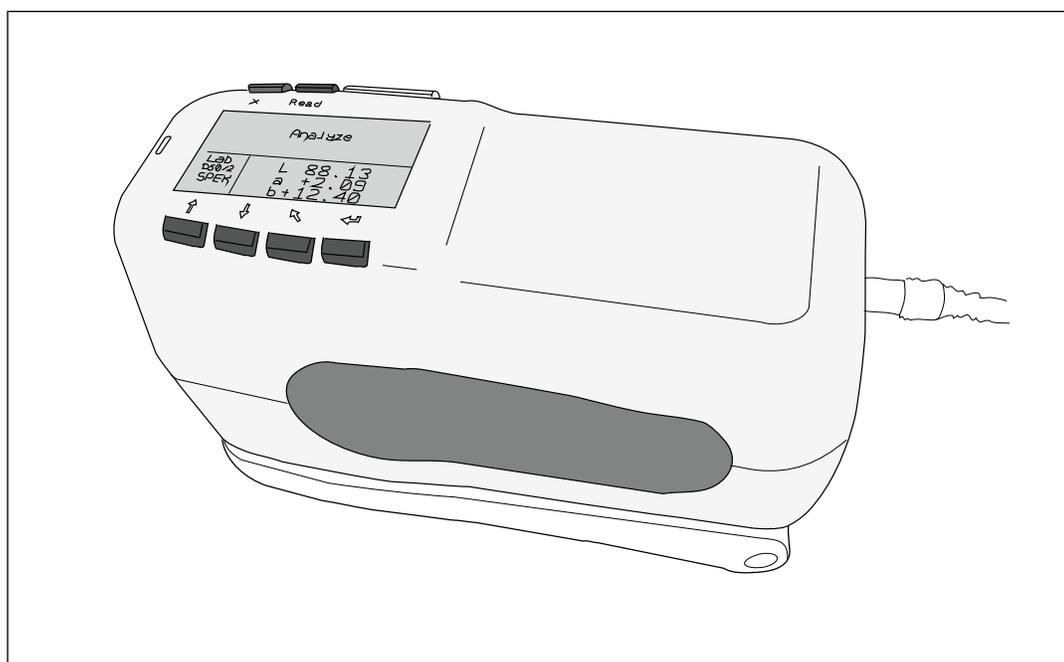# Determinate Hand Papermaking

VI

Paper Color Matching

Text and illustrations by
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# Calculating and blending half-stuff to visually match a target paper color

Whereas Lab color is designed to approximate human vision and is device-independent, RGB is the color space for computer monitors and CMYK is the color space for process printers; hence my use of Lab.

Paper color test sheets made from natural fibers with the addition of MgCO3, CaCO3 and formation aid. Made with an AeroPress

Expanded Photoshop Swatches palette with seven colors of pulp

Creating a paper of the same color (value and hue) of a target sheet is often done by trial and error or in-painting/tinting after the fact. To make a paper with a more accurate infill paper color, a spectrophotometer and Photoshop can be used to calculate the relative percentages of available dry pulp (half-stuff) needed to create a specific paper color when blended.

Note: *For these tests the half-stuff pulps were sourced from handmade paper suppliers. Additionally, I found various sources for raw fiber and textile cuttings that I processed into dry half-stuff; shredding, retting, cooking in soda ash, washing and beating/breaking in a Valley Iron Works beater. Additives: MgCO3 and CaCO3 were added during breaking. I made the furnish in an inverted-blade-blender for 2 to 3 minutes and added formation aid prior to sheet formation.*
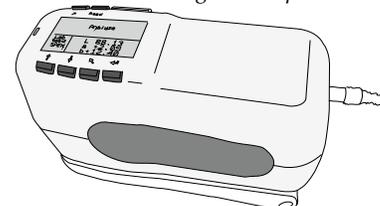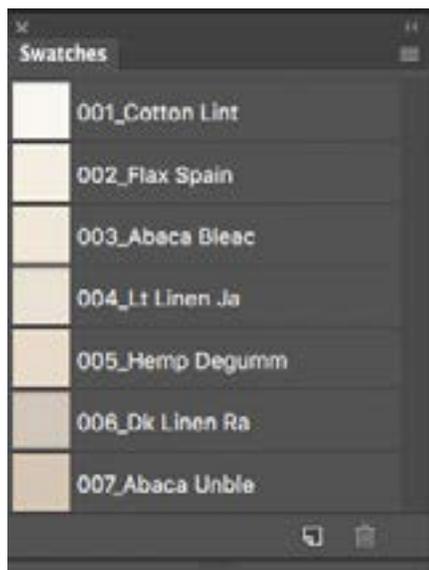

X-Rite Sphere Spectrophotometer

1 Make and document test pieces of paper from available pulp half-stuff you have on hand. (Use the fast and efficient Aero-Press techniques described in *Determinate Paper No. VII* for making small sheets). With the spectrophotometer set to "Analyze," measure the Lab values of each test paper.
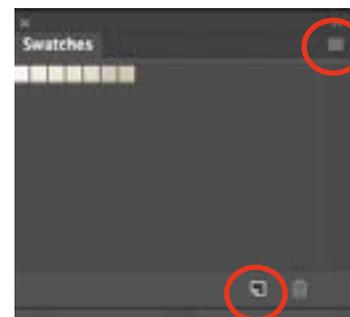
Fiber	L	a	b	
Cotton Linter	97	0	3	
Flax – Spain	94	1	6	
Abaca Bleached	92	1	8	
Lt Linen	90	1	7	
Hemp - Degummed	88	2	11	
Dk Linen	81	2	8	
Abaca Unbleached	81	3	11	

Documented Lab values of the sample sheets

2 In Photoshop, delete old swatch colors and make a new Swatch Palette propagated with the Lab values of colors obtained from your sample sheets. Swatch colors are made one at a time by clicking on the Tool Palette foreground color and editing the Lab values in Color Picker. When you add a color to swatches it will be the foreground color you

Swatches palette: "Pull Down Menu" & "New Swatch" circled

created. When all colors have been named and added to Swatches, click the palette menu and choose Save Swatches. Save as PulpPalette.aco

Calculating and blending pulp to match a target paper color (continued)

③ Use the spectrophotometer to measure the Lab value of the target sheet, sampling from non-image areas where the paper is not stained. Within Photoshop (in 8-bit RGB mode) make and fill a 10 pixel x 10 pixel rectangle with the Lab value of the target sheet. Note: In a 10 x 10 pixel square there are 100 pixels; although this small size is sufficient for our purposes, a 100 x 100 pixel document would be more accurate, giving 2 decimal places in your pulp-blending percentage formula.

④ Next, select from the main menu: Image > Mode > Indexed Color. To load your Pulp Palette use the pull-down menu: Custom > Load; find your PulpPalette.aco that you made of your pulp colors. Within that dialog box, change the settings to: Dither = Pattern, Forced = None and click OK. Photoshop will choose the closest colors in the PulpPalette.aco to render your target color.
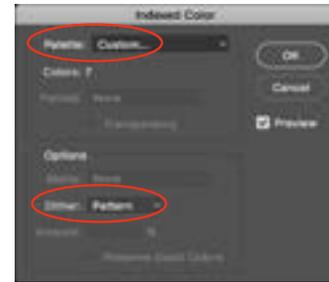
Note: The more colors of pulp in your palette, the more accurate your result. Photoshop's limit is 256 colors (8 bit).

⑤ Your small square is now "indexed" into the colors of your PulpPalette.aco. Zoom in so you can see the pixels. In this test, Photoshop chose three of the seven colors of pulp to best match our target color: Hemp, Bleached Abaca and Lt Linen Rag.
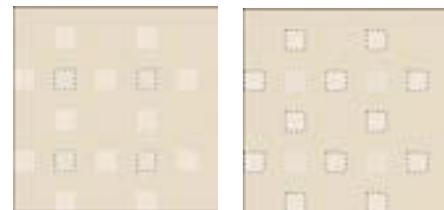
With the Magic Wand Tool set to a tolerance of 1, Anti-alias unchecked and Contiguous unchecked, choose one of the values with the magic wand. All colors of that value will then be selected.

Lab values: 88, 2, 11 = Hemp (84)
92, 1, 8 = Abaca bleached (12)
90, 1, 7 = Lt. Linen Rag (4)

⑥ As you select each of the 3 different sets of color pixels, the Histogram dialog box will show the number of pixels selected, which represents the percentage of pulp that should be used of each fiber type.

Note: To discern which fiber type a pixel value represents, open the Info Dialog box (from the Window pull-down menu). From the dialog's pull-down menu select Palette Options and set the CMYK space to show Lab values instead. Now, when you mouse over a pixel, you will see a Lab value of a pixel which you can compare to your master pulp list.
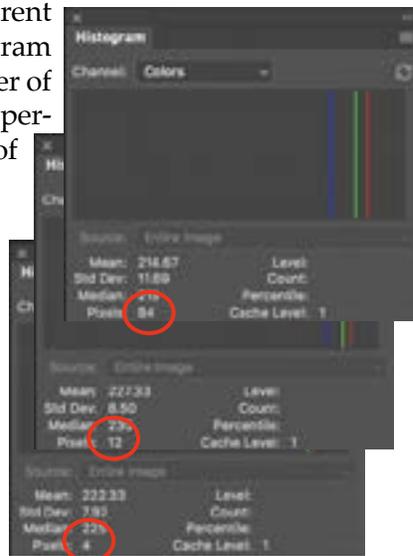
For this test the fibers are to be blended in these proportions:
84% Hemp • 12% Bleached Abaca • 4% Lt. Linen
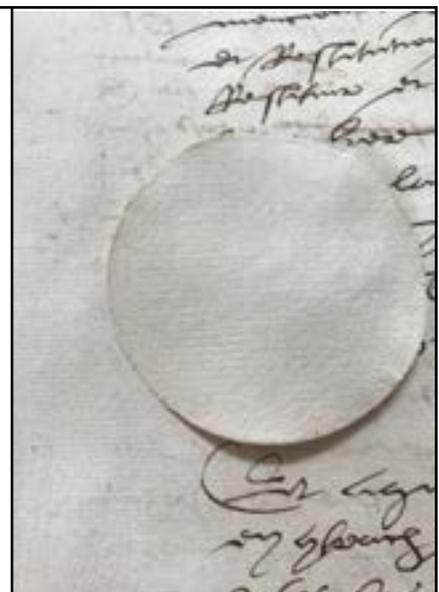
The result of this test: AeroPress laid paper made in test proportions, photographed on our target page from a 1547 manuscript.

Expanded Photoshop Swatches palette in Large List view

Swatches palette in Small Thumbnail view
Cotton linter, cotton rag and sisal have been set to black to prevent them from being chosen

Making subsets of pulp color palettes:
When working with a more extensive pulp color library, colors representing unwanted fibers may be turned off to eliminate the selection of those fibers. For example, when making a 16th century paper repair, the bright whites of cotton rag and cotton linter might not be desirable. Since we are indexing to a palette of available colors, we must remove the unwanted color(s) from the palette and then re-index, per the steps below:

1. In the Swatches palette drop-down menu, choose "Replace swatches" and select your saved pulp color palette. Be sure you are viewing swatches in list view: in the Swatches palette drop-down menu, choose "Small Thumbnail" or "Large List" view. If you labeled your colors, the name of each fiber will appear alongside its swatch color in "Large List" mode.

2. Open Preset Manager from the Swatches palette drop-down menu.

3. Within this dialog box, right-click (control-click) on the swatch and delete the undesirable fiber color(s). Alternatively, set their Lab value to 0,0,0 (black).

4. Select "Save swatches" from the Swatches palette drop-down menu. Take note where you are saving and choose a unique name, noting removed fiber(s).

Magnolia Pulp Swatches				6/24/17
Description	L	a	b	Color
1 Cotton Linter	97	0	3	
2 Cotton Rag Bleached (Cheny)	96	0	2	
3 Flax Spain	94	1	6	
4 Kozo Bleached H2O2	93	0	5	
5 Linen - Lt RL Marin	93	0	4	
6 Abaca Bleached	92	1	8	
7 Linen - Lt Jacquard	90	1	7	
8 50/50 Hemp dg, Lt Linen Jacq	90	1	8	
9 Flax bleached Cave ppr 1/4" cut	90	0	9	
10 Hemp Degummed	88	2	11	
11 Jute Mexico Coffee Bag	87	2	10	
12 Kozo Unbl solvent exchange	84	3	12	
13 Linen - Dk Rag jacquard	81	2	8	
14 Abaca Unbleached	81	3	11	
15 Linen -Dk RL Marin	80	2	9	
16 Gampi unbleached	77	4	17	
17 Sisal cooked hand beaten	73	4	17	
18 Flax Roving Cooked	69	2	10	

Example: an AeroPress test sheet reveals the need to remove Sisal (color 17) from the palette: In the test on the left (paper disk), my sisal half-stuff (made from coffee-retted bean sacks) was part of the color formula but added many speckles that were not appropriate for the project. After re-moving that swatch and re-indexing to the limited palette, I had a new recipe with which to work, sans sisal. Photoshop compensated by adding more and less of other swatch colors, resulting in a color blending formula that was nearly perfect.

Series links:

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