Advanced Imaging Techniques

Examination of art using visible light is often followed by the use of radiation not visible to humans. Sometimes the resulting images are visible, but in other cases sensitive films and cameras are needed to capture the images. The knowledge of the complex processes behind creating these images allows skilled conservators and conservation scientists to interpret images obtained with advanced imaging equipment. The two most common types of illumination used in advanced imaging are **ultraviolet** and **infrared light**.

Overall Ultraviolet Florescence
Antonio Vivarini, *Virgin and Child*, c. 1440. Tempera and gold leaf on wood. 34 3/4 x 17 1/4 x 1 1/8 in. The MFAH, The Edith A. and Percy S. Straus Collection.

Ultraviolet Illumination

Known most commonly as "black light," ultraviolet (UV) illumination has frequencies slightly higher than what is visible to the human eye. Materials on the surface of a painting interact with UV radiation in various ways. Some materials simply scatter or reflect UV radiation without changing it, while others absorb the energy and re-emit it in the form of fluorescence (UVF), the color of which can be characteristic of the material. For example, natural tree-resin varnish (varnish is a sealing final coating on some paintings) tends to have a bright yellowish glow, shellac appears orange, while more modern synthetic varnishes appear duller and greenish-blue. Additionally some pigments fluoresce strongly under UV light: zinc white glows brightly in contrast to other whites. Examination with UV will also reveal retouches on a painting and show damages that are normally hard to see.

Revealing Loss of Paint and Varnish Coatings

In Vivarini's *Virgin and Child* the UVF photograph clearly shows the darker purple areas of retouching on the vertical cracks as well as several other small losses mostly on the Christ child and near the bottom of the Madonna's robe. The UVF photograph also distinguishes the warm-toned coating applied to the modern re-gilding along the outside edges (appearing pinkish-red in the UVF) from the uncoated original 15th century gold around the figures. The extra coating was probably used to match the new gold to the color of the original gold, but over time the coating darkens and becomes distracting to the viewer.

Additionally the UVF photograph demonstrates that the overall varnish coating is very even and thinly applied and probably very recent since it does not strongly fluoresce. All of this information helps a conservator know what kind of condition the painting is in, what has been done in the past, and what they expect to find before they begin the conservation treatment.

Infrared Light

Infrared light has slightly lower frequencies than the light seen by the naked eye. When an image of a painting is captured using infrared light, some pigments appear transparent in the infrared region. These certain pigments allow infrared radiation to travel through paint layers and be reflected back when they reach a light-colored ground layer, letting the viewer actually see through the paint.

Some pigments remain opaque while others are only transparent in narrow frequency ranges, requiring a particularly advanced camera system. These differences in transparency can also be helpful in distinguishing some pigments from others of the same color. For example, an artist could use both Azurite and Ultramarine blue, which often look very similar. These pigments can usually be distinguished in infrared because Azurite remains dark and Ultramarine becomes transparent.

The process of visualizing this reflected radiation is called **infrared reflectography** (IRR). IRR allows for details to be seen otherwise invisible to the unaided eye, including any preparatory drawing by the artist, or parts of the composition the artist painted over after changing his or her mind. In addition, losses in the paint that have been covered up or hidden details of the support underneath the paint may become visible with IRR.

Balthasar van der Ast, *Still Life of Flowers in a Glass Vase*, 1624. Oil on copper. 18 5/8 x 15 ¾ in. The MFAH, The Sarah Campbell Blaffer Foundation, Houston.

Under drawing Revealed - History and Science

The picture on the right shows some of the drawing lines, also known as under drawing, or the first marks Van der Ast made in order to precisely represent the flowers in this still life. Since flower still lifes were often used in the early 17th century as direct representations of particular blooms, as an almost encyclopedic account of flower species, it was extremely important to the artist and his potential patrons that every detail be correct. This infrared reflectograph detail of *Still Life of Flowers in a Glass Vase* displays how carefully the artist planned for overlapping petals and leaves before the application of paint.

Comparing the infrared reflectograph with the actual painting demonstrates how Van der Ast incorporated some of his drawing lines into the final composition. Often an underlying dark line is used to express a subtle shadow in the final appearance.

Detail of Infrared Reflectograph of Balthasar van der Ast, *Still Life of Flowers in a Vase,* 1