Stamp Colors

Towards a Stamp-Oriented Color Guide: Objectifying Classification by Color

John M. Cibulskis, Ph.D.

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Two Views of Color Varieties

- The Color is the Thing: Different inks or paper can contribute to color varieties, but the main thing is the COLOR.
- The Printing is the Thing: Different printings usually will use different Inks; Different Inks give rise to different colors. So the Color varieties help to distinguish between PRINTINGS.

Stamp Colors

Either way, we need to study stamp colors and be able to distinguish between them.

Do These Two Stamps have the Same Color?

- Mi 45 Stamps 1 and 6 from the Analysis

Steps to the Decision

- Decide on what you will mean by the "color" of a stamp.
- Determine the colors of the two stamps.
- Decide on an objective criteria for comparing the two colors.
- Determine an objective criteria for deciding whether the colors are "the same".

What will we mean by Color?

- NO: the physical description of color

  I am a philatelist, not a physicist.
- YES: a 3-dimensional numerical

  representation of the color that we can manipulate and study using a PC.
- There are three different color representations that we shall use in this study – they are called Color Models

The Three Color Models

- RGB - Red, Green, Blue
- HSL – Hue, Saturation, Luminance
- Lab – Luminance, a* and b*

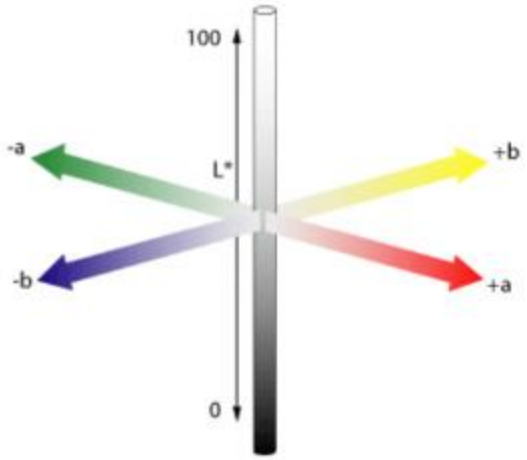
RGB

- Triples of integers in the range of 0-255
- These values come from a scanner
- 256 × 256 × 256 = 16,777,216 different colors
- R (Red), G (Green), B (Blue)
- Red = (255,0,0)
- Green = (0,255,0)
- Blue = (0,0,255)
- Black = (0,0,0)
- White = (255,255,255)
- All other colors are combinations of the RGB

HSL

- H (Hue), S (Saturation), L (Luminance)
- Hue – Basically, the “color”
  - Measured from 0 to 1, around a circle
  - 0 and 1 are both red; close to 0 or 1 are redish
  - 0.166 = Yellow; 0.33 = Green; 0.5 = Cyan; 0.66 = Blue; 0.833 = Magenta
- Saturation – The “Intensity” of the color
  - Measured from 0 to 1
  - near 0 = Grayish; near 1 = Strongest color
- Luminance – The “Brightness”
  - Measured from 0 to 1
  - 0 = Black, 1 = White, 0.5 = Brightest color

Lab



- L = Luminance (0 to 100 or 0 to 1)
- a negative = green, positive = red
- b negative = purple, positive = yellow
- I have no intuitive feeling for this model
  - But, it is USEFUL.

Determine the Color of a Stamp

- Scan the Stamp
- Extract Pixels in the Design
- The HS-Histogram
- Luminance

Scan the Stamp

- Select a Scanner
- Black Background
- Consistent Resolution (300 DPI)
- Consistent File Format (JPG)
- Consistent Naming Convention for Image Files

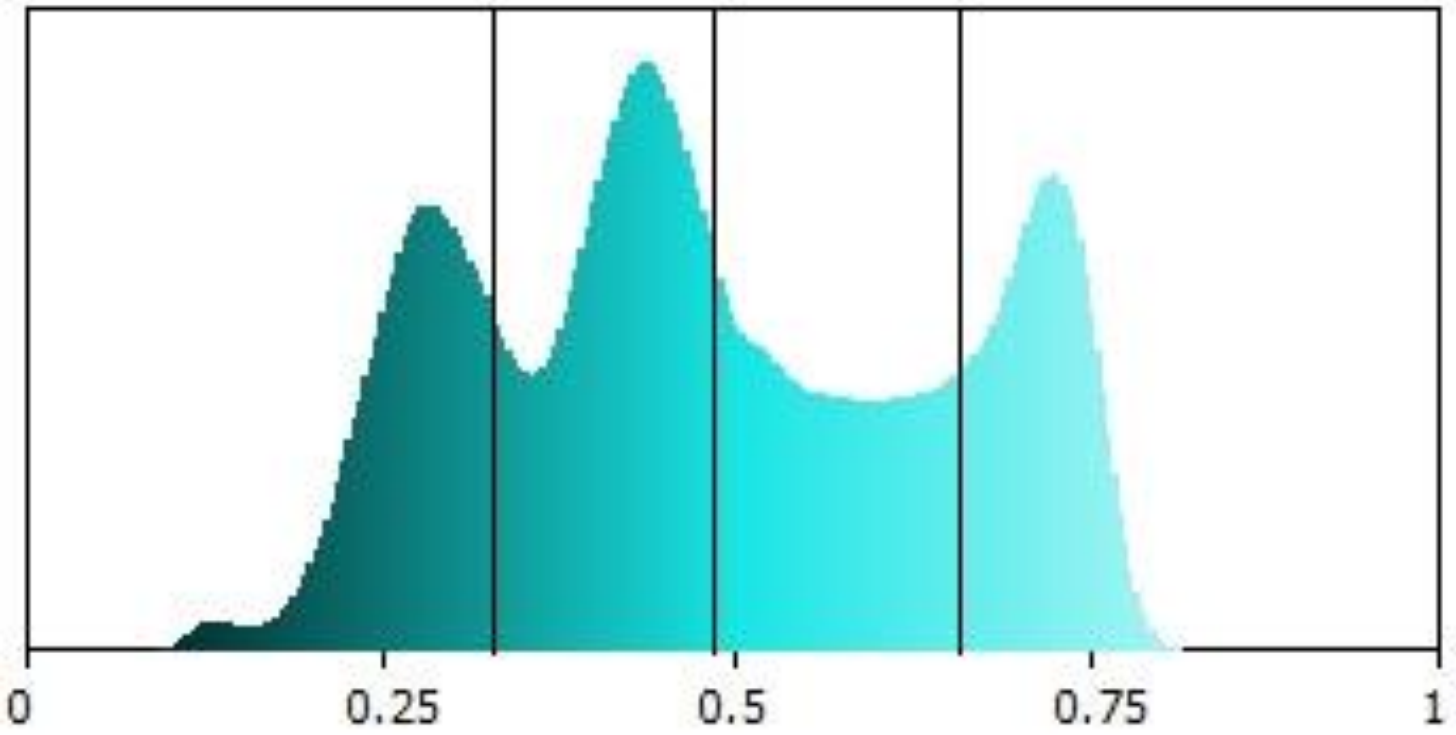
Extract the Pixels in the Design

- What Should We Use?
  - Only a Few Pixels?
  - All the Pixels?
- All the Pixels Contribute to the Overall Color Impression

How Did We Do That?

- Original Image
- Get Rid of All that Black Stuff

Luminance Histogram

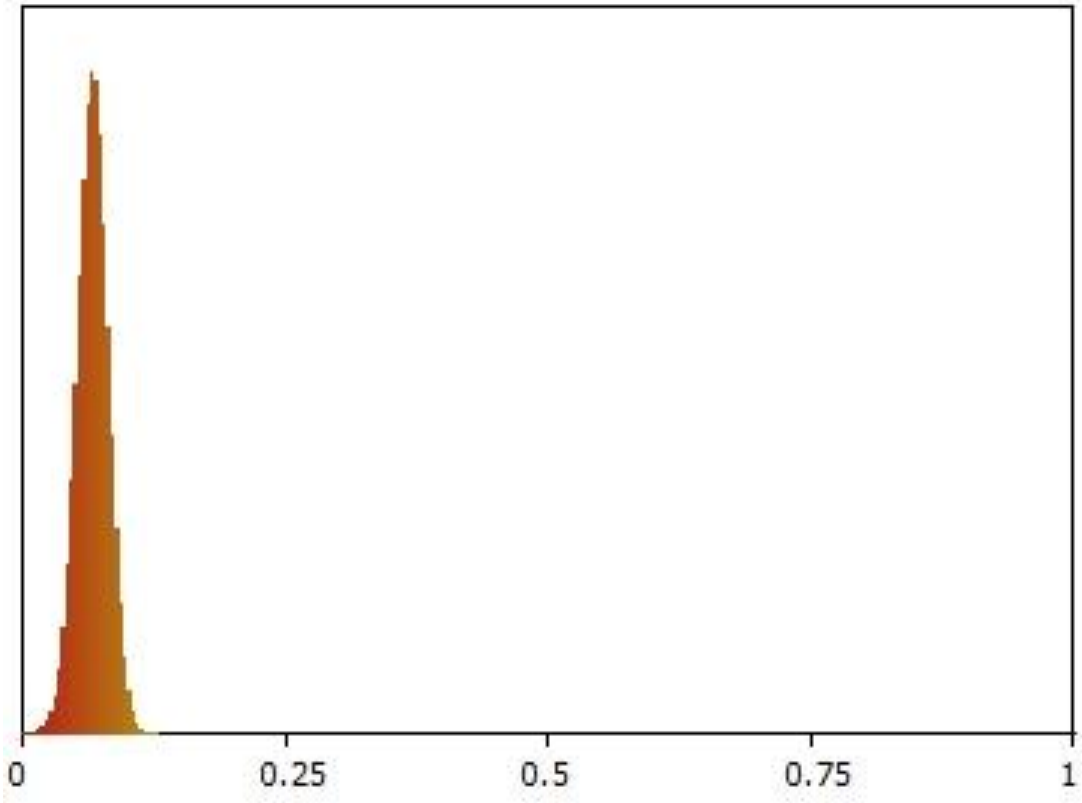


- Determine Which Pixels to Include
- Include Only the Pixels Whose Luminance Lies Between the Two Outer Vertical Lines
- The Center Vertical Line is the Average Luminance of Those Pixels

Included Pixels

- From This Point On, Only these Pixels Will Be Involved in the Analysis

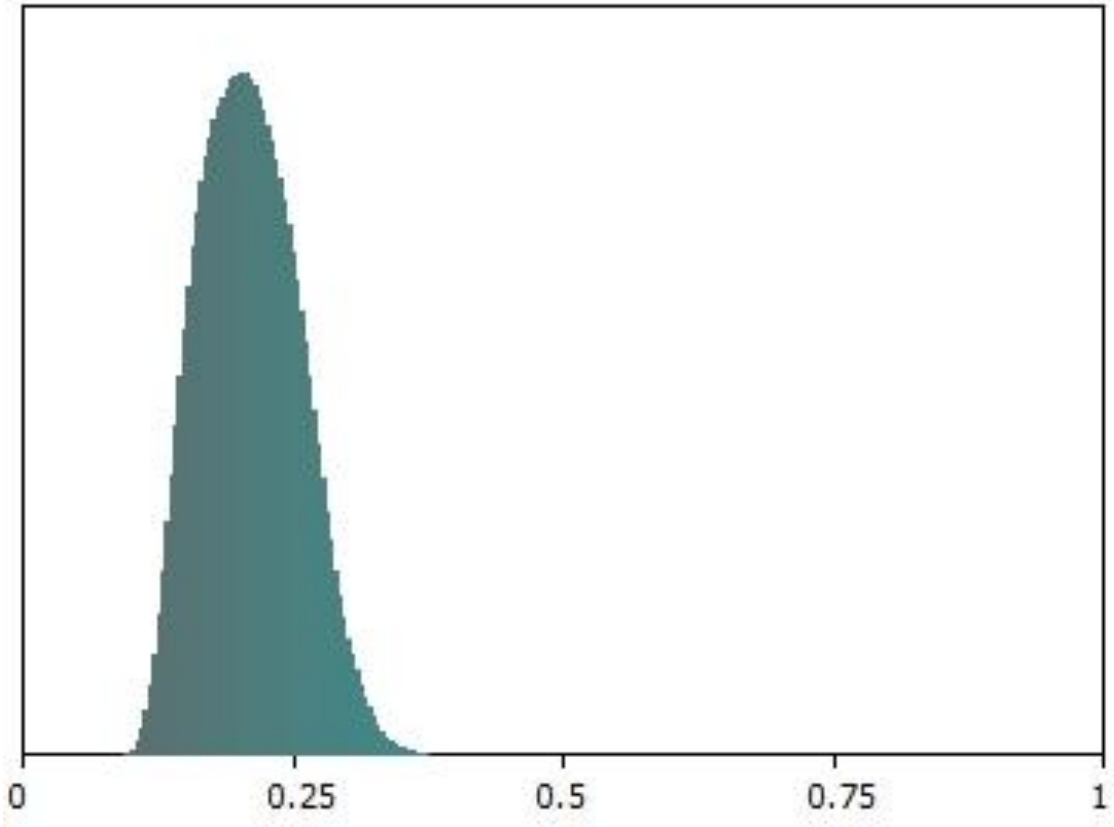
Hue Histogram



Horizontal Axis is the Hue (from 0=Red to 1=Red)

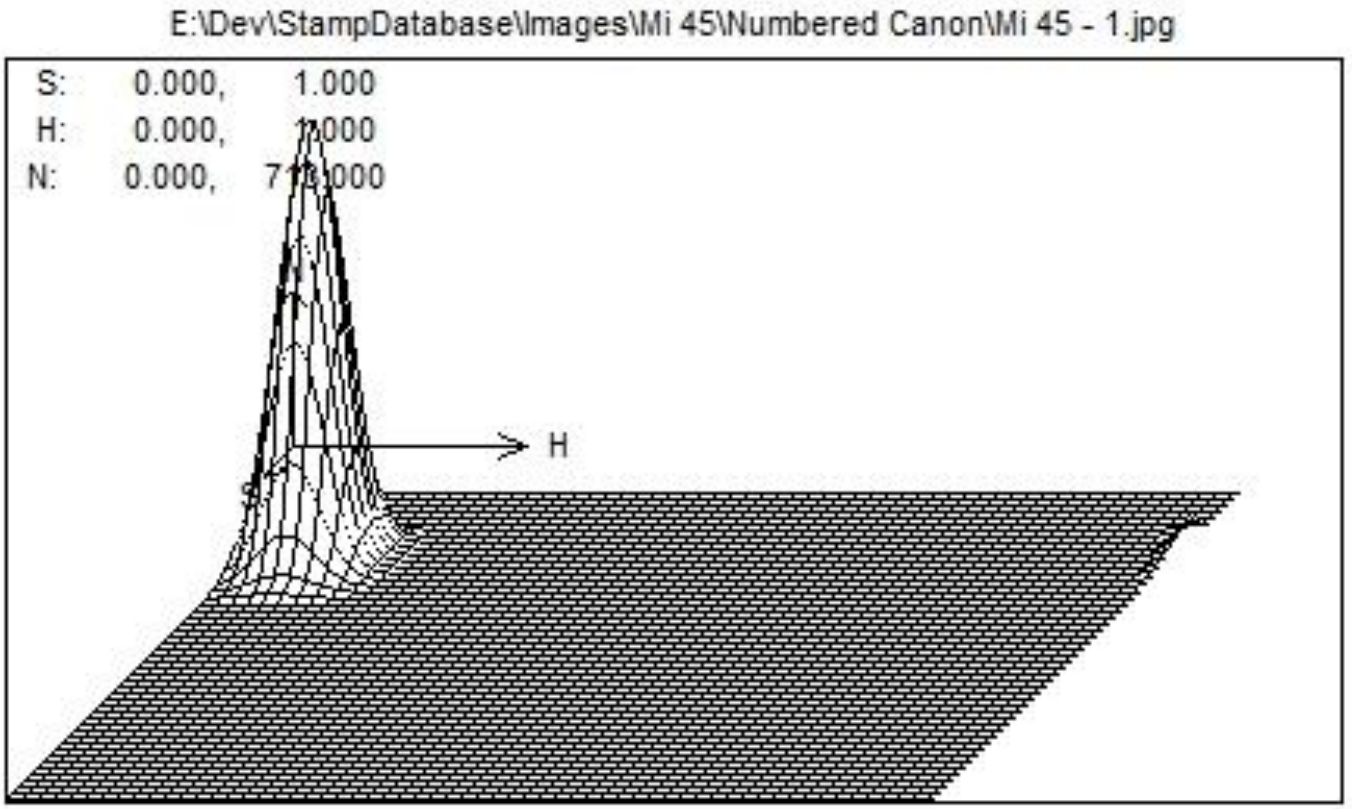
Vertical Axis is the Bucket Count

Saturation Histogram



Horizontal Axis is the Saturation (from 0=Gray to 1=Intense)
Vertical Axis is the Bucket Count

HS Histogram



Horizontal Axis is the Hue
Axis Coming Out At You is the Saturation
Vertical Axis is the Bucket Count

So What is the Color?

- The Luminance is the Average Luminance of the Included Pixels
- The Color is Either:

The Entire HS Histogram

or

The HS Coordinates of the Peak

Of Course, we must include the Luminance as the Third Component of the Color

The Simplest Route

- I have investigated both alternatives and I have found no real advantage to using the entire HS Histogram over just using the coordinates of the peak.
- Using the entire HS Histogram is much more complicated and much more computationally intensive than just using the HS coordinates of the peak.
- However, it does make you feel that you are looking at the entire design rather than just a few of its pixels.

Comparing Stamp Colors

- Using the HS-Histograms
  - One may have More Sample Pixels than the Other so we must first Normalize Them
  - Then Measure Their Degree of Similarity in One Way or Another
- Using the Coordinates of the Peak
  - Combine with Luminance to get HSL for the Colors
  - Convert to the CIE Lab Representation
  - Use the Distance DeltaE76 (1976 version) which is just the Euclidean Distance in the Lab Color Model

CIE ?

- CIE stands for
  - *Commission International de l'Eclairage*
  - *International Commission on Illumination*
- Why use DeltaE76 ?
  - Because it has been Studied
  - Distance 2.3 is Considered to be the "Just Noticeable Difference" Distance (JND)

When Are Two Stamps the Same Color?

- If their DeltaE76 Distance is Less than the JND

or

- If as part of a large lot, they are similar by comparison with the others

DeltaE76 Distance

- Their DeltaE76 Distance is 3.75 which is Larger than the JND
- Stamp 1 was dealer signed as type a and stamp 6 was dealer signed as type b

Clustering

- Idea is to break up the Lot into groups of stamps with the same color
- Apply some Clustering method to the Lot
- If the two stamps lie in the Same Cluster, conclude that they have the Same Color
- General Parameters of Clustering:
  - Clustering Process to Use
  - Distance (or Similarity) to use
  - Possibly the Number of Clusters to form
  - Other parameters specific to the Clustering Process

Show Some Clusters

- If time permits, show some clusters from the MS Word files.
  - Maximal Cliques
  - K-Means Clusters