

# Value of UV-Vis Spectrophotometry in Art Conservation



**Innovative Spectrophotometers From Agilent Technologies - for  
the Analysis of Fine Art, Sculpture and Historical Objects**

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# Agilent Molecular Spectroscopy Solutions: Complete the picture...

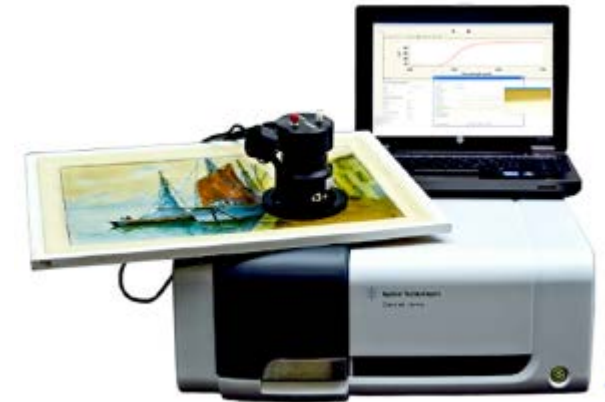
*Agilent has a unique and complimentary portfolio of non-destructive measurement capabilities for art and conservation*



Agilent 4100, 4200 and 4300 spectrometers. **Truly portable FTIR**

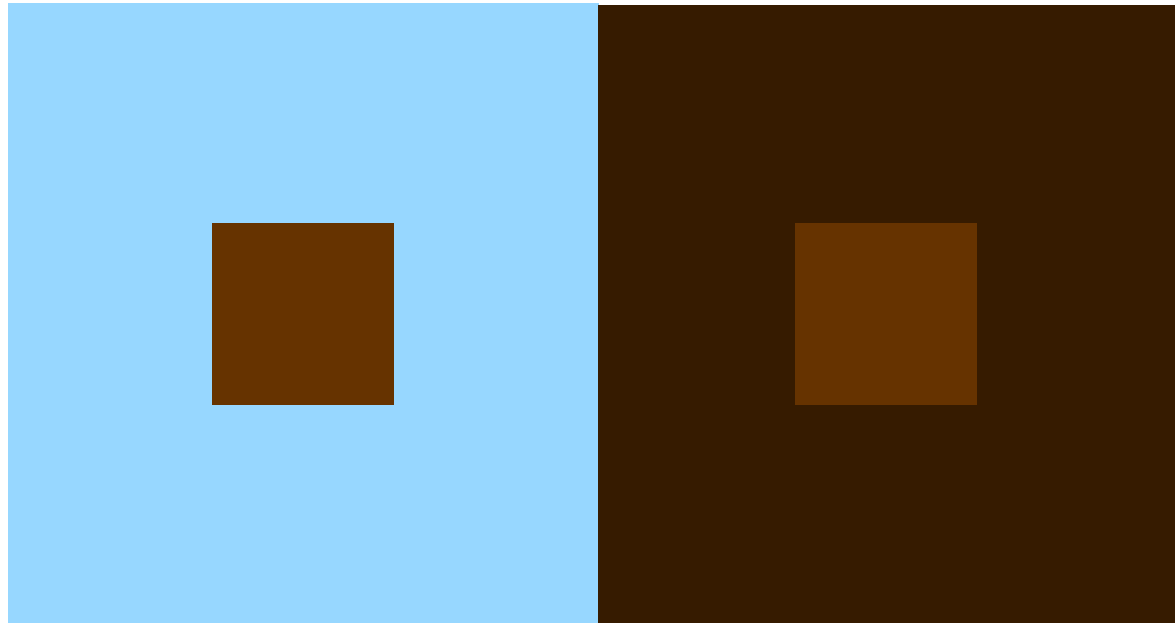


Agilent Cary 620  
**Leader in FTIR Imaging**



Agilent Cary 60. **Efficient and accurate color measurement**

# Our eyes are sometimes not the best judge



# Not all UV-Vis instrument are equal: The Cary 60 UV-Vis spectrophotometer

## Why the Cary 60 ?

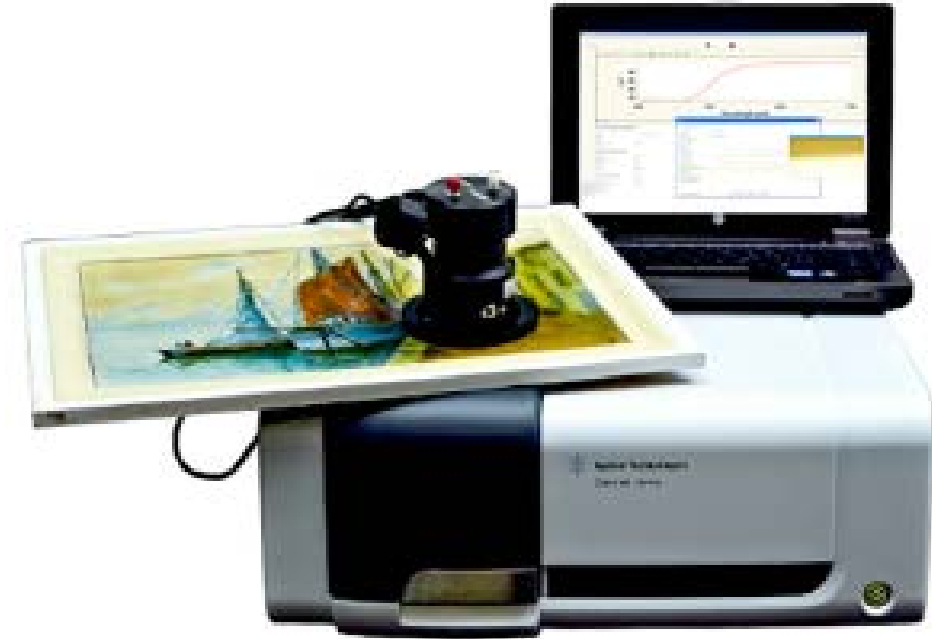
- Robust, easy to use solution with the lowest cost of ownership  
*why worry?*
- Small beam spot size  
*perfect for remote sampling using fiber optics*
- Room Light Immunity  
*essential remote sampling using fiber optics!*
- Short Pulse Duration  
*does not bleach samples*
- Can be run from a 12V car outlet or battery for field use  
*take the instrument to your sample*



# Remote color measurement using a remote Diffuse Reflectance Accessory (DRA)

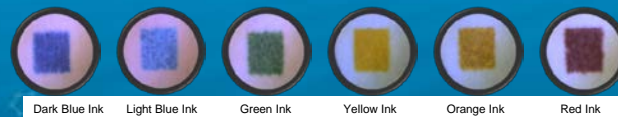
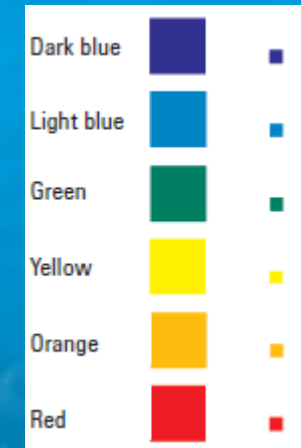
**Remote, efficient and accurate color measurement.**

- **Requested by the art restoration community:** Agilent listens
- Fiber optic accessory with moveable detector
- Non-destructive testing of all surfaces and materials
- Remote (< 1.5 m) diffuse reflection analysis of any sample
- The spatial resolution of the analysis is less than 1 mm so ideal for understanding sample surface porosity
- A video camera is integrated into the accessory allowing direct viewing of the illuminated spot.

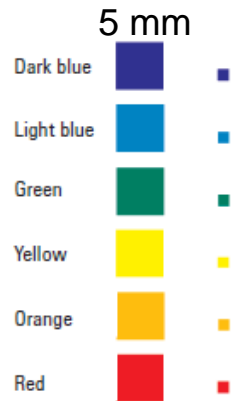


## The Cary 60 with the remote DRA for in-situ, non-destructive measurement of any sample: **Technique Overview**

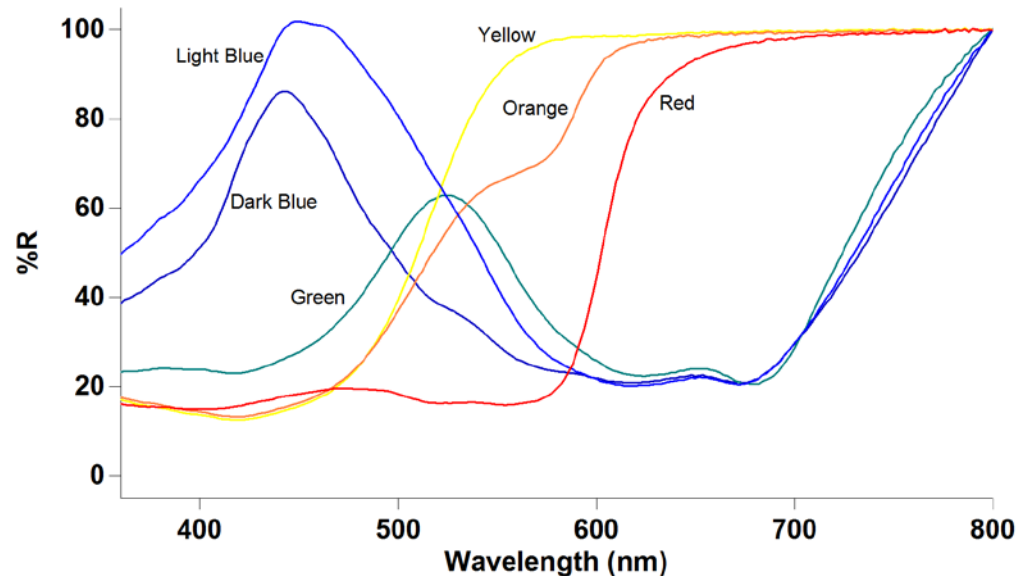
- Scientific color classification technique
- Live video for analytical precision
- Superior quality, reproducible performance



# Identify and classify color



Cary 60 Remote DRA



**Cary 60 with diffuse reflectance accessory for accurate color matching**

## Test Case: Quantitative and qualitative color matching

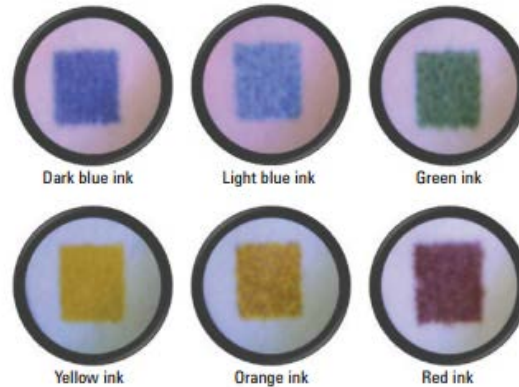
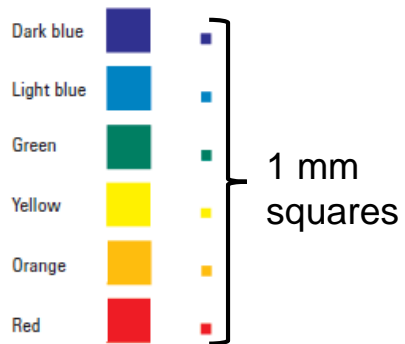
- **Challenge:**  
Quickly and simply measure 5mm square colored ink samples. Without destroying them!
- **Solution:**  
Cary 60 with Remote DRA accessory
- **Result:**  
Accurate, very high quality data to easily and systematically differentiate even subtle color differences.
- **Benefit:**  
Leave nothing to chance: quantifiable, scientific assessment of color accuracy.

# Watch what you measure!

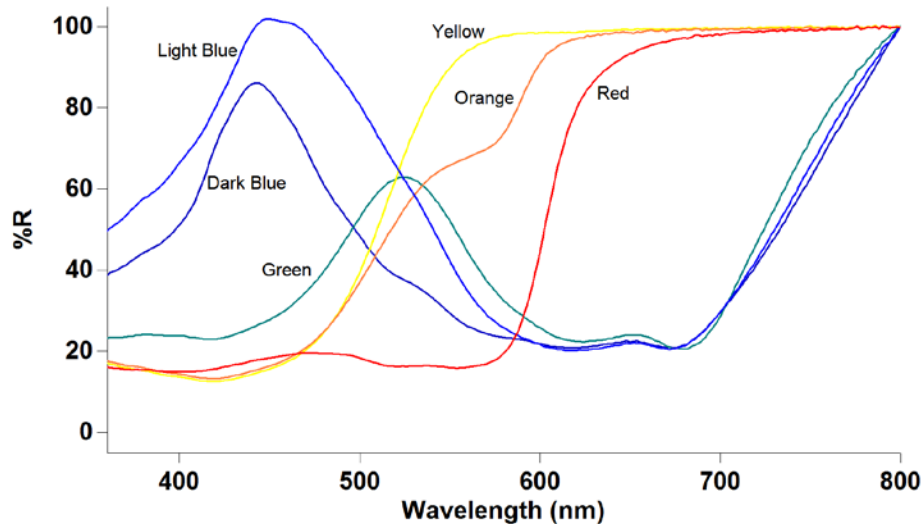
## The Cary 60 with diffuse reflectance for accurate color matching

### Test Case: Identify and analyse small color patches in a complex color matrix

- **Challenge:**  
Ensure visual access to the exact spot that you are measuring
- **Solution:**  
Cary 60 with live video output from the Remote DRA
- **Result:**  
Watch what you measure. The live video output from the Remote DRA provides live visual feedback so you can see that you are analyzing the correct part of the sample.
- **Benefit**  
Take guesswork out of the measurement. Save precious time and effort – and get the right answer the first time

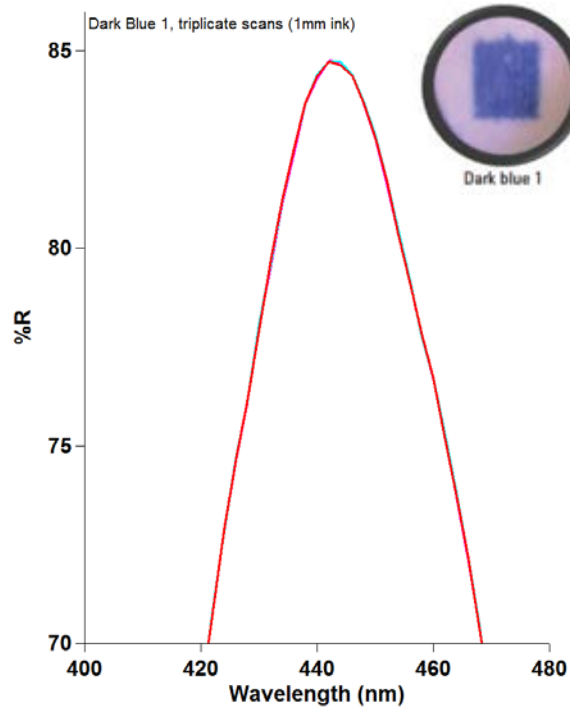


Cary 60 DRA video output for 1mm square color ink samples

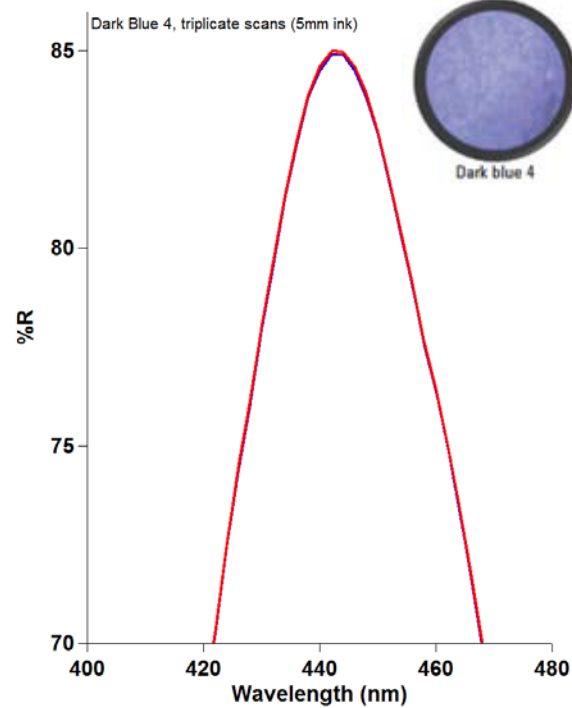




# Watch what you measure!



Spectrum and Cary 60 DRA video output (inset) for 1mm square dark blue ink sample



Spectrum and Cary 60 DRA video output (inset) for 5mm square dark blue ink sample

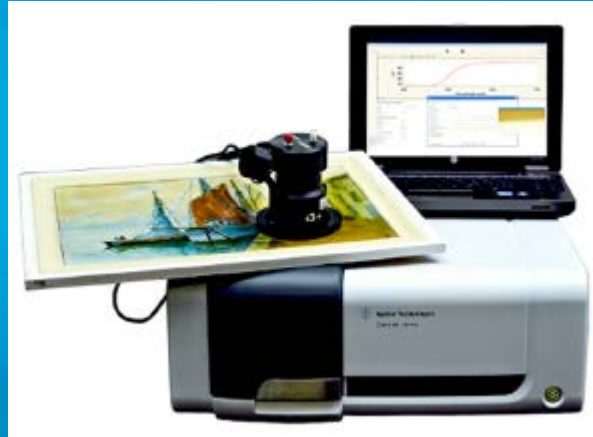
The built in live video of the DRA was used to monitor the position of the sample under the accessory and determine the optimal location for data collection. Each color sample was then analysed three times. The results of all three analyses are identical.

## The Cary 60 with diffuse reflectance for accurate color matching

### Test Case: Real time viewing and analysis of 1 mm squares

- **Challenge:**  
Selectively measure colored ink samples that are less than 1 mm across, without contamination from the surrounding matrix
- **Solution:**  
Cary 60 with Remote DRA accessory
- **Result:**  
The Agilent Cary 60 Remote DRA has excellent, reproducible performance with samples as small as 1 mm easily measurable
- **Benefit**  
You get the same, scientifically rigorous answer whatever the size of your target.

# Application examples



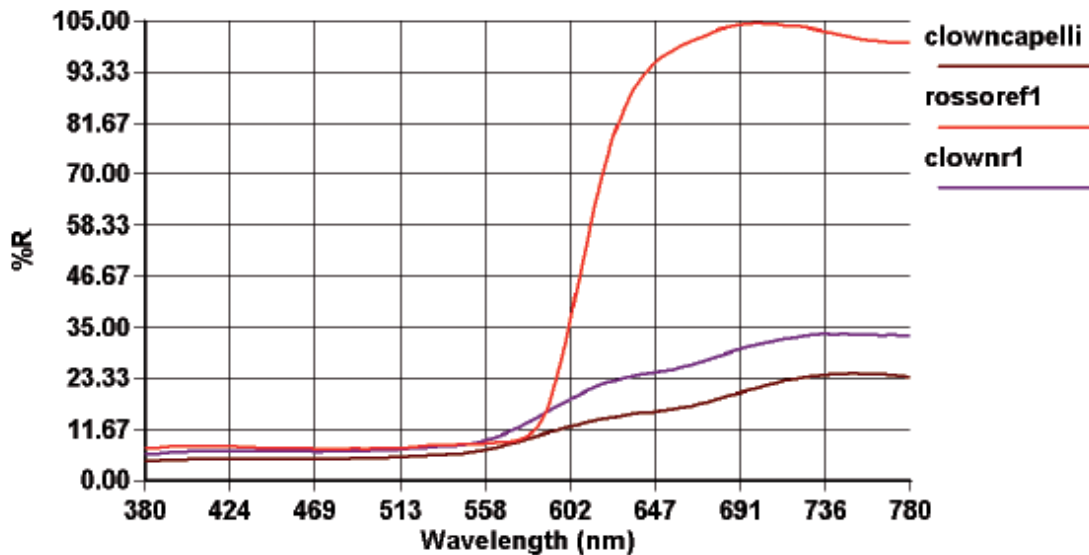
# Measuring the color of paint on a canvas



**UV-Vis spectra are essential to accurately classify and match the colors that comprise a painting.**

## Case Study:

- Color measurements can be difficult due to their size, shape and location of the sample.
- Reflectance spectra are key to understanding and classifying colors so that accurate and reliable restoration can take place.
- The color of paint depends on the pigment color the binding medium, surface absorbency, texture of the finish, size of particles, etc.
- Spectra clearly show allows real comparisons between original color and restoration to be made.



# And it's not just for pictures:

## The Use of UV-Visible Reflectance Spectroscopy as an Objective Tool to Evaluate Pearl Quality

[Snezana Agatonovic-Kustrin\\*](#) and [David W. Morton](#)

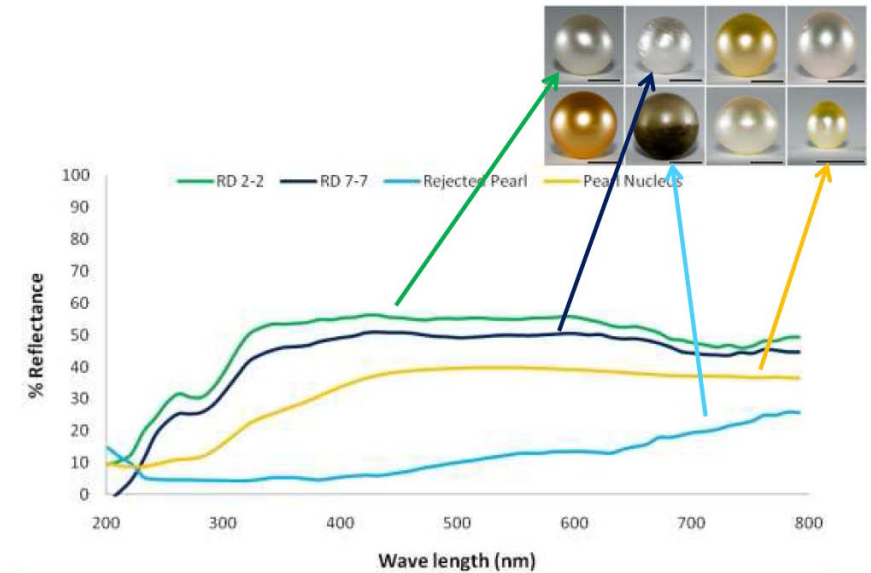
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### Abstract

Go to: 

Assessing the quality of pearls involves the use of various tools and methods, which are mainly visual and often quite subjective. Pearls are normally classified by origin and are then graded by luster, nacre thickness, surface quality, size, color and shape. The aim of this study was to investigate the capacity of Artificial Neural Networks (ANNs) to classify and estimate the quality of 27 different pearls from their UV-Visible spectra. Due to the opaque nature of pearls, spectroscopy measurements were performed using the Diffuse Reflectance UV-Visible spectroscopy technique. The spectra were acquired at two different locations on each pearl sample in order to assess surface homogeneity. The spectral data (inputs) were smoothed to reduce the noise, fed into ANNs and correlated to the pearl's quality/grading criteria (outputs). The developed ANNs were successful in predicting pearl type, mollusk growing species, possible luster and color enhancing, donor condition/type, recipient/host color, donor color, pearl luster, pearl color, origin. The results of this study shows that the developed UV-Vis spectroscopy-ANN method could be used as a more objective method of assessing pearl quality (grading) and may become a valuable tool for the pearl grading industry.

**Keywords:** artificial neural network, diffuse reflectance UV-Visible spectroscopy, pearl grading, pearl quality



# Summary

## Agilent UV-Vis Cary 60 Spectrophotometers for Art Conservation

### Exceptional flexibility to meet application requirements

- Provides rigorous colour information
- Complementary to Agilent handheld and laboratory FTIR techniques

### Agilent Cary 60 UV-Vis spectrophotometer with remote DRA

- No compromise color analysis in and out of laboratory
- Don't take your sample down from the wall – just measure it
- Compact, rugged and reliable instrument

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