How to meet or exceed E-Factor?

Fifth of the 5 C's of Color Control

Capture — assess instrumentation capabilities

Calibration- make device consistent to itself & over time

Characterization — define device gamut and create profile(s)

Conversion — map one gamut to another in the workflow

Conformance — verify new results and meet Color expectations

ChromaChecker

Overview: Conformance

5th C of the 5 C's of Color Control

- Most important C because it determines if print is salable
- Entire reason to use Color Control is eliminate waste
- Salable is in the eye of the buyer… Different Expectations
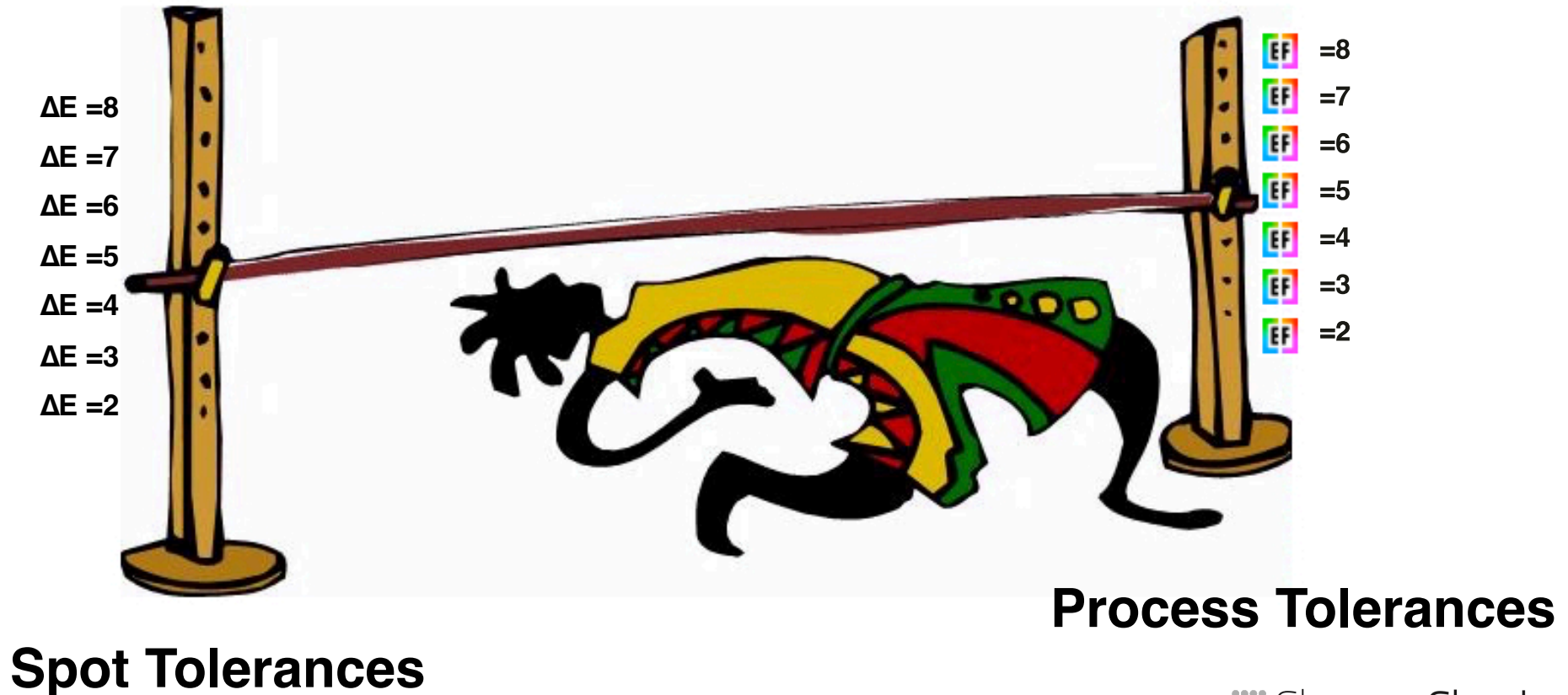- Critical to base Conformance on your Buyer's Expectations

Process Control vs. Color Conformance

Process Control Metrics- Do NOT assess Visual Match

- CMYK Solids within a determined ΔE

- RGB Overprints within a determined ΔE

- G7 Gray balance and Tonality within a determined Δab, ΔL

- Peak and Average ΔE within X

- The hope had been that if these metrics pass, that sheet is visually good, but compared to what? GRACoL, Proof?? Doesn't work!!! All vendors score cards use PC metrics

Understand… Tighter the Tolerance- Harder

Exponentially Harder to Achieve- More $$$

$\Delta E = 8$
$\Delta E = 7$
$\Delta E = 6$
$\Delta E = 5$
$\Delta E = 4$
$\Delta E = 3$
$\Delta E = 2$

EF =8
EF =7
EF =6
EF =5
EF =4
EF =3
EF =2

Process Tolerances

Spot Tolerances

Output Device Capabilities?

Print Device Production Capabilities

◆ Not just process control (ensuring CMYK and G7 gray is OK)

◆ Sum of all variables: print device, consumables, operator

◆ Manufacturer's don't publish this number (mileage varies)

Defining Method to Control Output

Depending upon Process, and Reference

- Create G7 Curve to accommodate device condition
    - E-Factor= 4-6
- Create an ICC Profile to accommodate device condition
    - E-Factor= 3-5
- ICC Device links with ink savings
    - E-Factor= 2-4

Then Determine if Tolerance is Possible…

Depending upon process, may not maintain

- True spot color with custom ink formulation for substrate

- Spot color simulation on digital device

  - Using CMYK builds to simulate the desired color

ΔE

Measurement	Created	x	y	L*	a*	b*	dE₀₀		
CocaCola Oryginal-20191216150342.cxf	2019-12-16 21:03	1792	359	45.37	68.02	49.72	0.4	✔	🔍
CocaCola Oryginal-20191216150342.cxf	2019-12-16 21:03	1670	359	45.27	68.13	49.80	0.5	✔	🔍
CocaCola Oryginal-20191216150342.cxf	2019-12-16 21:03	1604	359	46.48	65.26	43.01	2.7	✖	🔍
CocaCola Oryginal-20191216150342.cxf	2019-12-16 21:03	1560	565	44.83	68.87	52.04	1.1	✔	🔍
CocaCola Oryginal-20191216150342.cxf	2019-12-16 21:03	1483	577	44.92	68.42	50.76	0.8	✔	🔍
CocaCola Oryginal-20191216150342.cxf	2019-12-16 21:03	1340	632	44.85	68.68	51.27	0.9	✔	🔍
CocaCola Oryginal-20191216150342.cxf	2019-12-16 21:03	1208	632	45.07	68.86	51.39	0.7	✔	🔍
CocaCola Oryginal-20191216150342.cxf	2019-12-16 21:03	894	632	44.69	68.97	52.40	1.3	✔	🔍

Benchmarking Printing Devices

Over 1 Million measurements- published report

◆ Benchmark procedures to audit your devices- free software

◆ Digital press, large format, flexo, offset

◆ Gamut Size, Consistency, Accuracy, Resolution

Benchmark #1 Gamut Size: Results

◆Fuji J-Press*	558,700	75%
◆Kodak Prosper	515,200	74%
◆KM1 Press*	513,900	76%
◆Konica Minolta KM1	512,900	76%
◆Digital Press NEE	504,100	71%
◆Digital Press NI	459,400	70%
◆Indigo 10000*	451,100	66%
◆Indigo 12000*	450,500	66%
◆Digital Press O	445,300	68%
◆Indigo WS6600*	420,900	63%
◆Igen 6 Press*	401,300	65%
◆Digital Press N	351,900	57%
◆Kodak Nexpress*	350,700	57%

Benchmark #2 Variation: Results

Printer	With/in		Between		E-Factor M
◆Indigo 12000*	1.0	P	1.0	P	1.1
◆Domino press	1.0	P	1.0	P	1.1
◆Fuji J-Press*	1.2	P	1.1	P	1.1
◆KM1 Press*	1.3	P	2.0	P	1.6
◆Kodak Nexpress*	1.2	P	1.8	F	2.9
◆Konica Minolta KM1	1.4	P	1.2	F	1.1
◆Digital Press O	2.3	F	3.2	F	2.2
◆Igen 6 Press*	2.5	P	2.2	P	2.8
◆Kodak Prosper	3.0	F	1.4	F	3.6
◆Digital Press N	5.1	F	5.5	F	4.7
◆Indigo 6600 *	.9	P	Incomplete		3.0
◆Indigo 6000 *	1.8	F			

ecker

Assessing all Output Devices

- Centralized, Accountable Color Control
- Allows Each Operator to be Responsible
- Notifications sent if Device not maintained

System Overview

Determining Salable Color Printing

Level of Acceptance for Color Match

- Quality of Color match of print dependent on:

    1. Capture Devices- Quality of Instrumentation?

    2. Calibration procedures- How often?

    3. Characterization procedures- Quality and how many?

    4. Conversion processes- Quality and Purpose?

    5. Plus Paper consistency, backing material, and Lighting

Paper Manufacturing

Many Variables, OBA, Water, Fiber

- Paper variation in manufacturing- Oregon vs. Wisconsin
- Proofing Paper tolerances- Max 1Δ in L* or a* or b*
- Photo Paper tolerances- Max 2Δ in L* or a* or b*
- Track Paper independent of Ink
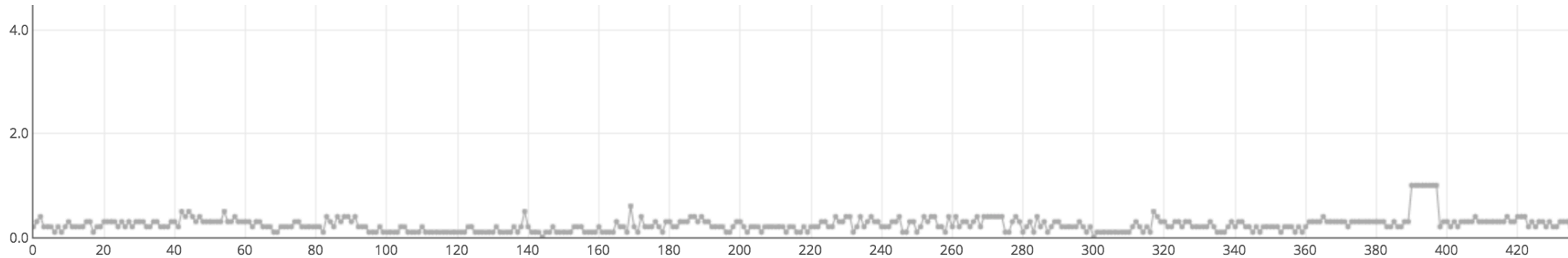
Measurement Backing Differences

Actual Data- Changing backing behind measure

- Measuring same target with same accurate instrument
- Measure on ISO White, ISO Black, and actual paper
- Differences are greater than 2 E-Factor…

Press Side Measurement= Black

Proofing Measurement= White

Compare Files

Summary

ΔE 2000	Capture - X-Rite eXact sn. 00 0317 - 2019-12-15 21:13:05 2019-12-15 21:13:05	Capture - X-Rite eXact sn. 00 0317 - 2019-12-15 21:11:57 2019-12-15 21:11:57
Capture - X-Rite eXact sn. 00 0317 - 2019-12-15 21:13:05 2019-12-15 21:13:05		

E-Factor	2.3
Substrate	2.0
Primaries	2.3
Overprints	1.8
Tints	2.7
G7 grays	2.0

ISO 13655
L* = 95
a* = .9
b* = 1.3

ChromaChecker

How Measurement Device Influences Result

No two measurement devices measure same…
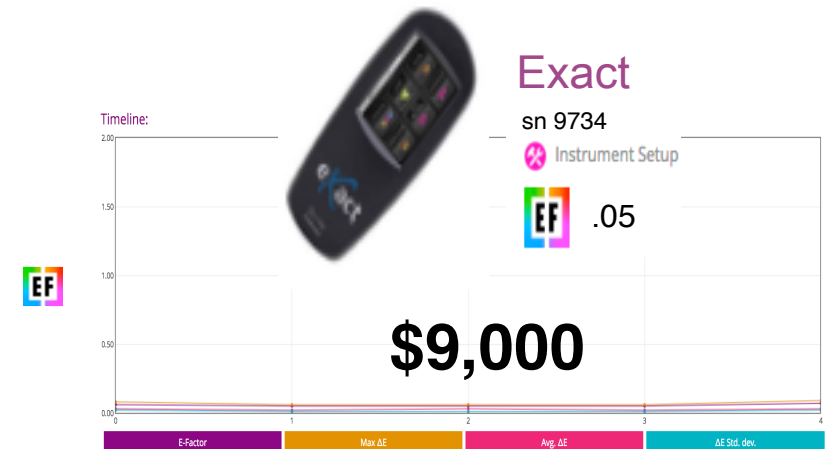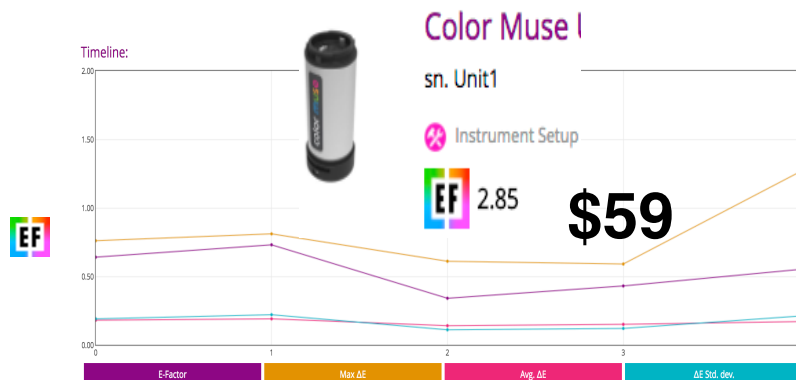
Color Conversion Conformance

Different Tracks for Different Workflows

- Match to GRACoL2013
- Match to Full Gamut of Printing device

Digital

Collapse ☰ Expand ☷ Uncheck All ☐ Check All ☑

▼ ColorPress 1

Track Name		Files ◎			Reference Printing Conditions	Substrate		Last Meas.	EF		
☐ Coated		485	6.0		SCCA GRACoL2013_CRPC6 V2	DW-62	1.1	2 years	4.6	✓	🔍
☐ Uncoated		4	8.0		SCCA CRPC5_Baltoro_G7			1 year	4.7	✓	🔍
☐ Coated_Full Gamut		3	6.0		SCCA PrintWide2020 - Idealliance	DW-62	4.1	6 years	4.1	✓	🔍
☐ Matte Lamination		3	8.0		SCCA OK2			6 years	1.9	✓	🔍
☐ PRE Matte Lamination		2	8.0		SCCA ok4			6 years	1.9	✓	🔍

▼ ColorPress 2

Track Name		Files ◎			Reference Printing Conditions	Substrate		Last Meas.	EF		
☐ Coated		389	6.0		SCCA GRACoL2013_CRPC6 V2	DW-62	1	2 years	5.3	✓	🔍
☐ Coated_Full Gamut		0	6.0		SCCA PrintWide2020 - Idealliance	DW-62					🔍

ChromaChecker

Each Variable Stacks on Top of Each Other

Cumulative Process:

- Each Workflow Component is tracked using **ΔE** or **E-Factor**

- **They all stack on each other**

Light Booth Variations

Reference Variations

Backing Differences

Printer Variations

Instrument Variations

Paper Variations

or 12 **EF**

= 8 **EF**

or 5 **EF**
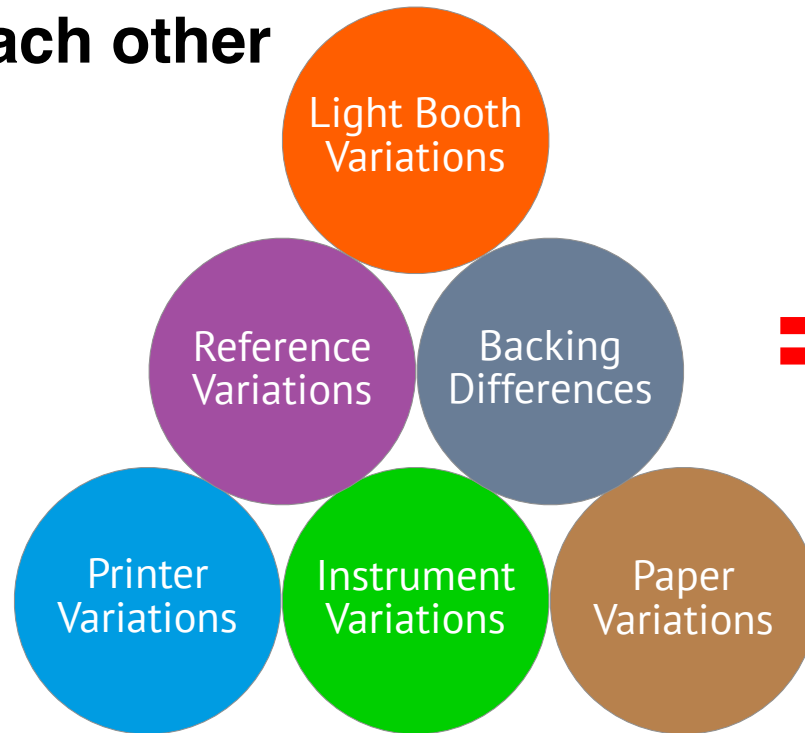
Summary- Conformance

Color Control is complicated!!!

- Need Print Quality Program

- Understand where printing devices compare to Reference

- Learn which ones are most out of specification, priorities

- Align printers, substrates to one another

- Ensure Instruments, Calibration, Paper, Lighting, Backing

- Optimize Conversions for different Purposes are correct