

BASED IN SCIENCE

- The hue angles and chroma scale for pigments are defined by CIECAM02, a color appearance model that accounts for viewing context and which is recommended for judgement of surface colors by Bruce MacEvoy.
- Edge color circuits show the lines traced through CIECAM02 by the two spectral "edge color" series, which encompass purely "warm" and "cool" colors. Hues centered in these loops (blues and oranges) are the safest for CVD accessibility. Greens & pinks are neither warm nor cool.
- Color names around the ring reflect the most frequent basic color categories perceived and named by English speakers, based on the research of Mylonas & MacDonald. I've also marked approximate centroids of some frequently used names for high- or low-chroma variations: cyan, indigo, magenta, maroon, brown, and olive.
- Artist's pigment hue/chroma positions are based on Bruce MacEvoy's average spectrophotometer readings of watercolors (except PB86).

USE THIS RESOURCE TO

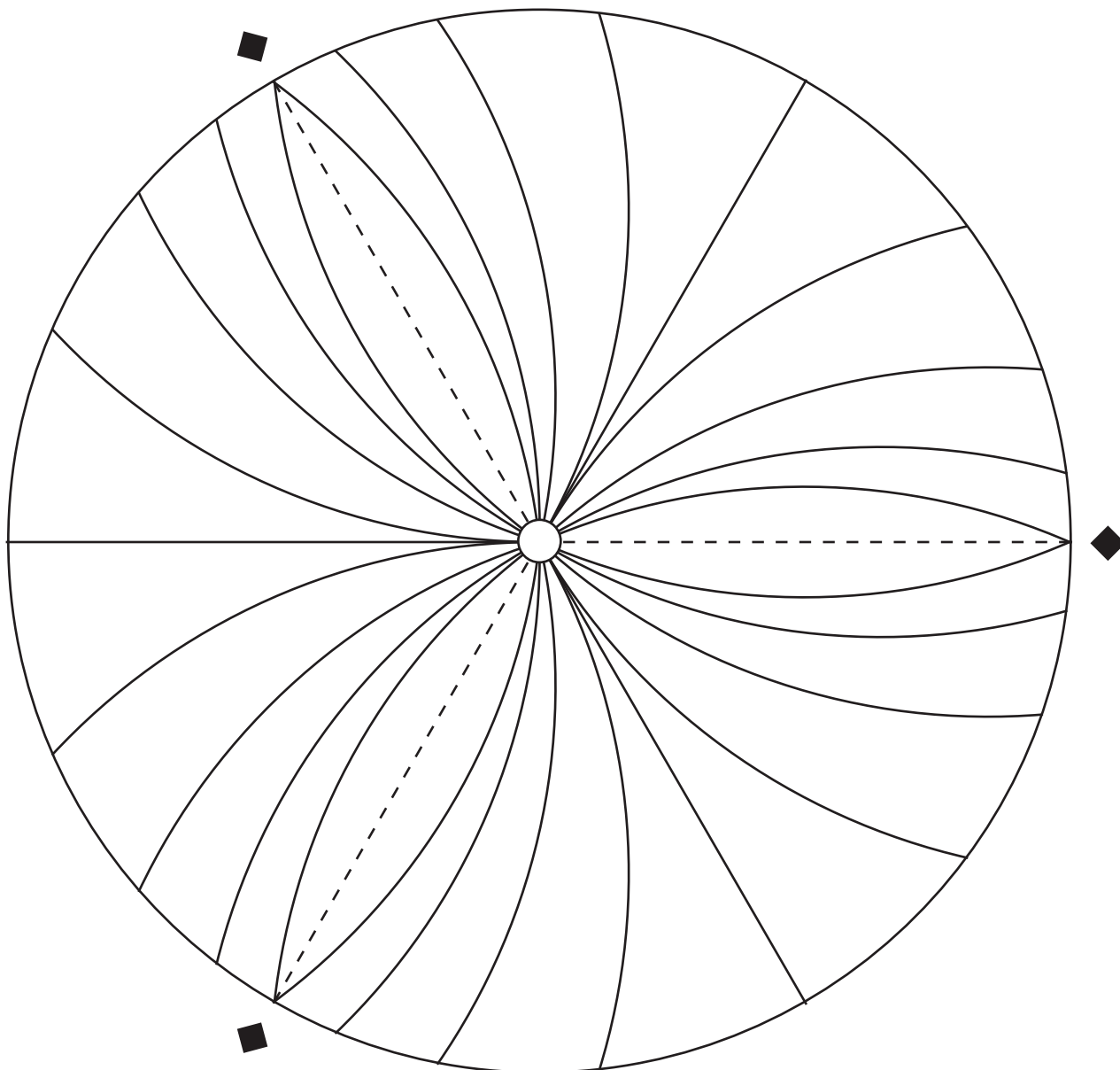
- communicate about color across disciplines and across colorspaces.
- assess correct perceptual color complements, which are based in additive mixing, not pigment mixing, and are opposite each other on this wheel.
- plan harmonious palettes with gamut masking, a method described by James Gurney.
- estimate the chroma cost of mixing two paint pigments. Pigment mixing is not purely subtractive, and mixing paths follow curves through the colorspace influenced by a bias toward the additive primaries (Red, Green, Blue-Violet). Use the TRILLIUM overlay to predict the hue/chroma curvature when two pigments are mixed.

THE COLORDISK Version 7.1

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CAVEAT: Be aware that the token colors presented on this ColorDisk will not correctly print on CMYK printers nor accurately display all colors on RGB screens. This tool is NOT designed for color-matching or color identification.

THE TRILLIUM



WHAT IS THE “TRILLIUM” ?

Most artists know paint mixing is different from additive mixing. But most also wrongly assume paints mix subtractively. Paint mixture, or the integration of different-colored pigments in a viscous medium, is a compromise between subtractive and optical mixing. (Harald Küppers called it integrative mixing.)

Named after the three-petaled flower it resembles, the **Trillium** is a pattern of curved and straight lines that emerges in predictive models of pigment mixing, such as Kubelka-Munk theory and Scott Burns’ “weighted geometric mean” approach. The pattern’s ability to predict the bias of paint mixtures is not infallible, but is far more accurate than other methods that assume pigments mix on straight lines through a perceptual colorspace.

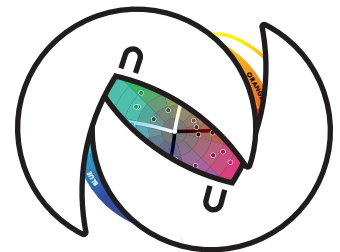
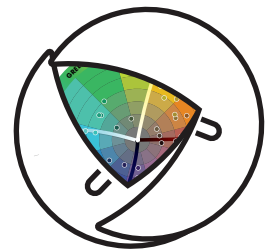
HOW TO USE THE OVERLAY

- Print this page on clear acetate.
- Select a **starting** pigment and a **target** pigment. Center the overlay on the starting pigment’s dot on the ColorDisk. Do NOT rotate the Trillium; it should always be aligned the same way.
- The lines of the Trillium pattern will then predict how the starting and target pigments on the ColorDisk will interact, with a reasonable degree of accuracy. (No two-dimensional figure can predict pigment mixture with complete accuracy, because different pigments have different scattering and absorption coefficients at every visible wavelength; a pigment’s transparency/opacity will also influence its mixing path.)
- **EXAMPLE:** Center the Trillium on PG7 (Phthalo Green). The curved line connecting it to PBr7.BS (Burnt Sienna) tells us to expect these pigments to mix through a near-neutral. If we follow the curve beyond the edge of the Trillium toward PR122 (Quinacridone Magenta), the model predicts it will mix with PG7 to create low-chroma violets and purples. Some quick mixing on your palette will bear this out.
- When centered on the ColorDisk, the Trillium will predict hue shifts when **white** is added to a pigment. For example, cool reds will shift toward magenta as they lighten.

Don’t have acetate? you can print the ColorDisk and Trillium on regular printer paper, and use a light table or bright window to see through the paper.

GAMUT MASKS

EXAMPLES OF USE



HOW TO USE THE GAMUT MASKS

Use the Gamut Planner to explore and troubleshoot limited palettes.

Print this on cardstock, and cut out both "C" shapes. to create handy "knobs," cut the small tabs with a craft knife and bend up. These knobs will make it easier to slide and rotate the masks.

By arranging the shutters to obscure some areas of the colordisk and reveal others, you can approximate the range of low-saturation hues and neutrals available when you choose specific pigments as "subjective primaries."

Through experimentation, you will discover that the Gamut Planner can't show all possible limited palettes, but will show a greater variety of color plans than the classical "color harmonies" you may have learned in school.

GAMUT MASKS



LET'S REDEFINE BASIC COLOR TERMINOLOGY:

GAMUT

the range of colors that can be mixed from a given set of primary colors.

PRIMARY COLOR

a color at the corner of a gamut.

SECONDARY COLOR

a color along the edge of a gamut.

TERTIARY COLOR

a color within the area of a gamut, not on the edge or at the corner.

NEUTRAL

the color at the geometric center of a gamut.

COMPLEMENTS

a pair of colors which perceptually neutralize each other within a given gamut; colored light stimuli that when mixed neutralize to perceived white.

*Note that paint pigments with perceptually complementary colors may or may not mix to gray, the perceptual neutral of the total gamut of human vision. The quirks of how pigments mix should not limit the way you define visual contrasts or harmonies.

PIGMENT LIST

CIECAM02 HUE
COLOUR
INDEX

98	PY35	Cadmium Lemon ☼
97	PY184	Bismuth Yellow
86	PY129	Copper Azo Green-Gold
89	PY154	Benzimidazolone Yellow
82	PY35	Cadmium Yellow ☼
77	PY150	Nickel Azo Yellow
?	PY83	Disazo Yellow
63	PY110	Isoindoline Yellow
63	PY35	Cadmium Yellow Deep ☼
≈64	PY43	Yellow Ochre
≈55	PY42	Gold Ochre
44	PO20	Cadmium Orange ☼
35	PO48†	Quinacridone Orange
37	PO73	Pyrrole Orange
	PBr7	Natural Iron Oxides (Raw & Burnt Umber Raw & Burnt Sienna, Mars Violet / Caput Mortuum)
≈30	PR101	Venetian Red
20	PR179	Perylene Maroon
24	PR108	Cadmium Red ☼
24	PR254	Pyrrole Red
22	PR209	Quinacridone Red
	PW6	Titanium White

CIECAM02
COLOUR
INDEX

≈18	PV19	Quinacridone Rose
7	PV19	Quinacridone Violet
1	PR122	Quinacridone Magenta
266,299	PV15	Ultramarine Violet BS & RS
331	PV16	Manganese Violet ☼
334	PV49	Cobalt Violet Light ☼
299	PV23	Dioxazine Violet
271	PB60	Indanthrone Blue
245	PB27	Prussian Blue
245	PB28	Cobalt Blue ☼
254	PB29	Ultramarine Blue
237	PB15	Phthalo Blue
231	PB35	Cerulean Blue
201	PB36.T	Cobalt Turquoise
223	PB33†	Manganese Blue ☼
217	PB16	Phthalo Turquoise
199	PG50	Cobalt Titanate Green / Teal ☼
178	PG7	Phthalo Green
177	PG18	Viridian
180	PG26	Cobalt Green Dark ☼
139	PG17	Chromium Oxide Green
162	PG36	Phthalo Green YS
	PBk7	Ivory/Bone Black
	PBk26	Spinel Black

THE COLORDISK 7.0 - Simplified

