

THE IMPORTANCE OF TECHNOLOGICAL KNOWLEDGE FOR THE VALORIZATION OF AZULEJO HERITAGE

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ABSTRACT

In this article considerations regarding the importance of recovering and protecting the knowledge of *azulejo* production techniques are elaborated. A tentative overview of the Portuguese *azulejo* production system is made. The method of knowledge transfer through oral dissemination and learning “by observing and executing/imitating” is noted. A comparison is made with the Dutch case, where a larger amount of tangible historic information exists – namely technical treatises and potter’s books - describing the materials, recipes and techniques used for historical tile production. The preservation of this knowledge has allowed potteries (such as Makkum and Harlingen) to continue to use similar raw materials and techniques. This has highlighted the need to create sources of information to contribute to the research and preservation of knowledge regarding Portuguese *azulejo* production techniques. The physicochemical characterization of *azulejos* enables us to draw information about raw materials and production methods. The possibility of gathering information from contemporary *azulejo* artisans has also been suggested, namely those related to workshops and factories. Above all, the article will explore the technical knowledge of *azulejo* production as an important intangible cultural value in the construction/development of *azulejo* as Heritage.

Keywords: Cultural value / Technical knowledge / Methods of manufacture / Azulejo / Tile

1 INTRODUCTION

While belonging to the category of ‘Heritage’, glazed tiles (*azulejos*) are particularly valued for their visible aspects: the glaze, the painting, the pattern, the shine. However, besides what we can obviously observe, there exists a whole group of materials, procedures, practices and meanings that cannot be directly seen by an observer. One of the aspects of *azulejos* that is less evident is their technical and material side. In many cases these characteristics comprise of traditional knowledge of production techniques and materials. This technical and traditional knowledge of ‘doing’ is by itself an immaterial heritage that deserves to be researched, understood and documented, also forming an important element of the scientific knowledge relating to the *azulejo*, their conservation and restoration, but also of their value.

Despite the recognition of the importance of the traditional technical-knowledge in the studies of *azulejo* heritage very little is yet known, namely in Portugal. There is little documentation on the subject since the knowledge was usually transmitted verbally

and by observation. The most ancient factories/potteries have closed; and many artisan-artists with this knowledge are disappearing. On a different perspective, it is known that in the case of Dutch tiles, much of the traditional technical knowledge has been recorded and archived in a number of factories/potteries.

The purpose of this reflexion is to give visibility to aspects that are not always made evident in the process of bringing value to *azulejo* heritage. For this purpose, the traditional technical-knowledge should be given priority as a form of valuing this material cultural heritage.

2 CONSIDERATIONS ABOUT PORTUGUESE AZULEJO PRODUCTION

Majolica *azulejo* production is believed to have started in the 16th century in Portugal after the arrival of Flemish artisans in the country (Nobre Pais 2015, Esteves 2017). Through the 16th and 17th centuries the production was carried out in independent production workshops/potteries. In the last years of the 17th century the generalised adoption of a single colour (blue) simplified the production processes and lowered prices. However, in this period the local workshops also had to develop and improve their technical quality in order to fight imports from the Low Countries (Simões, 2010). In reaction to this, and together with an effort towards the selection of raw materials and improvement of the technology, genuine artists were invited to paint *azulejo* panels bringing about the “Cycle of Masters” which is considered to be the Golden Age of Portuguese *azulejo* production spanning from 1675 to 1725 (Santos, 1957; Salema, 2012).

The period of 1725-1755 was the period of the “Large Joanine production”, so named due to the countless orders for *azulejo* panels paid with the gold from Brazil, together with the onset of the industrial revolution that resulted in ceramic production factories changing from the fully artisanal production to a more rational process (Vasconcellos, 1907). The ceramic factories altered significantly the dynamics of *azulejo* production and commercialization. The need to reduce costs lead to the use of repetition of the figurative panels and the simplification of the paintings. Up to then *azulejo* production and commercialization was in the charge of the “azulejador”. According to Santos Simões, the “azulejador” was a person that had previously worked in the pottery and knew in detail all about the trade. He would advise and direct the clients, support the painters with prints and books, and coordinate all the production process, including the laying in the constructions by the “ladrihador” (Simões, 2010). With the new work organization factory workers had each a very specific role/function and the former job of the “azulejador” largely disappeared to possibly remain just as the intermediary person between the client and factory (Simões, 2010). In the second half of the 18th century a return to the use of other colours was observed, especially in the panel frames. To attain the high quantity of *azulejos* demanded, serial production was organized, with repetition of figurative panels and a prevalence of pattern *azulejos*, making the production faster and simpler. The more demanding figurative architectural coverings are now usually made by wainscots or independent panels without the complete covering and dedicated integration of the *azulejos* on the walls (Simões, 2010).

After the Lisbon earthquake (1755) there was a need for reconstruction, which, together with the efforts of the Marquis de Pombal towards industrialization, lead to the increased development of serial production and the use of simple and quickly executed

pattern *azulejos*, constituting what is now called *Pombalino style* (1755-1780) and *D. Maria style* (1780-1808) (Salema, 2012). The *Real Fábrica da Louça* or *Fábrica do Rato*, initiated its activity in 1767, but it is uncertain when it started to produce *azulejos*. It had a focal role in the creation and instruction of many ceramic factories in the country (Simões, 2010). Vasconcellos mentions that in the 18th century the number of factories was already large, estimating it to be 20 to 25 in the whole country, and they were spread throughout the territory but mostly in Lisbon, Porto, Coimbra and Viana do Castelo. He also mentions that in the 18th century all factories constitute a “big family” that has multiplied itself during four generations throughout the century without any of them questioning their “common tradition” (Vasconcellos, 1907).

The “transfer printing” decoration process was invented in 1758 in England. This process involved the transfer of the decoration from a copper plate to paper and then to the already glazed *azulejo* surface. The *azulejos* would then be subject to firing at a lower temperature and shorter periods of time therefore producing decorations subject to wear (Costa, 2013). In the second half of the 18th century the “ironware” composition was invented by an English potter by mixing clay without iron oxide and finely ground quartz and firing it until the body had no porosity. According to Costa (2013) it is however only during the 19th century that a series of English developments in ceramic industry lead to a production revolution in that country. In 1830 a lithographic process was developed that allowed the colours to be applied directly on to the *azulejo*. But at this point the *azulejo* was still hand moulded, limiting the rate of production. Then in 1835 the manual mechanical pressing of *azulejos* was invented allowing a faster serial production and the transition from the hand-moulded clay paste (that was more subject to defects and would require long drying time), to the more reliable and fast low humidity “dry process” - pressing technology. This enabled the production of thinner *azulejos* with an even thickness. In 1873 the first steam *azulejo*-press was used in England permitting mass production at reduced prices (Costa, 2013).

Despite the English developments; due to the late coming of the full industrial revolution in Portugal it is unsure when these novel industrial technologies were introduced in the country. But it is believed that industrialization started to be implemented during de decade of 1830-1840 (Antunes, 2007). Up to World War I the industrial growth was not significant and during the first half of the 20th century a slow industrialization was observed (Antunes, 2007). As commented by Costa the historical information available regarding the production chain processes of *azulejo* factories producers is scarce, contradictory and fragmented (Costa, 2013).

The beginning of the 19th century up to around 1840 was marked by foreign invasions, civil war and unrest. It was a time of a decreased market for *azulejos* in constructions with obvious consequences deriving from a sharp reduction of production. By the second half of the 19th century demand returned and they were used for the tiling of urban buildings façades (Simões, 2010).

By the end of the 19th century the improved control in the selection of clays led to the development of “pó de pedra” ceramics, a local adaptation of the English “Ironstone”. White iron-free clays were mixed with silica dust in order to obtain a pure white ceramic that could be decorated directly over the biscuit and finished with a transparent glaze. It was used in Lisbon factories such as Sacavém and Alcântara. The hand-moulded *azulejos* become then formed with mechanical hand presses until the use of steam pressing (Costa, 2013). The production of “pó de pedra” *azulejos* coexisted with the one from calcitic clays.

At a time when painters had largely abandoned *azulejos* as an artist’s material, Jorge

Colaço (1868-1942) chose to start his career anew using them for a canvas. He introduced to the medium novel and controversial painting techniques such as painting over the already fired glaze with low-fusing smalts of many colours that were again fired in a reverberation kiln, or the use of serigraphy for repetitive patterns. His technique was considered risky by Vasconcellos due to the possible danger to the material stability and decrease of durability. His technique, however, allowed the introduction of a full colour palette in the *azulejo* panels creating highly varied and coloured masterpieces, sometimes including gold and silver details that grace many buildings to this day including the matchless São Bento train station in Porto.

During the 20th century modern electric/gas kilns have been introduced and their practicability and reliability, lower pollution and economic advantages have resulted in a cessation of the use of wood-fired kilns. This phasing out of an old technology can lead to the loss of the highly-specialized knowledge held by the operators of these kilns. Also during this century, high calcium content clays have mostly stopped being used due to process optimization concerns. Due to safety concerns lead glazes are now also avoided. Even if in some cases the traditional manual technical processes of producing *azulejos* and the final aesthetic results have been retained, the *azulejo* raw materials and final composition, the *azulejo* “matter”, is not at all similar to the traditional majolica *azulejos* with a consequent loss of the associated knowledge of these materials use for *azulejo* production.

3 THE DUTCH CASE AND THE NECESSARY VALORIZATION OF THE TECHNICAL KNOWLEDGE

The production of tin-glazed majolica started in the late 16th century in the Northern Netherlands with Italian potters that emigrated from Antwerp (van Lookeren Campagne, 2015).

During the following two centuries, the production of tin-glazed tiles (*tege/s*) grew into an important industry with significant production centres developing in cities and towns including Gouda, Haarlem, Delft, Utrecht, Rotterdam, Amsterdam, Harlingen, Bolsward en Makkum. During the 17th and 18th century millions of tiles were produced in the Northern Netherlands and an extensive export trade grew within Europe and beyond. The 17th century was a period of rapid economic and political change in the region and this was reflected in the production of Dutch tin-glaze tiles until the mid-18th century when production began to decline.

Dutch potteries, as with the Portuguese, were keen to protect their knowledge and did not make the details of the production techniques used easily available. However, some registrations of the production techniques from the 17th and 18th century have been kept (Paape, 1794; Sijbeda, 1712; Feijtama, 1725) together with information revealing clay sources such as the imported the marls from England (Van Lookeren Campagne, 2015; 2017). Paape’s treatise presenting the most comprehensive information on Delft production including the composition of clays and glazes as well as prints of the techniques and tools used (Lambooy, 2013). In some potter’s manuals the clay mixes and glaze recipes have been retained together with information about the firing results (Sijbeda, 1712; Feijtama, 1725). The existence of these pottery books enabled the maintenance of the memory of the ancient production techniques and recipes. Lambooy remarks, for instance, that the original tin-glazing technique is still practised nowadays by the Koninklijk Tichelaar Makkum and the Harlingen factory in Friesland in The Netherlands. It is known that these potteries still prize themselves for

their use of the same sources of clays for their tiles body preparation (P.J. Tichelaar 2001) and, while valuing the technical development of new glazes, they also does research historical ones.

In Portugal while many manual technical aspects of *azulejo* production and painting have been maintained, as said before the “matter” (clay – glaze – pigments) of the *azulejos* are largely different due to the loss of knowledge, safety concerns, process optimization and economic factors. Besides the fact that *azulejos* are advertised as being produced according to “ancient production methods”, they are in fact mostly made using hand production techniques but with “material” that is by no means according to the proclaimed “historical production” methods. This “material” that “cannot be seen” on *azulejos* is, however, part of the *azulejo* itself and the knowledge of how to produce it in a completely traditional way it’s an *azulejo* immaterial value, is important for the understanding of *azulejo* as an all and for their conservation–restoration actions.

Knowledge of the ancient and traditional *azulejo* production techniques can be found through three possible routes: the research of historic sources, the physicochemical and mineralogical analysis of the *azulejos* themselves, and through communication with artisan-artists (contemporary).

4 THE AZULEJO’S TECHNICAL KNOWLEDGEMENT

4.1 THROUGH HISTORICAL RESEARCH

Written sources regarding ancient majolica production techniques are very scarce. The *azulejo* artisans did not disclose their production procedures easily and there are little known registration of the materials and techniques they used. However, some technical treatises do exist and further historical research into archives factory inventories, port records, newspapers, and testimonies could shed some light on the origin and preparation of materials and production techniques.

The late 16th century Italian ceramic treatise from Cipriano Pilcopasso (Li Tre Libri dell’Arte del Vasaio) is the oldest technical source for majolica production. In Pilcopassos’s book recipes about the production of glazes and pigments are provided together with descriptions of production techniques, materials and equipment used for making general majolica items. This work is particularly important since it is known that the majolica technique originated in Italy and propagated throughout Europe, arriving in Portugal at the end of the 16th century via artisans from Antwerp that started to work in the country (Nobre-Pais, 2015; Lurdes, 2017). We may therefore assume that the technology used in Portugal at the beginning of majolica production was based in this contemporary knowledge probably with local alterations to accommodate the raw materials and knowledge that already existed in Portugal.

Several documents relating to the Dutch tin-glaze production, including recipe books, kiln records and legal documents provide information regarding the Dutch technical knowledge in the 17th and 18th centuries (Van Lookeren Campagne, 2015). The first technical manuscript on Dutch majolica production, even if not specifically relating to tiles, was from the German Johann Kunckel (possibly 1637-1688) entitled “Von der Holländischen kunstreichen weissen und bunten Topffer- Glasur – und Mahlwerck, (von etlichten Holländische Barcellan – Arbeit genennt) as a part of his book on glass *Ars Vitrarya Experimentalis* (Kunckel 1679) with information regarding the Dutch tin-glaze recipes and firing techniques. The rare recipe book from Petrus Sijbeda (1712-

1724) a tile and majolica producer from Harlingen (Friesland), provides detailed information regarding the clay and glaze preparation, drying of tiles and other aspects he considered relevant (Lambooy, 2013). While the kiln book from Feijtema Tjallingii (1725) also provides unique technical sources regarding the Dutch tile production such as glaze recipes, describing firing problems and attempts to solve them (Van Lookeren Campagne, 2015). Paape's 1794 treatise "De Plateelbakker of Delftsch Aardewerkmaaker" (Paape, 1794), describing Delft majolica production between 1788 and 1820 provides - after Picopasso's - the most detailed technical source about tin-glaze production (Lambooy, 2013). His work provides formulae for the composition of clay and glazes (even if questions are posed as to the accuracy of the recipes) and includes prints showing the techniques and tools used. Lambooy also comments that the techniques described in Paape's treatise, that was written about one century after the Dutch Golden Age and the glory days of Delft pottery industry, are very similar to the Italian process described by Picopasso's 16th century work. Pointing to the fact that, despite possible technical optimizations in the procedures, they have probably not changed much during this time span (the 16th-to the beginning of 18th centuries), the main changes probably consisting of the glaze and clay- mixture recipes.

No written works describing Portuguese majolica technical processes from this period are known. This is possibly due to prevalence of the transfer of knowledge through oral and experience by observation/imitation rather than information documentation. However at the beginning of the 19th century French technical encyclopedias such as *Arte do Louceiro* (1804) from José Ferreira da Silva and '*Arte da loiça vidrada*' (1804) Antonio Velloso Xavier (1805) were translated into Portuguese and made available. In 1828 another ceramic production treatise appeared in France: "*L'Art de Fabriquer la Faience Recouverte d'un Émail Opaque Blanc et Coloré*" from F. Bastenaire-Daudenart which collects information about the techniques used when the author was the owner of a French ceramic factory founded in 1705. Keeping in mind the possible differences between techniques used for utilitarian majolica and tiles, it can be concluded that the manual production did not alter much until the introduction of pre-industrial processes and therefore that these manuscripts are probably reflective of the materials and techniques used in earlier centuries. Extra insight regarding 18th and early 19th century clay/glaze recipes can possibly also be retrieved through the Dutch sources. Regarding the 19th century, Charles Lepierre studied the clays used in the Portuguese ceramic industry (Lepierre, 1899). Also the exhibition catalogue "*Real Fábrica de Loiça ao Rato*" (Esteves 2003) contains details from the factory archives regarding information such as the raw materials used and comments about their majolica production. This constitutes to our knowledge the most detailed written source of information on traditional Portuguese production techniques.

4.2 THROUGH CHARACTERIZATION AND REPLICATION

Other source of information about raw materials and production techniques is obtained from the physicochemical and mineralogical characterization of the *azulejo*. The increasing development in the analytical techniques allows an ever increasing degree of information that can be taken from materials characterization about production technology. Insight into the raw materials used, clay and glaze composition, process sequence, firing temperature, oxidising/reducing firing atmospheres and their possible geographical provenance can be obtained via this type of analysis.

Although many art historical studies about Portuguese *azulejos* exist, only a few studies on the physical, chemical and mineralogical characterisation are available which relate the analysis to *azulejo* productions techniques.

For instance Vieira Ferreira characterized the biscuit, glaze and pigments of Portuguese utilitarian/decorative majolica and from the 16th -17th centuries (Vieira Ferreira 2013a; 2013b; 2015a; 2015b) where, besides insight on the raw materials used, the firing temperatures have also been proposed. These studies were performed on utilitarian/decorative majolica objects where we may assume that the production techniques are probably similar but attention needs to be played since extra care was probably been put into the selection of raw materials and production processes the utilitarian/decorative objects. A detailed study of Flemish tiles from the Vila Viçosa Palaça was undertaken (Mimoso, 2013) where consideration of the production techniques was also taken.

Regarding Portuguese majolica *azulejos*, in the few chemical-mineralogical characterization studies where the production techniques have been considered, the results have usually considered small sets of *azulejos* and the majority of them just focused on the pigment and glaze analysis. Some information exists regarding production techniques and materials of 17th *azulejos* (Coentro, 2010; Coentro, 2012; Coroado, 2003), as well as 16th to 18th glaze and pigments (Guilherme 2011), 17th-18th (Pereira, 2011) and 19th (Costa, 2013) 19th-20th (Sanjad, 2009) centuries can be withdrawn from these studies. Their analysis reveals, however, the need to do a systematic characterization of the several periods of Portuguese *azulejos* production, on pigments, glaze and body focusing on retrieving specific production technology information.

In addition to these analyses, tentative replications of the possible production procedures using similar materials and techniques would allow a better understanding of the production processes and resulting *azulejos* characteristics. Some effort on reproducing the ancient *azulejo* bodies has been made for the 18th century Lisbon *azulejos* (Pereira, 2015) and 19th century northern Portugal (Costa, 2013). While allowing to understand much of the production of calcitic body productions (Pereira 2015; Costa, 2013) and “pó de pedra” (Costa, 2013), both these studies tried to replicate the *azulejos* based on its previous physical-chemical characterization without the support of information regarding the production recipe or type of raw materials and their sources due to the absence of this information. Due to the difficulty in obtaining marls and to simplify the research, calcite has been added to the clays when preparing the calcitic pastes and electric kilns have been used instead of wood fired kilns (that have lower oxidation). The on-going study on 17th -18th Dutch body tiles reproduction based on existent recipes (Sijbeda, 1712; Feijtema, 1725; Paape, 1794) and collection of clays from registered raw material sources is studying the effect of calcite when included in the marl vs synthetic calcite as well as the effect of using a wood-firing vs an electrically-fired kiln (Van Lookeren Campagne, 2017).

4.3 THROUGH ORAL NARRATIVES FROM ARTISANS-ARTISTS AND FACTORY WORKERS

The study of the materials, techniques and processes of creating, producing and applying tiles is important for the valorisation of *azulejo* heritage. Research into written/historical sources and material characterization is essential but does not tell us everything about the *azulejos*. Recovering materials, recipes, tools, drawings, knowledge and techniques of “doing” through actions and words is a way to give significance, value and recover the lived experiences retained in memory by the workers of *azulejo*.

During the last decades an increasing deindustrialization of the cities and consequent

conversion of its facilities into urban projects is observed. Some of these conversions keep parts of the ancient memory and others completely erase their identity (Antunes, 2007). In the middle of the 20th century global conscience was taken about the importance to preserve and study the important signals to preserve the memory of this heritage appearing the "Industrial archaeology" concept (Antunes, 2007). Chamoux (2010) considers the technical production knowledge know-how as "the body of knowledge and conscious or unconscious human knowledge that allow the implementation of a technique. The know-how can be gestural and intellectual, collective and individual, depending also of the relations between men and the relationship between the laws of matter."

In Portugal the heritage regarding tiles production factories is in a vulnerable situation but also has high potential. It is therefore important to study and register the still existing tangible and intangible sources in order not to lose them forever. But how can we recover this experience?

By direct communication with factory artisans-artist another source of information can be added to the historical investigation and *azulejos* characterization/reproduction. Besides further technical-scientific information it allows the reconstruction of the reality of the working factory enriching it with sociologic information. The use of the oral history or oral source/narrative methodology is essential in the gathering of information related to the technical knowledge know-how. Through oral interviews with artisans-artists and processing of the collected information, new tangible sources are created that ensure the preservation of the memory of the factories and perpetuate the technical knowledge related to *azulejo* production. The role of the *azulejo* artisan/artists producers is valued and the importance of the technical knowledge highlighted.

For *azulejo* production factories, it is of importance to collect and register information from workers-artisans-artists in a systematic way regarding both ancient and new production techniques, tools and materials used. In the case of *azulejo* production factories, relevant information could be systematized in the following topics: 1) Provenience of the clays used, glazes, pigments and other necessary materials; 2) Organization of the production chain; 3) The different professions existent in the factory and how they interact; 4) The characteristics of the work force (gender distribution, education, number and variation throughout the years); 5) The work schedules and existence or not of differences with seasons; 6) The type of *azulejos* produced (existence of catalogues), 7) commercialization/distribution and 8) The production-chain techniques and tools: for clay preparation, *azulejo* body molding/pressing, *azulejo* drying, *azulejo* body firing, glazing, decorating and finally for *azulejo* firing (adapted from Antunes, 2007).

When we consider a factory that is no longer functioning, such as the Constância Factory that ceased its activity in 2001, it is of special importance to gather this information since the knowledge-transfer chain regarding *azulejo* production processes was stopped and is therefore at risk.

4.3.1 A study in perspective: MEMORIES OF the WORKERS of the Constância factory

The Constância factory produced majolica from 1836 up to 2001 when it closed. Situated in Lapa, a quarter of Lisbon, it produced several types of *azulejos*, mostly for the tiling of building façades, but also works by renowned artists such as Wenceslau Cifka and Leopoldo Battistini (also the factory owner) and architectural *azulejos* in the Art Nouveau style. A documentary was made during the Leopoldo Battistini period

before 1929 by *Companhia Cinematográfica de Portugal* showing the factory's artisanal majolica and *azulejo* production processes. The clay preparation (Figure 1), *azulejo* production (Figure 2), glaze preparation and glazing (Figure 3), painting and firing (Figure 4) are depicted in this video. In the final years of production large public art panels were produced by the factory such as João Abel Manta's large Gulbenkian Avenue wall and the Ivan Chermayef Lisbon Oceanarium façade *azulejos*.



Figure 1: Clay and paste preparation. Video print screen (Matos, 2014)



Figure 2: Azulejo molding and straightening. Video print screen (Matos, 2014)

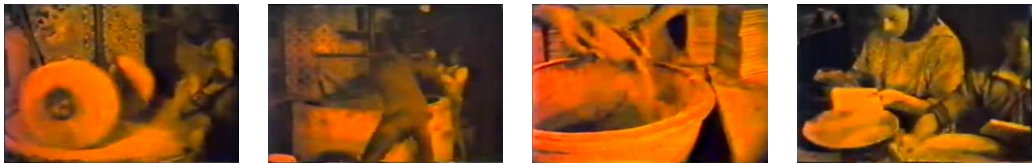


Figure 3: Grinding of the glaze, glazing the *azulejos* and correcting the glaze layer. Video print screen (Matos, 2014)

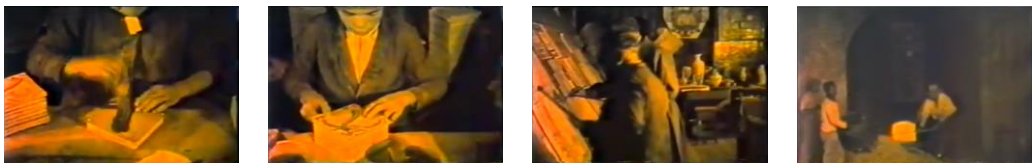


Figure 4: Stencilling, free hand painting and firing. Video print screen (Matos, 2014)

Although historical research into the Constância Factory will aid knowledge of the factory *azulejo* producing process, much will still need to be done to better understand the techniques and knowledge associated with its production. Much of this knowledge has been transmitted down the generations, without written or physical records of these processes. Regarding the importance that this knowledge has in the field of conservation, restoration and valorization of *azulejo*, the creation of such knowledge sources is extremely important.

7 FINAL NOTES

The value of the knowledge of immaterial production procedures is currently not much considered but is an essential component of our understanding of the *azulejo* as Heritage. This article has tried to underline the relevance of investing in the research of technical knowledge for understanding the cultural value of *azulejo* heritage. Not intending to present an exhaustive description of this knowledge the state of the art reveals however the need to perform extra research through the three types of sources that can allow recreating it: historical investigation, materials characterization/replication and communication with artisans-artists/factory workers. It highlights the fact that there is more to *azulejos* than just 'what we see' and that the value attributed to *azulejos* is related to their production technique. The technical knowledge of *azulejo* is therefore a value that supports the construction of *azulejo* as Heritage and should therefore be studied, protected and disseminated.

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