Examine paintings on wood or canvas using 3D x-ray imaging with Digitome®
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Abstract
X-ray imaging in three dimensions offers many exciting possibilities for application to art and artifacts. We demonstrate the application of a newly-available 3D x-ray imaging technology, Digitome®, to the examination of paintings on wood or canvas with supporting understructures in the form of cradles or stretchers/strainer bars. Traditional transmission x-ray images of such paintings show a superposition of the paint layer, the wood panel or canvas plus the horizontal and vertical cross pieces from the underlying support. Selecting the focal plane of the Digitome view to be at the level of the paint layer virtually eliminates contributions from the support structure and the full gray-scale range is applied to the paint layer. Accurate and precise measurements can be made of panel thickness and the width, depth, and extent of cracks. For paintings on canvas, the thread size and count can be determined.

Advantages
• Portable – only requires DR panel, x-ray source and Digitome software
• Accurate, precise and repeatable dimensioning along any axis
• Acquisition is non-tomographic – no interpolation between slices
• Non-destructive method of studying art and archaeological artifacts
• Quick exam acquisition time (~15 minutes for small paintings; larger paintings can be stitched). Small dataset provides for near real-time changes in view
• Flexible configurations

King William III – Anon.
(4.25 × 5.7 in.)
The Colonial Williamsburg Foundation has a matching set of portraits of King William III and Queen Mary. The portrait of King William seen below is on oil on a panel with horizontal wood grain, unusual for this type of portrait. With Digitome, we are able to measure the crack depths along the grain of the wood. The voids in the paint surface caused by the cracks were filled by earlier conservation work.

Haymakers at Montfermeil - Georges Seurat, c. 1882
(6.125 × 9.75 in.)
This oil on wood painting was bequest to the National Gallery of Art by Mr. and Mrs. Paul Mellon. Images shown here are scaled to 4/5 of actual size. a) Traditional 2D radiograph. b) Cradle is masked by adding inert synthetic resin powder to the gaps in the cradle to match absorption of wood. c) Digitome exam result. d) Exam configuration for Seurat painting in NGA’s x-ray vault. e) Gray-scale histograms show greater spread of image information from Digitome over powder image. (8-bit range)

Examination conditions for Seurat painting:
75 kVp, 2.0 mA

The Hatseller
(10 × 12 in.)
This Goya-esque painting is part of the Davidson College Art Collection. Mounting nails and crossed wooden stretcher, about 0.5 in thick, are clear in the traditional 2D radiograph. With Digitome set to present the plane of the paint on the canvas, the wood and nails are nearly undetectable. Canvas thread count is 9 threads/cm.

Conclusions
Digitome non-destructively removes from view underlying support structures so that full gray-scale range can be devoted to paint layer. Portability and flexibility of configuration allows art to be examined without leaving the museum. Accurate, precise and reproducible measurement provided by this scientific tool.

• Challenge: Limited by the active area of detector in the size of paintings we can examine in a single, all-encompassing exam
• Future Work: Explore more applications of Digitome in conservation of paintings, art objects and artifacts.

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