– THE STROSSMAYER GALLERY THROUGH WORDS AND IMAGES –

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HOW EASEL PAINTINGS WERE MADE

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FRONT COVER

Giuseppe Cesari known as Cavaliere d'Arpino (1568 – 1640),
Saint George slaying the dragon, around 1600

PREFACE

Here in front of you lies the second booklet from the publication series *The Strossmayer Gallery through words and images*, envisaged as a series of popular editions on subjects related to a variety of areas, such as the history of style, iconography, painting techniques and conservation, illustrated through examples of selected works from the holdings of the Strossmayer Gallery. Publications from this series could thus serve as a kind of guide through the Gallery's collection, as well as its periodical exhibitions. They are intended for a wide reading audience, from older high school students and their teachers, to art lovers in their golden years. We would also be glad if they were to be of use to students of art history and related disciplines. It should be mentioned that younger visitors to the Gallery would benefit from additional interpretations of the text.

This years' booklet is dedicated to the secrets of creating easel paintings or, more specifically, the painting materials and techniques used from the 14th to the 19th century. It is the product of collaboration between a curator and a conservator-restorer, based on their individual theoretical and practical insights into research and the protection of artworks, as well as on their pedagogical work. The text itself is based on selected expert literature of relevant subject matter, while its methodology is modeled after comparable editions by world renowned museums and online sources of educational museum content. Readers and/or visitors who are especially interested in the subject matter are encouraged to view the bibliography at the end of the booklet.

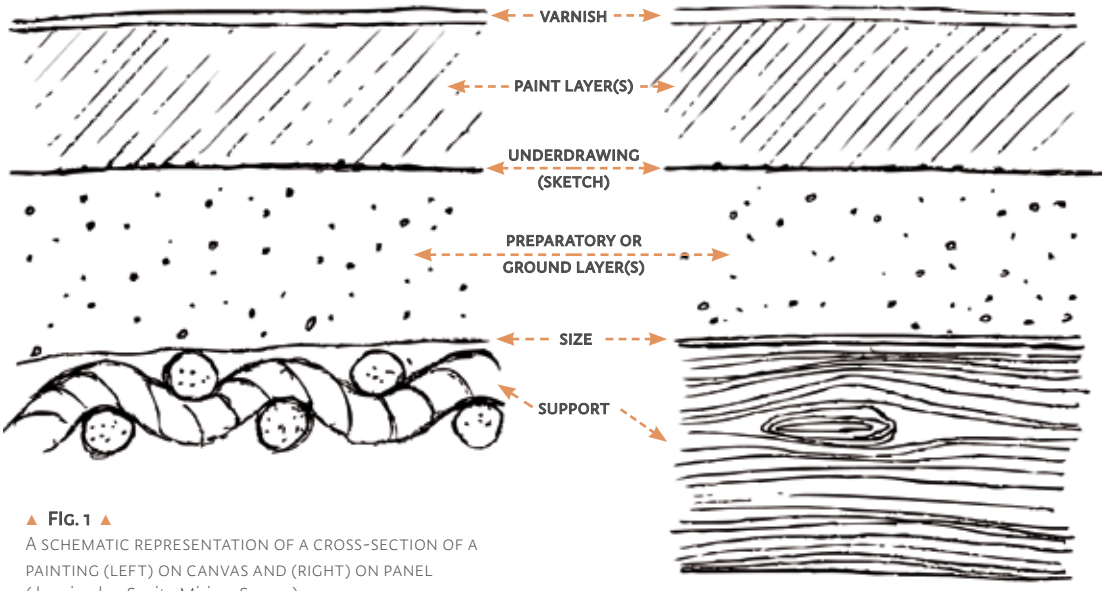
Familiarity with the materials from which a painting was created and the techniques that were used in its crafting can help art historians in determining when a work of art was created. For example, we know that a painting which was found to contain of Prussian Blue, the first completely artificially manufactured pigment, cannot be older than the 18th century, as this pigment was discovered sometime between 1704 and 1710, becoming widely available only during the 1720s. Sometimes we can identify the painter on the basis of technical information. For example, during the 1640s, Rembrandt applied a preparatory layer for his paintings that was comprised of quartz with a small addition of led white and umber, which he mixed together using drying oil. It is highly likely that this type of ground was used only by Rembrandt (1606 – 1669) and his associates, which means that – if the presence of such a preparatory layer is discovered on a painting – it is a strong indication of authorship attributed to this master painter or an artist from his circle. Being familiar with changes that painting materials are prone to can help in analyzing an artwork from an art historical point of view. An excellent example is the winter landscape painted by Vincent van Gogh (1853 – 1890) in the year 1890, *Snow-Covered Field with a Harrow (after Millet)*. In the cold blue and green tones that dominate the painting, art historians saw the reflection of the artist's powerful sense of loneliness. But, the tonality of the painting had originally been much warmer. The red pigment Van Gogh used faded due to light exposure, which caused the ultimate change in tonality and altered its interpretation.

Information about painting materials are exceptionally important for conservator-restorers, as they influence the choice of materials and techniques that will be used in the conservation-restoration process. A gold leaf placed on a layer of bole, which contains some animal glue or egg-white as a binder, cannot be cleaned with water because it will cause damage. A conservator-restorer should be familiar with painting techniques of individual artists or those belonging to a certain art movement. For example, we know that many impressionists refused to have their paintings varnished. In the past, conservation-restauration interventions on impressionist paintings usually included the application of varnish, while today this is no longer the case. If we know from which materials a painting was made, we can ensure that it is properly stored, extending effectively its lifespan. Paintings that contain pigments sensitive to light will not be kept next to a window, where they would be exposed to sunlight.

In researching the techniques of painting creation, art historians and conservation-restoration specialists refer to each other. An art historian researches documentary sources: the artist's notes, old recipes, books of regulations of various guilds, book accounts, inventory lists... Conservation-restoration specialists research another kind of document: the artwork itself. In this effort they are often assisted by experts from other disciplines: physicists, chemists, radiologists... Only once the all of the fragments of knowledge come together – like pieces of a puzzle – can we truly understand and appreciate a work of art.

We hope that this booklet will succeed in showing the advantages of interdisciplinary cooperation, and motivate interest in studying works of art from the aspect of their physical and chemical makeup.

One of the front-runners of this so-called technical art history, is the National Gallery in London, whose publications served as inspiration for the creation of this booklet. Since the year 1977, the curators of that institution, its conservation and restoration specialists and experts from the natural sciences, have been publishing the results of their research into the techniques and materials behind the Gallery's paintings in the scientific journal *National Gallery Technical Bulletin*. In the year 1988, The National Gallery instigated a series of exhibitions under the title "Art in the Making", which presents results of technical research of works by individual artists (Rembrandt, Degas), style periods (Italian Medieval Painting, underdrawings on paintings by Renaissance masters), and art movements (Impressionism), to the general public.



▲ **Fig. 1** ▲
A schematic representation of a cross-section of a painting (left) on canvas and (right) on panel
(drawing by: Sagita Mirjam Sunara)

INTRODUCTION

This booklet is dedicated to the subject of easel paintings, so the first thing that should be explained is what this term actually means. An easel is a kind of stand, usually made of wood, on which a painter places the painting he or she is creating. Therefore, easel paintings are paintings painted on an easel. However, some paintings are also referred to as easel paintings, even though they were not created using an easel. For example, the American painter Jackson Pollock (1912 – 1956) created his paintings by dripping or spraying paint onto a canvas which he had laid on the floor. What makes his paintings classified as easel paintings is the fact that they can be transported. This makes easel paintings different from wall paintings, which are physically tied to architecture, making them immoveable.

In the booklet we will talk about how easel paintings were made from the 14th until the 19th century. This particular time period was set by the artworks from the holdings of the Strossmayer Gallery. Although this is a very broad span of time – five hundred years! – painting practices were codified for almost this entire time, actually up until the final quarter of the 19th century. This means that all of the paintings at hand have a similar, layered structure. The bottom most layer – called the SUPPORT – is most often wood or canvas. The support is first coated with SIZE, then a PREPARATORY LAYER is applied. The UNDERDRAWING is executed directly on the ground. Layers of PAINT are then applied over the underdrawing, followed by VARNISH at the very end. A fascinating fact is that painters, over the centuries, had at their disposal only a limited number of materials, which they used in such various and creative ways that allowed them to grow their unique individual styles.

In the following text we will consider each of the mentioned layers in more detail. We will get to know the materials and techniques used by artists in the particular time periods or in a specific geographic region. Along the way we will learn something about the ageing

and deterioration of paintings, as well as about the conservation-restoration treatments relied upon to remove or minimize the changes caused by the passing of time or by human intervention. All of this will be illustrated on the examples of artworks from the Strossmayer Gallery.

To gain information about the materials used to make a painting we rely on various methods. The first step is the visual examination, performed first by the naked eye, and then by a magnifying glass or microscope. The examination is primarily carried out in the visible spectrum. Light can be directed vertically onto the surface or at an oblique angle; in the latter case, the texture becomes highly pronounced. Afterwards we use ultraviolet light, infrared radiation and x-radiography. Ultraviolet light can help us determine the presence of varnish on the painting, or old retouches and overpainting. Aged dammar and mastic varnish, for example, fluoresce in green and yellow. Under ultraviolet light, retouches and overpainting are often seen as dark spots. Infrared radiation can help us see an underdrawing, while x-radiography can reveal an image that preceded the visible one (fig. 2, 3). The next step is to take a small sample of the paint – smaller than the head of a pin. The sample is usually covered in resin, cut in half and polished, enabling us to see the number and sequence of layers on the support (fig. 1). Further examination can include sophisticated analytical methods, and is conducted in cooperation with experts from the natural sciences.

From the support to the varnish, a painting can tell us so much. Let us discover what secrets are hidden under its surface!

▲ **Fig. 2** ▲ After: Titian (1488/90 – 1576), *Mater Dolorosa*, oil on canvas, glued to a wooden support, 49,9 x 43,7 cm, SG-237
(Photo archive of The Strossmayer Gallery (PSG))

▲ **Fig. 3** ▲ An X-ray image of the painting *Mater Dolorosa* recorded during the conservation-restoration process showed that the figure of the Madonna was painted over a partially finished portrait, that is, the canvas support was reused (photo: Mario Braun, Croatian Conservation Institute (CCI))

SUPPORT

PANEL

Until the Renaissance, wood panel was the favorite painting support. *The Expulsion of Adam and Eve from Paradise* by Florentine painter Mariotto Albertinelli is an example of an easel painting made on panel (fig. 4, 5). Let us remember here that an easel is a painting stand, and easel paintings are those paintings that are moveable. Painters usually used wooden panels that were available locally. Until the second half of the 13th century, Italian painters most often worked on panels made from fir wood. At the end of the 13th century, their favorite support became poplar wood, although they used other kinds of panels as well: walnut tree, linden, oak, and chestnut. Albertinelli's painting is (judging by old gallery catalogues) created on a panel made from poplar. Conservator-restorers have determined that the painting *The Martyrdom of Saint Laurence*, attributed to Lorenzo Leonbruno, was painted on a support made from linden wood (fig. 6). Northern European master painters – Dutch, Flemish, and Germans – most frequently painted on oak panels. Beginning with the 17th century, they start to use panels from walnut and pear trees, cedar wood, and also from some exotic wood, such as mahogany.

▲ **Fig. 4** ▲ Mariotto Albertinelli (1474 – 1515), *The Expulsion of Adam and Eve from Paradise*, around 1514, oil on panel, 57 x 55 cm, SG-95 (photo: Goran Vranić, PSG)

▲ **Fig. 5** ▲ Photograph of the back of Albertinelli's painting (photo: Goran Vranić, PSG)

Only thoroughly seasoned wood was used to make a painting support. Most often, painters did not prepare the support themselves, but left this to carpenters. A painting of smaller size could be made on a single plank. For larger paintings, however, two or more planks were joined together. The planks would be joined by glue, most often animal skin glue or casein mixed with calcium oxide. Animal skin glue is made by boiling animal skin and bones, while casein is made from mammal milk. For the assembly to be stronger, slots could be made in the panel sides, in which round or rectangular wooden cleats would be inserted.

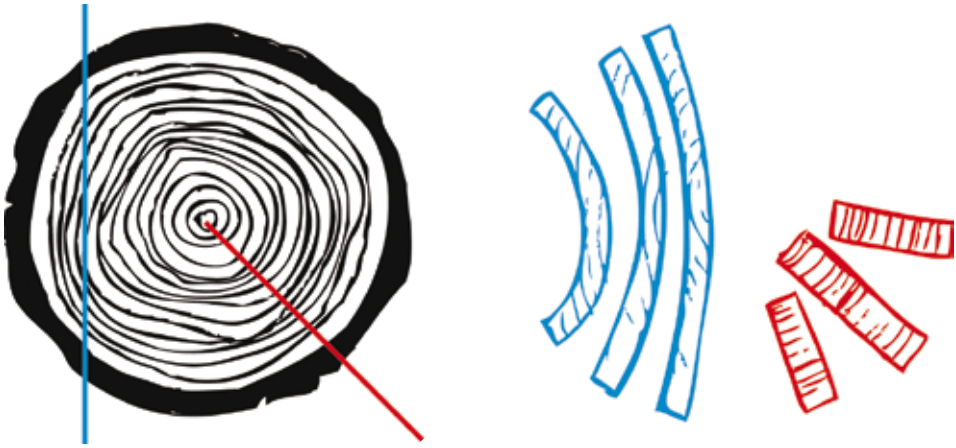
▲ **Fig. 6** ▲ Lorenzo Leonbruno (?), (1489 – around 1537), *The Martyrdom of Saint Laurence*, tempera on panel, 234,8 x 151,8 cm, SG-99 / This X-ray image taken during conservation-restoration work shows that the support is made of four planks of approximately the same width, which are in some places joined by the so-called butterfly keys. Three transverse bars additionally consolidate the back (photo: Mario Braun, CCI)

▲ **Fig. 7** ▲ Niccolò di Pietro Gerini (around 1340 – 1414/15), *Temptations of Saint Antony the Hermit*, 1390 – 1400, tempera on panel, 22 x 32 cm, SG-28 / Detail of an archival photograph taken during conservation-restoration work, with visible traces of canvas that was glued to the panel surface before the ground was applied (photo: PSG)

Fig. 8 ►►
Neri di Bicci (1418 – 1492), *Madonna with Child and Two Angels*, 2nd half of the 15th century, tempera with oil on panel, 82,6 x 46,9 cm, SG-47 / Detail of an X radiograph showing pieces of canvas covering knots in the wood (photo: Mario Braun, CCI)

Another method would be to create indents at the juncture between two panels in which wooden "butterflies" would then be inserted. A support made from more planks was usually reinforced at the back with transverse or diagonal bars (fig. 6).

Wood is a hygroscopic material, which means that it increases and decreases in volume depending on the relative humidity in the environment. The shrinkage of wood can cause gaps to open between the boards used to make the panel. In order to prevent the preparatory and paint layers along these joints from breaking, until the 14th century artists used to glue gauze or fine canvas over the entire wooden support. Only then would they start to apply the preparatory layer. From the 15th century, they used smaller pieces of canvas which they glued only over the joints, knots, and other flaws in the wood panel. Later on, these fragments of canvas were replaced by parchment and plant fibers mixed with glue (in Italy) or horse and



▲ **Fig. 9** ▲ On the left-hand side of the image we can see a cross-section of a tree trunk. The blue line signifies a tangential, and the red line a radial cut. Blue shapes on the right-hand side of the image represent boards produced by a tangential cut and their typical deformations after seasoning. Boards produced by a radial cut are shown in red. (drawing: Sagita Mirjam Sunara)

cow hair (in Northern Europe). An archival photograph of the painting *Temptations of Saint Antony the Hermit* by Niccolò di Pietro Gerini, from the final decade of the 14th century, shows a small damaged area of the painting where we can clearly see the canvas that the artist placed onto the panel before he began painting on it (fig. 7). A detail of an X radiograph of the painting *Madonna with Child and Two Angels* by Neri di Bicci, which dates to the second half of the 15th century, clearly shows the large knots in the wooden support. Prior to applying the preparatory layer, these knots were covered by square pieces of canvas (fig. 8; see also: fig. 38).

▲ **Fig. 10** ▲ Girolamo Sicciolante Sermoneta (around 1521 – 1575), *The Holy Family*, oil on panel, 100,9 x 77,5 cm, SG-105 / Photograph of the back of the painting with the original crossbeams. (photo: Ljubo Gamulin, CCI)

The part of the log from which the board was cut plays a crucial role in its long term stability and durability. Boards of the highest quality are produced by a so-called radial cut. When it comes to tangentially cut boards the most suitable ones are produced from the central part of the tree trunk, as panels cut near the outer part of the trunk are more prone to distortions. The panel side facing the tree bark contracts more, because it dries more quickly and easily (fig. 9). With panel paintings, distortions could also be the result of one side of the support being painted, while the other is not. This means that unequal amounts of moisture are released and absorbed on the opposite sides of the support, causing unequal contraction and expansion as well.

We have already mentioned crossbars that were fastened to the back of a support in order to reinforce further the joints between panels (fig. 10). However, these bars had another function: they ensured that the panel maintains its general planarity. These kind of reinforcements could also be added as

a part of conservation-restoration work. We will frequently find that a back of a painting on a wooden panel contains a complex structure (grid) made of vertical and horizontal battens, so-called cradle (fig. 11, 12). The battens running parallel to the panel's grain direction are glued onto the surface. They have a slot at the bottom through which another set of battens is pulled through. These battens, which run perpendicular to the panel's grain direction, are not fixed to the support, but can be moved. The moveable battens prevent the support from warping, although they do not hinder its contraction and expansion altogether, as this would cause the wood to break due to the constant pressure.

In order for the cradle to be fastened onto the support, the back of the painting needs to be straightened if it is at all crooked. When the panel has been planed down, traces of tool work, and sometimes even guild markings are removed. These pieces of information are valuable for understanding the technology used to create the wooden support, as well as determining its origin. The wooden support was frequently thinned down to less than half of its original thickness. Namely, it was believed that a thinner panel endures more changes in temperature and humidity than a thicker one. In extreme cases, the support was completely removed, while the image layer, the ground with the various layers of paint and varnish, was glued onto a new support, often made of canvas. This process is called transfer. Today, these kind of drastic measures are seldom taken.

Fig. 11
Charles-François Daubigny (1817 – 1878), *Landscape*, 1857, oil on panel, 21 x 38,5 cm, SG-598 (photo: Goran Vranić, PSG)

Fig. 12
Photograph of the back of Daubigny's painting with cradle (photo: Goran Vranić, PSG)

Fig. 13
Giovanni Bellini (around 1431 – 1516), *Saint Augustin and Saint Benedict*, around 1490, tempera and gilding on panel, each 108,7 x 42,3 cm, SG-243 (photo: Goran Vranić, PSG)

Fig. 14
Macro photograph of insect in the wooden support of Bellini's painting (photo: Mario Braun, CCI)

Warping is not the only issue we encounter in panel paintings. Namely, wood is susceptible to infestations of insects and microorganisms. Tiny insect holes are visible on the back of Albertinelli's painting *The Expulsion of Adam and Eve from Paradise* (fig. 5). These holes are actually exit openings created by wood-boring beetles. Tunnels found beneath the wood surface were not created by adult insects, but by larvae. Larvae feed on wood, leaving behind feces and fine sawdust. While conducting conservation-restoration work on two paintings by Giovanni Bellini, *Saint Augustin* and *Saint Benedict*, through magnification, conservator-restorers spotted a larva of a wood-eating insect (fig. 13, 14). The conventionalized term for these larvae is "worms", causing the holes that they created by eating the wood to be named "wormholes".

CANVAS

During the 16th century, canvas became the favorite support of artists. Paintings on canvas were lighter than those on wood. Since they could be removed from the auxiliary support and rolled up, they were easier to transport. This does not mean that canvas had not been used for paintings in earlier centuries; in his book, *The Book of Art* (around the year 1400), Italian artist and painter Cennino Cennini gives detailed instructions on how to paint and decorate linen canvas and silk. Canvas was used to create paintings, ceremonial coverings, processional banners, flags, scenography... Cennini mentions linen cloth and silk. The former was used most often, but painters also worked with textile supports weaved from hemp and wool. Since the 19th century, painters have been using cotton cloth, and even jute.

A painter could choose a textile support based on its texture or type of weave; this enabled him to achieve a certain optical effect. However, artists often used what they could find. For example, there is a whole array of paintings created on striped canvas, which was usually used in the production of mattresses!

Canvas enabled painters to create paintings of very large size. A larger painting surface was formed by joining two or more pieces of canvas together (fig. 15, 16). Namely, the width of the canvas was determined by the width of the loom, which made it impossible to weave

▲ **Fig. 15** ▲ Jacopo Palma il Giovane (around 1548 – 1628), *The Deposition*, 230 x 136 cm, oil on canvas, POH-7 (photo: Hrvoje Gržina)

▲ **Fig. 16** ▲ Photograph of the back of Palma's painting showing that the support is composed of three pieces of canvas (photo: Hrvoje Gržina)

▲ **Fig. 17** ▲ Francesco Capella (1711 – 1784), *Christ falls under the cross*, around 1750, oil on canvas, 94,3 x 125,2 cm, SG-296 (photo: Nikolina Oštarijaš, CCI)

Fig. 18 ►►
Photograph of the back of Capella's painting showing traces of earlier lining recorded during conservation-restoration work in the year 1954 (archival photograph, CCI)

a single cloth that would be three or four meters wide. Supports composed of more pieces of canvas can be found in Italy right after the first quarter of the 16th century, and after the 16th century in Benelux countries. Many paintings of this type today have visible seams where the two pieces of canvas were joined. This is because they were glued onto a new canvas during conservation-restoration work, which included exposing the back of the painting to pressure. The process of gluing the painting onto a new canvas is colloquially called lining. The painting *Christ falls under the cross* by Francesco Capella is an example of a painting on which this process was used (fig. 17, 18)!

▲ **Fig. 19** ▲ Jean-Baptiste Paulin Guérin (1783 – 1855), *Portrait of King Charles X*, 1824 – 1830, oil on canvas, 73,6 x 59,5 cm, SG-37 (photo: Goran Vranić, PSG)

▲ **Fig. 20** ▲ Photograph of the back of Guérin's painting with a keyed stretcher and visible mark of the supplier of painting materials, which aided in the dating of the painting (photo: Goran Vranić, PSG)

In order for a canvas to be used as a painting support, it needed to be flat and taut, which was achieved by fastening it to a wooden framework. This framework should be distinguished from a decorative frame, which we will focus on in the penultimate chapter. There are two basic types of frameworks: stretcher and strainer. The dimensions of a strainer cannot be modified, while the stretcher, as its name suggests, can be enlarged. Stretchers first appeared in the 18th century, and enabled artists to regulate the level of tightness in the canvas (a loose canvas could be tightened). In the mid-18th century in France, a so-called keyed stretcher was invented. This type of construction can be seen on the painting *Portrait of King Charles X* by Jean-Baptist Paulin Guérin (fig. 19, 20). If we take a closer look at the back of Guérin's painting, we will see triangle wedges ("keys") in the corners of the stretcher. By pushing them into the corner joints, the stretcher is widened and elongated, which gives the canvas more tension. We will notice another transverse bar in the middle of the stretcher, whose purpose is to provide reinforcement to the whole construction. These kinds of reinforcements were necessary in paintings of large dimensions. On the back of Guérin's painting, we can see that the canvas bears the mark of a supplier of painting materials (*BELOT, rue de l'Arbre sec. № 3 A PARIS*). In the 19th and early 20th century, suppliers of painting materials frequently marked the backs of paintings with their individual symbols, usually by using a stencil. On the basis of these markings, and the name of the supplier, its address or graphic design, it can be determined when a canvas was prepared or sold, which can be useful when dating a painting. Sometimes, a mark can also be found on the back of the auxiliary support. In this case, it could signify the producer of the stretcher or strainer, and not the company that procured, prepared and fastened the canvas onto the auxiliary support.

A canvas was fastened to an auxiliary support with small wooden wedges or metal pins, but it could also be glued. The wedges and pins would usually be hammered in along the sides of the auxiliary support although there are examples where the canvas itself was nailed onto its front. The finished painting would be transferred onto a solid support (a wooden panel) or onto a "permanent" auxiliary support. Only later did it become common practice to leave the painting on the same auxiliary support on which it was created. However, Dutch artists of the 17th century still used "working" supports. These frameworks were somewhat larger than the painting itself, and the canvas would be tightened with the help of a long piece of string which was woven through the edge of the canvas and then wrapped around the framework. Once the painting process was finished, the painter would remove the painting from the "working" supports and attach it to another framework of adequate size.

The tacking margins can reveal a lot about the painting's history. While stretching the canvas, the weave along its edges undulates, creating deformities. If we cannot see undulations on a painting's edges, it is possible that the work was trimmed. If the tips of the undulations do not match the position of the wooden wedges or metal pins, and especially if there are small holes in the canvas lined up between the wedges and pins, we can safely assume that the painting had been, at one point, removed from the auxiliary support and re-stretched onto a new supporting structure. If the ground and paint layer extend all the way to the edges of the textile support, all along the edges over which it is fastened to the auxiliary support then we know that the present painting had been cut from a larger whole. This could have happened while transferring it from the "working" support to the permanent one or, as is most common, during radical modifications. In some historical periods, namely, paintings were trimmed in accordance with the prevailing taste or their new environment. The smoothly cut edges of Carletto Caliari's painting *Angels playing music* point to the fact that the painting's original dimensions were larger (fig. 21).

It should be mentioned that damaged edges of painting were, in the past, often cut off while gluing the textile support onto a new canvas. Damage to painting edges was usually caused by the corrosion of metal pins with which the painting was fastened to the stretcher or strainer. Today, conservator-restorers regularly replace metal pins with copper or aluminum ones. Sometimes they can even use a stapler. If you happen to see new pins or staples at the edge of a painting, this is a sure sign that it has recently undergone conservation-restoration work.

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Fig. 21
Carletto Caliari (1570 – around 1596), *Angels playing music*, 1570-96, oil on canvas, 28,8 x 24,5 cm, SG-227 (photo: Žorž Draušnik, PSG)

▲ **Sl. 22** ▲ Giuseppe Cesari known as Cavaliere d'Arpino (1568 – 1640), *Saint George slaying the dragon*, around 1600, oil on slate, 51 x 40 cm, SG-103 (photo: Goran Vranić, PSG)

▲ **Fig. 23** ▲ The back of Cesari's painting on a slate support (photo: Goran Vranić, PSG)

OTHER SUPPORTS

Most paintings in the Strossmayer Gallery were painted on panel or canvas. However, we can also find supports made from other kinds of material. For example, the painting *Saint George slaying the dragon* by Giuseppe Cesari, also known as Cavaliere d'Arpino, was painted on slate (fig. 22, 23). It is considered that the first paintings on stone supports were created in the 16th century in Rome. Italian painter, architect, and writer, Giorgio Vasari (1511 – 1574), commended the durability of paintings created on slate, as well as the high quality of this kind of support: solidity, fine structure, the ability to achieve a uniformly smooth surface, and lesser absorption as opposed to wood and canvas. Black stone supports, like black jasper and marble, were very widespread. Painters readily utilized their color in the creation of their paintings, leaving the dark support visible in shadowy areas and contours of figures. Paintings were also created on colorful marbles, porphyry and alabaster, and even on semi-precious stones (such as amethyst and lapis lazuli). While usually covering his paintings on slate completely in color, Cavaliere d'Arpino made one famous example on a lapis lazuli support, utilizing its chromatic values by leaving it visible in more than half of the support's surface.

The painting *Temptations of Saint Anthony the Hermit*, attributed to Jan Brueghel the Younger, was painted on a thin copper plate (fig. 24). Copper was the most commonly used metal support. The introduction of metal supports is also tied to 16th-century Italy. This was a time when artists experimented with new types of supports for paintings, and copper plates were readily available thanks to the growing popularity of printing techniques. Moreover, many artists practiced printing as an art form, which meant that they had a good understanding of printing materials. No less important is the fact that the color of copper greatly resembled toned *imprimatura*, used by Italian painters since the end of the 15th

▲ **Fig. 24** ▲ Attributed to: Jan Brueghel the Younger (1601 – 1678), *Temptations of Saint Anthony the Hermit*, oil on copper plate, 23,6 x 31 cm, SG-154 (photo: PSG)

century, a topic we will deal with in the chapter dedicated to preparatory layer. Painting on copper plates was especially widespread in 17th-century Northern Europe.

In order for paint to bind well to the copper support, the surface of the plate needed to be roughened. This was done by light roughening or, more rarely, scratching the metal. The support would then be rubbed with garlic, whose juice made the surface sticky and lightly granulated, causing the paint to bind better. Several thin layers of oil paint would then be added, serving as priming color. The preparatory layer(s) needed to be uniform and very smooth, which was often accomplished by rubbing the final layer in with fingers or the palm of the hand. The surface was then ready to be painted on with oil paints. Paint was applied in thin, more or less transparent layers. Even thinly applied paint had a very saturated appearance, as the surface did not absorb the binder. This was especially true for dark shadows, which appeared dull when painted on absorbent surfaces, such as canvas.

Unlike wood and canvas, copper is not subject to changes in size as a result of changes in the relative humidity of air. Neither is it subject to insect damage. Because of its particular durability, some paintings made on copper plates seem as though they were just taken down from the artist's easel, even today.

Some artists preferred copper plates coated with tin or a tin-lead alloy. The use of tin supports was especially common in Poland and Austria from the 16th until the end of the 18th century. Tin plates also served as bases for large altarpieces. In the 19th century, painters frequently used tinplate (steel coated with tin) as a painting support. Sometimes, they also painted on zinc plates.

At the end of the 16th and beginning of the 17th century, painters started to create paintings of smaller size on parchment. They painted portraits, still lifes, landscapes, botanical illustrations, etc.

Parchment is animal hide (calf, goat, lamb, sheep, pig) processed by a special method. The hide is first washed in clean and cold running water, after which it is dried in the sun, or soaked in lime bath from three to ten days, while being stirred regularly with a wooden rod. Afterward, residual fur and meat are removed. The lime is cleared away by washing the hide twice a day in clean water. This is followed by stretching the hide in a wooden frame and moistening it with warm water. Both sides are scraped with a special tool. Once the hide is smooth and uniform, it should be moistened and rubbed down with pumice. In order for it to become a suitable painting surface, it requires another fine rubbing down with pumice, or chalk and clay dust – this removes the remaining fat and fills the pores on the hide. Instead of dusty compounds, a mixture of glue and pigment can also be used. A surface prepared in this way would then serve as a painting support. An underdrawing would usually be made with a metalpoint stylus, and then enhanced by quill or brush. The metalpoint stylus – the precursor of the modern pen – was a tool made of silver, lead, copper or gold wire inserted in a wooden holder. Full metal could also be used instead of wire. This drawing instrument left a mark similar to graphite (slate pencil) on the parchment. Graphite was not adequate for the creation of underdrawings, as it would rise to the surface with time, becoming visible. An artist would paint with egg tempera or watercolors. Some artists experimented with pastel, oil paint, etc. Paintings on parchment were never varnished.

The holdings of the Strossmayer Gallery include works on parchment as well. Along with a complete illustrated book of prayers from the end of the 15th century, and around twenty miniatures originating from two separate illuminated manuscripts from the beginning of the 16th century, we have several "easel paintings", mainly watercolors, from different time periods and of different genres. One of these is *Girl on a tortoise* (fig. 25), attributed to Bernard Lens III, a renowned British painter of miniature portraits from the first half of the 18th century. Although he sometimes used parchment as a support for his paintings during his career, he is much better known for paintings on ivory, and is seen as the British forerunner of miniature painting on ivory. He even made copies of various works for private patrons. These included paintings by famous masters in miniature form, as well as works by earlier miniature painters. He also restored and reframed older miniatures.

◄◄
Fig. 25
Bernard Lens III (?) (1682 – 1740), *Girl on a tortoise*, 1st half of the 18th century, watercolor on parchment, 69 x 75 mm, SG-314 (photo: Boris Krstinić, PSG)

SIZE LAYER

When discussing paintings created on a copper support, we said that the support was prepared for the application of paint in a way that would ensure that the paint would bind to the metal surface. Wood and canvas required a somewhat different preparation process. These materials can absorb the binder from the paint, causing it to lose its shine and weaken its bond to the support. The absorption power of wooden and textile supports is reduced by applying an adhesive substance (glue) over the surface of the panel or stretched canvas. Old masters would give the support a layer of size made from goat, sheep, cow, or pig hides, various types of fish, parchment skins, or pieces of skin leftover from making gloves. Some recipes from the 17th and 18th centuries mention the use of flower or starch mixed with glue. However, animal glues were most commonly used.

Prior to the application of the size, a wooden plank would be roughened, usually by notching. The size could be applied once or in several layers. Thick types of wood, like oak, are less absorbent and therefore required less size. Wood of smaller density, like poplar, required several layers of size. Canvas requires only one or two layers. The application of size would flatten the fibers on the canvas and partially fill the openings in the weave. In addition, the size would protect the canvas from the abrasive action of drying oils.

The size layer is crucial for the future characteristics of the textile support. If we were to wet a canvas that has not been coated in size, it would shrink. By drying, or releasing moisture again, it would expand. Just like canvas, size is also a hygroscopic material, but it behaves completely differently from canvas: when it absorbs moisture, size increases in volume, and when it dries, it shrinks. If the canvas is impregnated with size, it will behave differently from its nature: it will expand with high humidity, and shrink with low humidity. You have surely noticed by now that paintings made on canvas expand in humid conditions, while dry environments cause them to become taut. Now we know that the reason for this is the application of size. However, in conditions of very high relative humidity (over 80%), even canvas that has been impregnated with size behaves like "normal" canvas: it shrinks.

The size layer can cause many problems to a painting. This is especially true for paintings from the 19th century which are painted on densely woven canvases. These kinds of canvases react strongly to water: they shrink quickly and drastically. Commercially produced painting canvases in the 19th century were often coated with a cold size. Gelatin-based size, which is applied by a spatula or knife, cannot completely impregnate the weave fibers, but rests as a thin film on their surface. Once moisture from the canvas reaches the size layer, it softens, loosening the bond between the ground – which absorbs moisture much more slowly, remaining rigid and hard – and the textile support. Conservator-restorers coined a special term for these kind of canvases: *shrinkers* (from the Eng. verb *to shrink*).

When talking about size, we have to mention a special group of paintings for which the term *Tüchlein* is used in expert literature. The term is taken over from the diary of the German Renaissance artist, Albrecht Dürer (1471 – 1528), who used it to mark his paintings of smaller format painted on canvas (Ger. *tuch* – cloth, *klein* – small). Today, this term stands for all paintings created on finely woven linen canvas, with paints that contain a water-based binder (animal glue, vegetable gum, or egg-whites). Preparing the painting surface most often only included sizing. In rare cases, the textile support would also be coated with a thin layer of ground. The painting would then be executed in a glue tempera medium. At the end, it would not be varnished. Due to a lack of ground and a protective coat of varnish, such works are exceptionally prone to deterioration. Lean paint renders them a matte finish, while the texture of the woven support is highly pronounced. The oldest paintings on canvas were created in this particular way.

PREPARATORY LAYER

After the sizing is complete, a preparatory layer is applied to the painting surface. Apart from playing an important role in the overall aesthetic effect of the painting, this layer additionally reduces the absorption power of the surface, ensuring the stability of the paint. The main ingredients of the preparatory layer, or ground, are filler(s) and binder. Artists working south of the Alps used gypsum (calcium sulfate) as the filler in their ground, while those working north of the Alps used chalk (calcium carbonate). The choice of filler was conditioned by the local availability of the material. For example, Dutch artists used gypsum while working in Italy. The first binders were animal glues which were later replaced by drying oils.

Cennini meticulously described the preparation process of wooden panels used in Italian painting workshops in the 14th century. Two types of ground would be applied to the wood, *gesso grosso* and *gesso sottile* (It. *gesso* – gypsum). *Gesso grosso* was made by rubbing burned gypsum with animal skin glue. The paste would then be applied to the panel with a straight spatula in multiple layers. Once it was dry, the ground would be evened out by scraping and polishing. The *gesso sottile* would be applied over the *gesso grosso*. The filler for this type of preparation was created by the prolonged soaking of either the raw gypsum or burnt *gesso grosso* in water, accompanied by everyday stirring. A large amount of water would be poured into the bucket, preventing the gypsum from drying and turning into a useless mass. Being continuously soaked in water caused the gypsum to lose its binding ability. The dried "loaf" of gypsum would be re-soaked in water, rubbed down, strained, and then mixed with binder. The resulting creamy liquid would then be applied warm to the painting surface. In order to avoid overheating, the mixture was kept in a bowl above a pot of heated water. The first layer of *gesso sottile* was applied with a soft brush, and then rubbed into the surface by hand. The other layers were applied by brush only. Once it dried, the *gesso sottile* also needed to be scraped. Its surface would first be dusted with ground coal, and then scraped until the black dust was no longer visible. This kind of complex and lengthy preparation process was necessary in order to get a very smooth painting surface, which was in turn required in order for the gilded surfaces to be polished, giving them that pure-gold shine.

Preparatory layers on paintings by artists from the north of Europe are much thinner than those by Italian artists, which is probably because the wood used by Northern painters was less absorbent. Unlike gypsum, chalk did not require such a complex treatment before being used; it was enough to rinse it of dirt and it could instantly be mixed with adhesive.

In the 15th century, Italian artists drastically simplified the preparation process of wooden supports. Only one type of ground was often applied to the surface, either *gesso grosso* or *gesso sottile*, or both, but mixed together. Flemish and Dutch masters of the 18th century replaced animal glue in the preparatory layer with drying oil. Drying oil creates a compact film when exposed to air, with the aid of light and heat. For example, olive oil does not fall under this category. It is interesting that linen seeds, from which linseed oil is produced, were frequently pressed in olive mills. Due to the resulting contamination of linseed oil with olive oil, some considered that linseed oil was not a drying oil.

During the 15th century, oil paint gradually replaced egg tempera. In order to prevent the oils in the paint from being excessively absorbed into the surface, painters applied a layer of glue size or drying oil onto the prepared surface to act as an isolation. This layer is also called the imprimatura. Somewhat later, lead white started to be added to the imprimatura. This pigment accelerates the drying process of oils, all the while retaining the brightness of the ground. At the end of the 15th century in Italy, the use of pigmented imprimatura layers became the norm.

This type of imprimatura spread beyond the Apennine Peninsula in the 16th century. Apart from preventing the ground from absorbing too much paint binder, colored imprimatura also played an aesthetic role: the artist could use it to tone down the whiteness of the preparatory layer and/or to determine the tonality of the entire painting. Some painters used imprimatura as the middle tone, leaving it visible in parts of the finished painting, usually in the background or in the shadows, effectively shortening the painting process.

When talking about *Tüchlein* paintings, we said that paintings on canvas created with glue paint did not usually have a preparatory layer. The first paintings on canvas made with oil paint were created in Venice at the very end of the 15th century. Italian recipes from the middle of the 16th century mention two types of ground used on woven supports: a mixture of gypsum and animal glue, or a mixture of flour, nut oil, and lead white. The latter was supposed to maintain the flexibility of the canvas and prevent flaking when the painting is rolled. The imprimatura was comprised of a layer of glue size, and a coat of pigmented oil isolation layer.

By the end of the 15th century, Italian painters started to tone their preparatory layers by adding colored pigments. Under the influence of Italian painting, even Northern European masters of the 16th century began to use colored grounds. During the 17th century, most Italian painters were using a preparatory layer of reddish brown color. Even though this practice spread outside of Italy, Northern masters still preferred lighter ground colors.

Towards the end on the 19th century, preparatory layers got lighter in tone, just like the color palette used by artists of the time. Furthermore, stores selling painting material in the 19th century offered fully prepared canvases.

UNDERDRAWING

Before beginning the painting process, the artist often created a preparatory drawing on the previously prepared surface. Some artists would just make a rough sketch of the composition; others would meticulously deal with every single detail. The underdrawing could be executed in charcoal, ink, metalpoint, chalk, paint, pastel, graphite... The choice of drawing material depended on the type of drawing (for example, a metalpoint was useful for creating very precise sketches) and the color of the painting surface (a white preparatory layer could be used for drawing with both red and black chalk, but red chalk was barely visible on a dark toned ground.

Cennini suggested that painters use charcoal tied to a cane or stick when drawing; in this way, the artist could easily step away from the panel and view the entire composition. Once the drawing was finished, it needed to be lightly swept with a brush, after which the lines could be intensified with watered down ink.

A preparatory drawing could be made by free hand directly on the painting surface, or it could be transferred onto it from a sketch or another painting. Various techniques were used to transfer a sketch onto a painting surface. For example, the back of the sketch could be blackened with charcoal or black chalk. The sketch would then be placed onto the prepared painting surface, and the lines of the drawing would be traced with a metalpoint; the pressure caused by the drawing instrument would result in a black trace on the ground. The *spolvero* technique (It. *spolverare* – dusting) included the creation of a drawing on paper (It. *cartone*), followed by pricking small holes along the lines of the drawing, placing the paper onto the prepared painting surface, pressing charcoal dust or black pigment through the holes, removing the paper and,

finally, connecting the dots left on the preparation (fig. 28). The sketch could also be transferred through a grid. The process went as follows: first a squared grid would be drawn over the sketch, then a grid with the same number of squares would be drawn on the painting surface. The content of each square from the sketch would be transferred by free hand into the corresponding square on the painting surface. This process enabled an artist to increase and decrease the scale of the painting.

An artist would not always adhere to the preparatory drawing in the painting process. In the painting *Madonna with Child,* by an unknown master from San Miniato, deviations from the underdrawing can be seen by the naked eye (fig. 26). The Madonna's right hand was originally designed quite differently: her fingers were supposed to point upwards. The changes that an artist makes during the painting process are called *pentimenti* (It. *pentimento* – repentance, regret). These kinds of modifications are usually invisible, because they are hidden beneath layers of paint. However, paintings made by oil paints sometimes reveal them, as oil paints get slightly more transparent over time. The *Madonna with Child* was created by tempera, but the underdrawing became visible because the paint was applied thinly, becoming transparent over time.

▲ **Fig. 26** ▲ Maestro di San Miniato, 2nd half of the 15th century, *Madonna with Child*, tempera on panel, 57 x 48 cm, SG-55 / The *pentimento* is visible with the naked eye through the now more translucent paint (photo: Hrvoje Gržina)

With the help of infrared radiation, we can sometimes see what lies beneath the layers of paint. Since the human eye cannot register this kind of radiation, two imaging techniques are used for detecting an underdrawing: infrared photography and infrared reflectography. The underdrawing will be visible under infrared radiation if it was made with material that contains carbon (e.g. charcoal or graphite), if it was drawn on a white ground (the kind that can be found on paintings from the Middle Ages and the Renaissance), and if the pigments present in the layer of paint do not absorb infrared radiation (which applies to most pigments). The painting *Madonna with Child, Saint John, and Angel* by Raffaellino del Garbo meets all of the mentioned criteria, enabling us to see its underdrawing quite well (fig. 27, 28). If the underdrawng was created with white chalk on a dark ground, or with oil paints that have a pigment that does not contain carbon, we will not be able to see it under infrared radiation. However, the fact that we cannot see it does not mean that it does not exist.

Fig. 27 ►►
Raffaellino del Garbo (around 1470 – around 1527-28), *Madonna with Child, Saint John, and Angel*, tempera on panel, ⌀ 73,3 cm, SG-104 (photo: PSG)

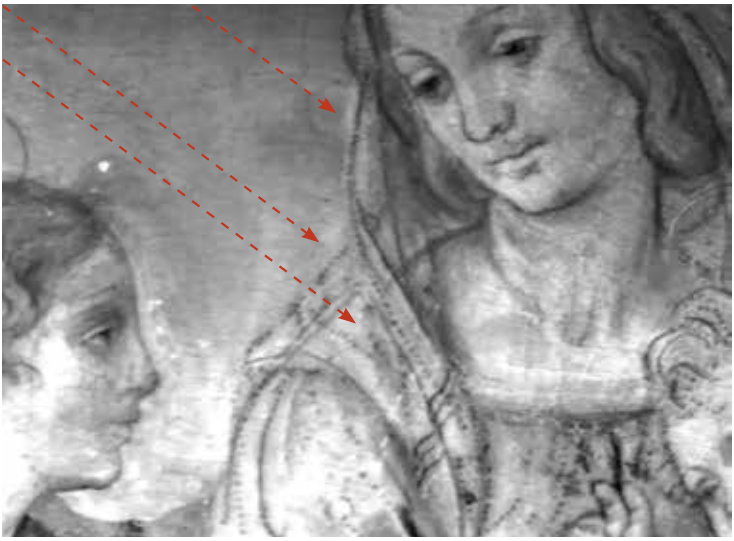


Fig. 28 ►►
Detail of an infrared image of Del Garbo's painting with a clearly visible underdrawing, which was, judging by the visible dotted lines, transferred onto the painting surface through the *spolvero* technique (photo: Mladen Blažević, PSG)

GILDING

If you take a look around the Gallery, you will notice gilding in paintings of religious subjects. This kind of paintings used to adorn altars in churches and private chapels, which were spaces with low lighting. Candlelight in front of the paintings reflected from their polished golden surfaces, causing the viewer to believe that the paintings themselves shone and shimmered, adding to the overall feeling that they are witnessing something otherworldly. Gold had a strong symbolic value and was very expensive.

Gold is a soft and elastic material, thanks to which it can be beaten out to very thin square leafs for use. Cennini mentions that one ducat can produce as many as one hundred and forty five gold leaf sheets! Gold dust is also produced from gold. Gold leafs are placed whole or cut into a desired shape on the painting surface. The cutting is performed on a padded leather cushion with a knife whose blade is straight, but not too sharp. Apart from gold, paintings were also covered in silver, tin, and leafs or dust made from other metals, often as a replacement for gold. For example, a silver leaf could be glazed yellow or covered with yellow- colored glaze, causing the surface to appear as real gold (coating the silver leaf with varnish would prevent it from oxidizing, that is darkening over time). Namely, it should be mentioned that gold was very expensive and not always readily available. Furthermore, the patron did not always know what kind of solution the artist came to; there were cases when the painter "planted" a cheaper material, while charging for a more expensive one. In order to avoid deception, the contract between the patron and artist would often include the mention of gold and the size of the painting surface that would be covered in gold leaf. The amount of ultramarine, an expensive blue pigment that will be discussed in the next chapter, was also often stipulated in the contract.

There are two types of gilding: so-called water gilding and so-called oil gilding. The process of water gilding entails the gold leaf being placed on bole (a soft, orange or reddish-brown clay) to which a little watered-down animal-skin glue or egg-white has been added (the egg-white is beaten, water is added to it, and it is left to sit overnight; the resulting foam is discarded, while the residue is used as the adhesive). In order for the underdrawing not to be lost under the layers of bole and gold leaf, Cennini suggests that the lines around the surfaces that will be gilded be cut into the preparatory layer with a prod. The bole with added adhesive is applied by brush in several layers, and burnished with a cloth once it is dry. The gold leaf should be moistened with water before being placed on the painting surface; this is where the term *water gilding* comes from. Cennini suggests that a bit of egg-white be added to the water, and that the leaf be placed with the help of a square piece of carton whose edges have been cut off. Today, a wide, flat brush made of squirrel hair is used to transfer gold leaf onto the painting surface. The sheets of gold leaf are positioned in a way that their edges slightly overlap. Gilded backgrounds of medieval paintings, or gilded decorative frames, often show a grid made up of these overlaps (fig. 29). The layer

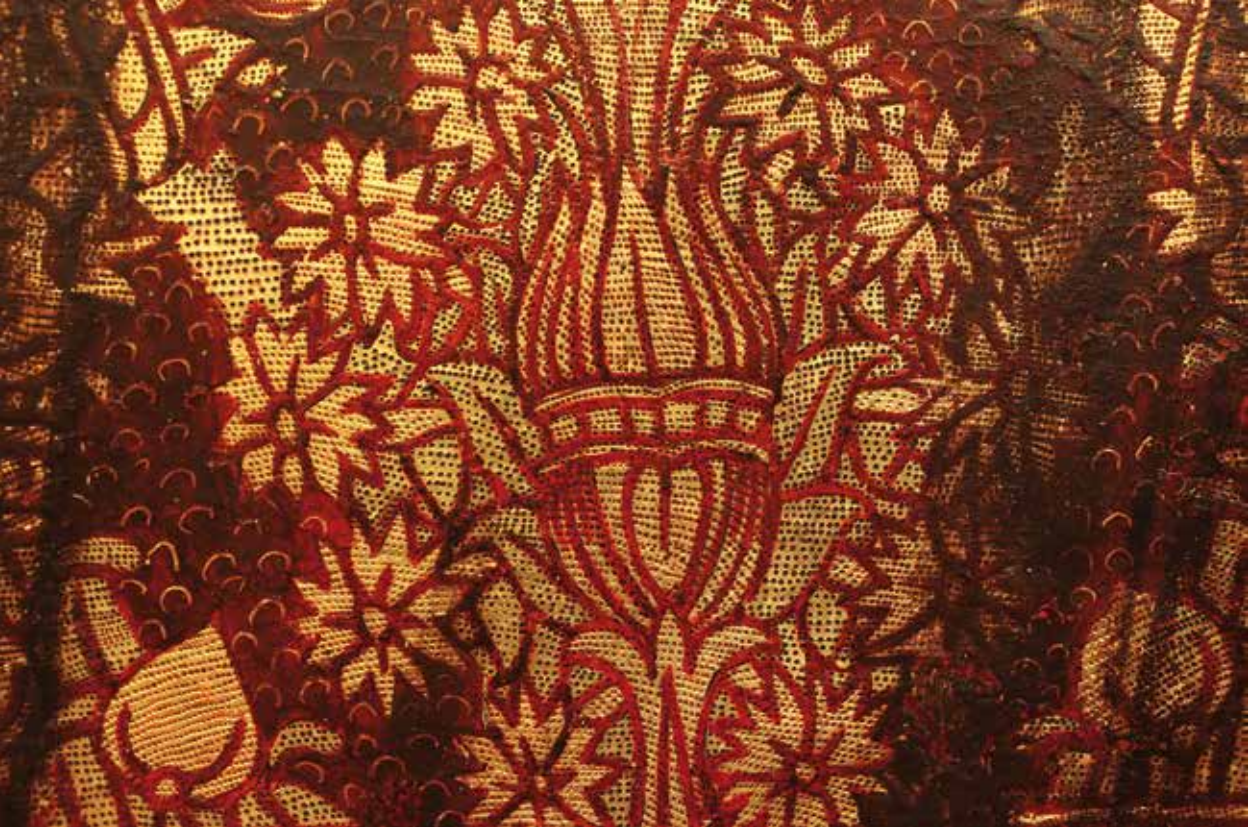
▲ **Fig. 29** ▲ Detail of a gilded decorative frame, with visible overlapping of sheets of gold leaf (photo: Hrvoje Gržina)

▲ **Fig. 30** ▲ Lorenzo di Bicci (around 1350 – 1427), *Saint Francis of Assisi*, tempera and gilding on panel, 62,5 x 26,8 cm, SG-685 / Punches are visible under raking light (photo: Nikolina Oštarijaš, CCI)

of gold in these places is thicker, while being thinner in the rest of the surface. Sometimes this thin layer of gold is washed away as a result of cleaning. Since gold leaf looks wrinkled and dull right after positioning, it required polishing. Cennini mentions different polishing materials: from minerals (hematite, sapphire, emerald, topaz) to the teeth of dogs, cats, and even wolves and lions!

Surfaces with water gilding were decorated in various ways. One of the most frequent was punching: covering the surface with tiny dents, so-called punches. The small punching tools could have various endings: a protruding half-bead, ring or some other more complex shape. The tools would be set vertically onto the surface and tapped gently with a hammer; the punch would then be imprinted into the surface. Punching tools were not used only on gilded wood surfaces, but also on metal objects, and leather. Punches can sometimes be used for identifying an artist or workshop, because some artists used specifically designed decorative tools. The halo on the painting *Saint Francis of Assisi* by Lorenzo di Bicci has three types of punches: tiny punches that fill wide strips running along the edges of the painting and on the Saint's halo, round wide punches used in the formation of lines, the outer rim of the halo, and the floral decorations, and semi-circular punches used for the contours of the six-leaf flowers (fig. 30). Cennini mentions that the purpose of punching is actually to lighten the gold, because burnished gold is very dark. Light is reflected from the surface of the punches, making it shine and shimmer.

We will frequently see decorative patterns in relief on the halos of saints. This decoration technique is called *pastiglia*. It is modeled with a paste made with the same materials



▲ **Fig. 31** ▲ Unknown Spanish painter, 15th c., *Saint Peter enthroned*, tempera on panel, 176 x 87,6 cm, SG-512 (photo: Hrvoje Gržina) / The image shows that the transparent red paint was applied by brush over the gilding decorated with punches. On the red-colored surfaces around the flowers it can be noted that the painter used the brush handle or a wooden tool to cut semi-circular shapes into the wet paint.

that were used for the preparatory layer. Cennini recommends the use of *gesso sottile* with an added pinch of red bole. This softly toned paste was more easily distinguished from white preparatory layer on a wooden panel, which made the artist's work easier.

The painting *Saint Peter enthroned* by an unknown Spanish painter is interesting because of its richly decorated golden red drapery (fig. 31). The ornament is painted on a golden surface. One of the techniques used for painting golden draperies with a repetitive pattern was *sgraffito* (It. *sgraffiare* – to scrape, to grate). This is a method in which the entire gilded surface is coated with the desired paint, which is then allowed to dry. The chosen pattern is transferred onto the paint through the *spolvero* technique (which has been described in the chapter on underdrawings). The ornament is then formed by carefully scraping the color off the gilding by a wooden stylus.

Oil or mordant gilding was most often used to decorate painted surfaces, such as decorations on painted draperies. This technique entailed that the gold leaf be placed on a quick-drying oil-based adhesive, so-called mordant. Cennini describes mordant used for gilding that is made from thickened oil to which lead white was added, along with some verdigris and varnish. Mordant is applied to the surface with a thin brush, and the gold leaf is placed once the mordant is almost dry, but still sticky to the touch. Oil gilding cannot be burnished, so it is not as shinny as water gilding (enabling us to differentiate between the two). Because the mordant is thick and stiff, oil gilding is not as smooth as water gilding.

PAINT

The main ingredients of paint are pigments and binder. Pigments give color, while binder holds their particles together, binding them to the painting surface. Certain painting techniques were named according to the type of binder they use. Egg tempera uses egg as the binding medium (usually only the yolk), while oils use drying oil (usually linseed oil). Egg tempera dominated medieval European painting. After the 15th century, this primacy went to oils. The transition to oil painting was gradual; Flemish masters were the first to begin underpainting with egg tempera, and finishing their works with oil glazes. Some Italian painters of the second half of the 15th century added drying oil to egg tempera; this kind of tempera is called *tempera grassa* (fatty tempera).

Until the 19th century, artists had a limited number of pigments at their disposal, although different variations could be found in different geographic regions. For example, Venetian painters had a more opulent palette, because Venice was the trade center for pigments and textiles, along with being the center of glass manufacturing. Different colored materials were used as pigments; some originated from animals, some from plants, and others from minerals. Pigments were also produced artificially (Cennini says: through alchemy). For example, dried saffron pistil was used to produce a yellow lake pigment that went under the same name. The red kermes lake pigment was produced from the insect *Kermes vermilio* Planch that nests in the oak trees *Quercus coccifera* L., which grow only in certain parts of Europe and in the Middle East. Ultramarine, the blue pigment which Cennini says makes every painting shine, along with gold, was produced from the semiprecious stone lapis lazuli, mined in the region occupied by today's Afghanistan. Because of its high price, ultramarine was used only for the most important figures in the painting, most often for the Madonna's robe. Lead white was produced by placing pieces of lead into special clay pots whose bottom part contained a compartment for a weak solution of vinegar. The pots would be stacked on top of each other, covered in horse manure, and left for one to three months. The effect of vinegar combined with the heat and carbon dioxide produced by the manure as it fermented would cause a basic lead carbonate to form on the surface of the lead – this was lead white. By the end of the process, the flaky lead white would be scraped from the surface, washed, dried, and sifted. (The green verdigris pigment was produced in much the same way, only copper plates were used instead of lead ones.) Until the 19th century, lead white was the only white pigment used by European painters; due to its toxicity, it was gradually replaced with other pigments. Artists knew very well that some pigments were toxic, but they continued to use them anyway. Cennini advises painters to keep their mouths closed tightly while grinding orpiment to avoid poisoning. According to its chemical composition orpiment is a compound made of sulphur and the highly toxic arsenic, but it was highly prized because it resembled gold more than any other pigment (which is where its name comes from: Lat. *aurum* – gold, *pigmentum* – color). However, artists also used "less exotic" pigments. Readily available, natural materials, such as ochre and umber (natural earth pigments) had been used since earliest times.

From the 18th century, the painting palette has been enriched by new pigments. Information about the production year of individual pigments could help in dating paintings, and in detecting later interventions. Knowing when a particular pigment stopped being used can help us determine the latest possible date that a painting could have been created. For example, the blue smalt pigment, produced by grinding cobalt glass, was used from the 16th century until the middle of the 18th century. If its presence is determined in a painting, then we can with great certainty estimate that the painting was not created after the 18th century.

In the past, artists either prepared their own paints, or they entrusted this work to their apprentices. Pigment first had to be ground on a stone slab with some water. Cennini recommends the use of red porphyry, because it is hard and strong. The grinding was achieved by using another piece of stone, with flat bottom and dome-shaped top. The ground pigment was kept in a covered pot, topped up with water. By mixing the thick pigment paste with egg yolk, the artist would get egg tempera. Oil paint was produced by rubbing dry pigment and drying oil. During the 18th and 19th century, the paint industry gradually developed (the first paint tubes were manufactured in the year 1841), which gave artists more creative freedom – they could, for example, paint outside of their studios – but it also lead to the loss of interest in the preparation of paints, and the swift loss of knowledge about painting materials. This was, in turn, reflected in the technical quality of paintings. Sometimes, the consequences of experimenting with materials were fatal for artworks.

▲ **Fig. 32** ▲ Cosimo Roselli, *Madonna and Child with Two Angels*, tempera on panel, 69,3 x 46,4 cm, SG-56 / Detail showing short parallel brushstrokes (photo: Hrvoje Gržina)

▲ **Fig. 33** ▲ Antoine-Jean Gros (1771 – 1835), *Madame Récamier*, around 1825, oil on canvas, 62,3 x 51,2 cm, SG-36 / Motif detail comparable with the previous example (photo: Hrvoje Gržina)

Working with egg tempera and oil paint is very different, and these differences are also apparent in the appearance of the paintings created in these techniques. Since egg tempera dries very quickly, the paint cannot be blended/mixed on the painting surface, and needs to be applied with thin parallel or crosshatched brushstrokes. This is clearly visible in the painting *Madonna and Child with Two Angels* by Cosimo Roselli (fig. 32). Cennini recommends that the particular shades of color be prepared in advance for each area of the painting. Pure pigment is used as the darkest shade, and its mixtures with increasing amount of white for intermediate and lightest tones. Italian painters underpainted carnation (skin tone) with a paint containing the pigment green earth. The underpainting would not be covered completely, but the green color would be left to rise through in the shadows and transitions between lighter and darker tones. Paint was not supposed to be applied in a thick layer because it would shrink, crack, or start to peel once the painting dried. Dried egg tempera has a matte appearance, and is very light and stable.

Oil paint dries much more slowly than egg tempera. These paints are easily mixed/blended on the painting surface. If we compare the detail of the painting *Madame Récamier* by Antoine-Jeane Gros with Roselli's *Madonna and Child with Two Angels*, we will easily spot the difference between the egg tempera and oil paint techniques (fig. 33). Oil paint can be applied in layers, which can be transparent or completely opaque; extremely thin or thick and relief-like. Relief-like layers of paint (so-called impasto) can be seen on the painting *Landscape with Passengers by a Creek* by Antonio Francesco Peruzzini (fig. 34).

▲ **Fig. 34** ▲ Antonio Francesco Peruzzini (1643/1646 – 1724) and Alessandro Magnasco (1667 – 1749), *Landscape with Passengers by a Creek*, 1st decade of the 18th c., oil on canvas, 130 x 99 cm, SG-682 / Painting detail with a visible impasto (photo: Hrvoje Gržina)

A painting created with oil paints can be "built" in various ways. For example, the painter can make a monochrome underpainting, over which he can then apply multiple translucent layers of paint. He can create the main accents of light on the underpainting, and leave visible the dark ground or colored imprimatura in the shadowy areas. Furthermore, he could create the entire image at once by mixing the colors directly on the canvas; this painting technique is called *alla prima*.

The dried oil paint is not soluble in water, making it very flexible and resistant to external conditions. However, oil paints have several shortcomings. Unlike egg tempera that hardly changes over time, oil paint becomes yellow. Some artists tried to counteract this effect by producing lighter paints using oils that do not turn yellow over time, such as poppy or walnut oil. They bound darker pigments with linseed oil, knowing that the discoloration of the binder on a darkened surface will not greatly affect the painting's appearance. However, the problem is that oil paints become more transparent over time. If the painter worked on a dark ground, the increased transparency will change the tonality of the painting and ruin its integrity.

From the moment the artist sets down their brush, declaring their work finished, the material from which the painting is created begins to change.

▲ **Fig. 35** ▲ Nicolaes Maes (1634 – 1693), *Portrait of a Young Woman*, 1675 – 1680, oil on canvas, 60,1 x 49,3 cm, SG-295 / Detail with visible ageing cracks (photo: Filip Beusan, PSG)

▲ **Fig. 36** ▲ Jeanne Philiberte Ledoux (1767 – 1840), *Portrait of a Bacchante*, oil on canvas, 46,8 x 38,1 cm, SG-435 / Detail with visible drying craks (photo: Hrvoje Gržina).

Because of their exposure to light, pigments fade or change color. Due to chemical changes, oils turn yellow and become more transparent. The ground and paint layer manage to keep up with the expanding and shrinking dynamic of the wooden or woven support for a while, but in time they become more brittle, which leads to the appearance of so-called mechanical or aging-related craquelure – a dense network of fine cracks that extend all the way down to the support. Aging cracks can be clearly seen in the detail of the painting *Portrait of a Young Woman* by Nicolaes Maes (fig. 35). Another form of cracks appears during the drying process of the layers of paint – the so-called drying cracks. They are wider than aging cracks, and only reach the preparatory layer or the underlying layer of paint. We mostly find them in paintings from the 18th and 19th century. They are usually the result of the painter's experimenting with various materials (for example, adding different additives to the paint), although they could also be caused by technical mistakes (disregarding the rule that the upper layer must contain more binder than the lower one). Drying cracks can be seen in the painting *Portrait of a Bacchante* by the French painter Jeanne Philiberte Ledoux (fig. 36).

Some changes that occur on paintings are not caused by natural ageing, but by human activity: improper displaying or storing, accidental or deliberate damage, improper conservation-restoration work... The already mentioned painting *Madonna with Child and Two Angels* by Neri di Bicci was drastically altered in the 19th century (fig. 37). An X-radiograph shows that the original figure of the Madonna was quite different: her hair was plaited and lifted from the neck, her dress was tied by a ribbon below her breasts, and a thin vail fell from her right shoulder, held up by Jesus with his right hand (fig. 38). The Madonna's right fist was painted over in order to "fix" the position of her little finger. It seems that these changes, subsequently added over the original image, were done for the painting to be sold more easily, to make it "more beautiful" and in line with the expectations of the buyers of the time. During recent conservation-restoration treatment, the overpainting was removed entirely (fig. 39).

▲ Fig. 37 ▲

▲ Fig. 39 ▲

Fig. 37 ►► Neri di Bicci (1418 – 1492), *Madonna with Child and Two Angels*, 2nd half of the 15th c., tempera with oil on panel, 82,6 x 46,9 cm, SG-47 / Condition before the recent conservation-restoration treatment (photo: Nikolina Oštarijaš, CCI)

Fig. 39 ►► *Madonna with Child and Two Angels*, condition after recent conservation-restoration treatment (photo: Nikolina Oštarijaš, CCI) / The treatment included the removal of overpaint

◄◄

Fig. 38

An X-radiograph of the painting *Madonna with Child and Two Angels* reveals that it had been thoroughly overpainted (photo: Mario Braun, CCI)

VARNISH

Once the painting process was finished, the artist could apply varnish to the painting surface. Varnish protects the layers of paint from dirt and mechanical damage, unifies the sheen of the surface, and saturates the colors (so that they do not appear dull, but have "depth"). Therefore, varnish has a protective, as well as an aesthetic function.

The very first varnishes were prepared by dissolving a molten or ground resin in hot drying oil. These oil-resin varnishes were as thick as syrup. They were applied warm; by hand, sponge, or rag. The so-called *Manuscript of Bologna*, a handbook for the preparation of paints from the 15th century, describes the preparation of varnish by heating sandarac and oil on fire. Sandarac is a type of resin obtained by cutting into the bark of a tree from the cypress family. Cennini gives detailed instructions for varnishing a panel painting with a resin-oil varnish. He remarks that the painting and varnish should both be warm. The painting should first be laid out in the sun to warm. Afterward, it should be laid horizontally and varnish should be rubbed into it by hand in a thin layer, carefully so that it does not run onto the gilded planes. (It would be logical to ask whether the varnish was applied to the entire painting, or only to parts of it, that is, were different types of varnish applied onto different parts of a painting.)

Cennini also mentions a type of varnish that is applied to the painting only temporarily, and is made from well-beaten egg-whites left over night to rest. (The liquid that has settled on the bottom of the container is used, while the foam is discarded.) Water-based varnish was frequently used as a temporary solution. For example, the artist would use them when he wanted to show the patron what the painting would look like after being varnished.

By the end of the 15th and the beginning of the 16th century, artists started to use varnish prepared by dissolving fresh resin or some other resin-like substance in a volatile solvent, such as alcohol or turpentine. This kind of varnish became commonly used in the 17th century. In the 19th century, artists had at their disposal a wide variety of varnishes.

Not all paintings were originally varnished. We have already mentioned that varnish was not applied to *Tüchlein* paintings. To make matters even more complicated, the varnishing did not have to be done by the painter himself. Namely, prior to applying varnish, the painting needed to be completely dry. Cennini advises that the varnish be applied no sooner than one year after the painting has been finished; several years after would be preferable. In the meantime, the painter could sell the painting, leaving the varnishing to its new owner – not necessarily according to the artist's instructions (or wishes). The artist could dispatch the painting from his workshop with a temporary varnish, expecting that someone else would replace it with a proper varnish, which was not always the case. Furthermore, we know that exhibitions of the French Academy of Art during the 19th century displayed paintings varnished the day before the opening, which meant that, very often, the varnishing process was left to paint merchants who specialized in this work, and was not done by the artist. Paintings would usually be varnished with the same kind of varnish, regardless of the artists' preferences. (The French word *vernissage* – which means 'varnishing', is still used today, but it denotes the ceremonious opening of an exhibition attended only by invited guests.) The grand exhibitions of the English Royal Academy also had varnishing days. Artists would then be finishing their paintings, often performing corrections on already varnished works. If an artist applied paint on a varnished painting, removing the varnish would cause irretrievable losses of those parts of the original image.

▲ **Fig. 40** ▲ Girolamo Sicciolante Sermoneta (around 1521 – 1575), *Holy Family*, oil on panel, 100,9 x 77,5 cm, SG-105 / Condition of the painting before conservation-restoration treatment (photo: Natalija Vasić, CCI)

▲ **Fig. 41** ▲ Condition of Sermoneta's painting after conservation-restoration treatment (photo: Ljubo Gamulin, CCI)

It is a well-known fact that some Impressionist and Postimpressionist painters did not like to varnish their works, but it is also a known fact that their gallerists, or art dealers, would apply varnish to their paintings in order to make them look "finished".

Varnish made from natural resins turns yellow over time, which can drastically alter the appearance of a painting. Beneath a vale of yellowed varnish, white skin assumes a yellowish tone, while a blue sky turns green. Replacing an aged varnish with a new one is a technique used since the 17th century, and probably even earlier. If we compare the appearance of the painting *Holy Family* by Girolamo Sicciolante Sermoneta before and after cleaning, we can clearly see to what extent discolored varnish stifled the modeling and clarity of the details. The folds on the Madonna's robe and the drapery behind her figure were almost illegible prior to cleaning (fig. 40, 41).

Although Cennini advises painters to use bright and clear varnish on their paintings, which is repeated in other historical sources that mention transparent and colorless varnishes, it is well known that painters also used varnishes with added pigments or dyes. In addition to this, some painters believed that darkened varnish makes a painting look more harmonious, so they tried to simulate this aged-varnish effect by applying dark glazing. A so-called gallery varnish – a resin-oil varnish toned with a dark pigment – was very popular among art collectors and museum curators during the 19th century. Sir George Beaumont (1753 – 1827), a British art collector, patron, and amateur painter himself, had remarked on one occasion that a good painting should have the tone of an old violin.

▲ **Fig. 42** ▲ Fra Angelico (between 1395 and 1400 – 1455), *Stigmatization of Saint Francis of Assisi and the Death of Saint Peter the Martyr*, tempera and gilding on panel, 24,3 x 43,8 cm, SG-34 / An image of the painting without its frame (photo: Goran Vranić, PSG)

FRAME

The frame serves several functions: it attracts the attention of the viewer, separates the painted surface from the surrounding space, protects the edges of the painting from mechanical damage, and facilitates its transport and display.

For most paintings that we see on the walls of The Strossmayer Gallery, the frame is not the integral part, but a separate element. Exceptions to this rule are panel paintings by medieval and Renaissance masters whose frames are attached (nailed or glued) to the panels on which they were painted. In the present chapter we will briefly review these examples. We will not, however, deal with the typology, historical development, and the technology of making of frames, as that would exceed the scope of this booklet.

In the 13th, 14th, and partly 15th century, frames and panels formed a unified whole. The painting was actually framed even before the artist started painting it. The frame and painting could even be made from the same piece of wood: the central part of the panel would be hollowed out to form a level plane on which the image would be painted, while the elevated rim would be turned into the frame. Sometimes, only two sides of the frame would be carved on the same piece of wood as the panel (usually, these were the sides of the plank that followed wood grain direction), while the remaining two sides would be carved separately, and then attached to the surface with glue or wooden dowels. The third option was to make all the elements of the frame separately and then attach them to the panel; this kind of frame is found in works of larger format. Since the frame and panel were physically connected, work on them had to be performed simultaneously: glue size had to be applied on the frame at the same time as on the panel, the frame had to be covered in canvas as well (although not always), coated with ground and painted, or covered in bole and metal leaf. If we were to remove the frame, bare wood would be visible in its place. A case in point is Fra Angelico's *Stigmatization of Saint Francis of Assisi and the Death of Saint Peter the Martyr* (fig. 42).

The frame of the already mentioned painting *Madonna with Child and Two Angels* by Neri di Bicci is nailed to the wooden support (fig. 43; see also: fig. 38). The molding on the front of the frame is gilded, while the central flat recessed band is decorated with golden stars on a blue background. The bottom part of the frame contains the caption in golden letters: *AVE MARIA GRATIA PLENA DnoS TEC* (fig. 39). The lateral sides are painted in a way that makes them resemble multicolored marble. This decorative painting technique is called faux marbling. The oldest examples of its application on frames, even entire backs of paintings, can be found in works by Italian masters from the 14th century. Some researchers believe that this way of decorating panel paintings is connected to the import of Oriental marbled paper. In The Strossmayer Gallery we can find an example of well-preserved faux marbling on the back of the *Madonna of Humility* by a master called Sassetta from the first half of the 15th century. Another reason why this painting is interesting is that its frame is made from the same piece of wood as its support (fig. 44, 45).

During the 15th and 16th century, detachable frames were introduced, which meant that a frame could be replaced by a new one if necessary. Frames were replaced according to the shift in style and ownership, and/or during renovations to the space in which the painting was displayed. Paintings that are still in their original frames are very rare.

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Fig. 43
Lateral side of the frame of Neri di Bicci's *Madonna with Child and Two Angels* (photo: Nikolina Oštarijaš, CCI)

▲ **Fig. 44** ▲ Sassetta (around 1450 – 1450), *Madonna of Humility*, 1430-35, tempera and gilding on panel, 34,4 x 23,3 cm, SG-22 (photo: Goran Vranić, PSG) / Painting and frame made from the same piece of wood

▲ **Fig. 45** ▲ Image of the faux marbling on the back of Sassetta's painting (photo: Goran Vranić, PSG)

▲ **Fig. 46** ▲ Attributed to: Francesco di Gentile (active 1460 – 1500), *Saint Luke Paints the Madonna*, tempera on panel, 21,1 x 39,5 cm, SG-24 (photo: PSG)

WHO PAINTED?

Apart from handbooks and contemporary theoretical treatises, an important part of our knowledge about the history of painting practices is formed by archival documents (guild rules, contracts, inventory lists, workshop account books, personal diaries etc.), and original pictorial sources, even allegorical and idealized images. The first example of this kind in The Strossmayer Gallery is the painting *Saint Luke Paints the Madonna* (fig. 46) from the second half of the 15th century, by an Italian master. This subject was especially popular among Dutch painters in the 15th and 16th century, and it is based on the legend about Saint Luke as a painter and portrayer of the Madonna, who therefore became the patron saint of painters. The scene commonly takes place in a painting workshop, and its standard iconography includes painting tools and workshop equipment: an easel, brushes, palettes,

palette knives, and paint pots. Unlike oil paint that remains on the palette due to its solid structure, egg tempera is liquid, which is why painters kept it in shells and pots like the one we see on the painting from our Gallery. Painters of the time used two kinds of brushes: harder ones made from pig bristle, and softer ones made from hair of different animals, the most valued of which was ermine. The bundle of hair would be inserted into a quill of a goose feather, or another smaller type of bird's feather, the other side of which would be fastened to the brush handle. Metal ferrules, which enabled the production of a wide range of brush types, did not appear until late in the 16th century. Even palettes changed size and shape over time: in the simplest terms, they went from smaller to larger size, and from rectangular to oval shape. The basic appearance of the easel did not change much through history, except that it started to include a handle which enabled the painter to adjust the height of the ledge that held the painting. The English word *easel* comes from the Dutch word *ezel* (donkey) whose secondary, figurative sense for a painting stand appears in written sources around the year 1600. The development of this term mirrors the prestige of Dutch painting in the 17th century. It is also worth mentioning that Zagreb's portrayal of the legend about the painter saint testifies to the medieval and early-Renaissance custom of painters to paint on already framed paintings, which we have explained in the previous chapter.

Paintings of smaller dimensions, especially serially produced versions of popular designs, were offered on the free market. However, larger paintings, as well as those for which more material was needed, or paintings that required the use of more expensive materials, like blue pigments, were commonly commissioned. A commission was preceded by a contract that, apart from defining which materials would be used (such as the amount of gold and ultramarine, that is lapis lazuli), could also include, for example, a clause on the content of the painting. Sometimes, a contract would include a provision according to which the entire commission, or parts of it, had to be produced by the master with whom the contract was signed. However, the rules of a particular guild in which the artist worked allowed the master to “sign” every work that came out of his workshop. During the medieval and Renaissance periods, authenticity as we understand it today was not that much insisted upon. The master's name was itself a guarantee for the expected quality of the work. Although the Renaissance, with its particular intellectual climate, paved the way towards the modern conceptualization of artistry, it was not until the 17th century that the value of an artwork grew with the master's hand, as opposed to a workshop creation. Painters had long been considered mere craftsmen of a relatively low reputation even among other crafts, although some of them enjoyed an acknowledged position in society. Even expert masters, apart from painting, practiced ornamentation, painting chests and book covers, creating painted scenography for plays, ceremonies and festivals, painting ceremonial shrouds,

standards, parade shields, saddles, mantles, and plumages for knight tournaments! Judging by preserved pictorial sources, medieval and Renaissance craft workshops, including painting workshops, were open to the street, which probably made it easier for them to display works for sale, as well as procuring a source of daylight. One can assume that they were located at ground level and had high ceilings, for ease of access. Cennini's handbook especially stresses that workshop spaces and equipment should be kept clean and dust free. Based on sources of documents we know – and this is also true for later historical periods – that there was often no clear dividing line between a living and working space. Workshop inventory lists, usually compiled after the death of the workshop owner, testify to the fact that inventories usually comprised collections of drawings, engravings, paintings, plaster casts of sculptures, various types of drapery, pieces of armor and military equipment, skeletons, shells, corals, fossils, etc. A particularly interesting requisite were mannequin dolls; for example, the inventory list of a Dutch painter from the 17th century mentions a doll like this made from wood and one made from cloth. All of this equipment served to create paintings, as well as to train the master's apprentices.

The various tasks in the workshop were delegated according rank: the simplest tasks were performed by the apprentices (called *garzoni* in Italian workshops), followed by assistants, and then the master. A workshop (Ital. *bottega*) could be occupied by more than one master. In some cases more masters could work in partnership. However, there were also cases in which a painter never managed to work independently, but in an equal master status with the owner of the workshop, sometimes only occasionally assisting in large commissions. Some master painters only shared the workshop space. There are known examples of more painters forming an affiliation, a so-called *società*. Family workshops were also nothing unusual. In a family workshop, knowledge, typical designs and iconographic solutions were passed on over generations. The apprenticeship period was regulated according to special contracts, which were based on the specific standards of the local guilds. Guilds gathered craftsmen of the same, similar, and sometimes even unrelated professions according to today's standards. Membership was generally mandatory. To a certain degree, guilds were also of a religious character, which was mostly manifested through charitable activities. Furthermore, it was imperative for each guild to have a patron saint. However, the basic task of a guild was to protect the common interests of its members: forming and oversight of standards of quality, combating unfair competition, control of sales, establishing the rules and conditions of training. Even though Cennini prescribed a necessary education period of thirteen years for a painter, in practice this timespan was shorter. Preserved examples of contracts from 13th-century Florentine workshops testify to education periods lasting for three, four, or even eight years. In most regions this period did not last for less than two or three years. Education usually began at the age of ten, but in The Netherlands in the 17th century it could start at a much later age, between twelve and sixteen. Apprentices usually became members of the master's extended household, living and sharing food with his family, while the boy's parents or guardians payed for this. It is well-known that Rembrandt, famous as a painter and teacher even during his lifetime, charged the very high price of 100 guilders for taking on apprentices. Usually this amount came down towards the contract's expiration because, as the apprentice got better at his work, his contribution to the joint revenue of the workshop also grew. This however was not the case in Rembrandt's workshop. The apprenticeship began with simple tasks, such as preparing the painting support and grinding pigments. This was followed by drawing lessons, which began by copying drawings from the workshop's inventory. Afterwards the apprentice drew after a three-dimensional model, first a sculpture cast, and then a live model. Preserved examples of Renaissance drawings show that *garzoni* themselves often

▲ **Fig. 47** ▲ After: Balthasar van den Bossche (1681 – 1715), *Painter's studio*, after 1713, oil on canvas, 99 x 118,4 cm, SG-546 (photo: PSG)

posed for these purposes, for female as well as for male figures. Namely, female models were very rare at the time, which means that even depictions of the Madonna were based on studies of workshop boys in different poses, serving as templates for the final painting. The following education phase included training in the art of painting. Those less experienced executed the less important parts of the compositions of commissioned paintings, such as landscape backgrounds. As their skill grew, so did the apprentice's position within the workshop hierarchy. By being promoted into an assistant, they would be given more important tasks. The master's part varied from workshop to workshop, and depending on the task at hand. It is interesting that some workshops also included specializations (such as the human figure, flowers, etc.). In large and highly productive workshops certain visual solutions and models were frequently repeated: whether as details, or as entire compositions, sometimes with only slight variations. Apprentices were formed in the specific style of their master, causing many of them to paint in such a similar way that it is today very difficult, sometimes even impossible, to differentiate between their "hands". This greatly complicates the attribution process, especially if the deciphering of a painting's authorship cannot be assisted by any other supporting method or source. Once they gained the status of master painters themselves, painters could open their own workshop, and get their own

apprentices. Getting an education with a great master increased your chances of success in the future. As their allotted time period expired, some employees left the workshop in order to get further training with another master.

Training to become a painter was based primarily on practical work, while the general education of a candidate was usually finished by the start of his apprenticeship. Therefore, most artists were lacking in education, and only some had a better understanding of Classical languages. However, there have been examples of individuals, especially with the onset of Humanism and the Renaissance, who stood out with their versatile education, and belonged to contemporary intellectual circles. Thanks to experience in studying and restoring artworks from Antiquity, some of them became advisors to art collectors of the time. What is more, there appeared an array of theoretical texts in which, as opposed to medieval handbooks and recipes, emphasis is placed upon the intellectual work of artists, simultaneously developing a specific theoretical and critical vocabulary. As the status of the Italian language grew, and as editions in national vernaculars slowly started to appear, a wider circle of people were able to think about and develop the language about art. There were debates on the primacy of art types (for example, fine art in relation to poetry, or painting in relation to sculpture) and iconographical genres. Drawing was emancipated as an individual art form. The practice of collecting artworks according to authorship and not only content was started. The social self-awareness and economic status of artists were growing stronger, and some artists were even awarded noble titles. The affirmation of the importance of art education and training as virtues of an educated individual led to more frequent appearances of painters, both male and female, from noble families. The first "academies" are formed: whether as joint workshop sessions, a kind of additional classes that supplemented standard training, whether as more or less formal gatherings of intellectuals and artists. The Florentine *Compagnia e Accademia del Disegno* (where the *compagnia* points to its origin and continuity as a religious art fraternity), founded in the seventh decade of the 16th century under the patronage of Duke Cosimo Medici, was the first formally established and programmatic facility for art education. Its classes included lectures, demonstrations, and workshop practice. Poor students received financial aid. The Medici Academy was the precursor to higher institutions for the expert education of artists as we know them today.

A GLOSSARY OF LESS FAMILIAR TERMS

- ACADEMY – a higher education institution for the expert training of artists
- *ALLA PRIMA* – a painting technique that entails the entire image being created at once, by mixing colors directly on the canvas
- BOLE – a soft type of clay that, due to the presence of iron oxide, usually has a reddish-brown color; mixed with diluted animal glue or egg whites it serves as an underlayer for gold leaf in water gilding
- *BOTTEGA* – painting workshop
- CANVAS – a type of strong cloth
- CARNATION – skin tone color
- CASEIN – a type of glue obtained from milk; it acts as a strong binder, which is why it was used for centuries as carpentry glue; it was also used as a binder for paint and grounds
- CRADLE – a grid of wooden slats, placed vertically and horizontally, attached to the back of the panel painting to restrict its warping
- CRAQUELURE – a network of cracks in the paint surface; we differentiate between ageing cracks, which extend all the way down to the support, and drying cracks resulting from the drying process, which are often significantly wider than ageing cracks and extend only to the ground or underlying layer of paint
- DAMMAR – a light yellow, transparent resin, obtained from some types of trees that grow in Indonesia; its use as a varnish started in the first half of the 19th century
- EASEL – a stand, usually wooden, on which a painter created a painting
- EASEL PAINTING – a painting that can be moved, unlike wall paintings that are physically bound to architecture, making them immoveable
- EGG TEMPERA – paint made using pigments and egg (usually only egg yolk) as a binder, which dominated European medieval and Renaissance painting
- FERRULE – the metal ring of a brush that holds its hairs together, connecting them to the brush handle
- *GARZONI* – apprentices in Italian art workshops
- *GESSO* – the Italian word for the white mineral gypsum
- *GESSO GROSSO* – the coarse bottom layer(s) of the ground on wooden panels; usually composed of burnt or baked gypsum and animal glue (size)
- *GESSO SOTTILE* – the fine upper layer(s) of the ground on wooden panels; composed of slaked gypsum and animal glue
- GLAZE – a thin layer of mostly transparent or translucent paint

- GROUND – also called preparatory layer; the layer of the painting used to prepare a support for painting; it additionally reduces the absorption capacity of the support, ensures paint stability, as well as having an aesthetic function
- GILDING – covering the surface of the painting or frame with a thin layer of gold
- HYGROSCOPICITY – the capacity of a product to absorb or release water
- IMPAST(O) – a thick, relief-like layer of paint
- IMPRIMATURA – an isolation layer of glue, drying oil, or oil and resin mixture that prevents the painting surface from unevenly absorbing oils from paint; it can contain pigments and is sometimes used as a middle tone for the painting
- LINING – a conservation-restoration term for the process of gluing a painting onto a fabric in order to make it more durable
- LAPIS LAZULI – a semiprecious stone that was used in the production of the highly prized blue pigment called ultramarine
- MARMORIZATION – a kind of painting decoration (of wooden frames, church furniture, etc.) that imitates the appearance of marble
- MASTIC – a pale yellow to green resin that is used for producing varnish; it is obtained from a type of tree that grows in Mediterranean countries
- MORDANT – a quick drying oil-based adhesive used to apply gold leaf in oil-based gilding
- MOLDING – a form of ornamentation that contours or outlines the edges or surfaces
- OLD MASTERS – painters born roughly between the years 1400 and 1800
- ORPIMENT – a pigment that is a chemical compound of sulfur and highly toxic arsenic, which was valued because it resembled gold more than any other pigment
- PARCHMENT – animal hide (calf, goat, lamb, sheep, pig) treated by a special process
- *PASTIGLIA* – a technique for decorating paintings and decorative frames with a raised pattern made from gesso
- *PENTIMENTI* – alterations made by the artist in the course of painting, which often become visible due to the aging process of oil paint (it becomes more transparent over time)
- PIGMENT – insoluble solid substance of animal, vegetable, mineral, or synthetic origin that is, along with binder, the basic ingredient of paint; it gives paint color, while binder holds pigment particles together, binding them to the painting surface
- PUNCHING – decorating a gilded surface with small indentations, so-called punches
- RETOUCHING – replacing areas of loss in the paint layer
- *SGRAFFITTO* – a technique in which paint is applied over gold leaf and then scraped away to reveal the gold, usually to form a repetitive pattern on a drapery
- SHRINKERS – a term used by conservator-restorers to describe textile supports that, due to sizing technique characteristic of 19th-century manufacturing, dramatically contract in humid conditions
- SIZE – a water soluble adhesive obtained by boiling the skin and bones of animals; the adhesive can also be derived from fish (isinglass)

- SIZING – the process of preparing a wooden or canvas support for painting by reducing its absorption capacity, usually by applying size
- SMALT – a blue pigment obtained by grinding cobalt glass, colored by cobalt oxide, used from the 16th to the 18th century
- *SPOLVERO* TECHNIQUE – the technique of transferring a design onto the support by dusting a black pigment or charcoal through holes pricked along the outlines of a drawing on paper
- STRETCHER – a wooden framework onto which a canvas is fastened so that it could be painted upon, which can be expanded to increase the tension of the canvas
- STRAINER – a wooden framework onto which a canvas is fastened so that it could be painted upon, but which cannot be expanded to increase the tension of the canvas
- SUPPORT – the material on which a painting is executed, most commonly wood panel and canvas
- TECHNICAL ART HISTORY – studying artworks from the perspective of their physical and chemical build
- *TEMPERA GRASSA* – greasy or oil tempera, obtained by adding drying oil to egg tempera
- *TÜCHLEIN* – a technique of painting on a linen support with paints that contain an aqueous binding medium (animal glue, plant gum or egg-white), without applying a ground layer or varnish
- UNDERDRAWING – a preliminary drawing on the prepared support
- ULTRAMARINE – blue pigment obtained from the semiprecious stone lapis lazuli
- VARNISH – the final coating applied to the surface of a painting, which has an aesthetic and protective function; it is produced by melting resin in oil, or by dissolving resin or some other resin-like substance in a volatile solvent; there are also water-based varnishes (such as egg-white-based)
- VERDIGRIS – a highly toxic, and until the 19th century most frequently used green pigment; the product of copper corrosion; the most reactive and instable of all copper-based pigments
- *VERNISSAGE* – the process of varnishing a painting; figuratively, it is the ceremonial opening of an exhibition attended only by invited guests; the secondary meaning comes from the 19th century custom that paintings were varnished a day prior to the opening of the exhibition

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All websites were searched on 1st October 2017

Some significant events mentioned in the text according to the timeline

13th century

- Frame and panel form a single whole.
- Until the mid-13th century, Italian artists use fir wood as a painting support.
- By the end of the 13th century, poplar becomes the favorite painting support of Italian masters.
- Prior to applying the preparatory layer, Italian masters place canvas on the entire wooden support.

15th century

- From the 15th c., Italian painters use canvas only to cover defects on the wooden support.
- Italian painters simplify the process of preparing the wooden support.
- From the end of the 15th c. in Italy, artists start using toned preparatory layer and imprimatura more frequently.
- Oil paint gradually replaces egg tempera.
- The first oil paintings on canvas are produced in Venice.
- Detachable frames come into use.
- At the end of the 15th and beginning of the 16th c., oil-resin varnishes are replaced by solvent-based varnishes, i.e. varnishes made by melting fresh resin or another kind of resinous substance in a solvent that evaporates during drying.

16th century

- Canvas becomes the favorite painting support.
- After the first quarter of the 16th c., Italy sees the appearance of supports composed of two or more pieces of canvas.
- The first paintings on stone and copper supports are made in Rome.
- Toned imprimatura and preparatory layer spread from Italy to Northern Europe.
- The blue pigment smalt, obtained from cobalt glass, comes into use.

17th century

- At the beginning of the 17th c., Northern European artists start to use walnut, pear, cedar, and mahogany more frequently (until then, oak was their favored support). Also, they start to use woven supports made from two ore more pieces of canvas.
- Painting on copper supports spreads throughout Northern Europe.
- Reddish-brown preparatory layers dominate Italian painting

18th century

- At the beginning of the 18th c. the pigment Prussian blue is synthesized, the first completely artificially produced pigment.
- The paint industry develops.
- Expandable stretchers come into use.
- The first keyed stretcher is produced around the year 1750 in France.

19th century

- The industrial manufacturing of canvases begins (densely woven canvases).
- Painting canvases – prepared and attached to the stretcher – become commercially available.
- Artists' suppliers and colormen start to mark the backs of canvases (or strechers) with a stencil mark or label.
- Painters begin to use cotton canvas and jute.
- The blue pigment smalt, obtained from cobalt glass, goes out of use.
- Lead white pigment is gradually replaced with other, non-poisonous pigments.
- The first tube paints are produced in the year 1841.
- From the end of the 19th c., preparatory layers and color palettes become lighter.

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Giuseppe Cesari known as Cavaliere d'Arpino (1568 – 1640)
Saint George slaying the dragon, around 1600 / the back

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