Aardenburg

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IMAGING & ARCHIVES

Accelerated Light Fading Test Results

Canon Pro9000, Canon OEM Chromalife 100, Canon Photo Paper Pro

Sample # AaI_20081103_SN001

160 Megalux-hours completed

Conservation Display Rating *	
Lower Exposure Limit (Megalux hours)	Upper Exposure limit (Megalux hours)
3	12

* Please read document **AaI_2009_0118_TA-01.pdf**, "**An Overview of the AaI&A Conservation Display Ratings**", located on the Documents page of the AaI&A website for an explanation of the conservation display ratings.

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Test Print Prepared by: AaI&A member

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About this Report

This report contains light fastness information about a single test print produced by a specific digital printing system. "System" refers to all hardware, software, and materials used to make the finished print. The hardware, software, material components, and printmaker's skills contribute to the final image quality and image permanence. The tested sample is made with current or recently discontinued stocks of commercially available products unless otherwise stated. Each sample has been prepared by Aardenburg Imaging & Archives or one of its members in accordance with customary print making practices unless otherwise noted. The sample may also contain additional finishing materials such as overcoats and laminates which are also noted when used. Finally, the sample has been tested under standardized conditions that are defined on the Sample Description page (see page 2). AaI&A makes every effort to ensure but cannot guarantee that the samples are properly identified and documented and that test results are accurate. For this reason, AaI&A also strives to test independently produced sample replicates in order to increase sampling confidence and to provide information on process variability. Please compare the results in this report to replicate test samples when the data become available.

Understanding the Test Results



AaI_StandardColorSet(v2)forSRGB.tif

The magnitude and visual appearance of fading depends not only on the chosen printing system but the chosen image as well. In other words, different images are comprised of different colors, and the fading relationships between those colors dictate how the image will look as it fades. The sample print in this test report was made by reproducing the digital image shown on the left. It contains 30 standard colors. 24 of the colors are colorimetrically matched to the Macbeth ColorChecker™ chart viewed under D50 illumination. The remaining six colors supplement the ColorChecker™ array with four additional skin tone colors, one patch for paper white, and another for maximum black. The additional colors also round out the distribution of L* lightness values in the test target.

Information about the fading characteristics of the product is provided in three ways:

1) ***You can visually assess the fading.*** The target images reproduced in this report are digitally reconstructed from the spectrally measured color data rather than scanning or otherwise reproducing the physical print by conventional techniques. This method ensures a colorimetrically accurate representation of the print appearance as the print fades. A calibrated monitor is recommended to experience the best possible reproduction of the test sample appearance. The side-by-side presentation of the target images simulates looking at the light-exposed print along side a perfect duplicate of the unexposed original print. The "Before/After" Layer mode takes advantage of Adobe Reader Layer technology. Toggle the "Before/After" layer on and off using the layers feature of Adobe Reader to directly switch between the light exposed print colors and the initial print colors for the image located on the right side of each page. Also, use Adobe Reader's full screen mode to cycle through the pages and "animate" the fading.

2) ***I* Color and tonal accuracy scores are reported.*** This report includes I* metric scores that compare the color and tonal relationships of the light exposed samples to the color and tonal relationships existing in the original print prior to light exposure. Perfect I* scores of 100% can be approached when no significant fading occurs. Average scores above 90% generally indicate excellent retention of original quality, 80% good, 70% fair, etc., but your conclusions may vary depending on your image quality requirements. ***I* color*** rates the retained color accuracy (hue and chroma) while ***I* tone*** rates the retained tonal accuracy (lightness and contrast). The score is on a percentile scale where 100% is a perfect match between the comparison image (e.g., "after" light exposure) and the reference image (e.g., "before" any light exposure). 0% ***I* color*** means no color accuracy is left. 0% ***I* tone*** means essentially no tonality remains and all image information content is lost. Negative I* values have significance as well and contribute to the average I* score when they occur. Negative I* color values mean false color has occurred, for example, when a skin tone turns green or a neutral gray becomes distinctly colorful. Negative I* tone scores mean visual contrast between colors has become inverted (i.e., like the tonal relationships in a photographic film negative). Serious image quality problems must arise before false colors and/or tones appear. For more information on the I* metric, please refer to the AaI&A web site.

3) ***Color changes are also reported using the classic color difference model, ΔE.*** Note that ΔE values lose perceptual scaling significance when they become large (e.g., > 15). Also, the ΔE equation does not unambiguously measure changes in image contrast. This limitation is generally not a problem for paints and textiles, but can be a serious oversight when evaluating photographic images. It was a major reason behind the development of the I* metric.

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Sample Description

Printer: Canon Pro9000
Ink: Canon OEM Chromalife 100
Paper: Canon Photo Paper Pro

Sample #: AaI_20081103_SN001
Test Print Prepared by: AaI&A member, category: amateur



AaI_StandardColorSet(v2)forSRGB.tif

Test Image: AaI_StandardColorSet(v2)forSRGB.tif
RIP/Driver settings: PS/CS3/Canon OEM driver, print quality = "fine", color adjustment off
Media Setting: "Photo Paper Pro"

Printed: November 3, 2008
Original print colors measured on: March 12, 2009
Test started on: March 20, 2009

Profile: AaI_CnPro9000_CnPhProGl(1).icm **Rendering Intent:** Perceptual
Profile type: Custom, made by AaI&A staff
Profile Creation Software: Gretag/Macbeth Profilemaker 5.08

Paper White Color (UV–included versus UV–excluded) and Maximum Printed Black						
Optical Brighteners present? yes	L*		a*		b*	
	UV inc	UV exc	UV inc	UV exc	UV inc	UV exc
Maximum Paper White (no colorants printed)	96.0	95.8	-0.5	-1.0	-1.2	1.0
(1) ΔL*, Δa*, Δb* respectively	0.2		0.5		2.2	
(1) Calculated differences, especially for Δb*, indicate the role and magnitude of fluorescence on original paper color						
Maximum Printed black (UV included)	L* = 8.2		a* = 0.1		b* = -1.8	

Light Source: Phillips Colortone F40T12/C50
Filter/Glazing: Sample framed under Glass*
Light Exposure Cycle: 8 hours on, 4 hours off, twice per 24 hours
Average Illuminance during "on" cycle: 11,946 Lux
Average Temperature: 23.3˚C over full test duration, 24.8˚C during light exposure
Average Relative humidity: 57.1%RH full test period, 57.2%RH during light exposure
CIELAB measurements: D50 2˚ observer, Xrite Gretag/Macbeth Spectrolino/Spectroscan

Replicates/Compare to:

No Replicates are available at this time.

Notes/Comments:

* The Phillips Colortone F40T12/C50 fluorescent light source and ordinary glass picture frame glazing yields UVA content and overall spectral power similar to natural 5000˚K daylight entering a window and then striking a print that has been framed by **standard acrylic glazing** rather than ordinary glass. Other light sources and/or different glazing options may yield greater or lesser fade rates (generally, a 2-5x increase in fade rate for direct sunlight compared to UV–excluded sources at the same Lux level). The spectral quality of the light can also affect individual colors differently.

May 11, 2009 – 10 megalux hours: The preferential amount of change in patch E5 (skin shadow L*=11) has been observed in other dye-based ink systems in early stages of AaI&A light fade testing as well. See, for example, the Epson R1400/Epson Claria ink/microporus paper sample # AaI_20080222_SN001 test results. Whether this is a strickly light-induced phenomenon affecting high ink load color patches in particular or whether there are related dye diffusion and migration issues that help to account for the observed behavior is not clear. Patch E5 contains large amount of cyan, magenta, and yellow/orange inks that occupy much of the micropore volume in the paper after printing. No pigment-based ink systems have shown a similar behavior in light fade testing to date.

Table to Convert Megalux-hours of Light Exposure to estimated "Years on Display"											
Indoor Light Levels for Print Display		Multiply Mlux-hrs by	Megalux-hours in test									
Light Exposure	**Description**		**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**
≤ 10 Lux 24 hours per day	Interior rooms, storage areas, or hallways without windows, illuminated sparingly by artificial lighting	**11.42**	114	228	342	457	571	685	799	913	1027	1142
50 Lux 12 hours per day	"Museum Standard" display condition	**4.57**	46	91	137	183	228	274	325	365	411	457
120 Lux 12 hours per day "Kodak Display Years" (1)	Average home illumination level for photos is ~ 60 lux. 90% of all displayed photos do not exceed 120 lux (1).	**1.90**	19	38	57	76	95	114	133	152	171	190
228 Lux 12 hours per day	Relatively bright home or office. Note the simple 1:1 relationship between "years on display" and Mlux-hr values at this condition.	**1.00**	10	20	30	40	50	60	70	80	90	100
450 Lux 12 hours per day "WIR Display Years" (2) Also equals 500 lux for 11.8 hours per day	A bright home or commercial office building illumination level is 200-500 lux. Also, good illumination for color critical viewing and color matching tasks begins at about 500 lux.	**0.51**	5	10	15	20	25	30	35	41	46	51
2000 Lux 12 hours per day	Commercial Gallery. Also, critical color evaluation standards call for 2000 lux and a D50 illumination source.	**0.114**	1.1	2.3	3.4	4.6	5.7	6.8	8.0	9.1	10.3	11.4
5000 Lux 12 hours per day	E.g., Sunlight through a window striking print at an angle.	**0.046**	0.5	0.9	1.4	1.8	2.3	2.7	3.2	3.7	4.1	4.6
10,000 Lux 12 hours per day	South-facing window in U.S.A. , e.g., storefront display with photos directly facing window.	**0.023**	0.2	0.5	0.7	0.9	1.1	1.4	1.6	1.8	2.1	2.3

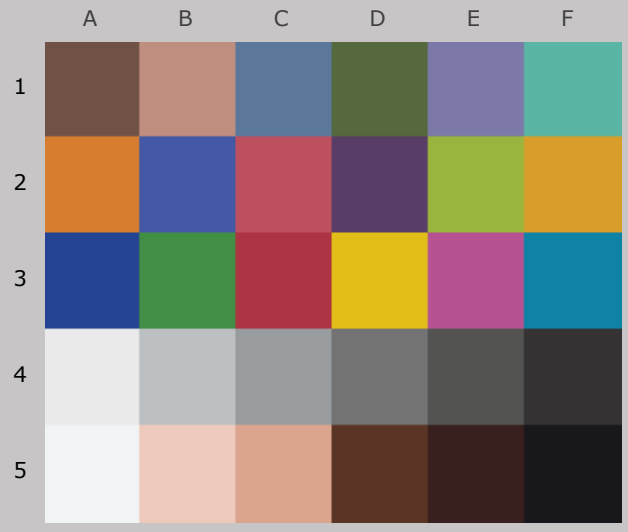
Light levels commonly encountered in the real world fluctuate widely throughout indoor print display environments and produce large variations in how long it takes for artwork to acquire light-induced damage. Use this table as a guide to estimate how many "years on display" (denoted in red text) it takes to accumulate the light exposure test dosage. Review the test results to decide which Megalux-hour dose has caused fading to your level of concern (e.g., just noticeable, easily noticeable, objectionable, etc.). Then choose the print display description that best represents how your print is likely to be displayed. You may want to obtain a lux meter and make some measurements in your own display environment!

Note that as the years of display time increase, light-induced fading can be eclipsed by other serious aging mechanisms such as fading and/or staining caused by heat, humidity, and air pollutants. Mould damage can also occur at high humidity. Even when colorants remain water fast, direct contact with liquids may result in physical deformation and staining of the substrate. Also, temperature and especially humidity cycling can cause physical cracks and/or flaking, etc. Handling damage such as scratching, abrasion, tears and creases, and catastrophic damage by smoke, fire, flood, etc., also degrade print quality over time. Thus, as illumination levels are reduced other forms of degradation take on greater proportion of risk and may appear in shorter time intervals.

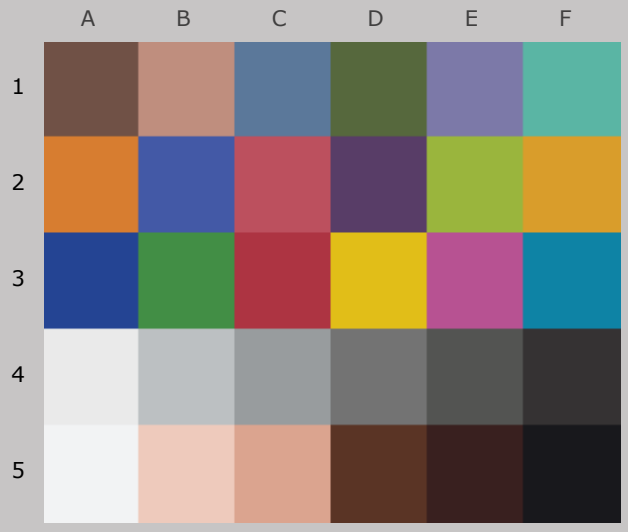
(1) Eastman Kodak has cited this exposure condition and 90% confidence limit as a rationale for estimating print fading times of traditional color photo materials in typical home display environments. For recent light fading claims regarding its line of pigment-based inkjet printers, Kodak has adopted the higher level of 450lux/12 hours per day which is also used by Wilhelm Imaging Research, Inc. (See below).

(2) Wilhelm Imaging Research (WIR) has standardized its light fastness ratings on 450 lux for 12 hours per day in order to estimate the years on display necessary to reach "noticeable" fading. This average light exposure condition, an assumed 75°F/60%RH temperature and humidity level, and WIR's visually weighted densitometric endpoint criteria set V3.0 has become a de facto industry standard for most predictive light fading estimates in the absence of a published International Standards Organization (ISO) test standard.

100color/100tone



Original Print Colors
(measured before light exposure)



Colors at Zero Megalux-hours of Light Exposure
(same as original print colors)

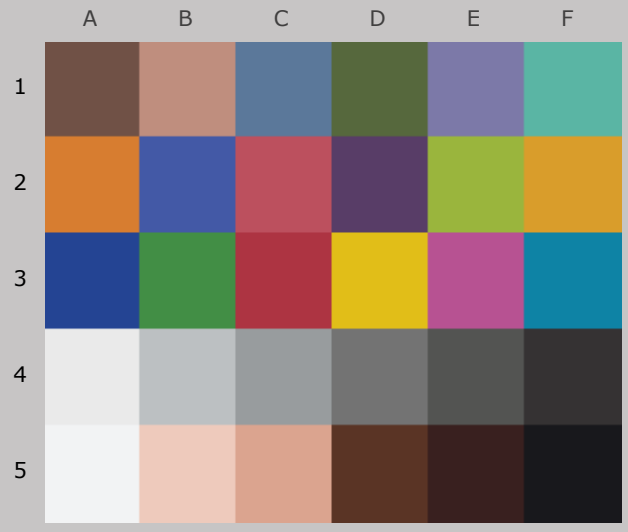
Canon Pro9000, Canon OEM Chromalife 100, Canon Photo Paper Pro

Original Print Colors as Measured and at Start of Test

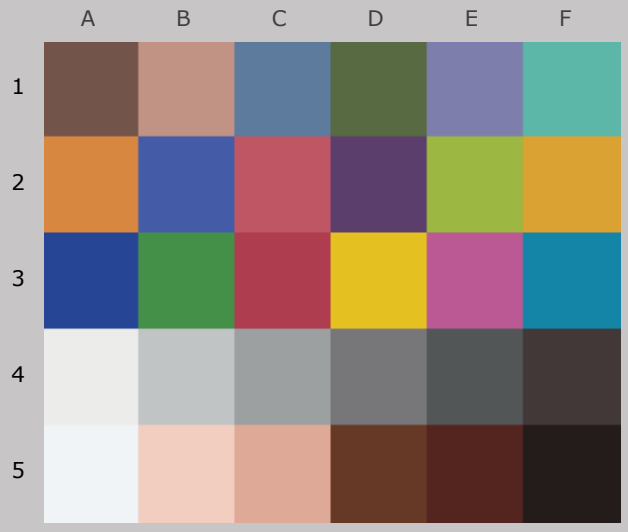
				L*		a*		b*	
Column/row	Color Patch	I*Color	ΔE	Before	After	Before	After	Before	After
A1	dark Skin	100.0	0.0	37.6		11.6		11.6	
B1	light Skin	100.0	0.0	63.4		17.1		16.3	
C1	blue sky	100.0	0.0	49.0		-4.3		-22.3	
D1	foliage	100.0	0.0	41.5		-13.1		20.8	
E1	blue flower	100.0	0.0	52.7		8.5		-25.1	
F1	bluish green	100.0	0.0	67.7		-31.8		0.3	
A2	orange	100.0	0.0	61.5		31.2		54.6	
B2	purplish blue	100.0	0.0	39.2		10.0		-44.7	
C2	moderate red	100.0	0.0	48.9		44.9		15.3	
D2	purple	100.0	0.0	30.1		19.3		-20.9	
E2	yellow green	100.0	0.0	69.8		-21.9		55.1	
F2	orange yellow	100.0	0.0	69.3		16.3		64.0	
A3	blue	100.0	0.0	30.2		11.0		-48.1	
B3	green	100.0	0.0	53.0		-35.9		31.1	
C3	red	100.0	0.0	41.1		49.8		21.6	
D3	yellow	100.0	0.0	78.3		3.4		76.0	
E3	magenta	100.0	0.0	50.0		46.8		-14.6	
F3	cyan	100.0	0.0	50.3		-21.5		-26.9	
A4	white	100.0	0.0	92.6		0.1		-0.1	
B4	neutral 8	100.0	0.0	77.8		-0.6		-1.0	
C4	neutral 6.5	100.0	0.0	64.4		-0.6		-1.0	
D4	neutral 5	100.0	0.0	48.8		0.2		0.1	
E4	neutral 3.5	100.0	0.0	35.5		-1.1		1.2	
F4	black	100.0	0.0	21.1		1.1		-0.4	
A5	paper white	100.0	0.0	95.5		-0.3		-1.4	
B5	skin highlight L*=89	100.0	0.0	84.3		11.6		11.8	
C5	skin highlight L*=75	100.0	0.0	72.2		18.9		18.9	
D5	skin shadow L*=25	100.0	0.0	26.5		16.1		17.3	
E5	skin shadow L*=11	100.0	0.0	15.5		12.1		6.4	
F5	Max Black	100.0	0.0	8.2		0.1		-1.8	

Summary Results	I*Color	I*tone	ΔE
Average Score for all patches	100	100	0.0
Average Score for the Worst 10% (3 lowest scoring patches)	100	100	0.0

91.3color/93.0tone



Original Print Colors
(measured before light exposure)



Colors after 10 Megalux-hours
light exposure

Canon Pro9000, Canon OEM Chromalife 100,
Canon Photo Paper Pro

10 Mlux-hrs Light Exposure (i.e., after) Compared to Original Print Colors (i.e., before)

				L*		a*		b*	
Column/row	Color Patch	I*Color	ΔE	Before	After	Before	After	Before	After
A1	dark Skin	97.7	1.6	37.6	38.9	11.6	11.5	11.6	10.7
B1	light Skin	95.9	2.1	63.4	65.0	17.1	16.4	16.3	15.0
C1	blue sky	100.0	1.1	49.0	50.1	-4.3	-4.5	-22.3	-22.3
D1	foliage	99.6	1.2	41.5	42.5	-13.1	-13.2	20.8	20.2
E1	blue flower	98.4	1.6	52.7	54.0	8.5	7.9	-25.1	-24.5
F1	bluish green	98.4	1.3	67.7	68.5	-31.8	-31.5	0.3	-0.6
A2	orange	91.5	6.3	61.5	63.7	31.2	27.4	54.6	50.1
B2	purplish blue	98.5	1.5	39.2	40.2	10.0	9.1	-44.7	-43.9
C2	moderate red	98.0	2.3	48.9	50.8	44.9	44.1	15.3	14.2
D2	purple	98.6	1.4	30.1	31.1	19.3	19.8	-20.9	-21.7
E2	yellow green	98.7	1.6	69.8	70.7	-21.9	-22.2	55.1	53.9
F2	orange yellow	97.0	2.8	69.3	70.7	16.3	14.9	64.0	62.0
A3	blue	100.0	0.8	30.2	31.0	11.0	10.7	-48.1	-48.0
B3	green	99.0	1.3	53.0	53.8	-35.9	-35.9	31.1	30.2
C3	red	89.1	6.7	41.1	43.2	49.8	48.3	21.6	15.4
D3	yellow	98.7	1.8	78.3	79.3	3.4	2.6	76.0	74.8
E3	magenta	96.7	2.8	50.0	51.9	46.8	45.3	-14.6	-13.1
F3	cyan	100.0	0.9	50.3	51.1	-21.5	-21.4	-26.9	-27.1
A4	white	97.3	1.0	92.6	93.3	0.1	-0.2	-0.1	0.6
B4	neutral 8	98.9	1.2	77.8	78.9	-0.6	-1.1	-1.0	-0.7
C4	neutral 6.5	99.2	1.4	64.4	65.6	-0.6	-1.0	-1.0	-1.4
D4	neutral 5	95.9	1.5	48.8	50.1	0.2	0.1	0.1	-0.8
E4	neutral 3.5	94.4	1.5	35.5	36.6	-1.1	-0.9	1.2	0.2
F4	black	72.5	4.4	21.1	24.3	1.1	3.5	-0.4	1.5
A5	paper white	96.9	0.9	95.5	95.9	-0.3	-0.6	-1.4	-0.6
B5	skin highlight L*=89	97.4	1.5	84.3	85.5	11.6	10.7	11.8	11.9
C5	skin highlight L*=75	95.3	2.3	72.2	73.7	18.9	18.0	18.9	17.4
D5	skin shadow L*=25	84.8	5.1	26.5	29.6	16.1	18.8	17.3	20.4
E5	skin shadow L*=11	10.0	14.0	15.5	21.0	12.1	22.1	6.4	14.5
F5	Max Black	41.3	6.6	8.2	10.8	0.1	5.1	-1.8	1.7

Summary Results	I*Color	I*tone	ΔE
Average Score for all patches	91.3	93.0	2.7
Average Score for the Worst 10% (3 lowest scoring patches)	41.2	83.9	9.1



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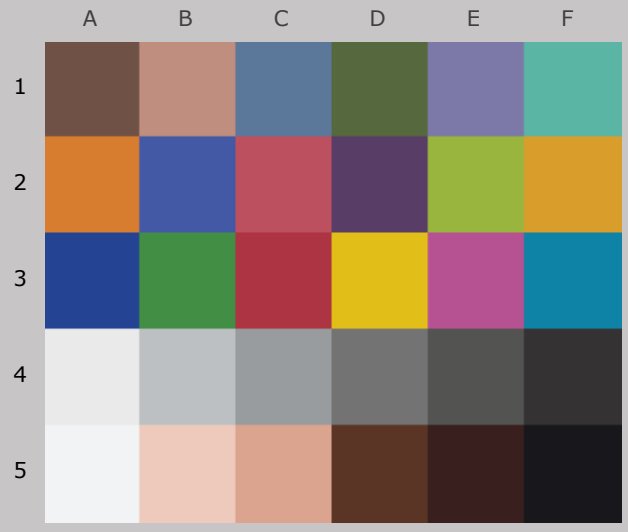
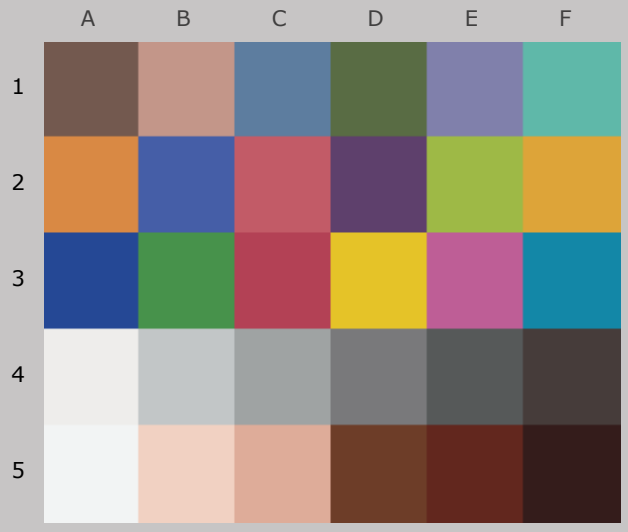
84.3color/88.9tone



Original Print Colors
(measured before light exposure)



Colors after 20 Megalux-hours
light exposure

Canon Pro9000, Canon OEM Chromalife 100,
Canon Photo Paper Pro

20 Mlux-hrs Light Exposure (i.e., after) Compared to Original Print Colors (i.e., before)

				L*		a*		b*	
Column/row	Color Patch	I*Color	ΔE	Before	After	Before	After	Before	After
A1	dark Skin	95.9	2.6	37.6	39.8	11.6	11.2	11.6	10.5
B1	light Skin	92.1	3.6	63.4	66.2	17.1	15.9	16.3	14.3
C1	blue sky	98.5	2.1	49.0	51.0	-4.3	-4.8	-22.3	-21.6
D1	foliage	100.0	1.8	41.5	43.3	-13.1	-13.2	20.8	20.4
E1	blue flower	93.7	3.1	52.7	55.0	8.5	7.2	-25.1	-23.4
F1	bluish green	97.8	1.8	67.7	69.1	-31.8	-31.2	0.3	-0.7
A2	orange	89.0	8.1	61.5	64.9	31.2	26.5	54.6	48.9
B2	purplish blue	94.9	3.4	39.2	41.0	10.0	8.2	-44.7	-42.5
C2	moderate red	96.4	3.9	48.9	52.1	44.9	43.4	15.3	13.7
D2	purple	99.8	1.9	30.1	31.9	19.3	19.8	-20.9	-21.2
E2	yellow green	98.0	2.3	69.8	71.3	-21.9	-22.2	55.1	53.5
F2	orange yellow	94.9	4.5	69.3	71.7	16.3	14.2	64.0	60.9
A3	blue	97.9	2.0	30.2	31.5	11.0	10.0	-48.1	-47.0
B3	green	99.0	1.8	53.0	54.5	-35.9	-35.7	31.1	30.2
C3	red	87.3	8.2	41.1	44.6	49.8	48.1	21.6	14.4
D3	yellow	97.5	2.9	78.3	80.0	3.4	2.1	76.0	74.0
E3	magenta	93.2	5.1	50.0	53.3	46.8	44.1	-14.6	-11.8
F3	cyan	100.0	1.6	50.3	51.8	-21.5	-21.6	-26.9	-26.5
A4	white	91.0	1.7	92.6	93.6	0.1	-0.4	-0.1	1.2
B4	neutral 8	96.7	2.0	77.8	79.6	-0.6	-1.3	-1.0	-0.6
C4	neutral 6.5	97.8	2.3	64.4	66.5	-0.6	-1.2	-1.0	-1.4
D4	neutral 5	97.8	2.3	48.8	51.0	0.2	0.0	0.1	-0.6
E4	neutral 3.5	97.3	2.1	35.5	37.5	-1.1	-0.9	1.2	0.5
F4	black	58.1	6.8	21.1	26.1	1.1	4.2	-0.4	2.8
A5	paper white	89.1	1.7	95.5	96.1	-0.3	-0.7	-1.4	0.2
B5	skin highlight L*=89	94.2	2.4	84.3	86.2	11.6	10.2	11.8	11.8
C5	skin highlight L*=75	91.8	3.7	72.2	74.7	18.9	17.4	18.9	16.7
D5	skin shadow L*=25	76.9	7.6	26.5	31.2	16.1	19.7	17.3	22.1
E5	skin shadow L*=11	-43.1	22.1	15.5	24.7	12.1	27.1	6.4	19.9
F5	Max Black	-43.8	15.2	8.2	13.7	0.1	11.7	-1.8	6.3

Summary Results	I*Color	I*tone	ΔE
Average Score for all patches	84.3	88.9	4.3
Average Score for the Worst 10% (3 lowest scoring patches)	-9.6	74.9	15.2



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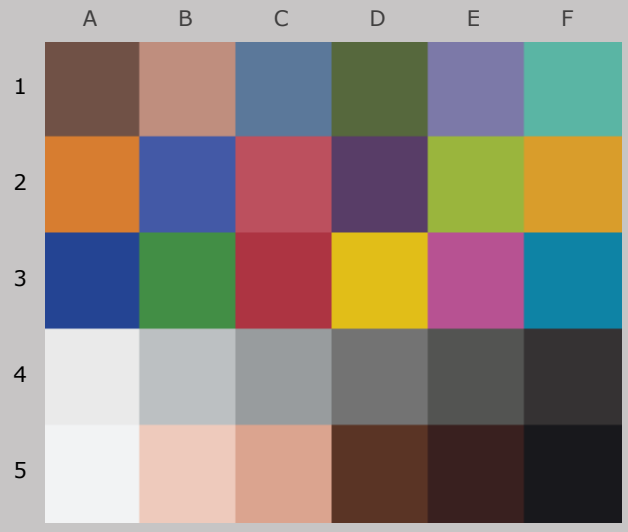
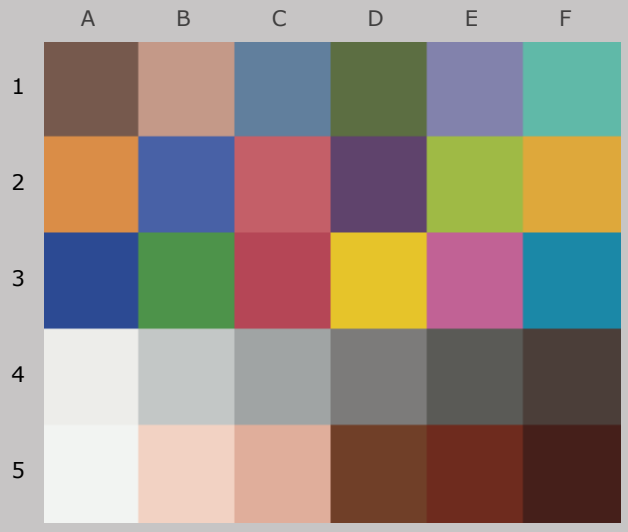
77.5color/84.8tone



Original Print Colors
(measured before light exposure)



Colors after 30 Megalux-hours
light exposure

Canon Pro9000, Canon OEM Chromalife 100,
Canon Photo Paper Pro

30 Mlux-hrs Light Exposure (i.e., after) Compared to Original Print Colors (i.e., before)

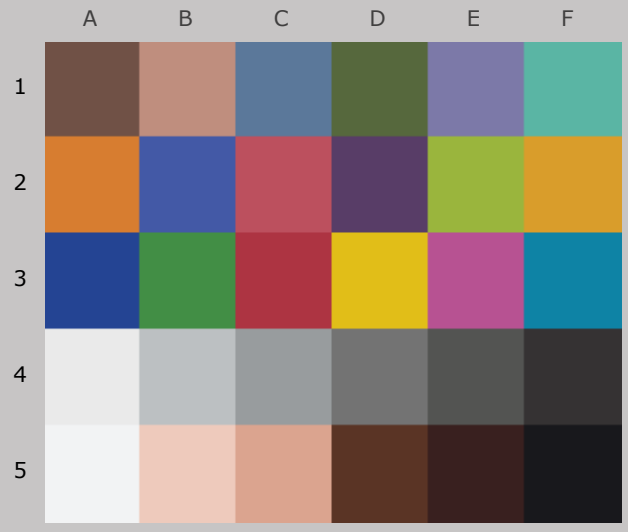
				L*		a*		b*	
Column/row	Color Patch	I*Color	ΔE	Before	After	Before	After	Before	After
A1	dark Skin	99.0	3.3	37.6	40.8	11.6	10.9	11.6	11.6
B1	light Skin	91.5	4.5	63.4	67.2	17.1	15.2	16.3	14.6
C1	blue sky	92.2	3.5	49.0	51.7	-4.3	-5.1	-22.3	-20.2
D1	foliage	98.6	2.7	41.5	44.0	-13.1	-13.2	20.8	21.7
E1	blue flower	87.4	5.0	52.7	55.9	8.5	6.7	-25.1	-21.8
F1	bluish green	97.7	2.2	67.7	69.5	-31.8	-30.7	0.3	-0.2
A2	orange	88.2	9.1	61.5	65.9	31.2	25.6	54.6	49.0
B2	purplish blue	90.3	5.5	39.2	41.7	10.0	7.3	-44.7	-40.6
C2	moderate red	95.3	5.3	48.9	53.5	44.9	42.3	15.3	14.7
D2	purple	95.8	3.2	30.1	32.9	19.3	19.4	-20.9	-19.2
E2	yellow green	98.8	2.3	69.8	71.8	-21.9	-22.2	55.1	54.0
F2	orange yellow	94.3	5.3	69.3	72.4	16.3	13.4	64.0	60.9
A3	blue	93.8	4.0	30.2	32.1	11.0	9.1	-48.1	-45.1
B3	green	99.9	2.0	53.0	54.9	-35.9	-35.5	31.1	31.4
C3	red	88.6	8.2	41.1	45.9	49.8	47.4	21.6	15.3
D3	yellow	97.2	3.4	78.3	80.4	3.4	1.6	76.0	74.1
E3	magenta	88.1	7.9	50.0	54.6	46.8	42.8	-14.6	-9.8
F3	cyan	96.7	2.6	50.3	52.3	-21.5	-21.6	-26.9	-25.3
A4	white	80.5	2.6	92.6	93.7	0.1	-0.5	-0.1	2.2
B4	neutral 8	91.5	2.7	77.8	80.2	-0.6	-1.5	-1.0	0.0
C4	neutral 6.5	96.0	3.0	64.4	67.2	-0.6	-1.4	-1.0	-0.7
D4	neutral 5	99.1	3.0	48.8	51.7	0.2	-0.2	0.1	0.5
E4	neutral 3.5	96.9	2.8	35.5	38.2	-1.1	-1.0	1.2	2.0
F4	black	40.7	8.9	21.1	27.6	1.1	4.5	-0.4	4.7
A5	paper white	77.3	2.7	95.5	96.0	-0.3	-0.8	-1.4	1.3
B5	skin highlight L*=89	90.4	3.1	84.3	86.7	11.6	9.6	11.8	12.2
C5	skin highlight L*=75	90.1	4.5	72.2	75.5	18.9	16.7	18.9	16.7
D5	skin shadow L*=25	70.2	9.7	26.5	32.6	16.1	20.1	17.3	23.8
E5	skin shadow L*=11	-74.7	27.2	15.5	27.3	12.1	29.6	6.4	23.5
F5	Max Black	-127.3	23.9	8.2	17.3	0.1	17.7	-1.8	11.6

Summary Results	I*Color	I*tone	ΔE
Average Score for all patches	77.5	84.8	5.8
Average Score for the Worst 10% (3 lowest scoring patches)	-53.8	68.2	20.3

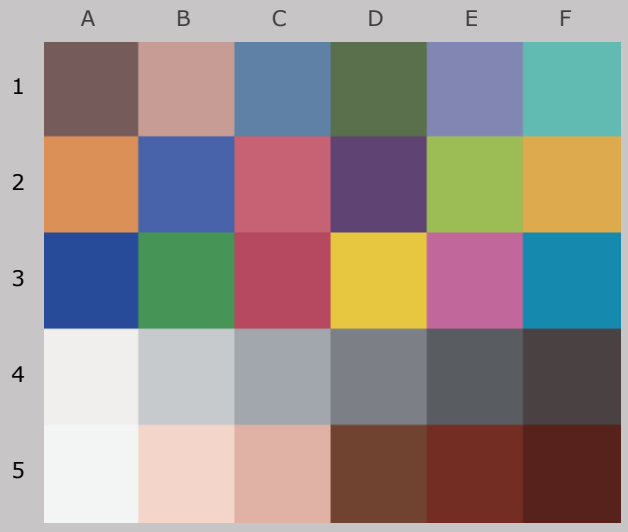


Aardenburg Imaging & Archives

68.7 color / 83.0 tone



Original Print Colors
(measured before light exposure)



Colors after 40 Megalux-hours
light exposure

Canon Pro9000, Canon OEM Chromalife 100, Canon Photo Paper Pro

40 Mlux-hrs Light Exposure (i.e., after) Compared to Original Print Colors (i.e., before)

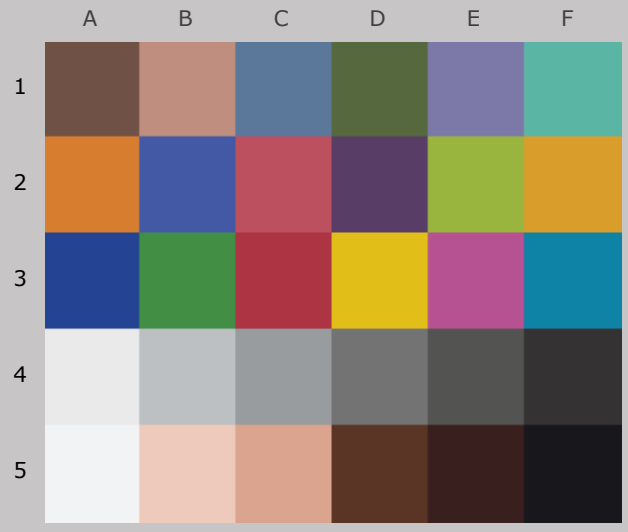
				L*		a*		b*	
Column/row	Color Patch	I*Color	ΔE	Before	After	Before	After	Before	After
A1	dark Skin	69.0	6.8	37.6	41.5	11.6	10.4	11.6	6.1
B1	light Skin	73.9	8.2	63.4	68.2	17.1	14.9	16.3	10.0
C1	blue sky	98.4	3.7	49.0	52.6	-4.3	-5.0	-22.3	-22.8
D1	foliage	84.4	5.4	41.5	44.7	-13.1	-13.9	20.8	16.6
E1	blue flower	92.6	4.8	52.7	56.9	8.5	6.4	-25.1	-23.9
F1	bluish green	87.7	5.1	67.7	70.3	-31.8	-30.1	0.3	-3.7
A2	orange	78.3	15.1	61.5	66.8	31.2	24.6	54.6	42.1
B2	purplish blue	92.0	5.3	39.2	42.5	10.0	6.9	-44.7	-41.9
C2	moderate red	87.3	8.5	48.9	54.4	44.9	41.8	15.3	9.6
D2	purple	94.0	4.0	30.1	33.5	19.3	19.6	-20.9	-23.1
E2	yellow green	88.6	7.8	69.8	72.6	-21.9	-22.8	55.1	47.9
F2	orange yellow	84.5	11.5	69.3	73.3	16.3	12.3	64.0	54.1
A3	blue	96.2	3.5	30.2	32.7	11.0	9.1	-48.1	-46.7
B3	green	90.5	5.7	53.0	55.8	-35.9	-35.9	31.1	26.1
C3	red	78.4	13.4	41.1	46.6	49.8	47.0	21.6	9.7
D3	yellow	89.3	9.1	78.3	81.2	3.4	0.6	76.0	67.9
E3	magenta	89.8	8.0	50.0	55.8	46.8	42.0	-14.6	-12.0
F3	cyan	99.2	3.0	50.3	53.1	-21.5	-21.3	-26.9	-27.7
A4	white	92.7	2.1	92.6	94.3	0.1	-0.4	-0.1	1.0
B4	neutral 8	88.6	3.7	77.8	81.1	-0.6	-1.5	-1.0	-2.3
C4	neutral 6.5	72.7	5.0	64.4	68.3	-0.6	-1.4	-1.0	-4.0
D4	neutral 5	64.2	5.6	48.8	52.8	0.2	-0.3	0.1	-3.8
E4	neutral 3.5	63.9	5.2	35.5	39.0	-1.1	-1.1	1.2	-2.8
F4	black	68.7	8.3	21.1	28.7	1.1	4.3	-0.4	0.9
A5	paper white	87.1	2.0	95.5	96.6	-0.3	-0.6	-1.4	0.4
B5	skin highlight L*=89	84.3	4.5	84.3	87.6	11.6	9.3	11.8	9.7
C5	skin highlight L*=75	76.4	8.1	72.2	76.6	18.9	16.3	18.9	12.6
D5	skin shadow L*=25	83.6	8.1	26.5	33.3	16.1	19.5	17.3	20.2
E5	skin shadow L*=11	-84.1	29.1	15.5	29.0	12.1	31.3	6.4	23.7
F5	Max Black	-211.9	32.8	8.2	21.3	0.1	24.0	-1.8	16.5

Summary Results	I*Color	I*tone	ΔE
Average Score for all patches	68.7	83.0	8.1
Average Score for the Worst 10% (3 lowest scoring patches)	-77.4	63.7	25.7

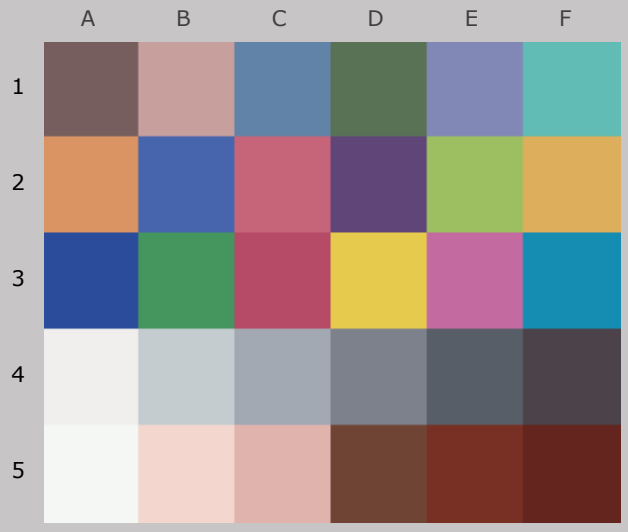


Aardenburg Imaging & Archives

59.3color/80.9tone



Original Print Colors
(measured before light exposure)



Colors after 50 Megalux-hours
light exposure

Canon Pro9000, Canon OEM Chromalife 100,
Canon Photo Paper Pro

50 Mlux-hrs Light Exposure (i.e., after) Compared to Original Print Colors (i.e., before)

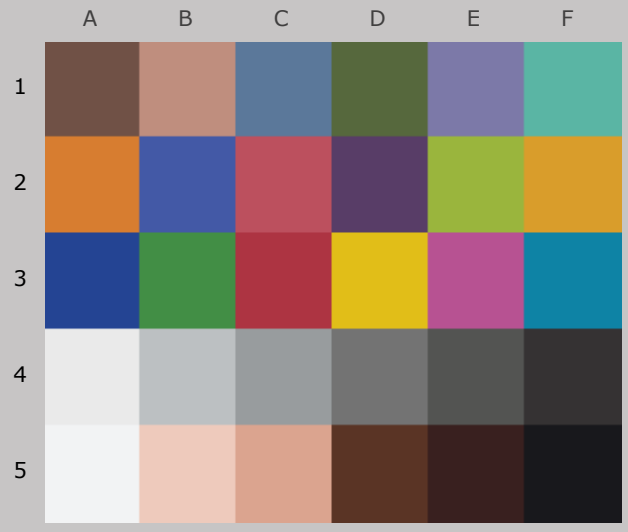
				L*		a*		b*	
Column/row	Color Patch	I*Color	ΔE	Before	After	Before	After	Before	After
A1	dark Skin	47.6	10.2	37.6	42.2	11.6	10.1	11.6	2.6
B1	light Skin	62.0	11.0	63.4	68.9	17.1	14.6	16.3	7.2
C1	blue sky	93.6	4.7	49.0	53.3	-4.3	-5.0	-22.3	-24.1
D1	foliage	69.3	8.9	41.5	45.4	-13.1	-14.1	20.8	12.8
E1	blue flower	92.5	5.5	52.7	57.6	8.5	6.1	-25.1	-24.6
F1	bluish green	79.8	7.6	67.7	70.8	-31.8	-29.2	0.3	-6.1
A2	orange	70.4	20.0	61.5	67.5	31.2	23.7	54.6	37.1
B2	purplish blue	91.3	6.0	39.2	43.2	10.0	6.4	-44.7	-42.1
C2	moderate red	81.4	11.3	48.9	55.3	44.9	40.9	15.3	6.9
D2	purple	87.9	5.6	30.1	34.1	19.3	19.5	-20.9	-24.8
E2	yellow green	80.2	12.7	69.8	73.2	-21.9	-23.0	55.1	42.9
F2	orange yellow	76.7	16.6	69.3	74.0	16.3	11.4	64.0	48.9
A3	blue	96.1	3.9	30.2	33.3	11.0	8.8	-48.1	-47.1
B3	green	82.1	9.6	53.0	56.3	-35.9	-35.9	31.1	22.1
C3	red	72.4	16.7	41.1	47.4	49.8	46.3	21.6	6.5
D3	yellow	82.4	14.4	78.3	81.8	3.4	-0.2	76.0	62.6
E3	magenta	88.3	9.2	50.0	56.7	46.8	40.9	-14.6	-12.7
F3	cyan	95.4	4.0	50.3	53.7	-21.5	-20.9	-26.9	-28.9
A4	white	94.2	2.2	92.6	94.5	0.1	-0.4	-0.1	0.9
B4	neutral 8	77.7	4.6	77.8	81.6	-0.6	-1.5	-1.0	-3.4
C4	neutral 6.5	52.0	6.9	64.4	69.0	-0.6	-1.4	-1.0	-6.0
D4	neutral 5	36.3	8.1	48.8	53.6	0.2	-0.2	0.1	-6.4
E4	neutral 3.5	32.6	8.0	35.5	39.7	-1.1	-1.1	1.2	-5.7
F4	black	69.8	9.1	21.1	29.6	1.1	4.3	-0.4	-1.7
A5	paper white	85.3	2.2	95.5	96.7	-0.3	-0.6	-1.4	0.5
B5	skin highlight L*=89	76.8	5.8	84.3	88.1	11.6	9.0	11.8	8.3
C5	skin highlight L*=75	66.8	10.7	72.2	77.3	18.9	16.0	18.9	10.0
D5	skin shadow L*=25	90.0	8.0	26.5	34.0	16.1	19.0	17.3	17.5
E5	skin shadow L*=11	-85.0	29.7	15.5	30.1	12.1	31.9	6.4	23.2
F5	Max Black	-267.0	38.9	8.2	24.3	0.1	27.9	-1.8	20.1

Summary Results	I*Color	I*tone	ΔE
Average Score for all patches	59.3	80.9	10.4
Average Score for the Worst 10% (3 lowest scoring patches)	-106.4	58.4	29.5

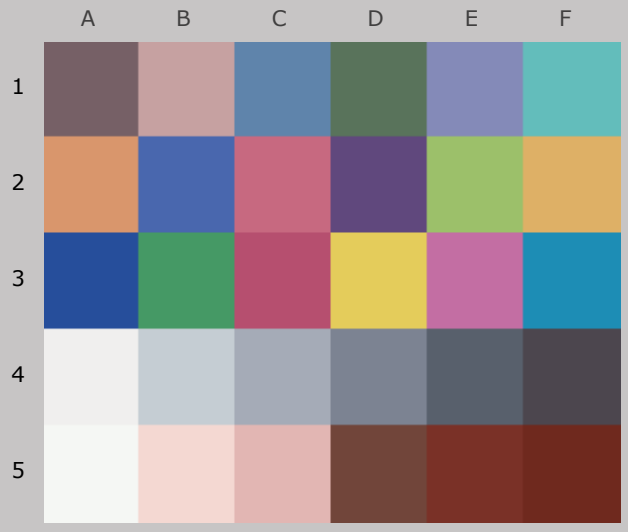


Aardenburg Imaging & Archives

50.7 color / 78.6 tone



Original Print Colors
(measured before light exposure)



Colors after 60 Megalux-hours
light exposure

Canon Pro9000, Canon OEM Chromalife 100, Canon Photo Paper Pro

60 Mlux-hrs Light Exposure (i.e., after) Compared to Original Print Colors (i.e., before)

				L*		a*		b*	
Column/row	Color Patch	I*Color	ΔE	Before	After	Before	After	Before	After
A1	dark Skin	28.9	13.3	37.6	43.0	11.6	9.8	11.6	-0.4
B1	light Skin	52.7	13.2	63.4	69.7	17.1	14.2	16.3	5.0
C1	blue sky	89.0	5.7	49.0	53.9	-4.3	-5.0	-22.3	-25.2
D1	foliage	56.5	12.1	41.5	46.0	-13.1	-14.2	20.8	9.7
E1	blue flower	91.4	6.2	52.7	58.3	8.5	5.8	-25.1	-25.2
F1	bluish green	73.5	9.6	67.7	71.2	-31.8	-28.5	0.3	-8.0
A2	orange	64.1	24.1	61.5	68.4	31.2	22.8	54.6	33.1
B2	purplish blue	90.5	6.8	39.2	43.9	10.0	5.9	-44.7	-42.1
C2	moderate red	76.5	13.8	48.9	56.2	44.9	40.0	15.3	4.8
D2	purple	83.0	7.1	30.1	34.8	19.3	19.5	-20.9	-26.2
E2	yellow green	73.1	16.9	69.8	73.8	-21.9	-23.0	55.1	38.7
F2	orange yellow	69.8	21.1	69.3	74.7	16.3	10.7	64.0	44.4
A3	blue	95.6	4.5	30.2	33.9	11.0	8.4	-48.1	-47.3
B3	green	74.7	13.1	53.0	56.9	-35.9	-35.6	31.1	18.6
C3	red	68.0	19.3	41.1	48.3	49.8	45.4	21.6	4.3
D3	yellow	76.3	19.0	78.3	82.3	3.4	-0.8	76.0	58.0
E3	magenta	86.0	10.6	50.0	57.6	46.8	39.6	-14.6	-13.2
F3	cyan	92.3	5.0	50.3	54.2	-21.5	-20.5	-26.9	-29.9
A4	white	95.0	2.3	92.6	94.7	0.1	-0.4	-0.1	0.8
B4	neutral 8	69.0	5.5	77.8	82.1	-0.6	-1.6	-1.0	-4.3
C4	neutral 6.5	36.8	8.4	64.4	69.6	-0.6	-1.4	-1.0	-7.5
D4	neutral 5	13.3	10.3	48.8	54.3	0.2	-0.1	0.1	-8.6
E4	neutral 3.5	6.4	10.5	35.5	40.3	-1.1	-1.0	1.2	-8.2
F4	black	58.4	10.3	21.1	30.4	1.1	4.2	-0.4	-3.6
A5	paper white	83.9	2.4	95.5	96.7	-0.3	-0.5	-1.4	0.7
B5	skin highlight L*=89	71.0	6.7	84.3	88.4	11.6	8.8	11.8	7.3
C5	skin highlight L*=75	59.9	12.6	72.2	77.9	18.9	15.5	18.9	8.2
D5	skin shadow L*=25	87.5	8.9	26.5	34.6	16.1	18.6	17.3	14.9
E5	skin shadow L*=11	-84.8	30.2	15.5	31.1	12.1	32.3	6.4	22.6
F5	Max Black	-317.8	44.5	8.2	27.3	0.1	31.2	-1.8	23.7

Summary Results	I*Color	I*tone	ΔE
Average Score for all patches	50.7	78.6	12.5
Average Score for the Worst 10% (3 lowest scoring patches)	-132.0	52.5	32.9



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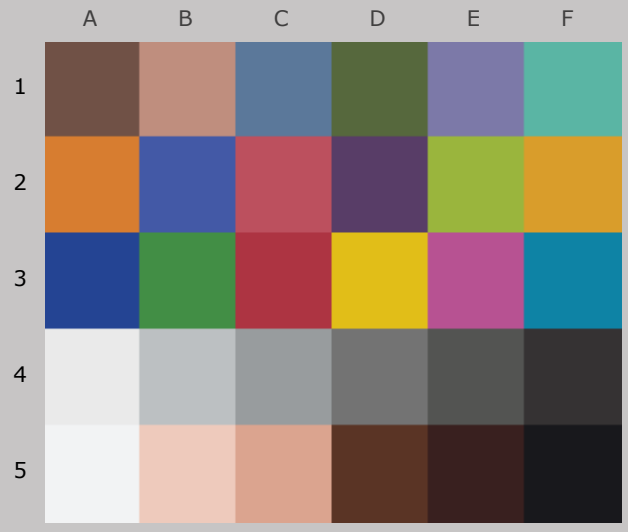
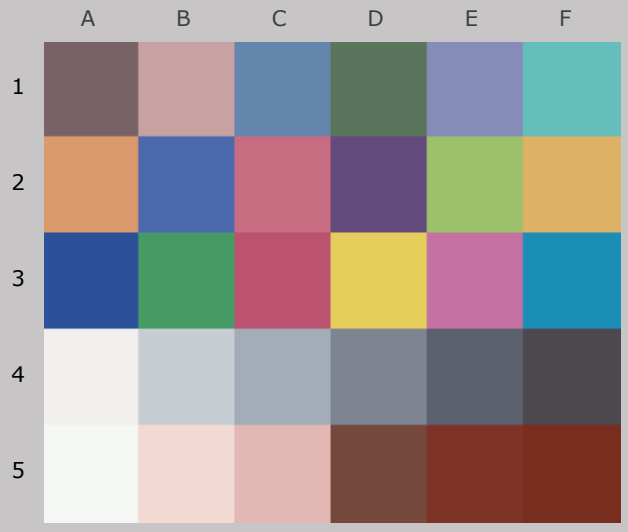
50.5color/76.2tone



Original Print Colors
(measured before light exposure)



Colors after 70 Megalux-hours
light exposure

Canon Pro9000, Canon OEM Chromalife 100, Canon Photo Paper Pro

70 Mlux-hrs Light Exposure (i.e., after) Compared to Original Print Colors (i.e., before)

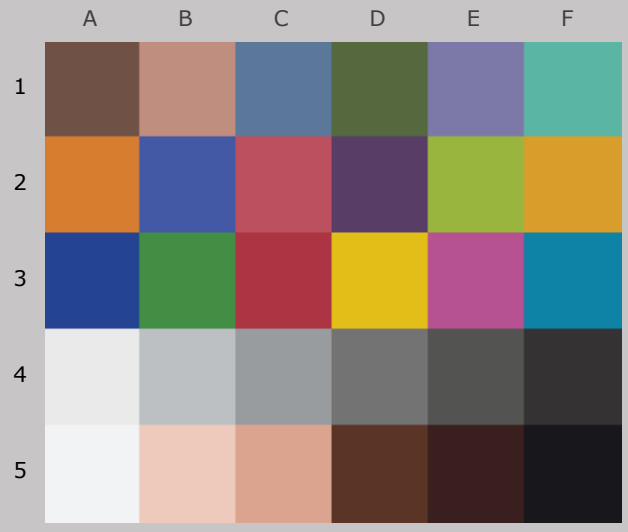
				L*		a*		b*	
Column/row	Color Patch	I*Color	ΔE	Before	After	Before	After	Before	After
A1	dark Skin	34.5	12.8	37.6	43.8	11.6	9.6	11.6	0.5
B1	light Skin	53.7	13.3	63.4	70.3	17.1	13.8	16.3	5.4
C1	blue sky	92.3	5.9	49.0	54.5	-4.3	-5.2	-22.3	-24.4
D1	foliage	60.8	11.4	41.5	46.6	-13.1	-14.3	20.8	10.8
E1	blue flower	89.6	7.0	52.7	58.9	8.5	5.4	-25.1	-24.3
F1	bluish green	74.0	9.6	67.7	71.5	-31.8	-28.4	0.3	-7.8
A2	orange	63.8	24.5	61.5	69.1	31.2	22.3	54.6	33.1
B2	purplish blue	87.8	8.1	39.2	44.5	10.0	5.2	-44.7	-40.9
C2	moderate red	77.3	14.0	48.9	57.3	44.9	39.2	15.3	5.6
D2	purple	87.5	6.8	30.1	35.6	19.3	19.0	-20.9	-24.9
E2	yellow green	73.5	16.8	69.8	74.1	-21.9	-23.1	55.1	38.9
F2	orange yellow	69.6	21.4	69.3	75.3	16.3	10.2	64.0	44.4
A3	blue	93.3	5.6	30.2	34.4	11.0	7.7	-48.1	-46.2
B3	green	76.6	12.4	53.0	57.3	-35.9	-35.6	31.1	19.5
C3	red	69.3	19.1	41.1	49.4	49.8	44.9	21.6	5.1
D3	yellow	76.1	19.2	78.3	82.7	3.4	-1.1	76.0	57.9
E3	magenta	83.7	12.1	50.0	58.6	46.8	38.7	-14.6	-12.0
F3	cyan	94.4	5.0	50.3	54.6	-21.5	-20.7	-26.9	-29.2
A4	white	92.5	2.4	92.6	94.7	0.1	-0.5	-0.1	1.0
B4	neutral 8	70.9	5.6	77.8	82.3	-0.6	-1.7	-1.0	-4.0
C4	neutral 6.5	40.3	8.4	64.4	70.1	-0.6	-1.6	-1.0	-7.1
D4	neutral 5	19.1	10.2	48.8	55.0	0.2	-0.3	0.1	-8.1
E4	neutral 3.5	16.7	10.0	35.5	41.0	-1.1	-1.1	1.2	-7.2
F4	black	65.5	10.6	21.1	31.0	1.1	4.1	-0.4	-2.7
A5	paper white	80.6	2.6	95.5	96.7	-0.3	-0.6	-1.4	1.0
B5	skin highlight L*=89	70.6	6.9	84.3	88.7	11.6	8.5	11.8	7.5
C5	skin highlight L*=75	60.0	12.8	72.2	78.4	18.9	15.1	18.9	8.4
D5	skin shadow L*=25	90.3	9.3	26.5	35.4	16.1	18.6	17.3	16.1
E5	skin shadow L*=11	-94.4	31.9	15.5	32.2	12.1	32.8	6.4	24.1
F5	Max Black	-355.4	48.8	8.2	29.7	0.1	33.2	-1.8	26.9

Summary Results	I*Color	I*tone	ΔE
Average Score for all patches	50.5	76.2	12.8
Average Score for the Worst 10% (3 lowest scoring patches)	-144.4	47.8	35.1

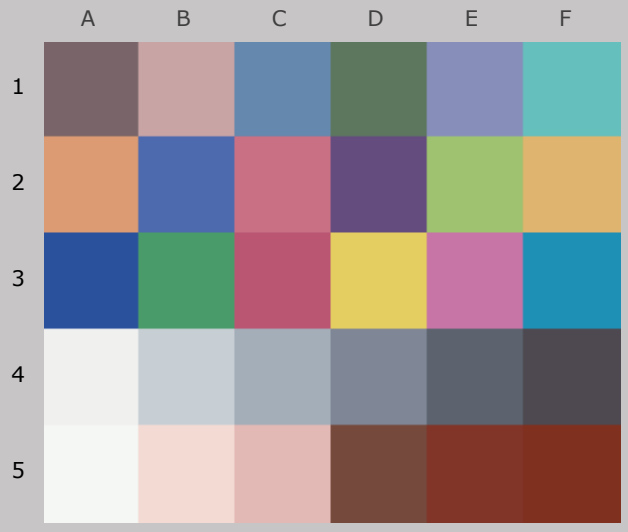


Aardenburg Imaging & Archives

47.0color/74.3tone



Original Print Colors
(measured before light exposure)



Colors after 80 Megalux-hours
light exposure

Canon Pro9000, Canon OEM Chromalife 100, Canon Photo Paper Pro

80 Mlux-hrs Light Exposure (i.e., after) Compared to Original Print Colors (i.e., before)

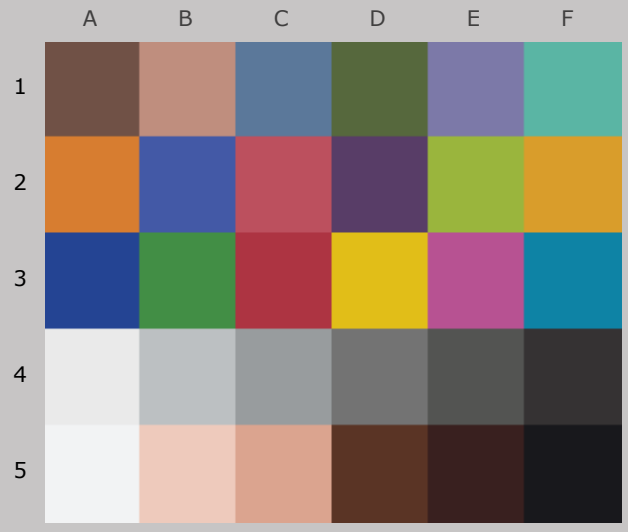
				L*		a*		b*	
Column/row	Color Patch	I*Color	ΔE	Before	After	Before	After	Before	After
A1	dark Skin	28.2	14.1	37.6	44.6	11.6	9.4	11.6	-0.5
B1	light Skin	50.1	14.4	63.4	70.9	17.1	13.5	16.3	4.6
C1	blue sky	91.8	6.6	49.0	55.1	-4.3	-5.3	-22.3	-24.5
D1	foliage	56.1	12.7	41.5	47.3	-13.1	-14.3	20.8	9.6
E1	blue flower	88.1	7.8	52.7	59.6	8.5	5.0	-25.1	-24.1
F1	bluish green	71.4	10.5	67.7	72.0	-31.8	-28.0	0.3	-8.5
A2	orange	61.0	26.4	61.5	69.9	31.2	21.7	54.6	31.5
B2	purplish blue	86.2	9.1	39.2	45.2	10.0	4.7	-44.7	-40.4
C2	moderate red	75.3	15.3	48.9	58.2	44.9	38.4	15.3	5.0
D2	purple	86.6	7.6	30.1	36.3	19.3	18.8	-20.9	-25.2
E2	yellow green	69.4	19.3	69.8	74.7	-21.9	-22.9	55.1	36.5
F2	orange yellow	66.2	23.8	69.3	75.9	16.3	9.8	64.0	42.2
A3	blue	92.1	6.5	30.2	35.0	11.0	7.2	-48.1	-45.8
B3	green	73.1	14.2	53.0	57.9	-35.9	-35.1	31.1	17.9
C3	red	67.9	20.2	41.1	50.4	49.8	44.1	21.6	4.6
D3	yellow	73.0	21.6	78.3	83.1	3.4	-1.4	76.0	55.6
E3	magenta	81.8	13.4	50.0	59.5	46.8	37.8	-14.6	-11.7
F3	cyan	94.0	5.5	50.3	55.2	-21.5	-20.5	-26.9	-29.3
A4	white	91.8	2.5	92.6	94.8	0.1	-0.4	-0.1	1.1
B4	neutral 8	69.1	6.0	77.8	82.7	-0.6	-1.8	-1.0	-4.2
C4	neutral 6.5	36.3	9.1	64.4	70.6	-0.6	-1.7	-1.0	-7.5
D4	neutral 5	13.2	11.1	48.8	55.7	0.2	-0.3	0.1	-8.6
E4	neutral 3.5	10.6	10.9	35.5	41.7	-1.1	-1.2	1.2	-7.8
F4	black	60.7	11.5	21.1	31.8	1.1	4.2	-0.4	-3.3
A5	paper white	78.7	2.8	95.5	96.7	-0.3	-0.6	-1.4	1.2
B5	skin highlight L*=89	68.4	7.4	84.3	89.0	11.6	8.3	11.8	7.2
C5	skin highlight L*=75	58.0	13.5	72.2	78.9	18.9	14.7	18.9	7.9
D5	skin shadow L*=25	90.0	10.1	26.5	36.1	16.1	18.4	17.3	15.6
E5	skin shadow L*=11	-96.3	32.6	15.5	33.1	12.1	32.9	6.4	24.4
F5	Max Black	-384.0	52.2	8.2	31.9	0.1	34.7	-1.8	29.3

Summary Results	I*Color	I*tone	ΔE
Average Score for all patches	47.0	74.3	13.9
Average Score for the Worst 10% (3 lowest scoring patches)	-156.5	44.0	37.1

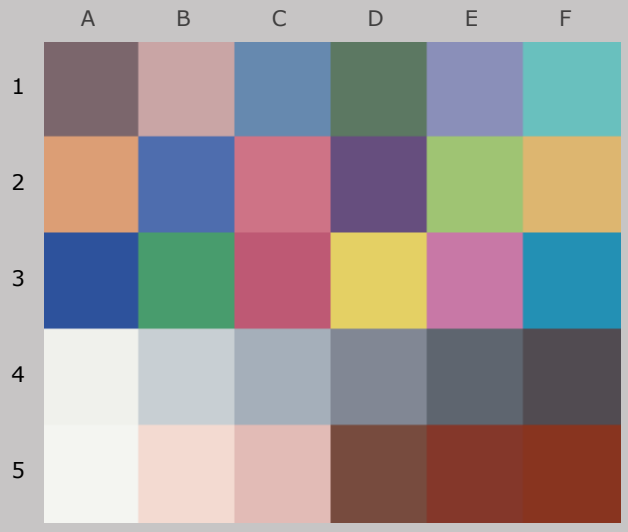


Aardenburg Imaging & Archives

45.6color/72.1tone



Original Print Colors
(measured before light exposure)



Colors after 90 Megalux-hours
light exposure

Canon Pro9000, Canon OEM Chromalife 100,
Canon Photo Paper Pro

90 Mlux-hrs Light Exposure (i.e., after) Compared to Original Print Colors (i.e., before)

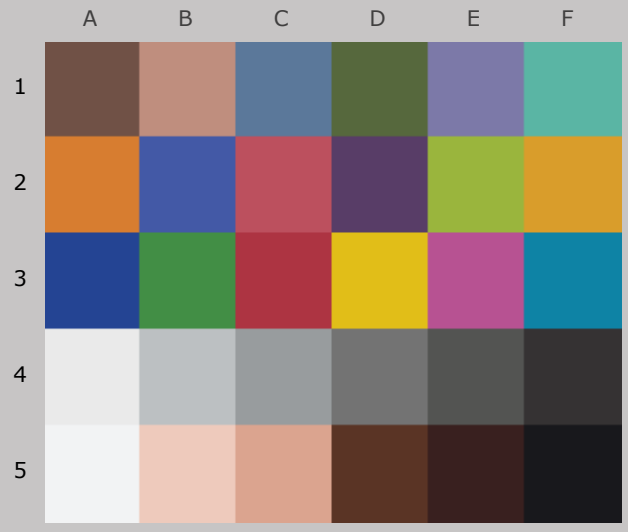
				L*		a*		b*	
Column/row	Color Patch	I*Color	ΔE	Before	After	Before	After	Before	After
A1	dark Skin	29.4	14.4	37.6	45.4	11.6	9.2	11.6	-0.3
B1	light Skin	51.1	14.5	63.4	71.5	17.1	13.1	16.3	5.0
C1	blue sky	94.4	6.8	49.0	55.6	-4.3	-5.5	-22.3	-23.6
D1	foliage	55.4	13.2	41.5	48.0	-13.1	-14.3	20.8	9.4
E1	blue flower	84.8	8.7	52.7	60.1	8.5	4.5	-25.1	-23.0
F1	bluish green	71.9	10.4	67.7	72.2	-31.8	-27.7	0.3	-8.2
A2	orange	60.2	27.1	61.5	70.6	31.2	21.2	54.6	31.2
B2	purplish blue	83.5	10.3	39.2	45.7	10.0	4.1	-44.7	-39.3
C2	moderate red	75.4	15.9	48.9	59.1	44.9	37.5	15.3	5.7
D2	purple	89.7	7.8	30.1	37.1	19.3	18.4	-20.9	-24.2
E2	yellow green	67.8	20.3	69.8	75.0	-21.9	-22.8	55.1	35.5
F2	orange yellow	64.9	24.8	69.3	76.5	16.3	9.3	64.0	41.4
A3	blue	89.8	7.6	30.2	35.4	11.0	6.6	-48.1	-44.8
B3	green	72.0	14.8	53.0	58.3	-35.9	-34.9	31.1	17.4
C3	red	68.6	20.4	41.1	51.4	49.8	43.3	21.6	5.3
D3	yellow	71.7	22.6	78.3	83.5	3.4	-1.7	76.0	54.6
E3	magenta	79.2	14.8	50.0	60.3	46.8	36.9	-14.6	-10.6
F3	cyan	96.3	5.5	50.3	55.4	-21.5	-20.7	-26.9	-28.5
A4	white	80.3	3.2	92.6	94.7	0.1	-0.6	-0.1	2.2
B4	neutral 8	75.5	5.8	77.8	82.9	-0.6	-2.0	-1.0	-3.4
C4	neutral 6.5	42.3	8.9	64.4	71.0	-0.6	-1.9	-1.0	-6.9
D4	neutral 5	17.1	11.2	48.8	56.2	0.2	-0.5	0.1	-8.3
E4	neutral 3.5	14.5	11.0	35.5	42.3	-1.1	-1.3	1.2	-7.4
F4	black	65.9	12.0	21.1	32.5	1.1	4.0	-0.4	-2.8
A5	paper white	65.1	4.0	95.5	96.6	-0.3	-0.7	-1.4	2.5
B5	skin highlight L*=89	70.2	7.3	84.3	89.2	11.6	7.9	11.8	7.8
C5	skin highlight L*=75	58.7	13.5	72.2	79.3	18.9	14.3	18.9	8.3
D5	skin shadow L*=25	91.2	10.7	26.5	36.8	16.1	18.2	17.3	15.8
E5	skin shadow L*=11	-102.4	33.8	15.5	34.0	12.1	33.2	6.4	25.3
F5	Max Black	-417.2	56.0	8.2	34.1	0.1	36.3	-1.8	32.2

Summary Results	I*Color	I*tone	ΔE
Average Score for all patches	45.6	72.1	14.6
Average Score for the Worst 10% (3 lowest scoring patches)	-168.4	40.1	39.0

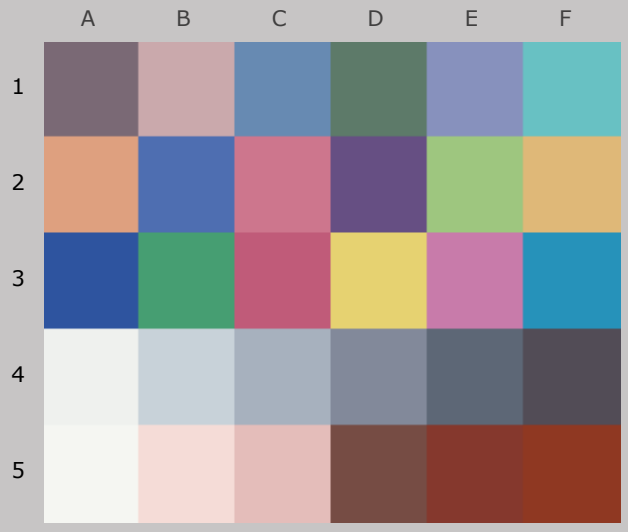


Aardenburg Imaging & Archives

38.4color/70.9tone



Original Print Colors
(measured before light exposure)



Colors after 100 Megalux-hours
light exposure

Canon Pro9000, Canon OEM Chromalife 100,
Canon Photo Paper Pro

100 Mlux-hrs Light Exposure (i.e., after) Compared to Original Print Colors (i.e., before)

				L*		a*		b*	
Column/row	Color Patch	I*Color	ΔE	Before	After	Before	After	Before	After
A1	dark Skin	9.3	17.6	37.6	46.1	11.6	9.0	11.6	-3.6
B1	light Skin	41.7	16.7	63.4	72.2	17.1	12.7	16.3	2.7
C1	blue sky	88.5	7.9	49.0	56.3	-4.3	-5.4	-22.3	-25.2
D1	foliage	40.0	16.9	41.5	48.7	-13.1	-14.2	20.8	5.6
E1	blue flower	85.9	9.1	52.7	60.8	8.5	4.4	-25.1	-24.2
F1	bluish green	65.0	12.6	67.7	72.7	-31.8	-27.0	0.3	-10.3
A2	orange	54.2	30.9	61.5	71.3	31.2	20.5	54.6	27.3
B2	purplish blue	84.2	10.6	39.2	46.4	10.0	3.8	-44.7	-40.0
C2	moderate red	70.7	18.1	48.9	59.9	44.9	36.8	15.3	3.5
D2	purple	83.3	9.3	30.1	37.8	19.3	18.3	-20.9	-26.1
E2	yellow green	60.6	24.6	69.8	75.7	-21.9	-22.6	55.1	31.3
F2	orange yellow	59.1	28.6	69.3	77.2	16.3	8.8	64.0	37.6
A3	blue	90.6	7.8	30.2	36.1	11.0	6.5	-48.1	-45.6
B3	green	64.0	18.6	53.0	59.0	-35.9	-34.5	31.1	13.6
C3	red	64.4	22.7	41.1	52.2	49.8	42.6	21.6	3.1
D3	yellow	66.0	27.0	78.3	84.1	3.4	-2.1	76.0	50.3
E3	magenta	78.6	15.6	50.0	61.0	46.8	36.2	-14.6	-11.8
F3	cyan	91.8	6.7	50.3	56.1	-21.5	-20.2	-26.9	-30.0
A4	white	89.0	2.9	92.6	95.1	0.1	-0.5	-0.1	1.3
B4	neutral 8	64.5	6.8	77.8	83.4	-0.6	-2.0	-1.0	-4.6
C4	neutral 6.5	25.4	10.5	64.4	71.6	-0.6	-1.9	-1.0	-8.5
D4	neutral 5	-4.1	13.2	48.8	57.0	0.2	-0.4	0.1	-10.3
E4	neutral 3.5	-12.1	13.5	35.5	43.1	-1.1	-1.2	1.2	-10.0
F4	black	46.0	13.4	21.1	33.3	1.1	4.0	-0.4	-5.2
A5	paper white	73.8	3.3	95.5	96.9	-0.3	-0.6	-1.4	1.6
B5	skin highlight L*=89	63.3	8.5	84.3	89.7	11.6	7.7	11.8	6.5
C5	skin highlight L*=75	52.4	15.3	72.2	80.0	18.9	13.9	18.9	6.7
D5	skin shadow L*=25	82.9	11.9	26.5	37.4	16.1	17.9	17.3	13.2
E5	skin shadow L*=11	-94.2	33.2	15.5	34.6	12.1	33.0	6.4	23.8
F5	Max Black	-434.0	58.2	8.2	35.9	0.1	37.4	-1.8	33.3

Summary Results	I*Color	I*tone	ΔE
Average Score for all patches	38.4	70.9	16.4
Average Score for the Worst 10% (3 lowest scoring patches)	-180.1	37.9	40.8



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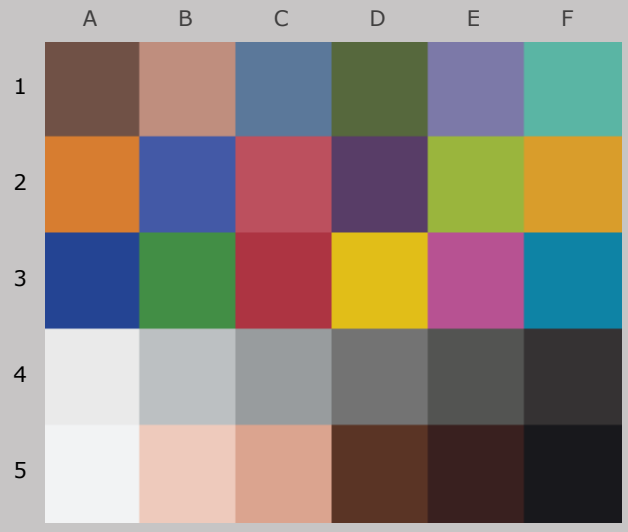
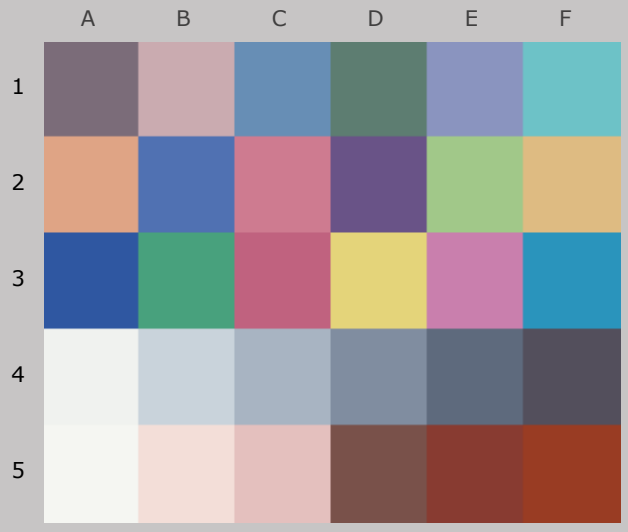
32.8color/68.1tone



Original Print Colors
(measured before light exposure)



Colors after 120 Megalux-hours
light exposure

Canon Pro9000, Canon OEM Chromalife 100, Canon Photo Paper Pro

120 Mlux-hrs Light Exposure (i.e., after) Compared to Original Print Colors (i.e., before)

				L*		a*		b*	
Column/row	Color Patch	I*Color	ΔE	Before	After	Before	After	Before	After
A1	dark Skin	-2.0	19.8	37.6	47.5	11.6	8.4	11.6	-5.3
B1	light Skin	36.4	18.3	63.4	73.1	17.1	12.0	16.3	1.7
C1	blue sky	86.8	8.9	49.0	57.2	-4.3	-5.8	-22.3	-25.5
D1	foliage	29.8	19.6	41.5	49.8	-13.1	-14.1	20.8	3.1
E1	blue flower	83.5	10.3	52.7	61.7	8.5	3.8	-25.1	-24.1
F1	bluish green	61.0	14.1	67.7	73.2	-31.8	-26.4	0.3	-11.4
A2	orange	49.5	34.1	61.5	72.5	31.2	19.5	54.6	24.6
B2	purplish blue	82.0	12.0	39.2	47.5	10.0	3.0	-44.7	-39.5
C2	moderate red	67.4	20.2	48.9	61.3	44.9	35.3	15.3	2.6
D2	purple	81.6	10.6	30.1	39.0	19.3	17.6	-20.9	-26.4
E2	yellow green	54.0	28.6	69.8	76.4	-21.9	-22.3	55.1	27.3
F2	orange yellow	53.2	32.6	69.3	78.2	16.3	8.1	64.0	33.7
A3	blue	89.0	9.1	30.2	37.1	11.0	5.8	-48.1	-45.2
B3	green	57.2	22.0	53.0	59.9	-35.9	-33.9	31.1	10.4
C3	red	61.7	24.8	41.1	53.8	49.8	41.0	21.6	2.2
D3	yellow	60.5	31.2	78.3	84.8	3.4	-2.6	76.0	46.1
E3	magenta	75.0	17.8	50.0	62.4	46.8	34.4	-14.6	-11.6
F3	cyan	90.9	7.5	50.3	56.9	-21.5	-20.1	-26.9	-30.2
A4	white	87.9	3.1	92.6	95.3	0.1	-0.6	-0.1	1.4
B4	neutral 8	61.3	7.5	77.8	84.0	-0.6	-2.3	-1.0	-4.8
C4	neutral 6.5	17.9	11.6	64.4	72.5	-0.6	-2.2	-1.0	-9.2
D4	neutral 5	-17.3	14.9	48.8	58.1	0.2	-0.7	0.1	-11.5
E4	neutral 3.5	-29.7	15.5	35.5	44.2	-1.1	-1.4	1.2	-11.6
F4	black	31.7	15.2	21.1	34.6	1.1	3.8	-0.4	-6.9
A5	paper white	71.1	3.6	95.5	96.9	-0.3	-0.6	-1.4	1.9
B5	skin highlight L*=89	59.3	9.4	84.3	90.2	11.6	7.2	11.8	6.0
C5	skin highlight L*=75	48.1	16.7	72.2	80.8	18.9	13.1	18.9	5.8
D5	skin shadow L*=25	73.4	14.0	26.5	38.7	16.1	17.2	17.3	10.6
E5	skin shadow L*=11	-87.0	33.1	15.5	35.8	12.1	32.7	6.4	22.6
F5	Max Black	-450.9	60.9	8.2	38.5	0.1	38.3	-1.8	34.7

Summary Results	I*Color	I*tone	ΔE
Average Score for all patches	32.8	68.1	18.2
Average Score for the Worst 10% (3 lowest scoring patches)	-189.2	34.3	42.7



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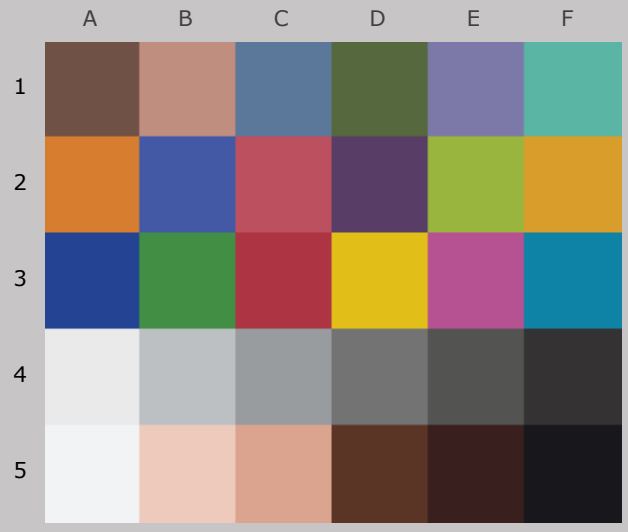
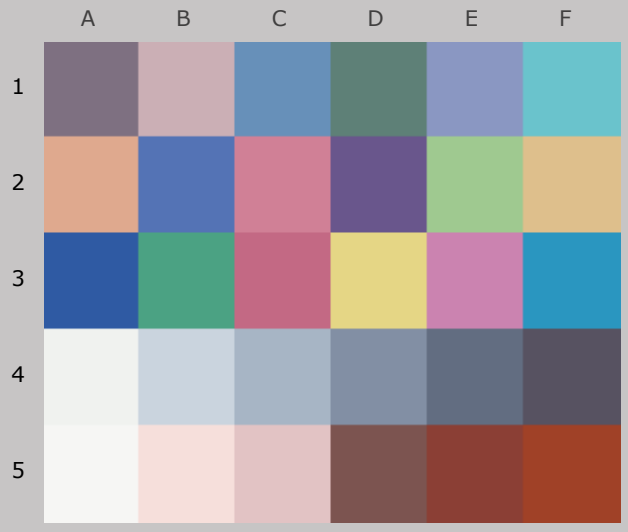
27.7 color / 64.9 tone



Original Print Colors
(measured before light exposure)



Colors after 140 Megalux-hours
light exposure

Canon Pro9000, Canon OEM Chromalife 100,
Canon Photo Paper Pro

140 Mlux-hrs Light Exposure (i.e., after) Compared to Original Print Colors (i.e., before)

				L*		a*		b*	
Column/row	Color Patch	I*Color	ΔE	Before	After	Before	After	Before	After
A1	dark Skin	-10.6	21.8	37.6	48.9	11.6	7.6	11.6	-6.6
B1	light Skin	31.2	19.9	63.4	74.1	17.1	11.5	16.3	0.6
C1	blue sky	85.0	9.9	49.0	58.1	-4.3	-5.8	-22.3	-25.9
D1	foliage	22.0	21.9	41.5	51.0	-13.1	-14.1	20.8	1.2
E1	blue flower	80.7	11.5	52.7	62.7	8.5	3.0	-25.1	-24.2
F1	bluish green	57.1	15.4	67.7	73.8	-31.8	-25.9	0.3	-12.6
A2	orange	45.5	36.8	61.5	73.7	31.2	18.4	54.6	22.3
B2	purplish blue	81.2	12.9	39.2	48.4	10.0	2.6	-44.7	-39.4
C2	moderate red	63.7	22.5	48.9	62.8	44.9	33.6	15.3	1.7
D2	purple	79.9	11.9	30.1	40.3	19.3	17.0	-20.9	-26.7
E2	yellow green	48.5	31.9	69.8	77.0	-21.9	-22.1	55.1	24.1
F2	orange yellow	48.0	36.2	69.3	79.1	16.3	7.3	64.0	30.4
A3	blue	87.8	10.1	30.2	38.0	11.0	5.3	-48.1	-45.0
B3	green	51.1	24.9	53.0	60.6	-35.9	-33.3	31.1	7.5
C3	red	59.1	26.9	41.1	55.6	49.8	39.1	21.6	1.6
D3	yellow	55.7	35.0	78.3	85.4	3.4	-2.9	76.0	42.4
E3	magenta	72.0	19.8	50.0	63.7	46.8	32.9	-14.6	-11.7
F3	cyan	89.3	8.3	50.3	57.5	-21.5	-19.9	-26.9	-30.8
A4	white	93.7	2.8	92.6	95.2	0.1	-0.5	-0.1	0.8
B4	neutral 8	53.5	8.2	77.8	84.4	-0.6	-2.4	-1.0	-5.5
C4	neutral 6.5	8.5	12.7	64.4	73.1	-0.6	-2.4	-1.0	-10.0
D4	neutral 5	-32.2	16.5	48.8	59.0	0.2	-0.7	0.1	-12.9
E4	neutral 3.5	-46.2	17.4	35.5	45.3	-1.1	-1.2	1.2	-13.2
F4	black	20.6	16.6	21.1	35.6	1.1	3.7	-0.4	-8.0
A5	paper white	78.3	2.9	95.5	96.8	-0.3	-0.5	-1.4	1.2
B5	skin highlight L*=89	51.8	10.5	84.3	90.5	11.6	6.7	11.8	4.9
C5	skin highlight L*=75	42.1	18.5	72.2	81.5	18.9	12.3	18.9	4.4
D5	skin shadow L*=25	65.1	16.1	26.5	39.9	16.1	16.8	17.3	8.6
E5	skin shadow L*=11	-82.3	33.4	15.5	37.0	12.1	32.5	6.4	21.8
F5	Max Black	-468.0	63.5	8.2	40.9	0.1	38.9	-1.8	36.5

Summary Results	I*Color	I*tone	ΔE
Average Score for all patches	27.7	64.9	19.9
Average Score for the Worst 10% (3 lowest scoring patches)	-198.8	30.8	45.5



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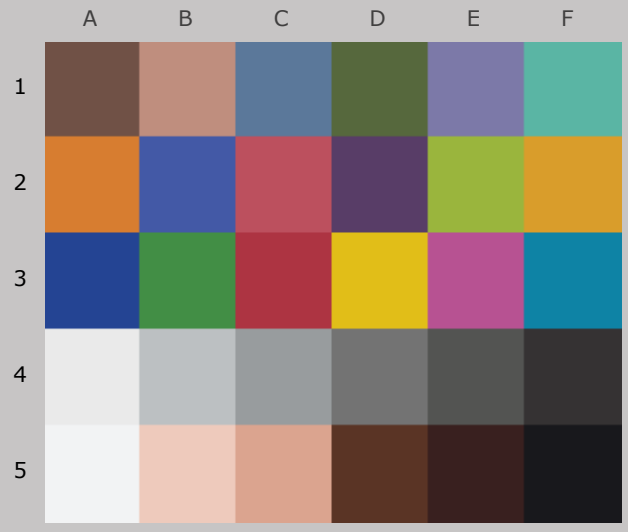
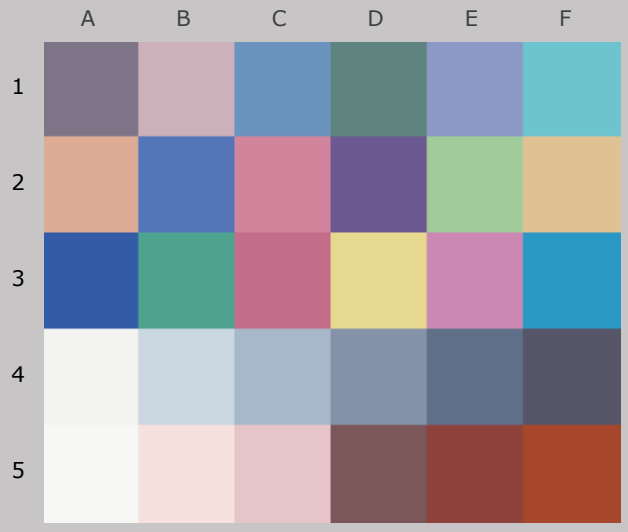
21.6color/63.1tone



Original Print Colors
(measured before light exposure)



Colors after 160 Megalux-hours
light exposure

Canon Pro9000, Canon OEM Chromalife 100, Canon Photo Paper Pro

160 Mlux-hrs Light Exposure (i.e., after) Compared to Original Print Colors (i.e., before)

				L*		a*		b*	
Column/row	Color Patch	I*Color	ΔE	Before	After	Before	After	Before	After
A1	dark Skin	-25.7	24.5	37.6	50.1	11.6	7.4	11.6	-9.1
B1	light Skin	24.7	21.6	63.4	75.0	17.1	10.7	16.3	-0.8
C1	blue sky	81.5	11.1	49.0	59.0	-4.3	-5.9	-22.3	-26.7
D1	foliage	7.2	25.6	41.5	52.1	-13.1	-13.6	20.8	-2.5
E1	blue flower	79.6	12.4	52.7	63.6	8.5	2.6	-25.1	-24.5
F1	bluish green	52.4	17.0	67.7	74.3	-31.8	-25.1	0.3	-13.8
A2	orange	40.6	40.1	61.5	74.6	31.2	17.5	54.6	19.3
B2	purplish blue	79.7	14.1	39.2	49.4	10.0	1.8	-44.7	-39.3
C2	moderate red	59.6	24.8	48.9	64.0	44.9	32.4	15.3	0.1
D2	purple	75.8	13.6	30.1	41.6	19.3	16.5	-20.9	-27.7
E2	yellow green	41.0	36.4	69.8	77.8	-21.9	-21.4	55.1	19.6
F2	orange yellow	42.9	39.7	69.3	80.0	16.3	6.7	64.0	27.0
A3	blue	86.7	11.3	30.2	39.1	11.0	4.6	-48.1	-45.0
B3	green	42.1	29.3	53.0	61.6	-35.9	-32.2	31.1	3.4
C3	red	55.1	29.4	41.1	56.8	49.8	37.8	21.6	-0.2
D3	yellow	49.5	39.7	78.3	86.2	3.4	-3.2	76.0	37.7
E3	magenta	69.4	21.5	50.0	64.9	46.8	31.5	-14.6	-12.2
F3	cyan	86.9	9.5	50.3	58.3	-21.5	-19.6	-26.9	-31.5
A4	white	94.3	3.1	92.6	95.6	0.1	-0.5	-0.1	0.8
B4	neutral 8	49.5	8.9	77.8	84.9	-0.6	-2.6	-1.0	-5.9
C4	neutral 6.5	-1.3	14.0	64.4	74.0	-0.6	-2.6	-1.0	-10.9
D4	neutral 5	-48.5	18.4	48.8	60.1	0.2	-0.9	0.1	-14.5
E4	neutral 3.5	-72.3	20.2	35.5	46.6	-1.1	-1.1	1.2	-15.7
F4	black	-6.1	19.1	21.1	37.0	1.1	3.6	-0.4	-10.7
A5	paper white	78.0	3.0	95.5	97.1	-0.3	-0.4	-1.4	1.2
B5	skin highlight L*=89	48.1	11.4	84.3	91.2	11.6	6.4	11.8	4.4
C5	skin highlight L*=75	37.7	20.0	72.2	82.4	18.9	11.6	18.9	3.4
D5	skin shadow L*=25	49.4	19.4	26.5	41.3	16.1	16.2	17.3	4.9
E5	skin shadow L*=11	-67.0	32.6	15.5	38.1	12.1	31.9	6.4	18.9
F5	Max Black	-461.9	64.0	8.2	42.8	0.1	38.8	-1.8	35.8

Summary Results	I*Color	I*tone	ΔE
Average Score for all patches	21.6	63.1	21.9
Average Score for the Worst 10% (3 lowest scoring patches)	-200.4	29.1	47.9



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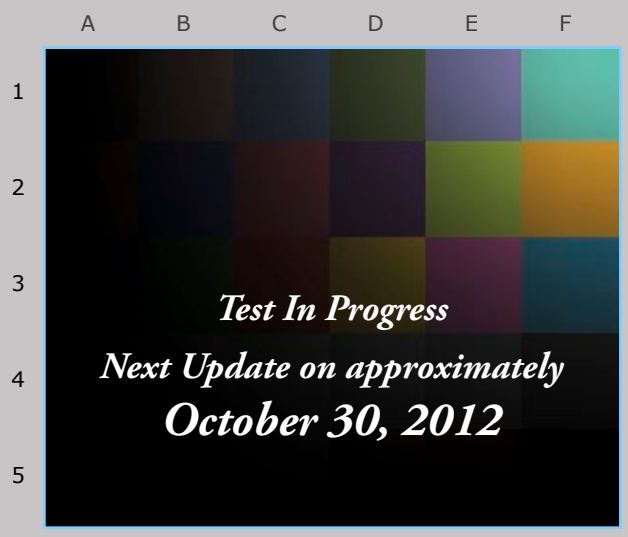
Original Print Colors
(measured before light exposure)



Next update is for 180 Megalux-hours
light exposure

Canon Pro9000, Canon OEM Chromalife 100,
Canon Photo Paper Pro

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