



Ink Composition

**U.S. Three-Cent
Issues of 1870-1881**

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The Printing Contracts

National

1870



Continental

1873, 1877



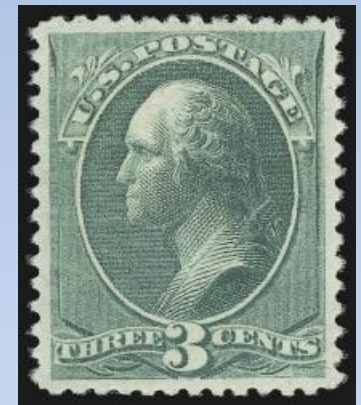
American

1879



American

1881



Die acid-etched



Die re-engraved

Why do this research?

Explain shades within/between printings

- What pigments caused hue variations?
- What caused bright vs. dull, pale vs. dark?

National 1870	Continental 1873, 77	American 1879	American 1881
Green	Green	Green	Blue Green
Pale Green	Bluish Green	Dark Green	Green
Dark Green	Yellow Green	Light Green	Yellow Green
Yellow Green	Dk. Yel. Green		
	Dark Green		
	Olive Green		

Green Shades Examined

Nat.
1870-73



pale



dark



yellow

Cont.
1873-78



pale



dark



yellow



olive

Am.
1879/'81



light



dark

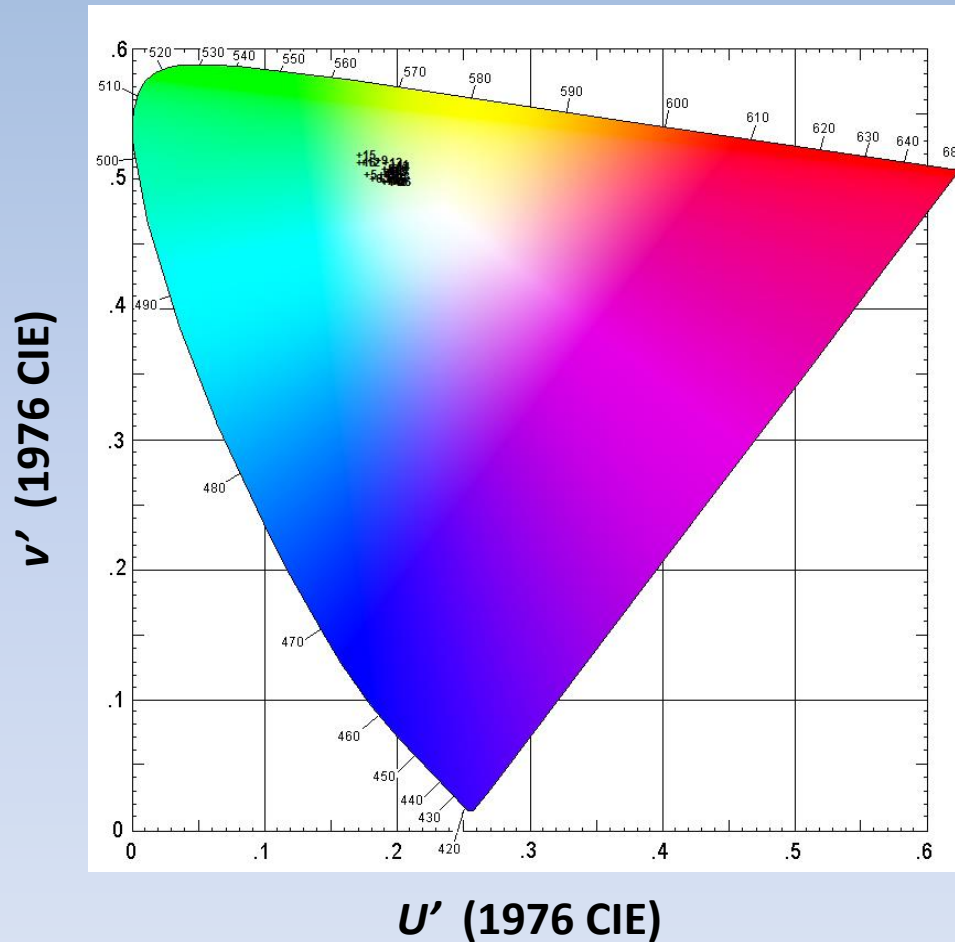


blue



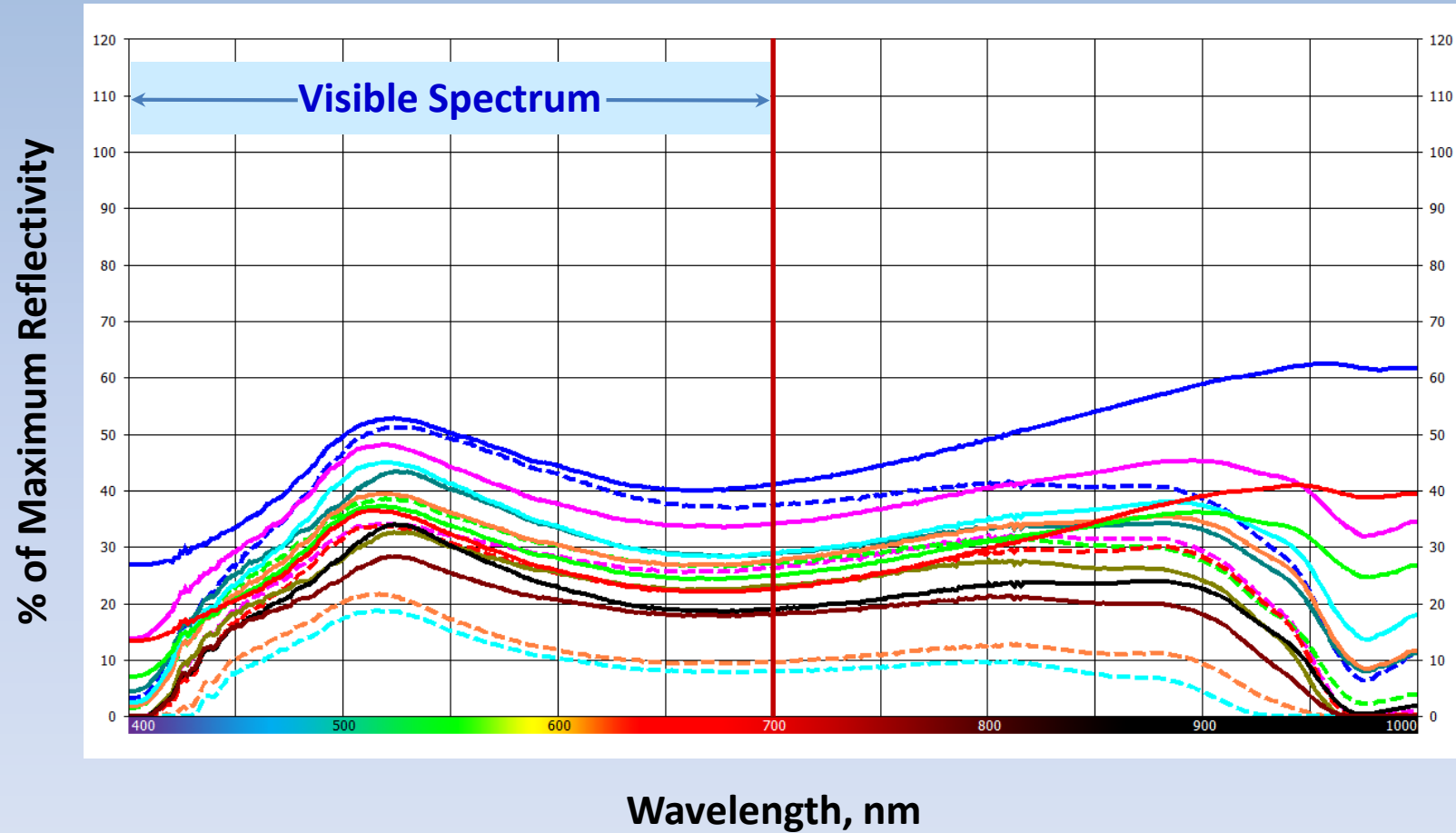
green

Chromaticity, All Shades



Courtesy T. Lera, National Postal Museum

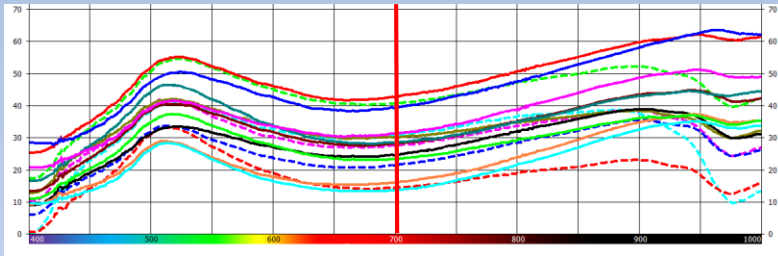
Reflectivity, Averages Per Shade



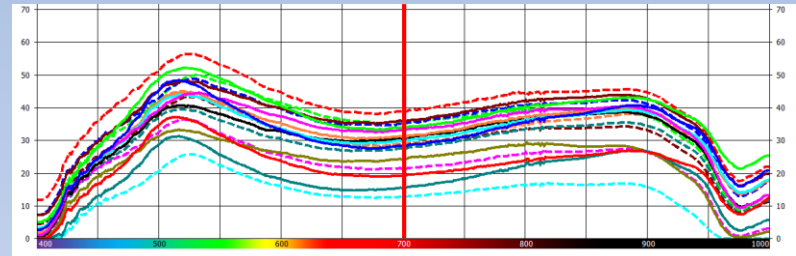
Courtesy T. Lera, National Postal Museum

Reflectivity, Per Printing

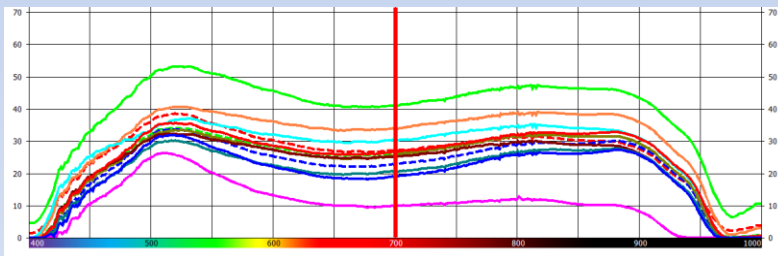
National



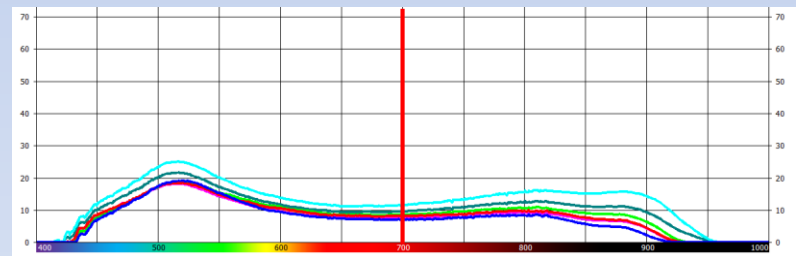
Continental



American

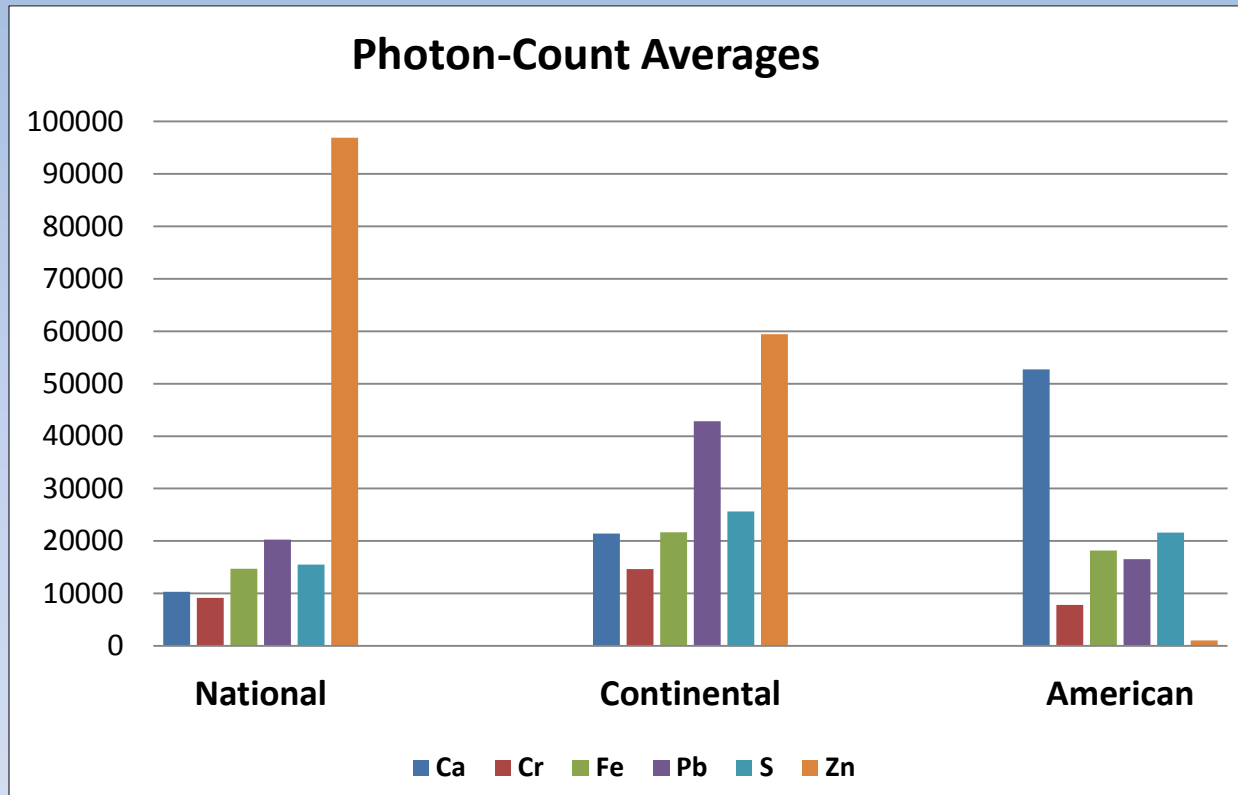


American Re-engraved



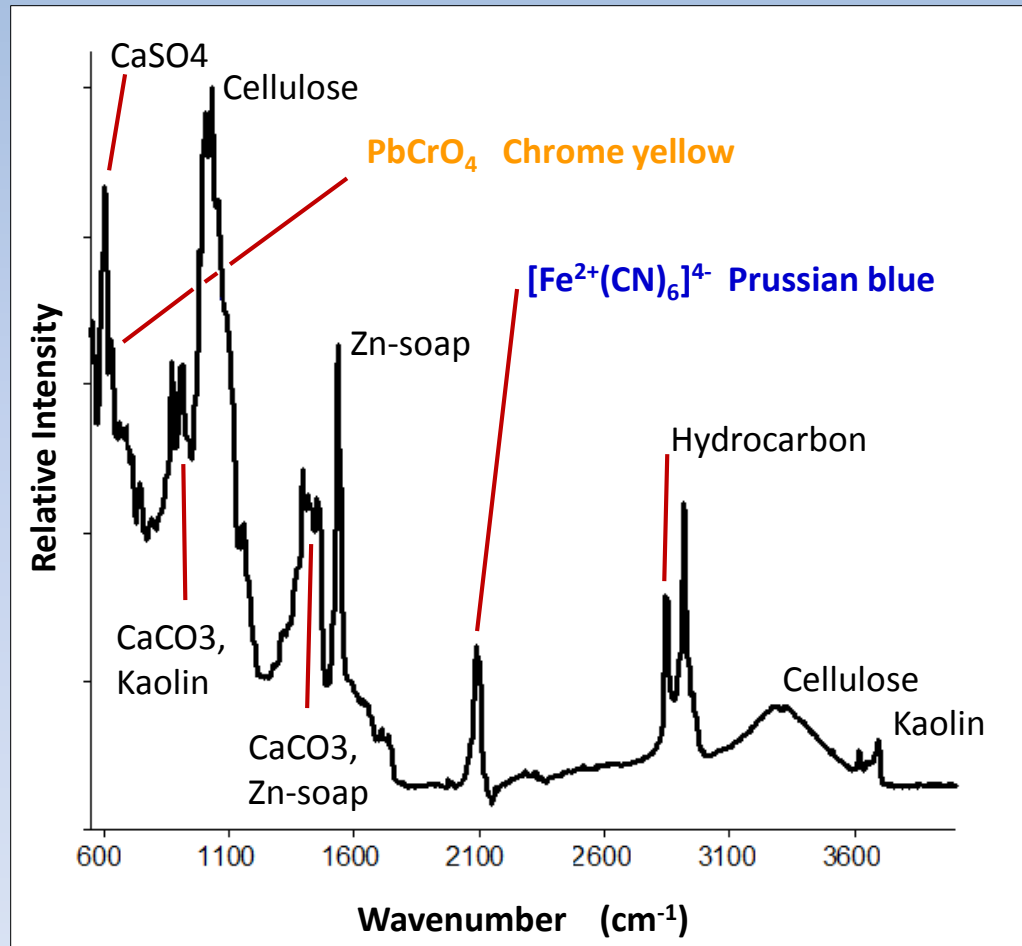
Courtesy T. Lera, National Postal Museum

X-Ray Fluorescence: Elemental Analyses

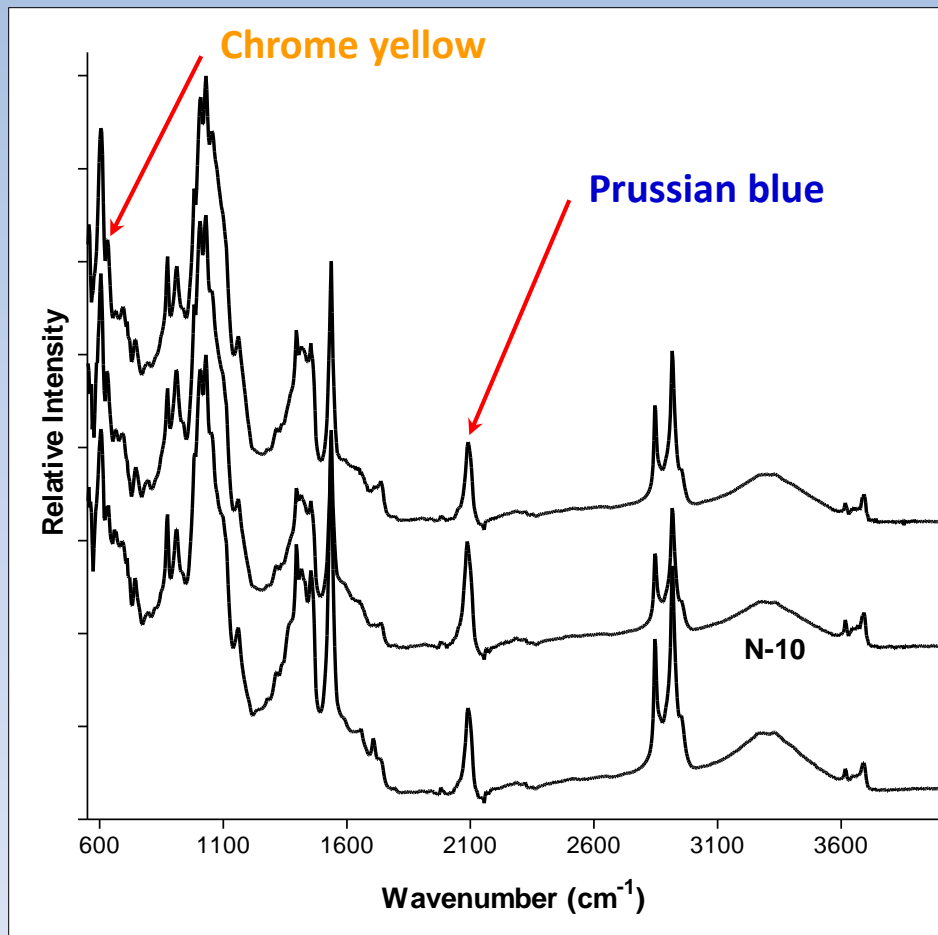


Courtesy T. Lera, National Postal Museum

FTIR: National Composite



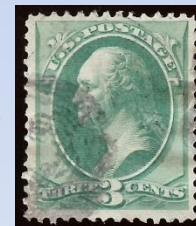
FTIR: National Shades 1870-73



Yellow Green

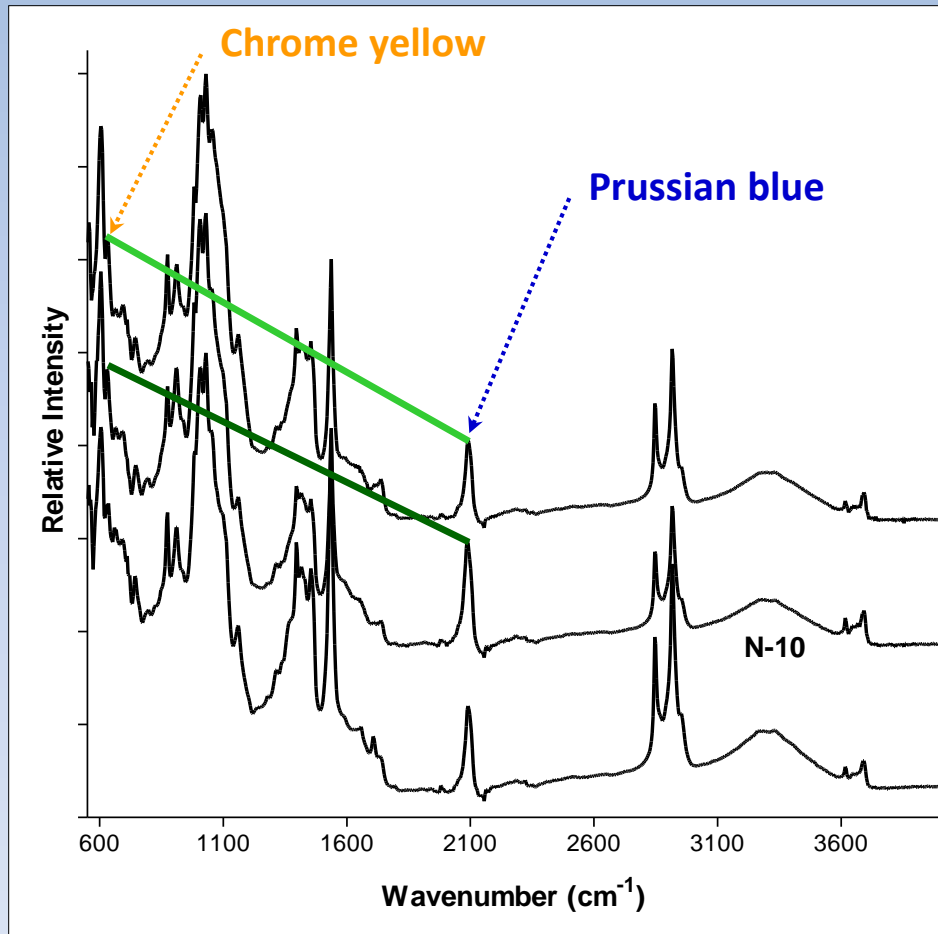


Dark Green



Pale Green

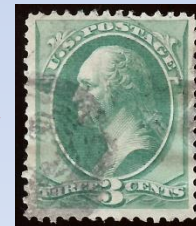
FTIR: Green vs. Yellow-Green



Yellow Green

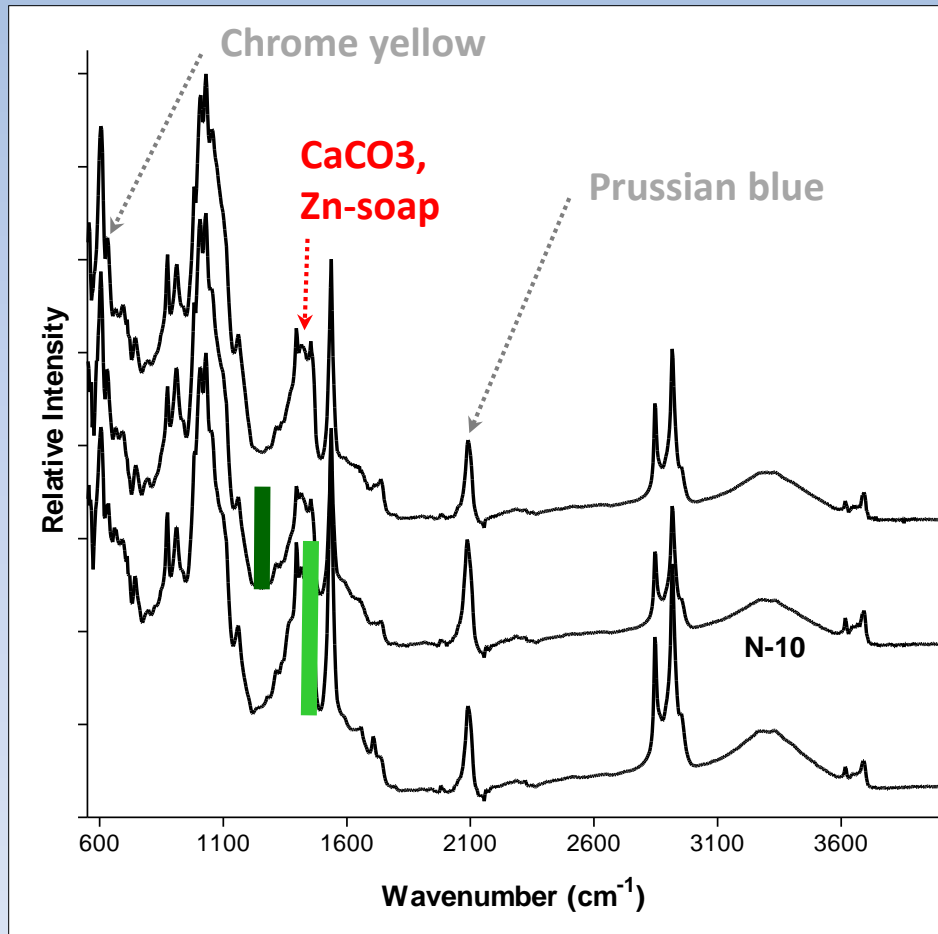


Dark Green



Pale Green

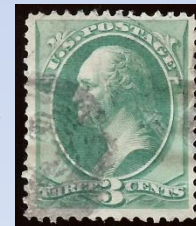
FTIR: Dark vs. Pale Green



Yellow Green

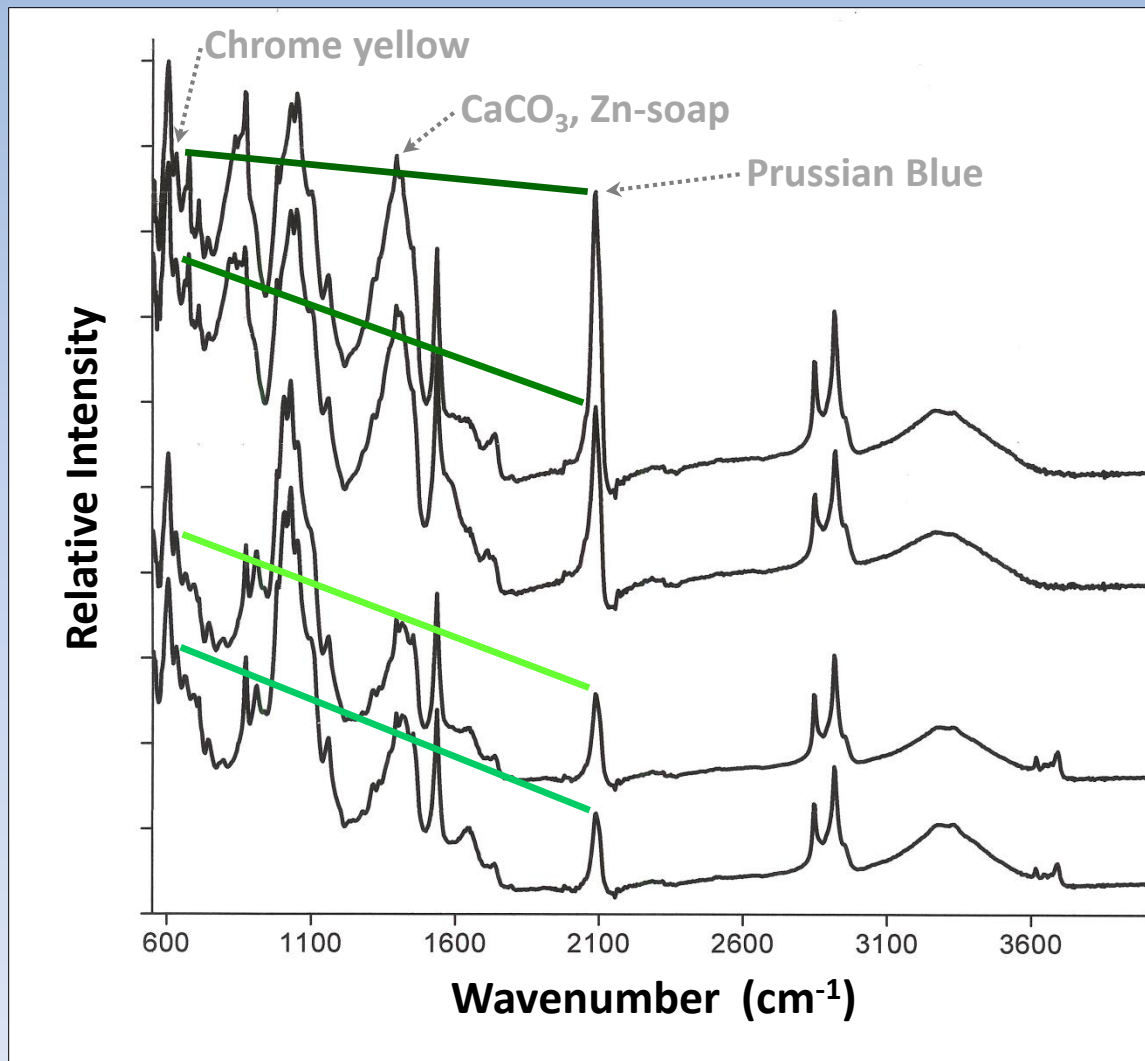


Dark Green



Pale Green

FTIR: Continental Shades 1873-78



Dark
Green



Olive
Green

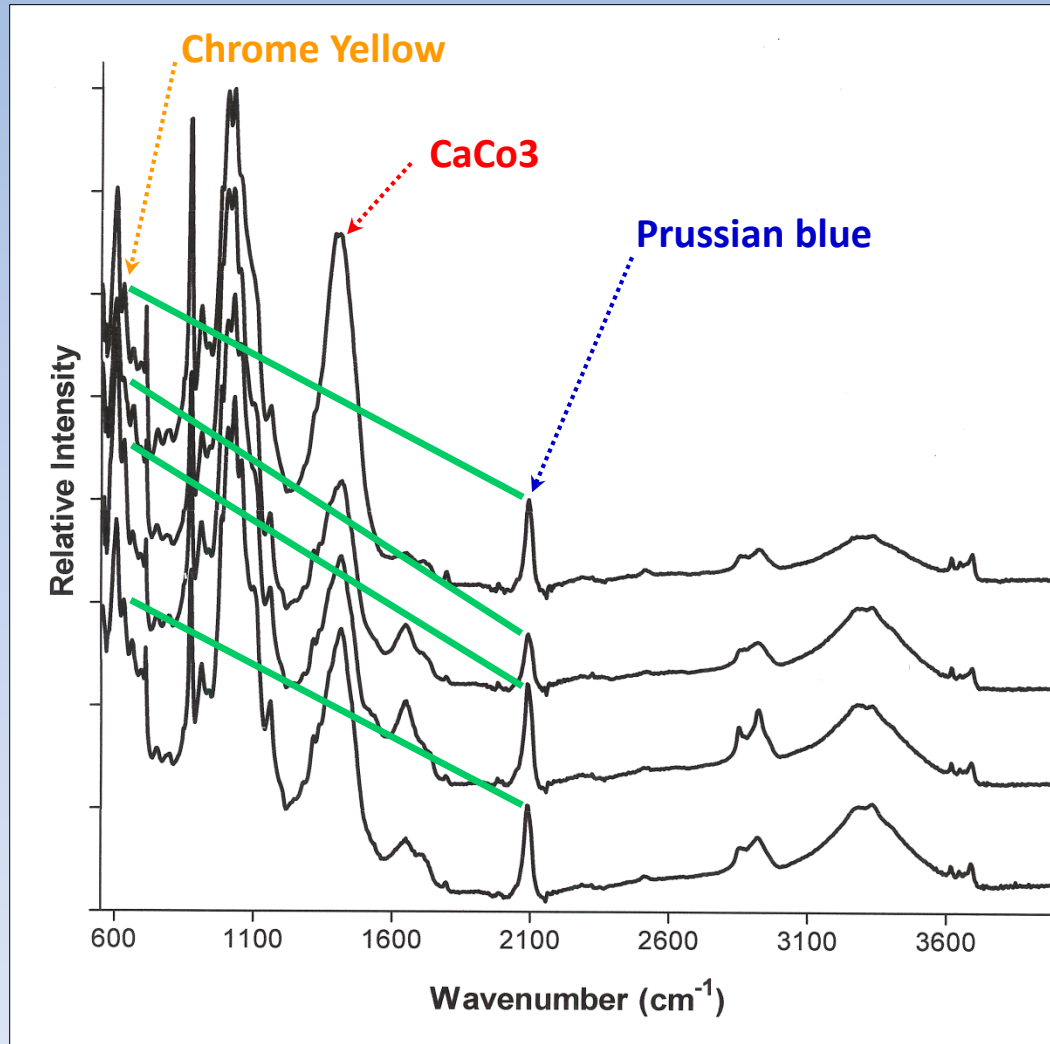


Yellow
Green



Pale
Green

FTIR: American Shades 1879-81



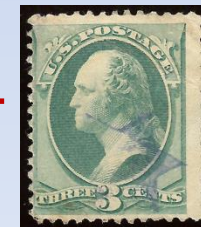
Dull
Blue-green
Re-engraved



Green
Re-engraved



Dark
Green



Light
Green

Conclusions

- All shades are mixtures of *chrome yellow* and *Prussian blue*.
- Deeper shades contain higher proportions of Prussian blue.
- All printings used CaCO_3 (calcite) as a brightener.
- American used the highest concentrations of CaCO_3 , which contributed to relatively dull, “washed-out” hues.
- All papers contain CaSO_4 (anhydrite) as a filler.
- Continental paper used for deep- and olive-green shades are alone in containing no kaolin.
- Zinc-soap was detected in all National and Continental BN Co. stamps, but in none of the American BN Co. stamps.

Key Learning

- Visual and spectrally determined color differences are not the same.
- Spectral power curves record every wavelength of light, **but:**
- Our eyes have only three types of receptors (cones); each senses cumulative energy from a broad range of wavelengths.
- The color we see is not an innate value of an object, but a construct of the tristimulus values created by our cones.
- Different people “see” different shades.