



CCI Notes

10/17

Know Your Paintings— Structure, Materials, and Aspects of Deterioration

Introduction

The proper care of paintings requires knowledge of both their structure and the properties of the materials from which they are made. The No. 10 series of CCI Notes, which includes a Glossary of Terms, covers various aspects of the proper care of paintings; the No. 11 series discusses the care of works of art on paper. This Note describes the structure of paintings so that the terms and recommendations in the other Notes will be more understandable.

Paintings are not merely painted surfaces; they are complex three-dimensional structures composed of a variety of materials combined in an infinite number of ways (Figure 1). The unique properties of each material and the ways in which each is used all affect the behaviour of the painting as a whole, and influence the safest way to handle, store, and display it.

A typical painting consists of support, size, ground, paint

layers, and varnish; in some cases non-original materials used in a previous restoration treatment will also be present. In addition, paintings can be framed, glazed, and have an auxiliary support and backing board.

Auxiliary Support

Non-rigid materials (e.g. canvas) require auxiliary supports to hold the flexible fabric securely in one plane. Auxiliary supports for paintings on canvas can be 'strainers' (wooden frames with no means of expansion) or 'stretchers' (which are capable of being expanded at the corners and crossbars). These auxiliary supports

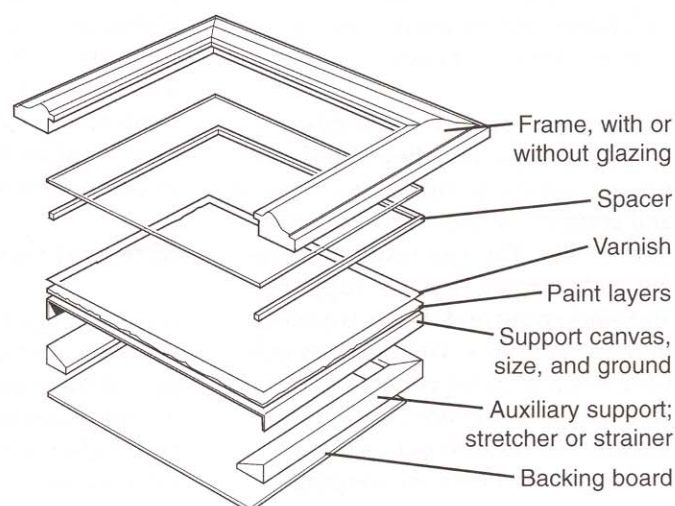


Figure 1. Layered structure of a typical framed painting on fabric.

can affect the nature of defects in a painting, e.g. paint and ground may crack along the inside edges of stretcher or strainer parts, or cracks radiating inward from the corners can develop if a stretcher is keyed-out excessively.

Paintings on rigid materials may also be adhered to or placed upon an auxiliary support to provide additional reinforcement for handling and framing. An ivory miniature adhered to a paper or rigid card backing is one such example.

Support

The support for a painting is usually fabric, wood, hardboard, or a rigid card, but artists may also use materials such as birchbark, metal, ivory, or glass. Because the support material has such a major influence on the behaviour and deterioration of the work of art, it often determines the best method for handling, storing, and displaying an object, the most appropriate framing method, and the most appropriate environmental conditions, i.e. relative humidity (RH) and temperature (see CCI Notes 10/3 *Storage and Display Guidelines for Paintings*, CCI Notes 10/4 *Environmental and Display Guidelines for Paintings*, and CCI Notes 10/14 *Care of Paintings on Ivory, Metal, and Glass*).

Wood, paper products, and fabric are hygroscopic (i.e. they absorb and release water vapour) so they expand and contract in response to fluctuations in RH. This can result in cracking and warping of wood supports, and slackening and draws (ripples) in fabric supports. Wood panels may have original or later braces ('cradles') attached to the reverse; these were intended to restrain out-of-plane movement and prevent warping, but they were often constructed improperly and may have damaged the wood support.

Most supports suffer some form of chemical degradation with aging.

This general deterioration, which results in weakening, embrittlement, and discoloration of the support material, is aggravated by high light levels, high RH, high temperature, air pollutants, dirt, dust, and poor-quality materials. Because overall weakening of the support increases the susceptibility of the work of art to mechanical damage, it is important to take preventive measures such as proper framing and backing board procedures. For example, the edges and corners of deteriorated rigid card supports are particularly vulnerable to mechanical damage and should be protected in a frame or sink mat. Similarly, the tacking margins of fabric supports are often weak and brittle (making them vulnerable to splitting along the edges folded over an auxiliary support) so they should be protected with a frame or edge strips (see CCI Notes 10/8 *Framing a Painting*, CCI Notes 10/10 *Backing Boards for Paintings on Canvas*, and CCI Notes 10/16 *Wrapping a Painting*).

Supports are sometimes composed of several parts or several different materials. Wood panels, for example, may consist of two or more pieces of wood that are joined together. Collages or assemblages, seen frequently in contemporary art, may consist of a variety of different materials. Such composite supports can be particularly vulnerable to handling because joints may be weak or loose, and the slightest movement could further weaken or damage the structure.

Size and Ground

A ground layer is applied to most supports. The ground ensures adhesion of the paint layers to the support and provides the desired texture and undertone for the design layer. Grounds are most often white but may be coloured or have a coloured layer (imprimatura) applied on top. The stability of the entire painting can be at risk if the ground is not a coherent layer or does not attach well to the support.

For oil paintings on fabric, a size is normally applied to the fabric before application of the ground. Size is usually animal glue, and it serves to isolate and protect the absorbent support from the acidic components of the oil in successive layers of the painting.

Paint Layer

The paint layers of a typical painting are composed of pigments in a binding medium, such as oil, tempera, or acrylic. Each medium has its own visual attributes as well as characteristic aging or deterioration properties; thus each has its own peculiarities in terms of basic care. Throughout history artists have also experimented with new and unconventional materials and methods which can hasten the deterioration of their works.

Oil

Oil paint consists of pigments dispersed in a drying oil to which other ingredients are added to modify the drying and working properties. It is popular because of its versatility, availability, and compatibility with both fabric and wood supports.

Oil paint is a relatively durable medium when used properly, but cleavage (separation between layers), excessive cracking, lifting, and flaking can occur if the paint is used in unconventional ways that do not pay attention to good technique or manufacturers' instructions. Some cracking of the paint and ground layers in response to environmental fluctuations over time is inevitable and does not necessarily suggest instability.

Some techniques, e.g. high impasto (peaks of paint), require special precautions to prevent physical contact with the fragile peaks of paint when framing, handling, displaying, and storing the painting.

Synthetic media

Various synthetic resins have been developed and used for paint media.

The most common synthetic paints in use today are the acrylic emulsion paints, which became available to artists in the early 1950s.

There are many types of acrylic paints. Their stability depends largely on how they are used and the environmental conditions to which they are exposed. Acrylic emulsion paints seem less prone to cracking in moderate environmental conditions than do oil paints, but they have not had the test of time to determine if similar defects develop with natural aging. Although both oil and acrylic paintings are vulnerable to cracking in low temperatures, acrylic paint increases dramatically in stiffness at 5–10°C whereas the dramatic change in stiffness for oil paint does not occur until around –5 to –10°C. The potential for cracking at these temperatures makes handling and/or transportation of paintings hazardous in Canadian winter conditions. Acrylic paints also have a greater tendency to attract and absorb dirt than do oils and they can be particularly difficult to clean.

Synthetic media lend themselves to the production of large paintings, which are frequently displayed in large public areas. Because these paintings often have fragile, delicate surfaces that are difficult to clean and repair, they must be safeguarded from the physical dangers of public display (see CCI Notes 10/3 *Storage and Display Guidelines for Paintings* or contact a conservator for advice).

Tempera

This paint medium is composed of pigments dispersed in a water-miscible emulsion binding medium, i.e. an oil component and a water-soluble component that are mixed with water before application. (The term is sometimes used incorrectly for opaque water-soluble paints such as poster colours, which are not produced to conform to artists' standards.) To avoid confusion, a qualifying term specifies the type

of emulsion medium used, e.g. *egg tempera*. The characteristics of the medium, and therefore the deterioration and care, depend on which part of the emulsion predominates, i.e. the oil or the water-soluble part. Egg tempera, which uses egg yolks as the binding medium, is usually executed on rigid supports due to its brittleness; it produces a delicate, smooth paint film (often characterized by fine brushstrokes and cross-hatching) which should be protected from abrasion and environmental fluctuations.

Note: Watercolour, gouache, and pastels are normally associated with paper supports which are beyond the scope of this Note. However, they can also be used on rigid cards or in multimedia works. For this reason, they have been included here.

Watercolour

Watercolours consist of pigments ground in water-soluble gums, and they are usually executed on a paper or rigid card support. Proper framing and glazing procedures are recommended because the exposed and porous nature of the support and medium makes watercolours susceptible to damage from dirt, dust, and other pollutants. Exposure to light should also be minimized because watercolour is often executed in thin washes and even slight colour changes or fading will be apparent in colours of poor or intermediate light stability (see CCI Notes 11/5 *Matting Works on Paper* and CCI Notes 11/9 *Framing Works of Art on Paper*).

Gouache

Gouache can be described as opaque watercolour. Pigments and fillers are combined with a water-soluble medium to produce a paint that is usually more thickly applied and more opaque than watercolour. As thick applications are prone to cracking and flaking, and porous, matte surfaces hold dirt and dust and are difficult to clean, the surface of gouache paintings should be protected with an appropriate frame.

Pastel

Fabricated chalks or pastels are composed of pigment particles and a small proportion of binding medium. The binding medium supplies cohesion and hardness to the pastel stick but does not greatly contribute to adhesion of the particles to the support, which is primarily a mechanical interaction affected by the physical nature of the ground and the support. Artists may use fixatives to secure the pastel particles more firmly to the support, but most fixatives change the appearance of the pastel so the custodian or owner of the work should avoid applying them later.

Pastel, characterized by its loose, powdery appearance, has a tendency to powder and flake. To avoid flaking, precautions should be taken to minimize vibration and shock during handling, display, and storage. Suitable matting and framing procedures will also help to protect the fragile surface (see CCI Notes 11/2 *Storing Works on Paper*, CCI Notes 11/3 *Glazing Materials for Framing Works on Paper*, and CCI Notes 11/9 *Framing Works of Art on Paper*).

Varnish

Varnish is a transparent coating of natural or synthetic resins applied in a volatile solvent. Not all paintings are varnished and some are only partially varnished. If present, varnish has both aesthetic and protective functions: it saturates the colours (revealing the depth, hue, and subtle details of the design); it produces the desired surface gloss; and it provides the paint film with some protection from atmospheric pollutants, dirt, grime, and minor abrasion. Unfortunately many varnishes tend to yellow with time, and the yellowing, cracking, or bloom (a whitish-bluish haze) may interfere with viewers' appreciation of the intended appearance of a painting.

Evidence of Treatment Intervention

Non-original materials from previous conservation/restoration treatments

can be present on paintings. On older paintings it is common to see a lining canvas, i.e. a second canvas adhered to the reverse of the original in a procedure intended to provide additional support to the paint, ground, and weakened canvas layers. Paper strips often cover the cut edges of an original canvas (cutting the original tacking margins was sometimes undertaken in past lining methods; this practice has now been discontinued). Poor or discoloured retouching may also be visible in areas of damage. Unfortunately, older retouching often extends beyond areas of damage and covers original paint, thereby earning the term 'overpaint'.

Frame

The frame is traditionally an integral part of a painting, and is important in enhancing its presentation. A suitable frame and framing method can also protect the painting against mechanical damage during handling, storage, and display (see CCI Notes 10/8 *Framing a Painting* and CCI Notes 11/9 *Framing Works of Art on Paper*).

Traditional frames are often wood mouldings covered with a thin layer of gesso and layers of paint or gilding. Ornamentation, sometimes carved but most often created by applying moulded 'compo' decoration, can be present, particularly in the corners. Traditional gilding techniques can use different colours of bole (preparatory layers) and different colours of metal leaf, together with various gilding methods and finishing techniques (including burnishing or applied layers) to create many aesthetic effects. The gesso layers and ornamentation can be fragile and susceptible to lifting, flaking, and loss. The thin gold leaf can be abraded by repeated or harsh dusting and cleaning methods; even the moisture from one's hands can mar the highly burnished surface of water gilding. Ill-advised attempts to 'restore' frames with bronze paint can be

irreversible and can destroy what is often an artwork in its own right.

Glazing and backing boards provide additional protection against mechanical damage, dirt, dust, other pollutants, short-term environmental fluctuations, vibration, and shock (see CCI Notes 10/10 *Backing Boards for Paintings on Canvas*). New glazing materials minimize undesirable reflections (see CCI Notes 10/8 *Framing a Painting* and CCI Notes 11/3 *Glazing Materials for Framing Works on Paper*).

Some contemporary paintings are meant to be viewed without frames. Extra care must be taken during handling and storage of these paintings to prevent damage (fingerprints, abrasion, dents) to the paint surface and exposed edges. Such paintings would benefit from a temporary handling-travel-storage frame that is attached to the reverse of the auxiliary support (see CCI Notes 10/16 *Wrapping a Painting*).

Conclusion

All materials in a painting respond to environmental fluctuations with changes in dimension (swelling and contracting) and in properties of stiffness and strength. Even with the highest quality materials and the best techniques, defects will result if the stresses imposed on the components of the painting become excessive. The extent and type of defects will be directly related to the artist's technique, the type and thickness of paint, ground, and size layers, the support material, and the environmental and handling conditions to which the painting is exposed.

Knowledge of the materials, structure, and condition of objects in a collection is essential when developing a program for their care. A condition survey, involving examination and condition reporting of all objects in the collection, is an important step in identifying the types of objects

present and their basic needs in terms of storage, display, and environmental conditions. The survey will identify problems, potential problems, and treatment needs, as well as improvements that can be made in the preventive conservation of the collection.

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