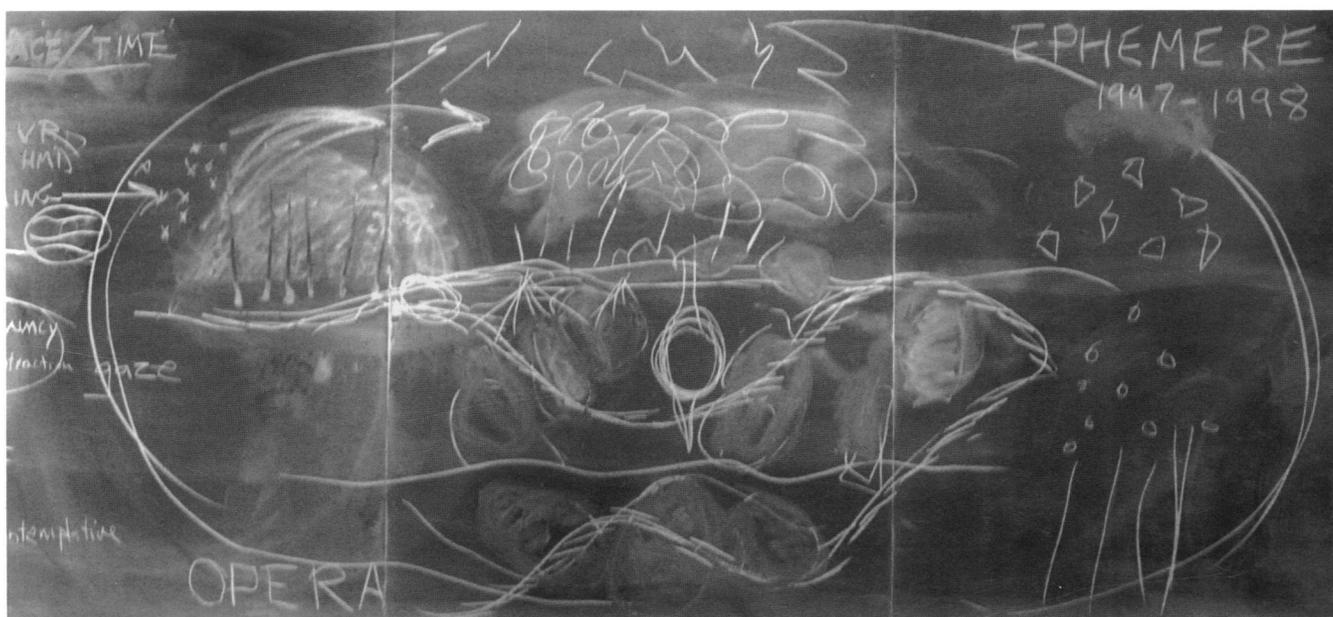


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STATEMENT

SPECTROSCOPIC IMAGING IN ART CONSERVATION: A NEW TOOL FOR MATERIALS INVESTIGATIONS

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The remote-sensing technique of spectroscopic imaging has been adapted to

the non-destructive examination of works of art [1]. The technique allows art materials to be distinguished by their composition and underdrawings to be revealed [2]. Our initial results indicate that even over limited wavelength ranges and with relatively coarse spectral resolution, a number of pigments can be distinguished on the basis of variations in their near-infrared reflectance (near-IR) spectra. Non-destructive identification of pigments can be used to address issues of attribution, age dating and conservation. Since the technique produces images, it also provides information on the distribution of the pigment types in the work being examined. By acquiring an image at each of dozens of wavelengths, spaced at 10-nanometer intervals through an extended spectral range (650–1040 nm), we can build up what is known as a 3D spectroscopic imaging data cube. An additional advantage of this technique is that it can be performed off-site using portable instrumentation and under relatively benign lighting conditions. The equipment it utilizes is specialized but relatively inexpensive.

The technique has been applied to the examination of a 15th-century drawing, *Untitled (The Holy Trinity)*, by Veit Hirschvogel, the Elder (Color Plate A No. 1), in the collection of the Winnipeg Art Gallery. Software adapted from the remote-sensing image-processing field has been used successfully to map the areas of different brown and black pigments across the drawing. Multivariate image analysis [3] produced a set of principal-component (PC) images highlighting different materials aspects of the drawing. A color composite image produced from the PC images provided a direct visualization of the compositional characteristics of the work (see Color Plate A No. 1). The images produced are easily interpreted, and the information obtained is directly usable by conservators, art historians and curators alike. Features of the underdrawing have been exposed, and its material tentatively identified as charcoal, by comparison with reference data. Identification of the other pigments awaits the creation of a more appropriate database of near-IR pigment spectra.

Based on the success of our preliminary work [4–6], the collaboration between our institutions (the University of Winnipeg, Winnipeg Art Gallery and Institute for Biodiagnostics of the Na-

tional Research Council of Canada) has been formalized as C-SCAPE (the Centre for Scientific and Curatorial Analysis of Painting Elements). C-SCAPE is purchasing dedicated instrumentation for infrared spectroscopic imaging, as well as other equipment for chemical and computer analysis of artworks. The research program being drawn up includes the following components: building a spectral library of historical pigments and other art materials based on collections held elsewhere and on knowledge of traditional recipes of known media types; acquiring spectra and spectroscopic images of known media types in order to correlate spectral properties with media; investigating multivariate computer techniques for the analysis and visualization of spectroscopic IR image sets; and analyzing works in other collections from the same period for corroboration of our results. The collaboration is also open to extending the application of these techniques to other types of works of art such as textiles, ethnographic specimens, pottery, stone, etc. Infrared spectroscopic imaging could also prove useful in document and forgery analysis, as well as in attribution of works of art.

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COLOR PLATE A



No. 1. Michael Attas et al., spectroscopic image analysis of Veit Hirschvogel, the Elder, *Untitled (The Holy Trinity)*, ink, wash, charcoal, red pigment on paper, 39.9 × 39.1 cm, 15th century. (a, top) Drawing as it appears to the eye. (b, bottom) Drawing enhanced using spectroscopic imaging and principal-components analysis to highlight differences among near-infrared spectra of materials. Charcoal lines are coded red. (Collection of the Winnipeg Art Gallery; Acquired with the S.C. Eckhardt-Gramatté Memorial Fund, [Accession # G-75-3]. © E. Michael Attas. Photo © Cathy Collins, The Winnipeg Art Gallery).

