SPECTRAL DATABASE APPLICATION FOR COLOR COMPENSATION PROCESS IN PAINTING

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Outlines

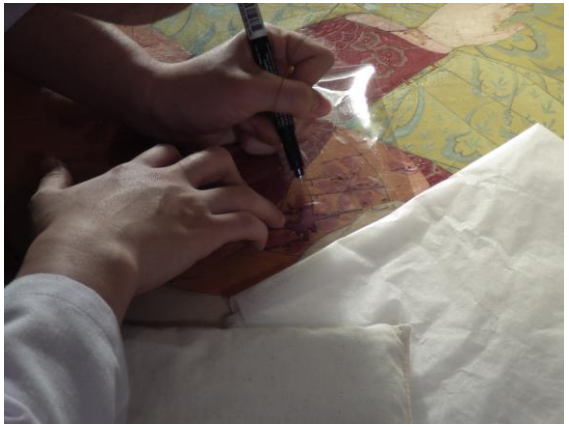
- Background information
  - Objective/Problem definition
  - Color compensation process
- Spectral analysis method
- Spectral property of pigments
- Proposed Spectral Database
- Results
- Summary

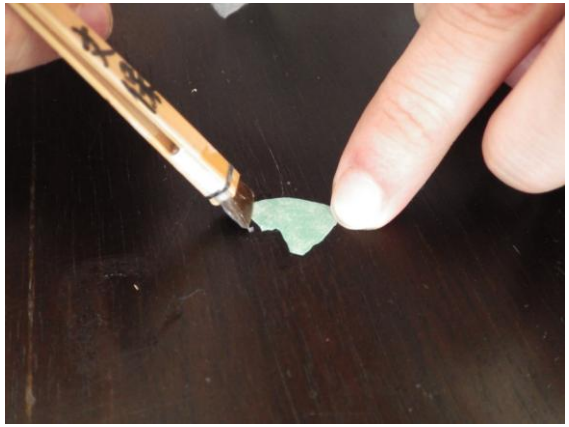
Color Compensation Example (Artist: CHEN Chin)

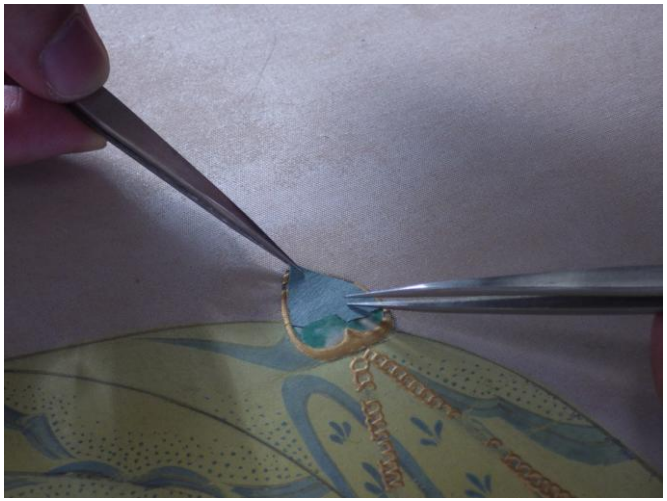
- Broken necklace

Color Compensation Example

- (Before final touch-up)

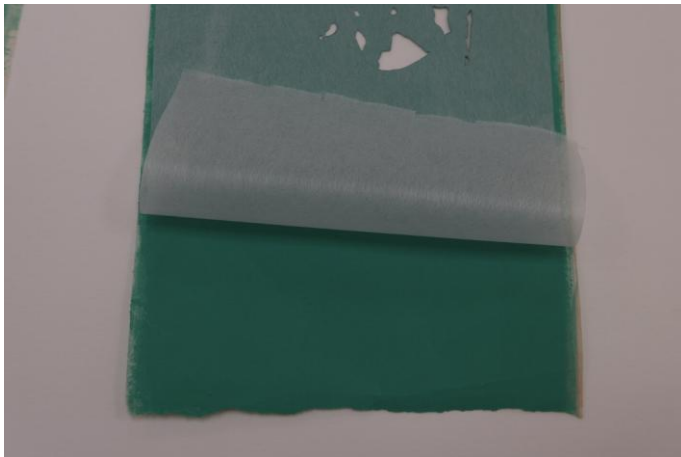






Compensation Process

- Analyze original pigment
- Determine the replacing pigment by visible and invisible band
- Make the infill material (base material + replacing pigment)
- Trace the missing area to make the infill
- Inlay the replacing infill to the painting surface
- Remove the facing rayon paper
- Finish touch-up



Objective – in Color Compensation

- Assure the identifiable and reversible in color compensation process
- Utilize the difference of spectral characteristics among pigments
  - Never apply pigment on original art works,
  - Identifiable accurately
  - Removable easily, safely and correctly

Guidelines for Color Compensation

- Not only color match, but also Identifiable and reversible

Solution – Spectral Database

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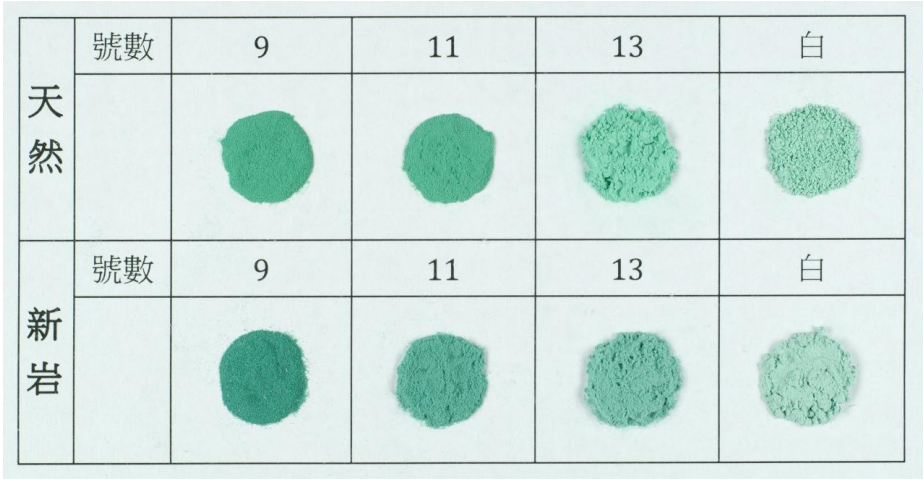
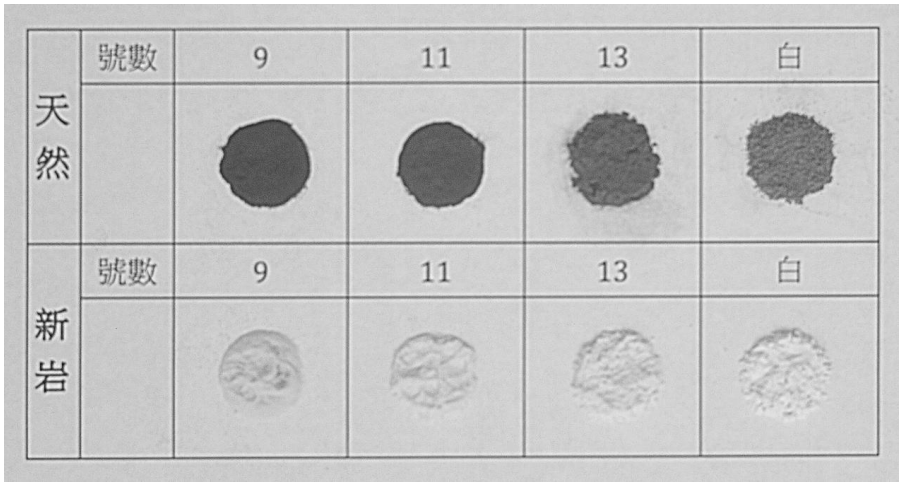
- Measure spectral reflectance values of the pigment
- Match color in visible band (CIELAB values)
- Identify the difference in non-visible band

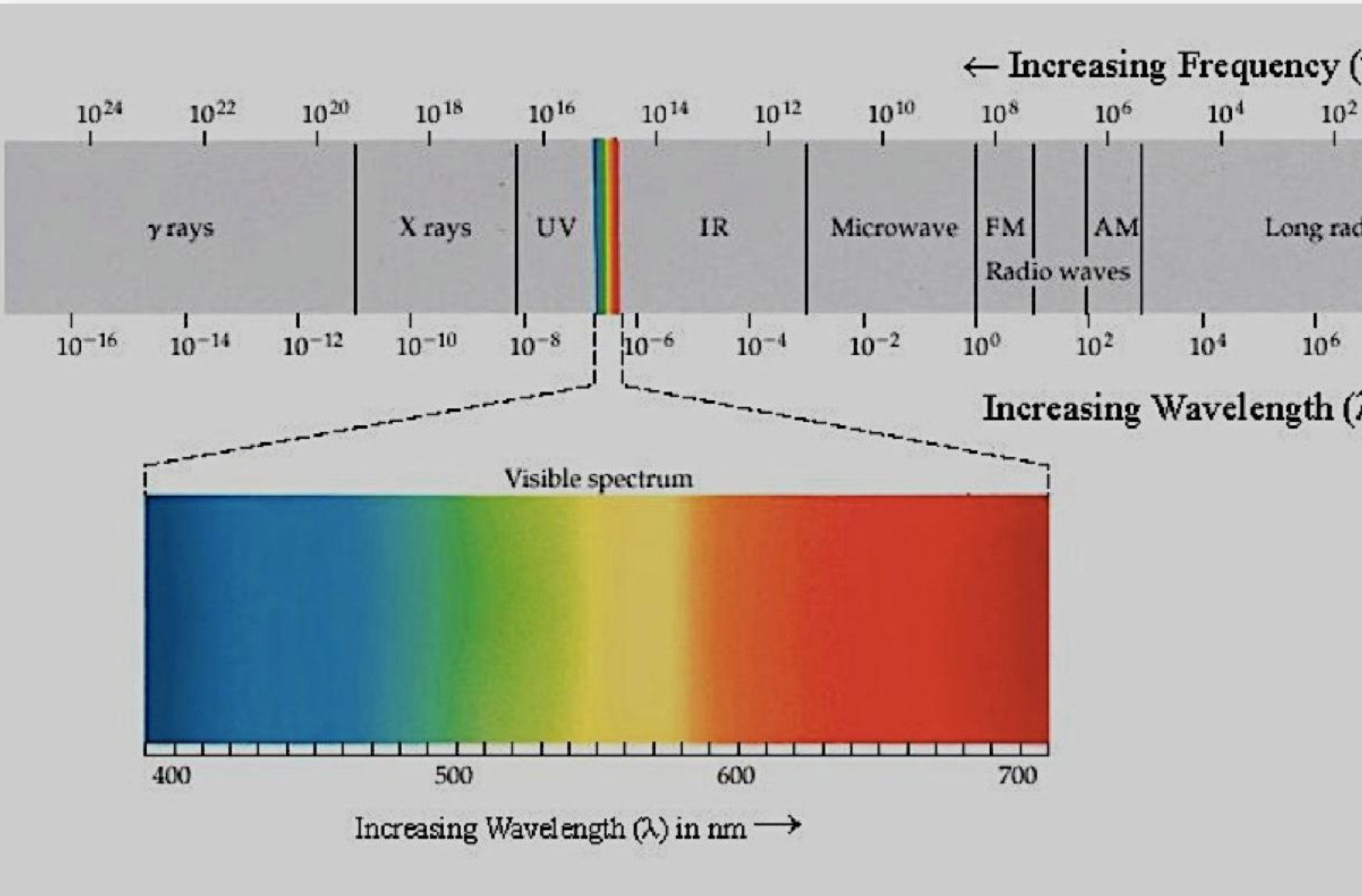
Regular visible band



Infrared band

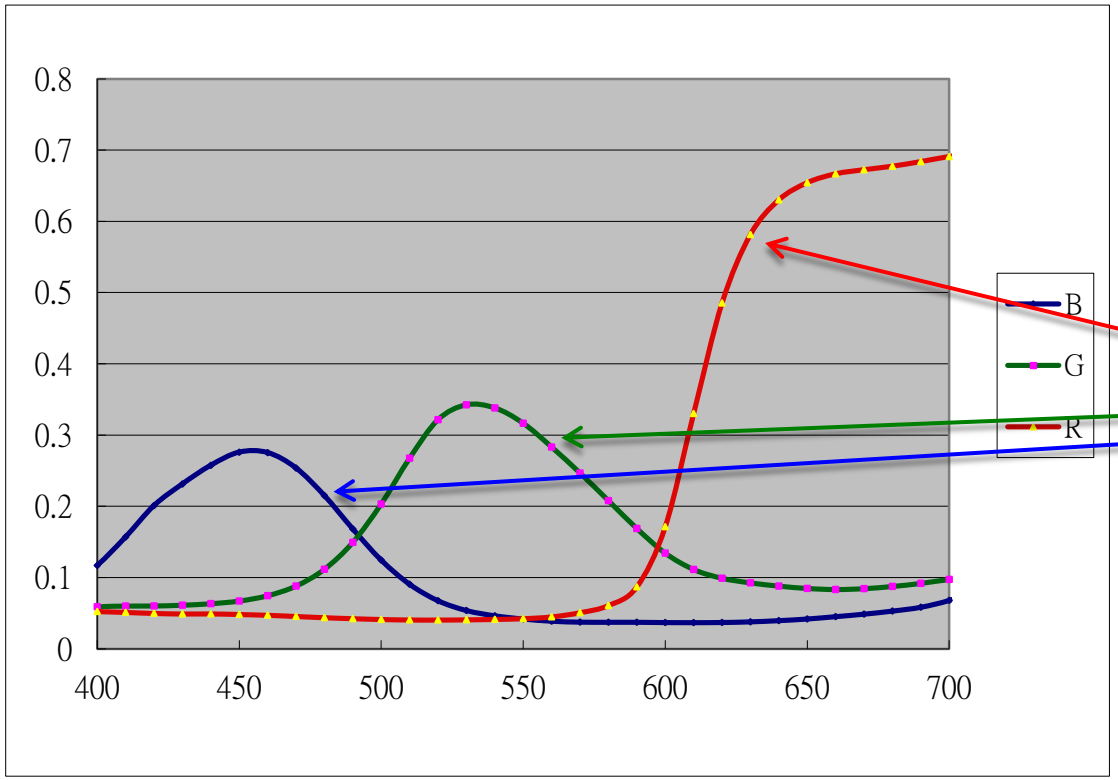


Spectral Range



Material Property: Spectral Reflectance

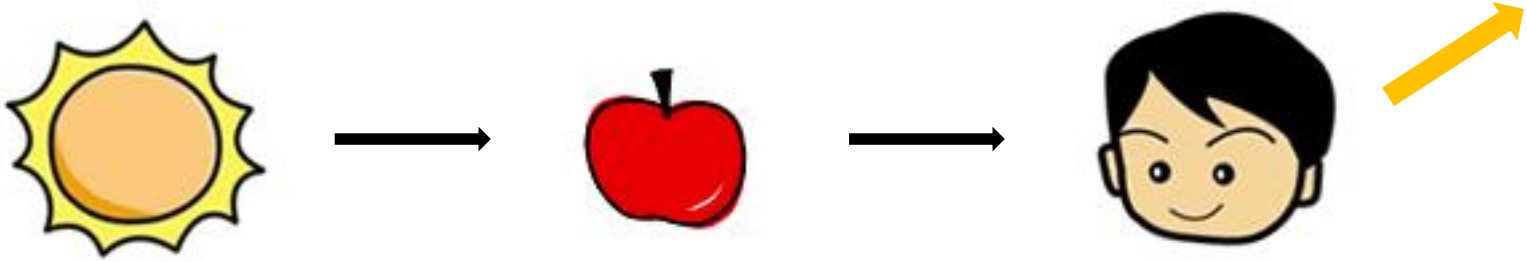
- R(λ) (400nm to 700nm in 10nm sampling)

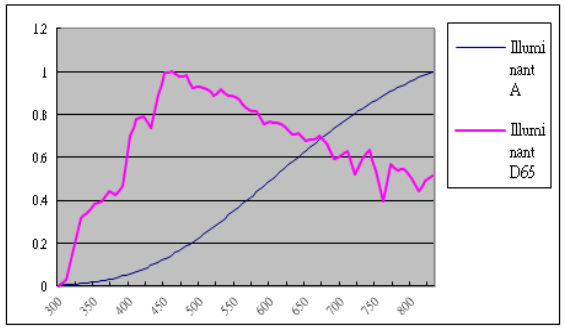


Theory of Colorimetry

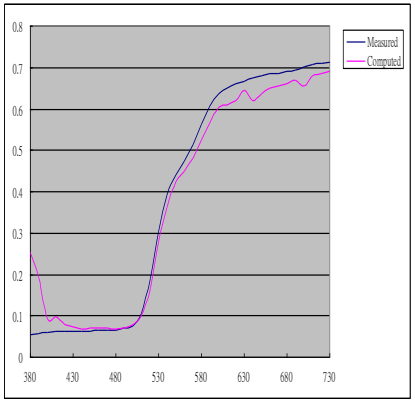
- Visible band (400-700 nm)

CIE LAB Values

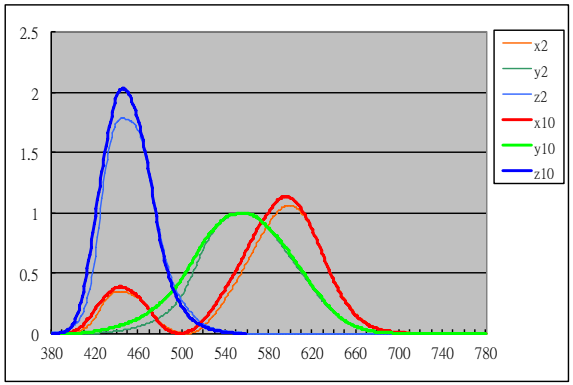




Light Source
(Spectral distribution
/Color Temperature)



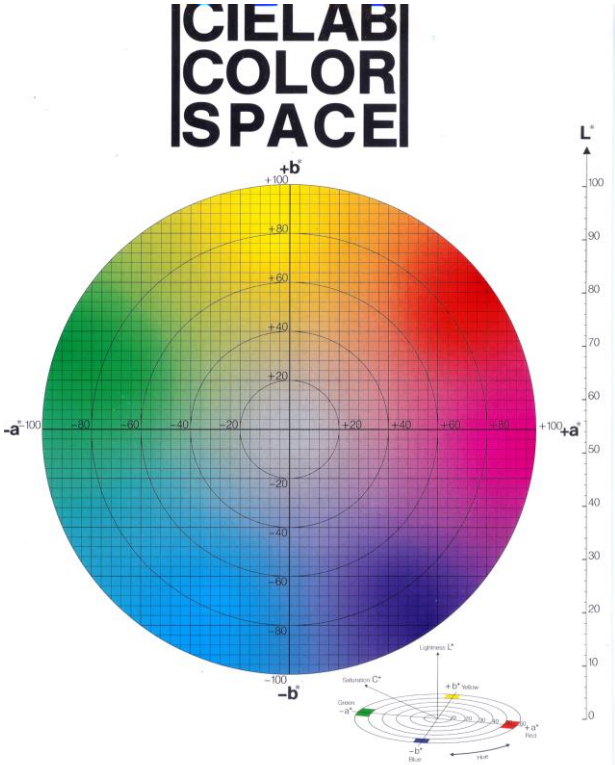
Object
(Reflectance factor)



Visual System
(Color Matching
Functions)

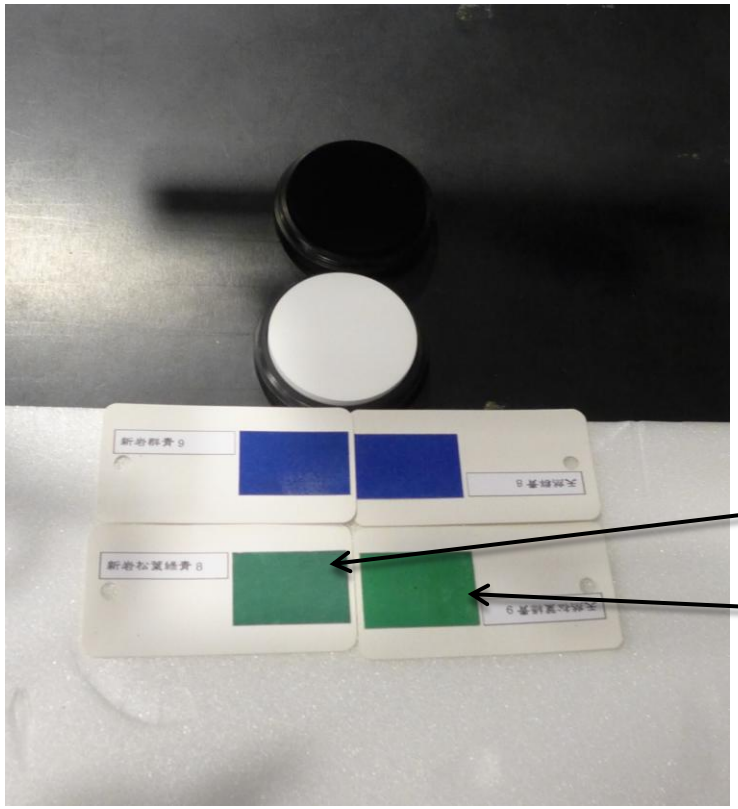
Colorimetry and Color Space

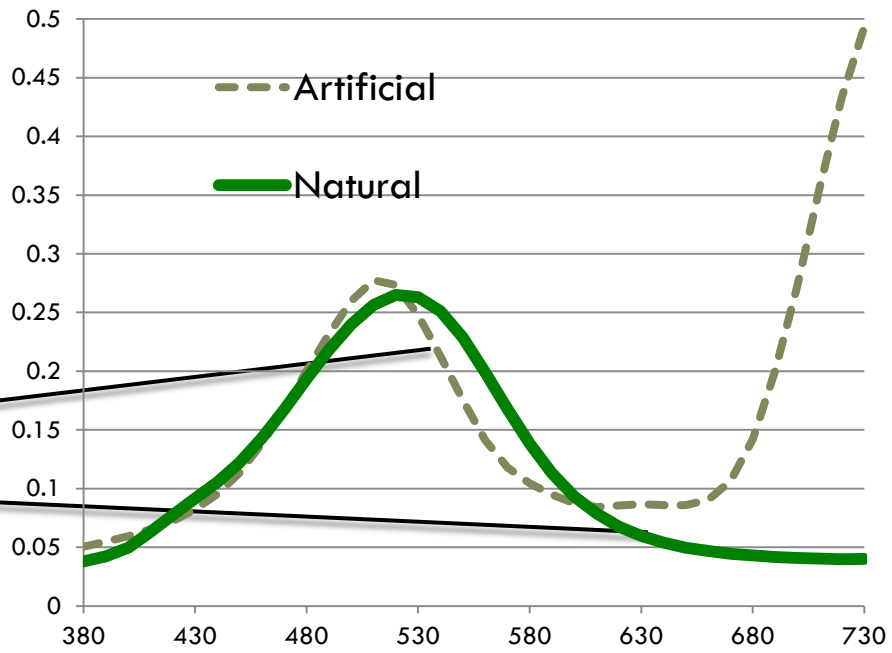
- Measurement Instrument and CIELAB Color Space
- Color matching by CIELAB value (Lightness, Chroma, Hue)



Spectral Characteristics of Pigments

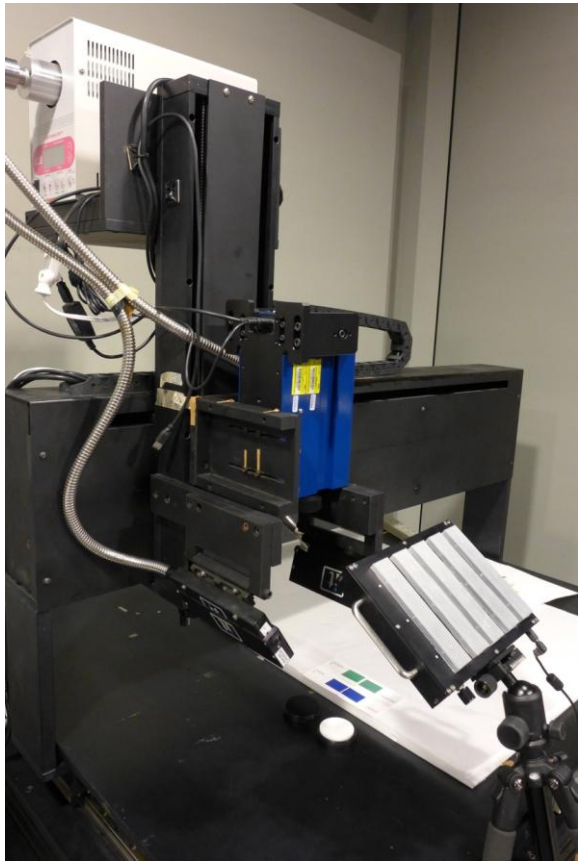
- Natural pigment(right) v. s. artificial pigment(left)

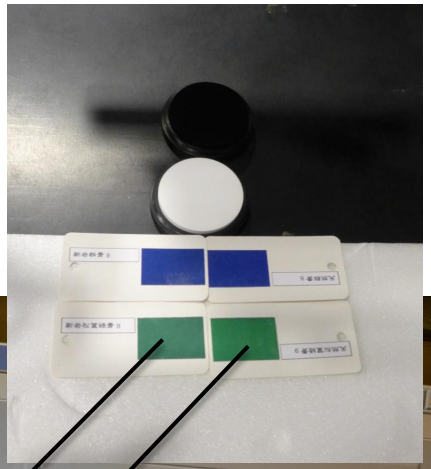


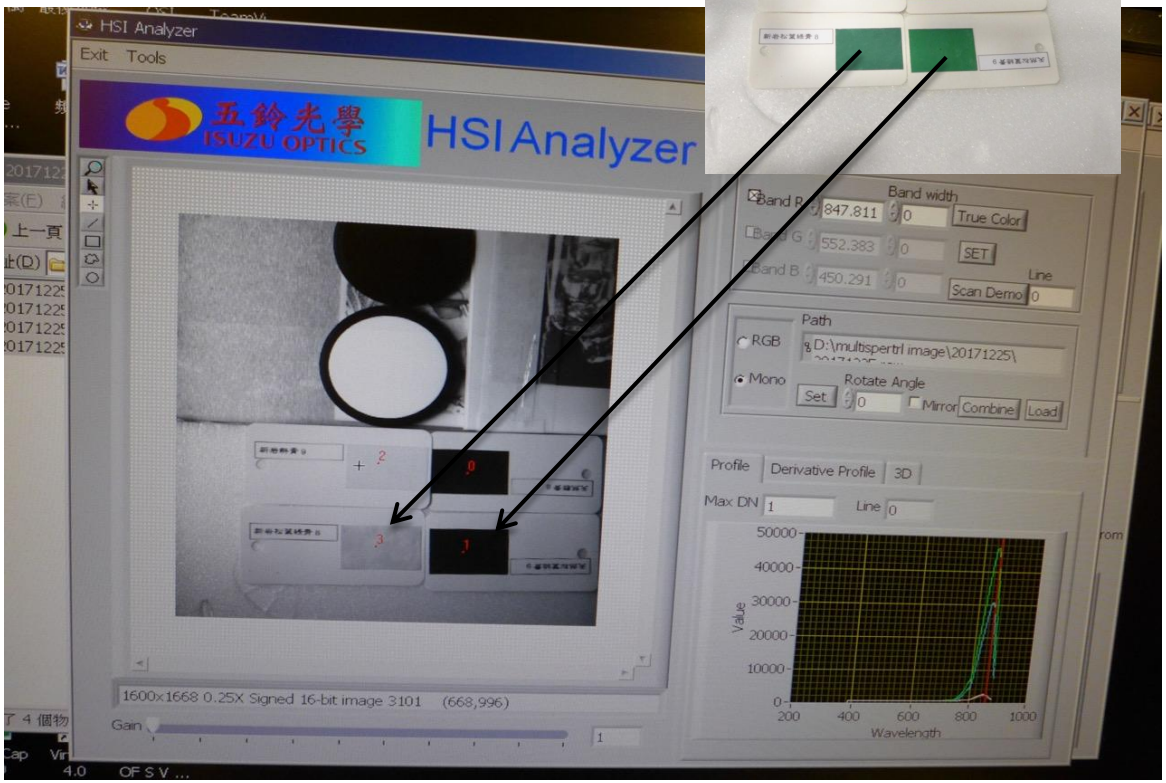


Spectral Camera to Capture Images

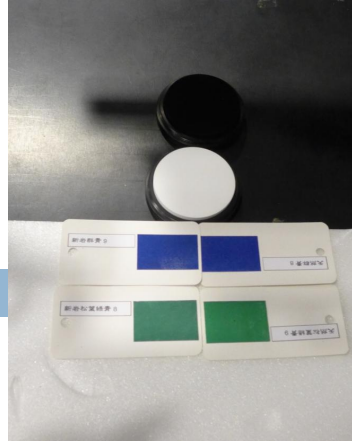
- Natural pigment become black under IR
- Artificial pigments become white under IR



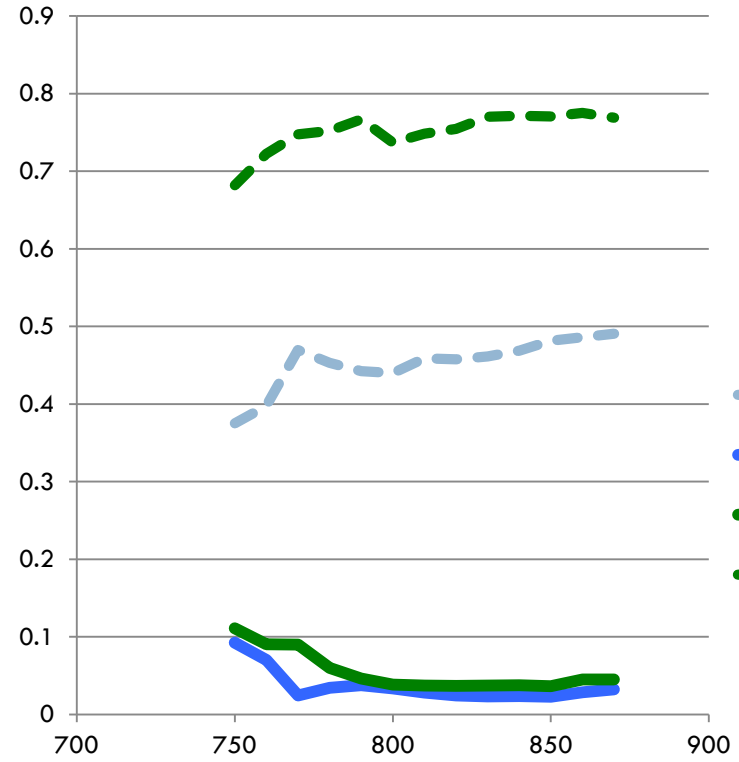


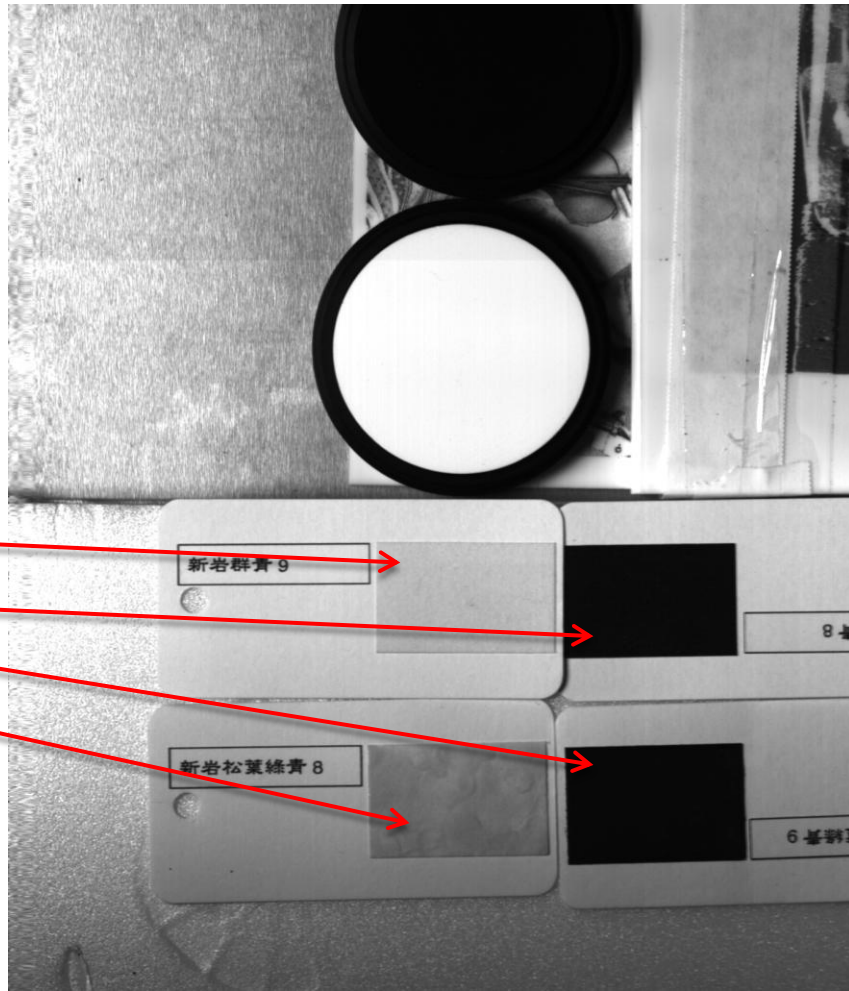


Narrow Band IR images



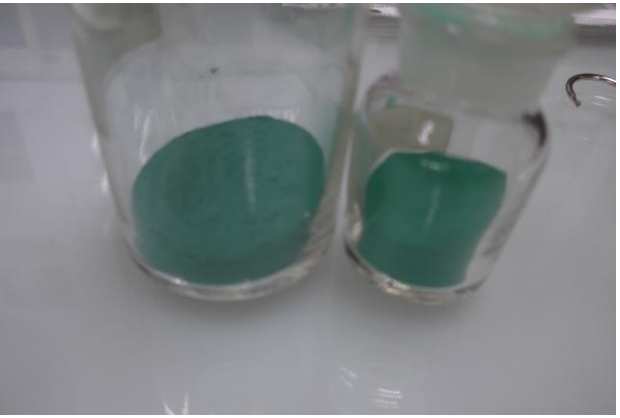
- Image from 850nm to 860nm

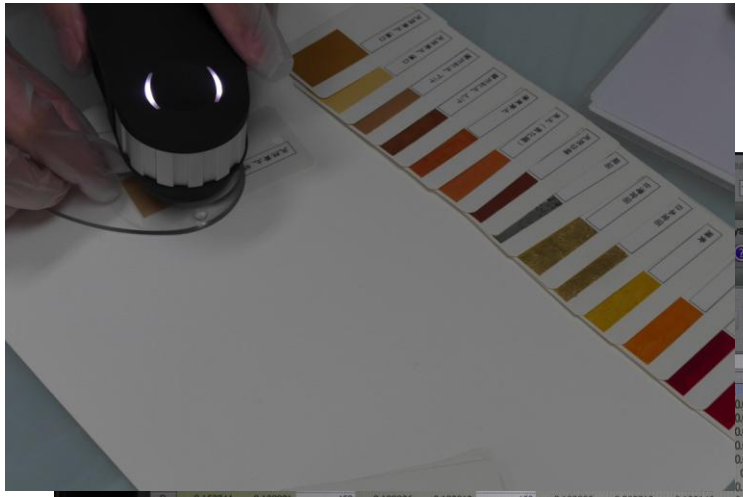




Proposed Spectral Database Design

- Measure the spectral data
  - Colorimetric data (CIELAB)
  - Narrow Band NIR (spectral reflectance)



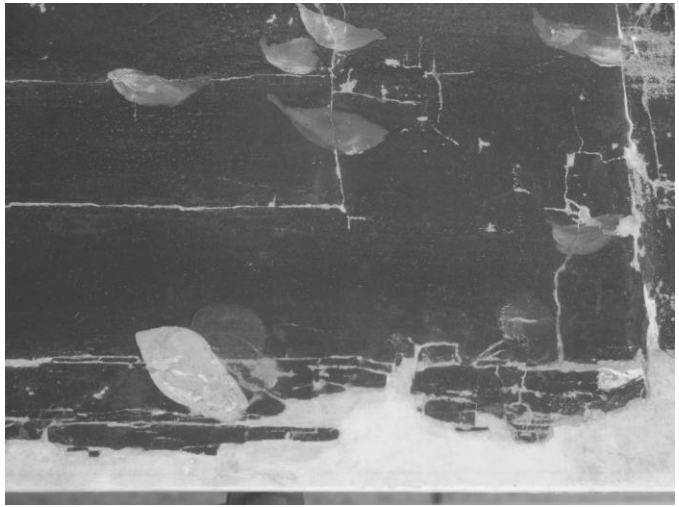


Workflow for Proposed Method

- Construct the spectral reflectance
  - Record the CIELAB values (visible)
  - Record the invisible narrow band reflectance values
- Selection criteria
  - Minimum CIELAB color difference
  - Maximum spectral difference (Narrow band)
- Use it as compensation color
- Identifiable by spectral imaging

Results:

(Artist: CHEN Chin)

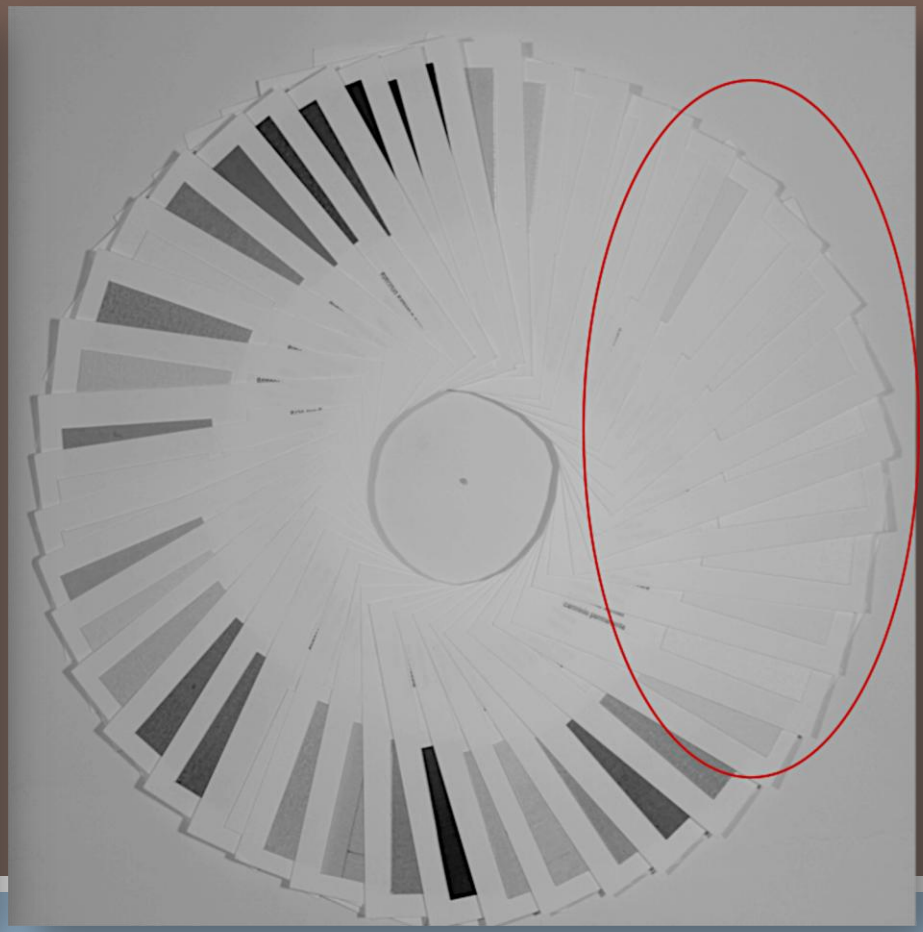


Summary

- An enhanced color compensation method is proposed in selecting replacing pigment
  - Maintain identifiable and reversible
  - Color match in visible band
  - Maximized difference in invisible band
- A new application for spectral imaging

- Thank you for your attention.

可見光與非可見光的交互應用



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