The Sensitive Perception of Cultural Heritage's Materiality through Digital Technologies

CLÉMENT SERAIN, University of Paris 8, France

This article focuses on the impact of digital technologies in the field of cultural heritage conservation and restoration (i.e., Conservation Science). It arises from thesis research I am currently preparing at Paris 8 University, in France. Having observed a renewal of our relationship to cultural heritage through information and communication technologies, I aim to explain how these technologies affect our sensitive perception and consequently our understanding of the materiality of virtually represented objects. In the double context of the museum institution and the conservation-restoration field, whose mission is not simply to transmit objects but also to transmit knowledge about the materiality of these objects, we will try to understand more precisely the effect of these digital technologies on sensory and temporal-spatial perception of objects important to cultural heritage.

Key words:
Cultural heritage, Digital technologies, Materiality, Conservation Science, Museums.

SDH Reference:
Clément Serain. 2018. The sensitive perception of cultural heritage's materiality through digital technologies. SDH, 2, 1, 54-66.

DOI: 10.14434/sdh.v2i1.24606

1. INTRODUCTION

According to art historian Charlotte Guichard, "the idea of Beauty, supported by a humanistic theory of painting and by its elevation as part of the liberal arts, was precisely built against that reminder of materiality within the work of art, that reminder of the object within the art" [Guichard 2015]. Furthermore, Monique Sicard explains that "the museum, which conveys the image of an ideal society, generally deals awkwardly with technique of art, which remains part of a daily life, from which it would like to escape" [?]. Nevertheless, as a result of the development of conservation and restoration techniques in the 19th century, the appropriation of new materials by artists along the 20th century, as well as the rise of material culture in the 1970s, the materiality of cultural heritage is now a rich field of study, generally called Conservation Science, attracting many experts.

That the growth of Conservation Science into an institutional field has helped link material preservation and theoretical investigation. Furthermore, it has renewed our awareness of the materiality of cultural heritage. This renewal is most obvious in museums as they open storerooms, organize restoration workshops, and even perform restorations in public. At the same time,

Author's address: Clément Serain, Département Hypermédia, Université de Paris 8, 2 rue de la Liberté, 93526 Saint-Denis, France; email: clement.serain@gmail.com

information and communication technologies have lately caused an upheaval in the overall museum activities of conservation, research and dissemination [Saou-Dufrêne 2014]. They have participated in changing our point of view on cultural heritage, and more specifically our relation to cultural heritage from the perspective of our senses. This raises a question: to what extent do digital technologies favor the development of a new sensitive perception of cultural objects regarding their materiality in the context of museum and Conservation Science? To answer that question, this paper will be divided into three parts corresponding respectively to the sense of sight, the sense of touch and the sense of time and space.

2. THE SENSE OF SIGHT

2.1 Seeing in the museum

The sense of sight plays a particularly important role within the museum. According to philosopher Michel Serres, the dominance of images in media pointed to preeminence of the sense of sight. The success of the word "blind" compared to the words "ageusia" (taste loss) or anosmia (loss of scent), he argues, shows through language that the loss of sight is considered especially grave, and thus that it is an especially important sense. That museums employ mediation devices specifically conceived for blind people shows that they privilege sight above other senses. The sense of sight is the sense most closely associated with contemplation and aesthetic experience, the main activities in most museums.

The conservation and restoration of cultural heritage do not participate in enhancing the importance of the sense of vision within the museum, yet they have an impact on what we see and thus on what we understand and what we feel while facing a work of art. Indeed, the activities of the field contribute to changing the materiality of the cultural heritage object, depending on the way a work of art is preserved and restored. In his analysis of the late fifteenth-century Città ideale attributed to Luciano Laurana, Hubert Damisch showed, for instance, that "the change of aspect induced by the cleaning did reactivate the interpretation and allowed for connections that were impossible until then [...]" [Guillemard 2013]. As a result, restoration can affect not only the legibility of the artwork, but also its comprehensibility. Thus, as Cesare Brandi noted, restoration is both a technical and a critical act [Brandi 1963]. Conservation and restoration modify the experience and observations of everyone from the art scholar to the casual museum visitor: their experience depends on any interventions performed on the work of art, and, more broadly, on the contemporary theories and practices of Conservation Science. Even though the architect Eugène Viollet-le-Duc (1814-1879) in the nineteenth century could go as far as recreate some parts of the monuments on which he worked in order to give an idea of how these monuments might have originally appeared, in recent years there has been a shift toward preventative conservation. This involves minimal intervention on the art object, aiming, instead, to reveal as much as possible the traces of the different eras through which the work of art passed.

2.2 Seeing the invisible

Thanks to the development of technology and science, experts can now produce scientific images which show, for example, the different pictorial layers laid on the canvas by the artist and later restorers. Through multispectral imaging it is possible to "photograph" the deeper and therefore invisible layers beneath the surface of an art object. These images are used to discern the physiochemical composition of a work of art, to identify some alterations and ancient restorations, and to understand the creative process of the artist. In addition, it is possible through these images to digitally restore the colors of a work of art so that we may see what it might have looked like at a precise moment in its history. Multispectral imaging, therefore, enables the researcher to build a history of the conception of the object, or even a history of taste—that is, the researcher can relate the history of the critical and popular reception of the work of art to its historical appearance. The restorer also uses these images to know where and to what extent he can intervene on an artwork. That was the case for the series of analyses carried out on the Mona Lisa in 2006 in Paris by Lumiere Technology and the Center for Research and Restoration of Museums of France [Mohen et al. 2006]. These analyses showed that da Vinci used a specific method of oil-painting known as the glaze technique The virtual restitution of the Mona Lisa simulated the removal of the varnish, which in life had yellowed and obscured the original bright colors of the painting. That virtual varnish removal also showed that physically removing the varnish would have been impossible because of the pigments had been mixed with it.

In French, what I should call the digital restitution is sometimes wrongly called a digital restauration. The distinction between the two appears not to be made in English. Restitution and restauration do not have the same goals: while restauration aims at preserving the totality of the traces of the different eras the object went through, restitution, naturally virtual, aims at giving an idea of what the object might have looked like at a precise time, most often when it was originally created by the artist. If the term "digital restauration" is favored compared to that of "digital restitution", it is certainly because of two preconceived ideas: first, the idea that restauration aims to return the object to its original appearance; and second, that restitution aims to show how the object looked exactly at the moment of its creation. Yet the restitution, whether digital or not, cannot perfectly render the colors, the shapes or the textures of works of art: the technological device is not able to render an exact color, for instance, and the evolution of materials and their interactions make that goal particularly difficult. Therefore, digital restitution only proposes a likely former appearance of the object, not an absolutely faithful image of it.

Aside from its inherent uncertainty, digital restitution cannot show the true appearance of an object because there is no single true appearance. Considering the original appearance of a work of art as its true appearance is considering that original appearance as the most important one throughout the history of the object. Conservation experts, however, aim to preserve all traces of the object's past: the changes the object's appearance undergoes are just as important as its original appearance. Digital restitution, therefore, tries to make us see the work of art differently, not better. Indeed, seeing the object as it is today and as it was at a former moment of its past are but two ways among many to observe and contemplate it. The artist necessarily conceives the artwork knowing that its appearance will change through time and that, in spite of the changes, the piece of art remains the artist's own work. Therefore, to the work of art's infinite series of meanings, which allow us to

understand it in endlessly different ways, we must add its endless different appearances. These appearances, in turn, will expand the meaning of the work of art.

We can see, therefore, that the development of digital technologies favors the multiplication of images and arouses the sense of sight in the museum space. On the other hand, when these images are presented in exhibitions, the eye of the visitor focuses not only on the real object, but also on corresponding documents that represent the invisible parts of the work of art and expand the visual perception of the work of art. While the display of works of art on pedestals or inside display-cases gives the impression that the object is frozen in time, these images show that the art object is really a living thing whose appearance changes through time, just as do human beings. The representation of the original appearance of the work of art is all the more alive when it brings us closer to the mind of the artist. However, the presentation of a digital restitution or of another type of digital image cannot afford to neglect providing an explanation to the public. While very suggestive, these images remain scientific documents, which call for an analysis that the public can understand, and the hypothetical nature of digital restitutions must also be explained. Besides, it should be noted that these documents rarely leave the laboratory and the expert's field in order to be presented to the museum public. Yet, even though the museum space must be that of contemplation and aesthetic experience, providing these documents would enhance the aesthetic point of view with a more scientific one. These two points of view are not necessarily opposed. Indeed, the American artist Robert Longo's work, which consists in making charcoal drawings based on radiographies of Leonardo da Vinci's works, such as Saint John the Baptist, can attest to that.

3. THE SENSE OF TOUCH

3.1 Touching at the museum

Unlike the sense of sight, the sense of touch might be the least solicited sense in the museum space. "Do not touch" is a fundamental rule, which is common to all museum institutions, yet it shows that this sense is not absent by accident, as it is forbidden for obvious reasons of conservation. Besides, it should be noted that the mediation devices for blind people generally are tactile devices. The sense of touch is, as a result, reserved for those who cannot really have no choice, which also shows how the museum conceives the integration of that sense in its space. On the other hand, when the sense of touch is not reserved for blind people, children can also benefit from it, for example, during creation workshops. The sense of touch is thus considered as a primitive act, too carnal and thus too far away from the comprehension of the object from a conceptual point of view, which, besides, underestimates the ability of children to comprehend a work of art. Yet, adults, too, would benefit from the opportunity to use the sense of touch in order to be moved and to understand works of art. It is true that artists have always conceived their works to explain things, convey messages or ideas, even more nowadays when the importance of the form of a work of art decreases progressively before the importance of the idea it represents. This situation progressively ended in opposing the world of Ideas to the sensible world as was formulated in the Myth of the Cave by Plato. Yet, these worlds remain complementary: the sensible world, which includes the sense of touch, is necessary to access the world of Ideas.

As we have just explained, the need to protect works of art is the main reason for which it is forbidden to touch the works. Some artists such as Marcel Duchamp who, in 1947, entitled one of his works of art "Please touch" mocked this very idea. Moreover, Duchamp's work was a woman's breast, an object implicitly designed to arouse the sense of touch, at least in the average male visitor. It is very easy to understand that if everyone could touch art objects, the unavoidable process of degradation would be accelerated, and this would jeopardize the mission and the goal of Conservation, that is to say the transmission of cultural heritage. The institutionalization of Conservation widely contributed to the prohibition of touching in museums. Indeed, the development of techniques of Conservation for more than two centuries has led to the taking into account of the fragility of cultural heritage, and thus has favored the idea of a cultural heritage which should not be touched. Experts were much less aware of the problems which could be induced by touch before these changes. In that respect, the same institutionalization created authorizations to touch the works of art: only specific professionals, such as restorers, are allowed to touch the art works, but that authorization is to be seen as given in the name of all. Indeed, the act of touching and the way restorers can touch works are guided by principles, deontological codes which represent the interests of the overall society, and these rules dictate that the restorer must account for all the values inherent to the work of art.

Beyond that institutionalization, it is the very existence of Conservation which has consequences for the prohibition of touching works of art. Conservation is the last step of the process of making an object part of cultural heritage, and it is probably the most important because it is the one that ensures the physical transmission of the work of art, without which its continued existence would not be possible, and the very idea of cultural heritage could not exist. That physical transmission of Conservation participates in elevating the artwork to an enshrined object from a conceptual point of view. Furthermore, this is somehow paradoxical regarding the use value: when a work of art is given the status of a cultural heritage object, it loses its use value, which, sometimes, implied that it had to be touched. Yet, in order to understand the piece of art, it can be interesting to touch it, as we explained earlier. One must conclude that the process of making cultural heritage objects, while aiming at transmitting the work of art to the future generations, sacrifices a part of the work of art which allows us to understand it and thus, to transmit it. Moreover, that conclusion characterizes the classical opposition between the mission of dissemination and the mission of conservation of cultural heritage: in reality, conservation has no purpose other than the dissemination of cultural heritage, even though conservation can create a certain limit to transmission and constitutes the tribute to be paid in order to avoid a total absence of transmission.

3.2 Touching the untouchable

The difference between the sense of sight and the sense of touch is a matter of space: touching an object implies that we have to share the same space as the object, while seeing an object can be done through any reproduction. That is one of the reasons for which the sense of sight is particularly solicited in the cultural heritage filed, as we talk about images and representations, while the sense of touch is particularly nonexistent. Some technologies, however, seem to reinvent the sense of touch in the museum space. Here one thinks, especially, of 3D printing. The contribution of this technology in the field of Conservation is notable. First, it allows the expert to study a piece of art without touching and causing its deterioration. Secondly, it allows the restorer to work as precisely as

possible on the work of art. Thirdly, it allows the curator to present and transport objects with maximum security: by perfectly fitting the object's shapes, 3d-printed items and protective foams greatly reduce the vibrations in the transport cases, and they favor a good presentation of the works of art in the exhibition rooms.

Beyond the obvious advantages for art conservation, 3D printing technology also becomes increasingly more important in the exhibition spaces of museums, and not only for blind people. Indeed, the idea is to offer a less conventional approach of the work of art by "experimenting" with the object, indirectly, by touching it. The appropriation of the artwork is no longer only symbolical, but it is also physical. That fact leads to a certain desacralization of art: settled inside the museum on a pedestal, as symbolical as it is real, the object now becomes accessible. Like the scientific images, 3D printing allows for presenting the work of art as an object, which was built, not like a finished, symbolic object. Furthermore, this kind of device now allows us to answer questions which the museum institution was not really interested in until now: what is it, how it is made, and how does it work? Though it is indirect, the creation of that concrete, bodily relation with the work of art leads to a new understanding of it, as well as to new emotions which complement the different emotions already induced by the mere vision of the work of art. The integration of 3D printing into the museum space is, therefore, doubly unconventional: for one, it solicits the sense of touch, which was forbidden until now. Secondly, it favors the appropriation of the artwork through its matter and not through its symbolic representation. In that respect, the museum soothes a certain frustration which was created by the prohibition of touching: there's nothing more efficient than a prohibition of sitting in an ancient armchair to make one actually want to sit in it, particularly during a long, tiring visit.

However, one must put the use of 3D printing into the context of two "competitors": the presentation of casts in exhibitions and the sale of sculptures as by-products. Casts can indeed be presented in a museum in order for the public, especially blind public, to be able to experiment on the objects by touching them. However, the casting of a sculpture, especially one that is fragile, is not always possible for conservation reasons, as the cast-maker needs to touch them and to risk causing their deterioration. This does not happen when we make a 3D print. On the other hand, the speed with which 3D printing technology is evolving implies the use of a large amount of materials in the future, which will allow for the ever more faithful reproduction of the shape, color or weight of the original. As for by-products, museum shops offer a lot of objects that the visitors can buy, notably reduced sculpture models. The relation to the work of art and its materiality is, however, not the same with an object conceived with 3D printing, because that object can be printed directly at home from a digital file that some museums allow to be downloaded from their website. Therefore, unlike the by-product, which evokes the memory of a gallery visit, the 3D printed object allows people to create their own private exhibitions without even visiting the museums where the art is on display. Since the 3D print is created by the consumer, the physical link between the object and the person is much more intimate than it is in the case of the by-product, which the consumer does not create but only can purchase. Moreover, 3D technology implies a certain desacralization of art, which had already been induced by by-products. Indeed, the objects can now be multiplied at will and are no longer created by the museum's authority. To conclude, it should be noted that smartphones are beginning

to develop 3D scanners. It is clear that the acquisition of 3D models may allow developing the 3D printing practice by different audiences.

4. THE SENSE OF TIME AND SPACE

4.1 The emotion of cultural heritage

The perception of the materiality of heritage, as well as the rest of the world, is made possible by our five senses but also through our perception of time and space. Time and space condition the reality of the work of art regarding its physical existence: thus, they have an impact on the materiality of the artwork, which evolves through time and is dependent on its location. These evolutions themselves are conditioned by conceptions of cultural heritage and of its conservation through time periods and geographical zones. So, in addition to the materiality of a work of art through the senses of sight and touch, we must also add its materiality through time and space. Like the values we attribute to works of art since Aloïs Riegl theorized them at the beginning of the century, time and space participate in the emotion we feel before the cultural heritage object. However, the values constitute projections of humans onto the work of art, which allow them to be understood, unlike time and space, which are not perceptible except insofar as they are naturally integrated within the material of the art object.

The emotion felt before a work of art is mostly the result of time. The work of art allows us to make a link between the present and the past. Therefore, the object constitutes a witness to our history, our memory, our roots, our identity, our past, and ourselves. It is, indeed, the quest for our sense of self-identity that we pursue through the cultural heritage object from the past, and which explains a part of the emotion we feel before it. Moreover, the cultural heritage object reminds us of our own human condition, as Muriel Verbeeck explains: "The common object which is ours, and finds itself chipped, cracked or broken, awakes inside us more than the mere regret of its utility, suddenly put in jeopardy; it evokes the relation with a suffering flesh, subjected to the whims of an existence which is engraved in time. Its imperfection draws us to that of human condition, marked throughout its life, preyed upon by old age and death" [Verbeeck 2007]. Time is not specifically a value of the work of art itself, but it gives it an authenticity value: sociologist Nathalie Heinich speaks of "the emotion before the authenticity value, which dwells on the permanence of the link between the actual state and the origin of the object" [Heinich 2012].

The emotion we feel in front of the work of art is also induced by space. Like time, space is not a value inherent in the object, yet it gives it a value of presence. Nathalie Heinich speaks of the "emotion before the value of presence, which dwells on the proximity with a person, on the feeling of an encounter, of a contact with the beings related to that object." However, unlike the perception of time, the perception of space is even more linked to human senses as it depends directly on the senses of sight and hearing. At any rate, the fact that the work of art shares the same physical space as its viewer also favors the emotion one feels before the cultural heritage object. The typical example of the Mona Lisa at the Louvre Museum shows how much visitors need to find themselves in the same space as that of the iconic work of art, in order to feel an emotion before it. To be sure, that emotion is the result of the experts' point of view on Leonardo da Vinci's work, which gives the Mona Lisa its

well-known importance. However, it is also the result of the particulars of the museum space in which it is encountered: all the panels that indicate its location in the museum; the painting's placement right in the middle of the room, which is itself conceived very much like a Greek temple, within which the god's statue was located at the center; the great throng of people in front of the painting, which makes it difficult to view and approach; or the imposed distance from the painting. All these spatial elements cause the painting to be a physical experience, made possible by the three-dimensional space in which it finds itself.

The role of Conservation regarding the relation of the work of art to space and time is more complex. Concerning time, Conservation scientists do typically reveal as traces of as many different periods as possible, as we explained earlier. They aim to sublimate the passage of time and, even more, the ties woven by the work of art between the present and the past. Concerning space, the institutionalization of Conservation somehow makes the emotion evoked by the cultural heritage object conditional on the space in which it is exhibited. It is thanks to the establishment of an institution, that is to say, to the museum, that a work of art is present in the space in which it is located, and that visitors can have physical access to it. However, the activities of Conservation scientists do not have any direct impact on the emotion we feel in front of an artwork, which shares the same space as ours. Conservation reveals the traces of time on the art object, but it cannot reveal the space in which it used to be: through its state of preservation, the work of art itself can implicitly communicate that, for example, it was once located in a wet environment, but it cannot reveal, through its materiality, the reasons why it was located in such a place and where that place was. Yet, given that artworks have been not infrequently conceived to be set in specific places (e.g., the chapel of a church), the knowledge of its former physical location might provide us with significant information in order to understand and see the work of art from a different perspective.

4.2 Feeling the disappeared

While the authenticity of a work of art is ensured by the link it creates between the present world and the object's original world, how does digitized cultural heritage, which is timeless, render that authenticity? As the authenticity of an artwork is not only symbolic but also physical, since it dwells on its matter, the digital representation of the original appearance of a work of art can, for instance, create the link between present and past. Besides, it should be noted that digital restitution allows the visitor to see the work of art as it was seen by the artist who created it, which contributes to strengthening the link with the past. However, given its hypothetical nature, digital restitution rather works like a ghost of the past and reminds us, in our quest for origins, that the knowledge of our past and, by extension, of ourselves, can only be illusory. What about digital cultural heritage, which is not represented in its original appearance but in its contemporary one? How can the museum institution convey the emotion of authenticity which we are supposed to feel in front of the original object, in order to reestablish the link between the object's original world and us? According to Cecile Tardy, there are three precise moments which allow the "digital substitutes" to transmit that authenticity of the original work of art. The first one is the moment when the cultural heritage object is represented and put back into a context in relation to its original world. The second moment is when the cultural heritage object is put in relation to the space within which it was originally located. The last moment is the "representation of the presence of the museum institution as ensuring the authenticity of the

relation between the substitute and the original world of the collections" [Tardy 2015]. It is, therefore, by the recreation, under the museum's authority, of a symbolic and institutional link between our present world and the object's past world that the authenticity of the work of art can be transmitted.

Nevertheless, space also plays an important role, as the recreation of that link is possible thanks to the link induced between the object and the museum space, which ensures the authenticity from a symbolic point of view, and thanks to the link between the object and its original location, which guarantees its authenticity from a physical point of view. The staging of the object in its original location is not possible in the museum space, unless a very detailed oral or written description is given or by using certain technologies such as augmented reality. Often used in architectural heritage, AR can be used within the museum space in order to offer the reconstruction of a lost part of an object or to digitally communicate the former environment in which the object was once located. To that recreation of the object's former spatial environment, we must add the use of digital technologies to recreate works of art, which are lost or not, and to put them back into the environment in which they used to be located. This was the case for "The Wedding Feast at Cana" by Paolo Veronese, currently exhibited at the Louvre Museum, and reproduced in its original location in the monk's refectory of the Benedictine monastery of San Giorgio Maggiore in Venice. The facsimile object here comes to "compete" with the true object. According to Bruno Latour and Adam Lowe, "the aura might come to attach itself to one or the other reproduction, depending on both the quality of what comes to be considered as different versions of a single work, as well as on the success of its inscription within a given location" [Latour and Lowe 2008]. In that respect, the authenticity of a work of art would above all depend on the place where it is located, which would question the museum's authority and the conservation of works of art. Indeed, can copies benefit from the same privileged treatment as the originals in order to guarantee that "transposed authenticity"?

Finally, the notion of the space of the work of art must be put into the context of digital technologies. The virtual space of digital technologies is often opposed to real space. Yet some experts consider the virtual space as an extension of the real space, in such a way that the virtual space should more accurately be considered a hyper-real space [Vial 2013]. One only has to order a pizza on the phone or to publish a controversial message on social media to realize that fact. Cultural heritage professionals do understand that fact, too. For several years it was said that virtual visits on museum's websites were going to replace physical visits in the museum's space, yet the exact opposite has happened. Indeed, the virtual visit is often a starting point from which visitors can prepare their physical visit, during which they will be able to physically experience the object's presence. Therefore, virtual visits will probably never replace physical visits because they are complementary and offer a different experience of the object. It should be noted that the impact of the place upon the emotion induced by the physical authenticity of the object also manifests itself through other mediation devices. For instance, the geolocation devices offered by some museums within exhibition spaces give visitors the opportunity to grasp exactly where they currently are in the museum and also to know how far they are from a work of art they are interested in finding. We might also mention digital social networks, a place where emotions are sometimes exacerbated, which themselves contribute to giving an importance to the place where one is located. On Facebook, for example, the user can simply publish his location thanks to a specific feature, and thus he can display the emotion he felt when seeing the Mona Lisa while at the Louvre Museum.

5. CONCLUSION

In the context of the museum, the human senses we have mentioned are not addressed in the same way, which creates a kind of hierarchy: we are encouraged to watch, to become aware of the space and time which separates us from the object, whereas touching the works of art is forbidden. Yet, the introduction of digital technologies into the museum space seems to renew that hierarchy thanks to an augmentation of each of our senses, which itself conditions the augmentation of the perception of the objects, and thus leads to a renewal of the understanding of the art objects as well as of the relation we maintain with their materiality. However, digital technologies do not come to replace the traditional ways of seeing, touching or feeling the space and time of the work of art. The direct observation of an object is still possible, touching the work of art is still impossible, and space and time are naturally inherent within the object. The question is rather to make our relation to the object's materiality more complex, through new mediation devices, without changing what already exists. Finally, as we explained earlier, these transformations might be analyzed without putting them back into the context of Conservation, the field par excellence of materiality. Indeed, we must observe that the use of digital technologies within the museum may have a direct impact on Conservation practices, while the development of technologies in the field of Conservation offers new ways of mediating cultural heritage in the museum space. As a result, we can conclude that conservation is not only a technical act but also that it contributes to examining cultural heritage from the point of view of its materiality. That point of view conditions the comprehension and the perception of cultural heritage by the public, and it is endlessly reshaped by the development of digital technologies

6. REFERENCES

F. Blais et al. 2008, "Ultra high-resolution 3D laser color imaging of paintings: The Mona Lisa by Leonardo da Vinci," in Lasers in the Conservation of Artworks - Proceedings of the International Conference LACONA 7, 435–440.

C. Brandi 2011. Théorie de la restauration, Paris: éd. Allia.

C. Guichard. 2015. Image, art, and artifact in the eighteenth century: art history and the test of the object, Perspective, 1 (2015), 95-112. DOI:10.4000/perspective.5805

G. Guidi, C. Atzeni, and S. Lazzari 2003, "3D Optical Scanning Diagnotics for Leonardo Da Vinci's 'Adorazione dei Magi' Conservation" in Fourth International Conference on 3-D Digital Imaging and Modeling, 2003. IEEE 3DIM 2003 Proceedings, 110–115.

D. Guillemard. 2013. Le point aveugle de la restauration, sa contribution à l'histoire de l'art, CRBC (Conservation-Restauration des Biens Culturels), 31 (2013), 3-12.

B. Latour and Adam Lowe 2008. The migration of the aura or how to explore the original through its fac similes. In T. Bartscherer and R. Coover. Switching Codes. Thinking Through Digital Technology in the Humanities and the Arts, University of Chicago Press, 275-297.

A. Lowe 2010, A Note on the Unveiling of the Facsimile of Veronese's Wedding At Cana, Coping with the Past, Creative Perspectives on Conservation and Restoration, in Cività Veneziana Studi 52, Gagliardi P., Latour B., Memelsdorff P., (eds), 8-9.

J.-P. Mohen, Michel Menu and Bruno Mottin 2006. Au cœur de La Joconde: Léonard de Vinci

dévoilé, Paris: Gallimard.
A. Riegl 1984. Le culte moderne des monuments, son essence et sa genèse, Paris: Seuil.
B. Saou-Dufrêne 2014. Heritage and digital humanities. How should training practices evolve?, LIT Verlag Münster.
M. Sicart 2002. Comment le musée fait voir, Technè, 15 (2002), 56-64.
C. Tardy 2015. La médiation d'authenticité des substituts numériques. In Cécile Tardy and Vera Dobebei. Mémoire et nouveaux patrimoines. Marseille: OpenEdition Press. DOI:10.4000/books.oep.453
M. Verbeeck 2007. L'œuvre du temps. Réflexion sur la conservation et la restauration d'objets d'art, Images re-vues, 4 (2007).
N. Heinich 2012. Les émotions patrimoniales : de l'affect à l'axiologie, Social Anthropology, 20, 1 (2012), 19-33. DOI:10.1111/j.1469-8676.2011.00187.x
S. Vial 2013. L'être et l'écran : comment le numérique change la perception, Paris: Presses universitaires de France.
T. Zaman, P. Jonker, B. Lenseigne, and J. Dik 2014, "Simultaneous capture of the color and topography of paintings using fringe encoded stereo vision" Herit. Sci., 2, 1, 23.

Received February 2018; revised September 2018; accepted September 2018.