beholder in action observation, suggests that mirror neurons integrate the «observed actions of others with an individual’s personal motor repertoire»<sup>28</sup>.

These studies indicate that observers are able to imitate the actions that they already know, but what happens when a beholder observes a novel action that does not belong to his or her motor repertoire, which is, after all, the essential precondition for an imitation learning process? This question has been addressed by Buccino and colleagues (2004). In their study, musically naive volunteers were monitored during both the observation of guitar chords (novel for them) and execution of the observed chords. In both cases, an activation of the frontoparietal mirror neuron system was registered<sup>29</sup>. The fact that they succeeded in correctly reproducing the guitar chords observed means that participants were able to learn novel hand actions by simply observing a model. The peculiarity of mirror neurons to

<sup>26</sup> Pliny (1938: III, 522): «animo autem videmus, animo cernimus; oculi ceu vasa quaedam visibilem eius partem accipiunt atque tramittunt». Translated in *ibid.*, 523.

<sup>27</sup> Rizzolatti and colleagues introduced the concept of ‘action understanding’ to explain the function of mirror neurons (Rizzolatti, Fadiga [1998]; Rizzolatti et al. [1996]).

<sup>28</sup> On the role of knowledge and expertise in visual perception, see also Calvo-Merlino et al. (2006); and De Preester, Tsakiris (2014).

<sup>29</sup> They also observed that, in the case of imitation and learning of novel hand actions, other neural areas, including area 46, are involved.

enable the beholder to imitate the actions of others, the authors advance, can facilitate learning. This explains why, for instance, children are able to acquire a new action by simple observation (Shimpi et al. [2013]).

Going back to Michelangelo's unfinished sculptures, these neuroscientific findings might confirm, at least in part, Vasari's and Cellini's statements on the pedagogical function of the unfinished. As we have seen, the unfinished often includes important information about the process and method undertaken by the maker, as well as the tools used. Indeed, the signs on the block of marble enable the observer to recognise the different kinds of chisels and drills used by the artist.<sup>30</sup> This characteristic of the unfinished – that is, to reveal the underlying layout of the sculpture through the marks left by the work tools – is likely to activate specific neurological functions similar to the ones activated during imitation learning. At this point, the beholder's imagination of the hands of the artist in the act of carving the sculpture may function as model to imitate and, therefore, establish an imitation learning process. In other words, observing an artist in the act of carving a block of marble or imagining an artist performing the same action both would activate the same brain networks – although, in imagination, the intensity of the activation of the brain networks would be lower than when we see the actual action. That means that, I posit, imitation learning is taking place in both situations.

However, some clarifications need to be made. That is, in this precise case, with reference to Wittgenstein (1953: 265), the task is not so much to imagine *the precise gesture* that Michelangelo executed, rather to imagine *a gesture* similar to the one that Michelangelo may have performed, a gesture that one may already have in his or her own memory. In other words, there is not, in Wittgen-

<sup>30</sup> In this respect, scholars are able to recognise the various tools used by the maker by observing the different kinds of traces left on the block of marble, thus enabling an understanding of the process of image-making. See Wootton et al., (accessed 9 May 2020); and Russell (2011).

steinian terms, a *correct gesture* to be imagined to imitate Michelangelo's method (not the style). What counts here is to understand (and possibly imitate) the directions and passages of his sculpting process, and this can be achieved by observing his unfinished output<sup>31</sup>.

## 7. CONCLUSIONS

By exploring an aspect of Michelangelo's unfinished, this article has shed light on the potentials of unfinished works of art that present a rough surface, that is, empathy, imagination and imitation learning. In its history, the unfinished has been mainly associated with a particular specificity, that is, the possibility to learn from skilled masters how to properly create works of art. This would be possible by the opportunity to see, through the unfinished, the various passages of art creation – for example, the underdrawing, the *pentimenti* and the intensity and direction of brushstrokes or chisel strokes. The pedagogical potential ascribed to the unfinished by Vasari and Cellini, we have ascertained, can be explained from a neuroscientific perspective, considering primarily the research on mirror neurons.

<sup>31</sup> See Wittgenstein (1953: 265): «Let us imagine a table, something like a dictionary, that exists only in our imagination. A dictionary can be used to justify the translation of a word X by a word Y. But are we also to call it a justification if such a table is to be looked up only in the imagination? – “Well, yes; then it is a subjective justification”. – But justification consists in appealing to an independent authority – “But surely I can appeal from one memory to another. For example, I don't know if I have remembered the time of departure of a train correctly, and to check it I call to mind how a page of the timetable looked. Isn't this the same sort of case?” – No; for this procedure must now actually call forth the correct memory. If the mental image of the timetable could not itself be tested for correctness, how could it confirm the correctness of the first memory? (As if someone were to buy several copies of today's morning paper to assure himself that what it said was true). Looking up a table in the imagination is no more looking up a table than the image of the result of an imagined experiment is the result of an experiment».

In this way, the neuroaesthetic approach allows us not only to illustrate how the unfinished as a rough surface can be perceived by beholders but also to offer, through the concept of imitation learning, a new interpretation of Vasari's and Cellini's passages on Michelangelo's unfinished. In doing so, this study applied for the first time the concept of imitation learning to the embodied simulation of the artist's gestures imagined by beholders of unfinished works of art. Furthermore, it established that, observing the unfinished, we can feel the artwork in ourselves in a particular way, that is, by retracing the dynamic morphology of the chisel strokes in our brain-body system.

Neuroscientific evidence suggests that the mirror neuron system plays a crucial role in a number of functions, including (i) the understanding of the actions performed by others, (ii) the ability to learn by observing and imitating others, (iii) the embodied simulation process, (iv) imagination and (v) empathy – all of which I have considered crucial for the study of the neurological responses to rough surfaces in visual works of art. As we have seen, neuroscientific findings on mirror neurons suggest that the observation of a graphic sign – such as a chisel stroke – leads to an automatic simulation in the embodied mind of the gesture that has produced it. In this type of visual perception, imagination may play an important role because it can allow the beholder to have an understanding of the gestures – and therefore of the creative process – that the artist performed on the block of marble. In this regard, imagination seems to be linked to the concept of imitation learning. Indeed, the imagined actions can function as a model to imitate, enabling the beholder to understand the artist's method of image-making.

To conclude, this essay also proposed that immersion in aesthetic response can occur in at least two different cases: (i) it can be the consequence of the inner simulation of the motions and emotions represented in the figures observed, and this would explain the motor and emotional responses to the work contemplated (as it is demonstrated by previous studies), or (ii) it can be the

result of the simulation of the process of making, and this would explain the pedagogical function of the unfinished and the imaginative response to visual works of art.

Future studies in this field should investigate the neuroaesthetic responses to unfinished works of art with empty spaces, such as the representation of human bodies with missing faces, thus considering the empirical literature on the fusiform face area and neural filling-in.

#### BIBLIOGRAPHY

- Ammaniti, M., Gallese, V., 2014: *The Birth of Intersubjectivity: Psychodynamics, Neurobiology, and the Self*, W. W. Norton & Company, New York.
- Bambach, C. C., 2016: *Leonardo, Michelangelo, and Notions of the Unfinished in Art*, in Baum, K., et al. (eds.), *Unfinished: Thoughts Left Visible*, The Metropolitan Museum of Art, New York.
- Buccino, G., et al., 2004: *Neural Circuits Underlying Imitation Learning of Hand Actions: An Event-Related fMRI Study*, "Neuron", 42, pp. 323-334.
- Buonarroti, M., 1973: *Il Carteggio di Michelangelo*, ed. by P. Barocchi and R. Ristori, 5 vols, Sansoni, Florence.
- Buonarroti, M., 1991: *The Poetry of Michelangelo: An Annotated Translation*, ed. by J. M. Saslow, Yale University Press, New Haven.
- Buonarroti, M., 2005: *I contratti di Michelangelo*, ed. by L. Bardeschi Ciulich, Studio per edizioni scelte, Florence.
- Calvo-Merlino, B., et al., 2005: *Action Observation and Acquired Motor Skills: An fMRI Study with Expert Dancers*, "Cerebral Cortex", 15, pp. 1243-1249.
- Calvo-Merlino, B., et al., 2006: *Seeing or Doing? Influence of Visual and Motor Familiarity in Action Observation*, "Current Biology", 16, pp. 1-6.
- Carabell, P., 1997: *Image and Identity in the Unfinished Works of Michelangelo*, "Anthropology and Aesthetics", 32, pp. 83-105.



- Cellini, B., 1568: *The Treatises of Benvenuto Cellini on Goldsmithing and Sculpture*, transl. by C. R. Ashbee, Dover Publications, New York, 1967.
- Cellini, B., 1568: *Della scultura*, in Ferrero, G. G. (ed.), *Opere*, Unione tipografico-editrice torinese, Turin, 1971.
- Changeux, J. P., 1994: *Art and Neuroscience*, "Leonardo", 27, pp. 189-201.
- Condivi, A., 1553: *Vita di Michelagnolo Buonarroti*, ed. by G. Nencioni, Studio per edizioni scelte, Florence, 1998.
- Damasio, A., 1994: *Descartes' Error: Emotion, Reason and the Human Brain*, G. P. Putnam, New York.
- Decety, J., et al., 1994: *Mapping Motor Representations with Positron Emission Tomography*, "Nature", 371, pp. 600-602.
- Decety, J., Grèzes, J., 1999: *Neural Mechanisms Subservicing the Perception of Human Actions*, "Trends in Cognitive Sciences", 3, pp. 172-178.
- Decety, J., Sommerville, J. A., 2003: *Shared Representations between Self and Other: A Social Cognitive Neuroscience View*, "Trends in Cognitive Sciences", 7, pp. 527-533.
- De Preester, H., Tsakiris, M., 2014: *Sensitivity to Differences in the Motor Origin of Drawings: From Human to Robot*, "PLOS ONE", 9, pp. 1-10.
- Fechner, G., 1876: *Vorschule der Aesthetik*, Breitkopf & Härtel, Leipzig, 1897-1898.
- Fechner, G., 1998: *Aesthetics from Above and from Below*, in Harrison, C., Wood, P. (eds.), Gaiger, J. (transl.), *Art in Theory: 1815-1900*, Blackwell, London, pp. 632-636.
- Freedberg, D., 1989: *The Power of Images: Studies in the History and Theory of Response*, University of Chicago, Chicago and London.
- Freedberg, D., 2008: *Empathy, Motion and Emotion*, in Herding, K., Krause-Wahl, A. (eds.), *Wie sich Gefühle Ausdruck verschaffen: Emotionen in Nahsicht*, Driesen, Berlin, pp. 17-51.
- Freedberg, D., 2010: *Movement, Embodiment, Emotion*, in Dufrêne, T., Taylor, A. C. (eds.), *Cannibalismes Disciplinares. Quand l'histoire de l'art et l'anthropologie se rencontrent*, Musée du quai Branly, Paris, pp. 37-61.
- Freedberg, D., 2011: *Memory in Art: History and the Neuroscience of Response*, in Nalbantian, S., et al. (eds.), *The Memory Process: Neuroscientific and Humanistic Perspectives*, MIT Press, Cambridge (MA), pp. 337-358.
- Freedberg, D., 2017: *From Absorption to Judgment: Empathy in Aesthetic Response*, in Lux, V., Weigel, S. (eds.), *Empathy: Epistemic Problems and Cultural-Historical Perspectives of a Cross-Disciplinary Concept*, Palgrave MacMillan, New York, pp. 139-180.
- Freedberg, D., Gallese, V., 2007: *Motion, Emotion and Empathy in Aesthetic Experience*, "Trends in Cognitive Sciences", 11, pp. 197-203.
- Gallese, V., 2005: *Embodied Simulation: From Neurons to Phenomenal Experience*, "Phenomenology and the Cognitive Sciences", 4, pp. 23-48.
- Gallese, V., 2011: *Embodied Simulation Theory: Imagination and Narrative*, "Neuropsychanalysis", 13, pp. 196-200.
- Gallese, V., 2014: *Bodily Selves in Relation: Embodied Simulation as Second-Person Perspective on Intersubjectivity*, "Philosophical Transactions of the Royal Society B", 369, pp. 1-10.
- Gallese, V., 2016: *Finding the Body in the Brain. From Simulation Theory to Embodied Simulation*, in Kornblith, H., McLaughlin, B. (eds.), *Alvin Goldman and his Critics*, Blackwell, New York, pp. 297-317.
- Gallese, V., 2017: *Visions of the Body. Embodied Simulation and Aesthetic Experience*, "Aisthesis", 10, pp. 41-50.
- Gallese, V., 2018: *The Problem of Images: A View from the Brain-Body*, "Phenomenology and Mind", 14, pp. 70-79.
- Gallese, V., 2019: *Embodied Simulation. Its Bearing on Aesthetic Experience and the Dialogue Between Neuroscience and the Humanities*, "Gestalt Theory", 41, pp. 113-128.
- Gallese, V., Di Dio, C., 2012: *Neuroesthetics: The Body in Esthetic Experience*, in Ramachandran, S. V. (ed.), *Encyclopedia of Human Behavior*, Academic Press, Amsterdam and London, 2, pp. 687-693.
- Gallese, V., et al., 2018: *Behavioral and Autonomic Responses to Real and Digital Reproductions*

- of Works of Art, "Progress in Brain Research", 237, pp. 201-221.
- Gilbert, C. E., 2003: *What Is Expressed in Michelangelo's 'Non-Finito'*, "Artibus et Historiae", 24, pp. 57-64.
- Gombrich, E., 1960: *Art & Illusion: A Study in the Psychology of Pictorial Representation*, Phaidon, New York, 2014.
- Heimann, K., et al., 2013: *How the Motor-Cortex Distinguishes Among Letters, Unknown Symbols and Scribbles. A High Density EEG Study*, "Neuropsychologia", 51, pp. 2833-2840.
- Huston, J. P., et al. (eds.), 2015: *Art, Aesthetics and the Brain*, Oxford University Press, Oxford.
- Iacoboni, M., et al., 2001: *Reafferent Copies of Imitated Actions in the Right Superior Temporal Cortex*, "Proceedings of the National Academy of Sciences USA", 98, pp. 13995-13999.
- Ione, A., 2003: *Examining Semir Zeki's 'Neural Concept Formation and Art: Dante, Michelangelo, Wagner'*, "Journal of Consciousness Studies", 10, pp. 58-66.
- Jackson, P. L., et al., 2005: *How Do We Perceive the Pain of Others? A Window Into the Neural Processes Involved in Empathy*, "Neuroimage", 24, pp. 771-779.
- James, W., 1890: *The Principles of Psychology*, 2 vols, McMillan, London, 1907.
- Kirk, U., Freedberg, D., 2015: *Contextual Bias and Insulation Against Bias during Aesthetic Rating. The Roles of VMPFC and DLPFC in Neural Valuation*, in Huston, J. P., et al. (eds.), *Art, Aesthetics and the Brain*, Oxford University Press, Oxford, pp. 158-173.
- Lange, C., James, W., 1922: *The Emotions*, transl. by K. Dunlap, Williams & Wilkins Co., Baltimore.
- Lanzoni, S., 2018: *Empathy: A History*, Yale University Press, New Haven.
- Lipps, T., 1903: *Empathy, Inner Imitation, and Sense-Feelings*, in Rader, M. (ed.), *A Modern Book of Aesthetics*, Holt, Rinehart and Winston, New York, 1979, pp. 374-382.
- Lipps, T., 1903-1906: *Ästhetik: Psychologie des Schönen und der Kunst*, 2 vols, Voss, Hamburg and Leipzig.
- Merleau-Ponty, M., 1945: *Phenomenology of Perception*, transl. by D. A. Landes, Routledge, London and New York, 2014.
- Merleau-Ponty, M., 1948: *Sense and Non-Sense*, transl. by H. Dreyfus and P. Allen Dreyfus, Northwestern University Press, Evanston, especially Part I, 1964.
- Molnar-Szakacs, I., et al., 2005: *Functional Segregation Within Pars Opercularis of the Inferior Frontal Gyrus: Evidence from fMRI Studies of Imitation and Action Observation*, "Cereb Cortex", 15, pp. 986-994.
- Mulas, U., 1973: *La Fotografia*, Giulio Einaudi Editore, Turin.
- Platek, S. M., et al., 2006: *Neural Substrates for Functionally Discriminating Self-Face from Personally Familiar Faces*, "Human Brain Mapping", 27, pp. 91-98.
- Pliny the Elder, 1938: *Natural History*, transl. by H. Rackham, 10 vols, Harvard University Press and William Heinemann, Cambridge (MA) and London.
- Pope-Hennessy, J., 1963: *Italian High Renaissance and Baroque Sculpture*, 3 vols, Phaidon, London.
- Ramachandran, W. S., 2003: *The Emerging Mind*, Profile, London.
- Rizzolatti, G., 2005: *The Mirror Neuron System and Its Function in Humans*, "Anatomy and Embryology", 210, pp. 419-421.
- Rizzolatti, G., et al., 1996: *Premotor Cortex and the Recognition of Motor Actions*, "Social Cognitive and Affective Neuroscience", 3, pp. 131-141.
- Rizzolatti, G., Fadiga, L., 1998: *Grasping Objects and Grasping Action Meanings: The Dual Role of Monkey Rostroventral Premotor Cortex (Area F5)*, "Novartis Foundation Symposium", 218, pp. 81-103.
- Rizzolatti, G., Craighero, L., 2004: *The Mirror-Neuron System*, "Annual Review Neuroscience", 27, pp. 169-192.
- Rizzolatti, G., Sinigaglia, C., 2008: *Mirrors in the Brain: How our Minds Share Actions and Emotions*, Oxford University Press, Oxford.
- Ruby, P., Decety, J., 2001: *Effect of Subjective Perspective Taking During Simulation of Action: A*

- PET Investigation of Agency*, "Nature Neuroscience", 4, pp. 546-550.
- Ruby, P., Decety, J., 2004: *How Would You Feel Versus How Do You Think She Would Feel? A Neuroimaging Study of Perspective-Taking with Social Emotions*, "Journal of Cognitive Neuroscience", 16, pp. 988-999.
- Russell, B., 2011: *The Roman Sarcophagus 'Industry': A Reconsideration*, in Elsner, J., Huskinson, J. (eds.), *Life, Death and Representation: Some New Work on Roman Sarcophagi*, Walter de Gruyter, Berlin and Boston, pp. 119-147.
- Sbriscia-Fioretti, B., et al., 2013: *ERP Modulation during Observation of Abstract Paintings by Franz Kline*, "PLOS ONE", 8, pp. 1-12.
- Schopenhauer, A., 1818-1819/1844: *Die Welt als Wille und Vorstellung*, 2 vols, Hesse & Becker, Leipzig, 1919.
- Schopenhauer, A., 1818-1819/1844: *The World as Will and Representation*, transl. by E. F. J. Payne, 2 vols, Dover Publications, New York, 1969.
- Schulz, J., 1975: *Michelangelo's Unfinished Works*, "The Art Bulletin", 57, pp. 366-373.
- Shimpi, P. M., et al., 2013: *Toddlers' Imitative Learning in Interactive and Observational Contexts: The Role of Age and Familiarity of the Model*, "Journal of Experimental Child Psychology", 116, pp. 309-323.
- Sugiura, M., et al., 2005: *Cortical Mechanisms of Visual Self-Recognition*, "Neuroimage", 24, pp. 143-149.
- Uddin, L. Q., et al., 2005: *Self-Face Recognition Activates a Frontoparietal 'Mirror' Network in the Right Hemisphere: An Event-Related fMRI Study*, "Neuroimage", 25, pp. 926-935.
- Uddin, L. Q., et al., 2007: *The Self and Social Cognition: The Role of Cortical Midline Structures and Mirror Neurons*, "Trends in Cognitive Sciences", 11, pp. 153-157.
- Umiltà, M. A., et al., 2012: *Abstract Art and Cortical Motor Activation: An EEG Study*, "Frontiers in Human Neuroscience", 6, pp. 1-9.
- Vasari, G., 1550: *Lives of the Most Eminent Painters, Sculptors & Architects*, transl. by Gaston du C. de Vere, 10 vols, Macmillan & Co. and The Medici Society, London, 1912-1915.
- Vasari, G., 1550: *Le vite de' più eccellenti pittori scultori e architettori: nelle redazioni del 1550 e 1568*, ed. by R. Bettarini and P. Barocchi, 6 vols, Sansoni, Florence, 1966.
- Vischer, R., 1873: *On the Optical Sense of Form: A Contribution to Aesthetics*, in Mallgrave, H.F., Ikonomou, E. (eds.), *Empathy, Form and Space. Problems in German Aesthetics 1873-1893*, University of Chicago Press, Los Angeles, 1994, pp. 89-123.
- Warburg, A., 1999: *The Renewal of Pagan Antiquity: Contributions to the Cultural History of the European Renaissance*, transl. by David Britt, Getty Research Institute for the History of Art and the Humanities, Los Angeles.
- Wittgenstein, L., 1953: *Philosophische Untersuchungen/Philosophical Investigations*, Hacker, P.M.S., Schulte, J. (eds.), Anscombe, G.E.M., Hacker, P.M.S., Schulte, J. (transl.), Wiley-Blackwell, Chichester (UK) and Malden (MA), 2009.
- Worringer, W., 1907, *Abstraction and Empathy: A Contribution to the Psychology of Style*, Routledge and Kegan Paul, London, 1953.
- Wootton, W., et al., *The Art of Making in Antiquity*, <[http://www.artofmaking.ac.uk/explore/sources/883/PR305\\_02\\_04](http://www.artofmaking.ac.uk/explore/sources/883/PR305_02_04)> (accessed 9 May 2020).
- Zahavi, D., 2010: *Empathy, Embodiment and Interpersonal Understanding: From Lipps to Schutz*, "Inquiry", 53, pp. 285-306.
- Zeki, S., 1999: *Inner Vision: An Exploration of Art and the Brain*, Oxford University Press, Oxford.
- Zeki, S., 2002: *Neural Concept Formation & Art: Dante, Michelangelo, Wagner*, "Journal of Consciousness Studies", 9, pp. 53-76.
- Zeki, S., 2004: *The Neurology of Ambiguity*, "Consciousness and Cognition", 13, pp. 173-196.
- Zöllner, F., et al. (eds.), 2007: *Michelangelo: Complete Works*, Taschen, Cologne.