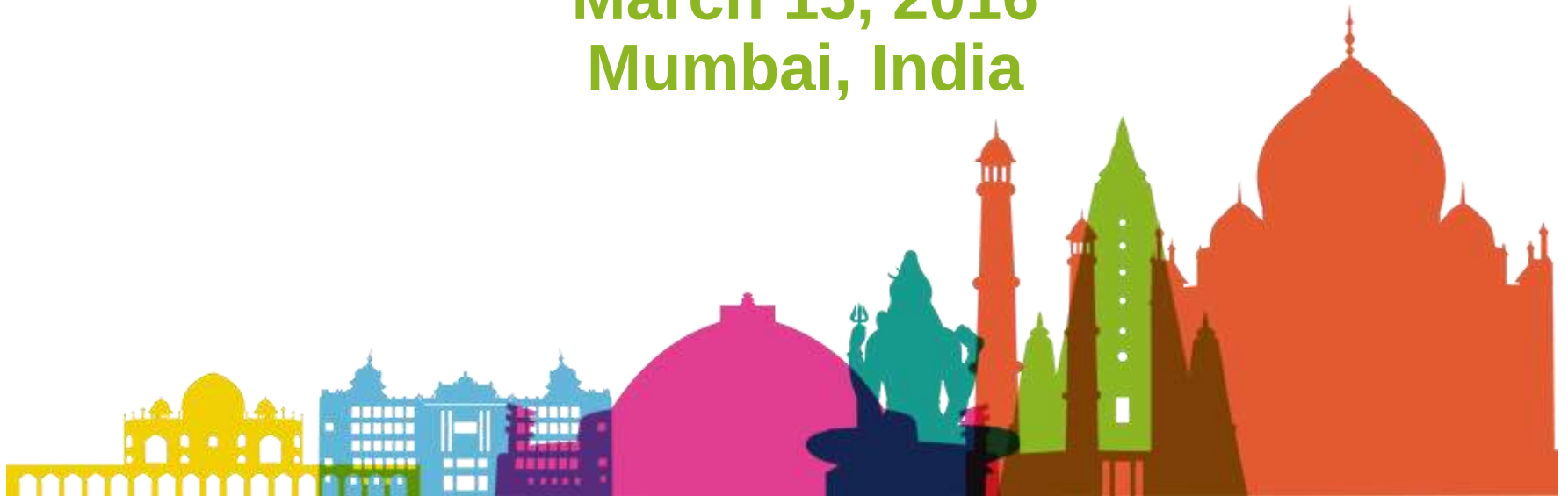


CREATING FUTURE PRINT THROUGH TECHNOLOGY AND INNOVATION



PRINT BUSINESS OUTLOOK CONFERENCE 2016

March 15, 2016
Mumbai, India



Color Management for Digital Photography

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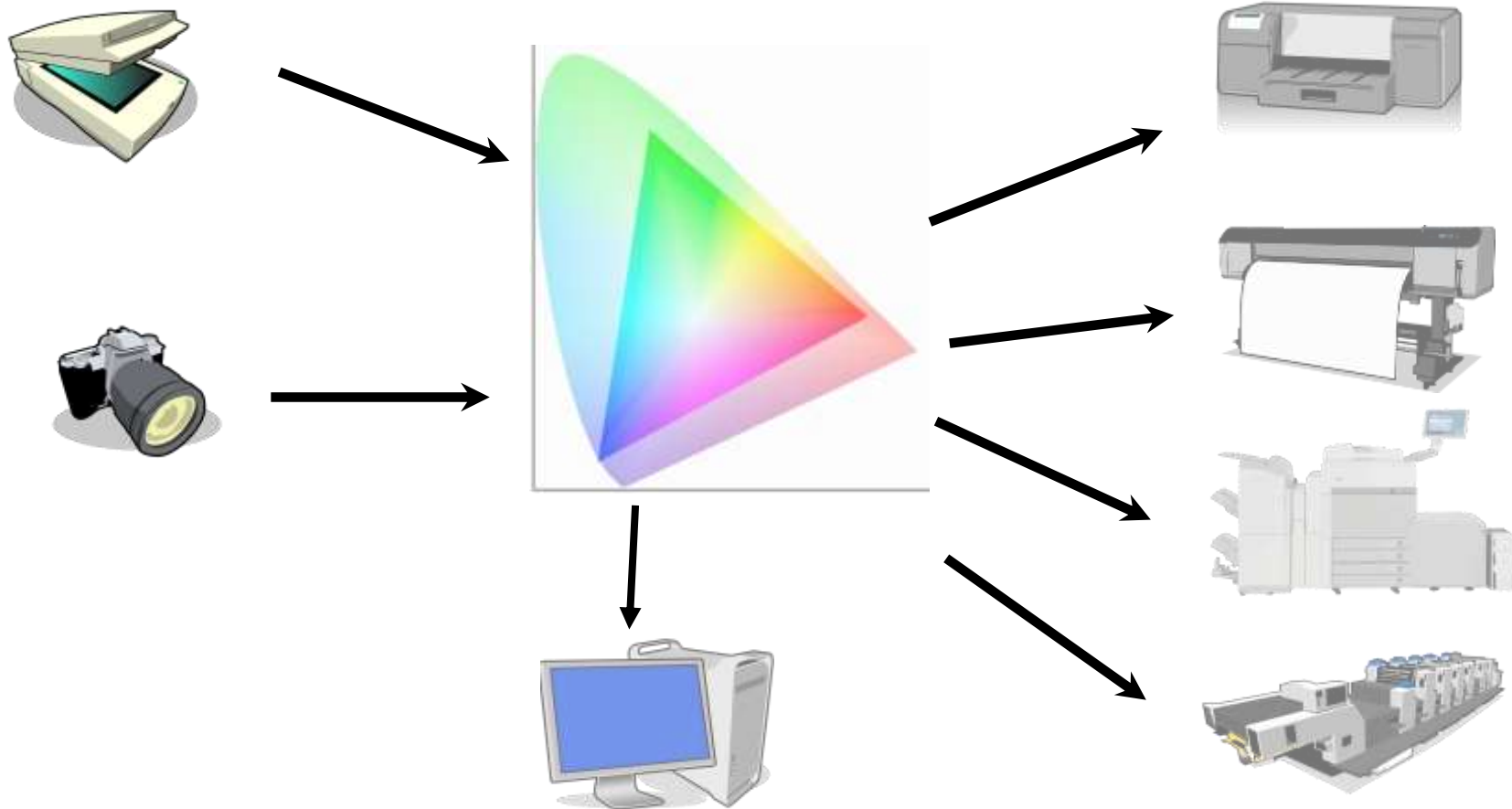


What's out, what's in for today

- Out
 - Spectral Profiling
- In
 - ICC profiles for Digital cameras
 - Raw “Profiles” for Digital cameras
- In and Out
 - Scene-referred Images
 - Display Calibration
 - Printer Calibration



Input to output



Scene Referred – Output Referred



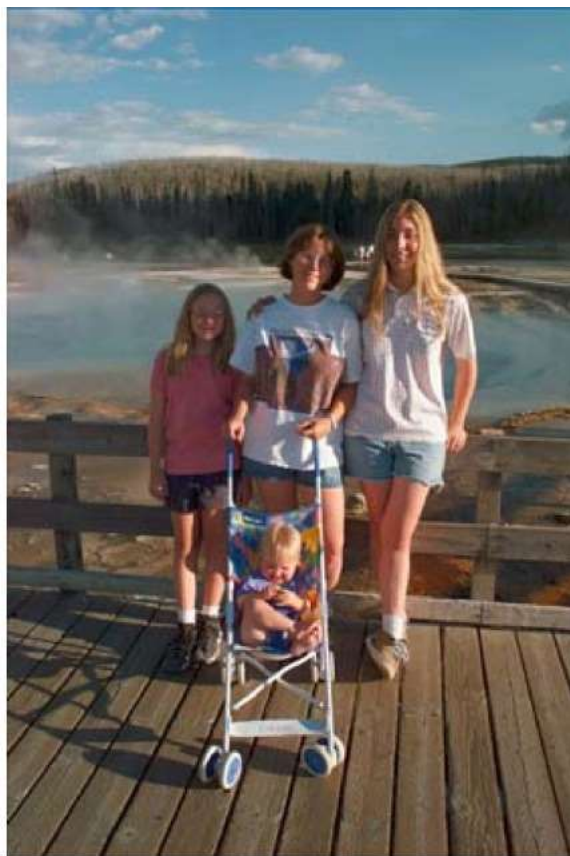
- Scene Referred:
 - The measured scene color the camera captures
- Output Referred
 - The transformation necessary to produce the desired interpretation for screen or print
 - Done in the camera for tiff and jpeg files if you set sRGB or Adobe RGB
 - If shooting RAW you become the renderer along with your RAW converter



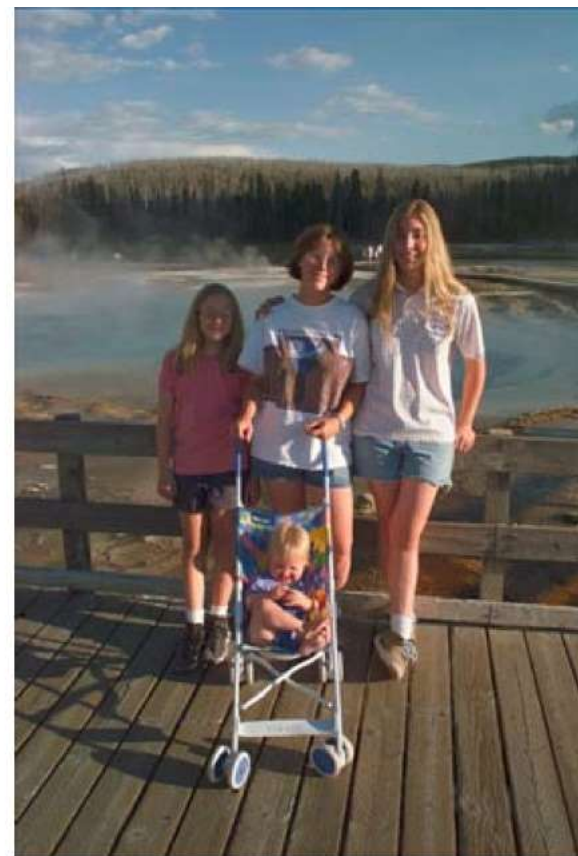
Scene Referred – Output Referred



Scene Referred



Camera A sRGB
rendering



Camera B sRGB
rendering



More Information

- ICC White Papers:
 - <http://color.org/whitepapers.xalter>
 - ICC_white_paper_17_ICC_profiles_with_camera_images.pdf
 - ICC_white_paper_20_Digital_photography_color_management_basics.pdf
- Creating Scene Referred images
 - <http://www.color.org/scene-referred.xalter>

International Color Consortium

MAKING COLOR SEAMLESS BETWEEN DEVICES AND DOCUMENTS

ABOUT ICC RESOURCES INFORMATION MEMBERS GETTING STARTED V4

ICC: EVENTS:

All ICC Events

2016

ICC Meetings - Munich

NPES-ICC Color Management

Creating scene-referred images using Photoshop CS3

Introduction

A scene is defined in ISO 22028-1 as follows:

scene
spectral radiances of a view of the natural world as measured from a specified vantage point in space and at a specified time

SEARCH ICC :
 GO

Got a question about ICC Profiles or colour management?
Ask Phil...

ICC: LIVE TOPICS:

iccMAX

Why profile a digital camera

Two common scenarios:

- Desire to have colorimetrically accurate reproduction
 - ICC workflow
- Desire to have pictorially consistent starting point
 - DNG or RAW calibration



Camera Color Management

- ICC workflow - TIFs and JPEGs
 - Processed in the camera
 - sRGB or Adobe RGB
- DNG or RAW
 - Processed in software
 - All data is captured
 - Large file size
 - Greater editing capabilities



Common workflow elements

- White Balance the Camera
 - Survey reports 3 hours a week lost in just post capture white balance edits
- Software to create the profile
- Physical target compatible with software using to render the profile.



Common input profiling targets



Custom profiling targets

- Used primarily for tight colorimetric reproduction
 - Use the actual materials to be reproduced
 - Artist pigments
 - Fabric swatches
 - Other materials
 - Most common is to emulate the Classic ColorChecker
 - New work in ISO 12641-2 to allow easier creation of custom input targets



How often to profile

When something changes

- ICC
 - Colorimetric accuracy
 - primary concern is the lighting
- RAW
 - Lighting less of a concern with dual illuminant profile



Capturing target

- Even lighting
 - No glare
 - Proper exposure
 - Square on to the camera



Building the ICC profile

- Capture the target
 - TIFF
 - RAW
 - JPG
- Process in the software of choice
 - May need to have a reference file
 - Various degrees of complexity



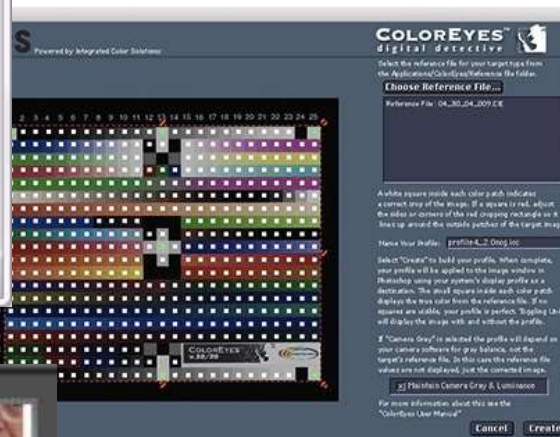
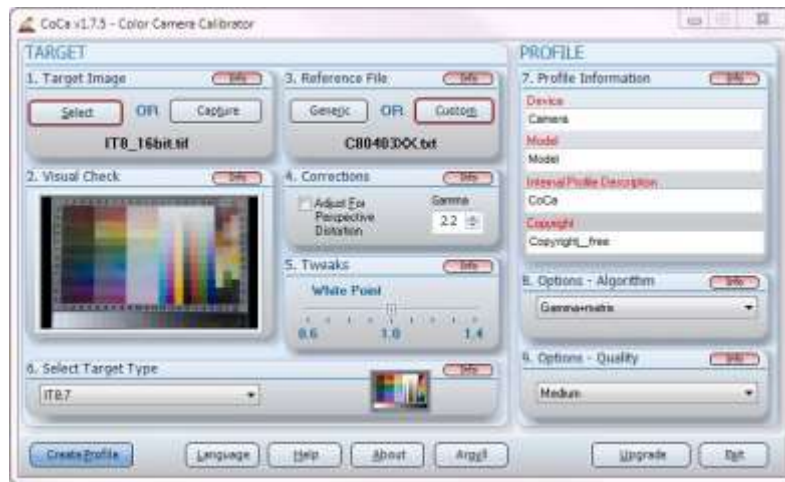
The data below is intended to be an average measurement of all ColorChecker Charts. ColorChecker Charts should be replaced every two years as fading of the colors will alter the values of the chart.

No.	Name	sRGB			CIE L*a*b*			Munsell Notation hue Value / Chroma	
		R	G	B	L*	a*	b*		
1.	dark skin	115	82	68	37.986	13.555	14.059	3 YR	3.7 / 3.2
2.	light skin	194	150	130	65.711	18.13	17.81	2.2 YR	6.47 / 4.1
3.	blue sky	98	122	157	49.927	-4.88	-21.925	4.3 PB	4.95 / 5.5
4.	foliage	87	108	67	43.139	-13.095	23.905	6.7 GY	4.2 / 4.1
5.	blue flower	133	128	127	55.112	8.844	-25.399	9.7 PB	5.47 / 6.7
6.	bluish green	103	189	170	70.719	-33.397	-0.199	2.5 BG	7 / 6
7.	orange	214	126	44	62.661	36.067	57.096	5 YR	6 / 11
8.	purplish blue	80	91	166	40.02	10.41	-45.964	7.5 PB	4 / 10.7
9.	moderate red	193	90	99	51.124	48.239	16.248	2.5 R	5 / 10
10.	purple	94	60	108	30.325	22.976	-21.587	5 P	3 / 7
11.	yellow green	157	188	64	72.532	-23.709	57.255	5 GY	7.1 / 9.1
12.	orange yellow	224	163	46	71.941	19.363	67.857	10 YR	7 / 10.5
13.	blue	56	61	150	28.778	14.179	-50.297	7.5 PB	2.9 / 12.7
14.	green	70	148	73	55.261	-28.342	31.37	0.25 G	5.4 / 8.65
15.	red	175	54	60	42.101	53.378	-28.19	5 R	4 / 12
16.	yellow	231	199	31	81.733	4.039	79.819	5 Y	8 / 11.1
17.	magenta	187	86	149	51.935	49.986	-14.574	2.5 RP	5 / 12
18.	cyan	8	133	161	51.038	-28.631	-28.638	5 B	5 / 8
19.	white (D50*)	243	243	242	96.539	-0.425	1.186	N	9.5 /
20.	neutral 8 (2.3*)	200	200	200	81.257	-0.638	-0.335	N	8 /
21.	neutral 6.5 (4.4*)	160	160	160	68.766	-0.734	-0.504	N	6.5 /
22.	neutral 5 (7.0*)	122	122	121	50.867	-0.153	-0.27	N	5 /
23.	neutral 3.5 (1.05*)	85	85	85	35.856	-0.421	-1.231	N	3.5 /
24.	black (1.50*)	52	52	52	20.461	-0.079	-0.973	N	2 /

Cie L*a*b* values use Illuminant D50 2 degree observer sRGB values for Illuminant D65.



Typical software interfaces





Applying the ICC Profile in Photoshop

- Edit > Assign Profile



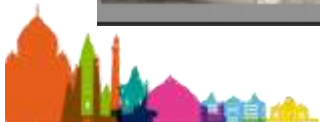
Raw Profiling in Lightroom

- Export with Preset > ColorChecker Passport



Applying the profile in Lightroom

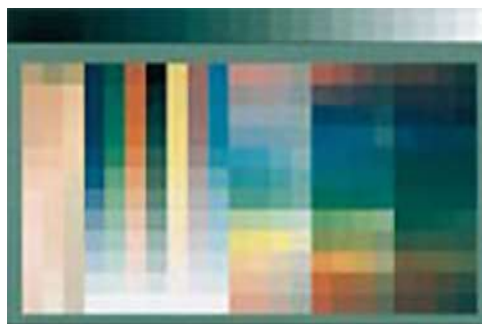
- Develop > Camera Calibration



Result of profiling



original



Capture



Profile applied



What could go wrong

- Biggest variables:
 - Camera settings
 - Variable internal image processing being applied
 - Auto white balance
 - Exposure
 - Lighting
 - Was the lighting on the target even
 - Was lighting on the target the same as corrected image



The new originals



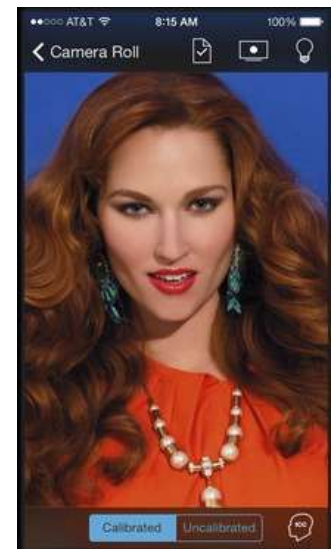
Display calibration

- The foundation for the digital darkroom
 - If editing on screen - display calibration is required
 - If sending to a lab or printing locally - display profiling reduces cost and rework
- In many cases the final destination is the display



Mobile Devices

- Mobile devices do not support system-wide color management
 - Assumption of sRGB
 - Application based color management is only option



Survey results

- Lack of display calibration resulted in an average of 4.5 extra hours of work per week in color correction
- In a recent survey 66% of respondents answered that display calibration did affect their design process
 - Cut down time adjusting colors
 - Provided 'More Confidence'
- “More efficient in achieving the right color on a print out, based on what's on the screen”
- Majority used the word “accurate” when responding to how display calibration made a difference
- “More accurate photo reproduction”
- “Photos look better”



What about film?



- Film is really a question of scanner profiling
 - Scanner profiling process is equivalent to ICC camera profiling
- Profiling scanner issues are primarily related to settings within the scanner software
- In most scanner applications the ICC profile can be directly applied to the resultant scan



Conclusions

- Camera Profiling or Calibration provide quantifiable benefits to digital photographers
- Monitor calibration is required for the new digital darkroom
- If printing closing the loop may require profiling your local printer, your lab or using their supplied profile



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