

## Infrared in Art – Major Uses

1. View the under-drawings. Detect artist changes in the drawing -style of the work.
2. To see the condition of a painting beneath an obscuring layer of darkened varnish or over glazing.
3. Sometimes inscriptions are more legible.

### How It Works

Some substances, such as varnish and oils, are more or less transparent to IR (Infrared) radiation making it possible to see elements underneath. One example is a badly burnt painting, where the varnish has turned almost black.

The reason under-drawings can be seen is because under-drawings were often executed in pigments (inks, temperas) containing carbon which absorbs IR rays, and therefore appears dark. Unfortunately other pigments absorb IR also, and if used over the carbon black under-drawing can obscure it entirely. These include azurite, malachite, siennas, umbers, ochers, prussian blue, emerald green. But a long list of pigments are also transparent to IR; madder lake, vermilion, cadmium red, white lead, zinc white, whiting, smalt, orpiment, lapis lazuli, and chrome yellow.

The opacity of a paint layer to IR is determined in part by the amount of scattering of incident light from its surface. Scattering is reduced as the wavelength of incident light increases. When scattering decreases, so does opacity. Thus a paint layer which appears opaque in visible light (400 - 700 nanometer wavelengths) is more transparent in infrared light (700 nm - 3000 nm).

Different pigments behave differently in the IR.

- Reds, Browns, yellow, and whites are semi transparent in the very near IR (700-850 nm)
- Blues and greens (azurite, malachite), are not transparent until 2000 nm.
- In general, the longer the wavelength the better the penetration, but carbon containing black pigments, absorb IR of any wavelength.

IR images are invisible to the naked eye. IR reflectography uses a vidicon tube with a lead oxide-lead sulfide target sensitive to wavelengths up to 2200 nm.

Factors effecting visibility using IR:

1. Percentage of carbon in drawing, signature, etc.
2. PVC: pigment - volume concentration
3. Number and thickness of paint layers
4. Hiding power of pigments
5. Medium

Depending on the application, both near infrared and near-mid infrared viewers can be useful.