International Color Consortium®

ICC Color Symposium

22/10/2018 · Hong Kong

How to get consistency in color appearance?
如何將顏色外觀達至一致?

Juergen Seitz
Senior Technical Advisor, GMG

Organizers

THE HONG KONG PRINTERS ASSOCIATION 香港印刷業商會

APTEC 印刷科技研究中心 Advanced Printing Technology Centre (A Subsidiary of The Hong Kong Printers Association)

ICC

about consistent color appearance
有關色彩外觀

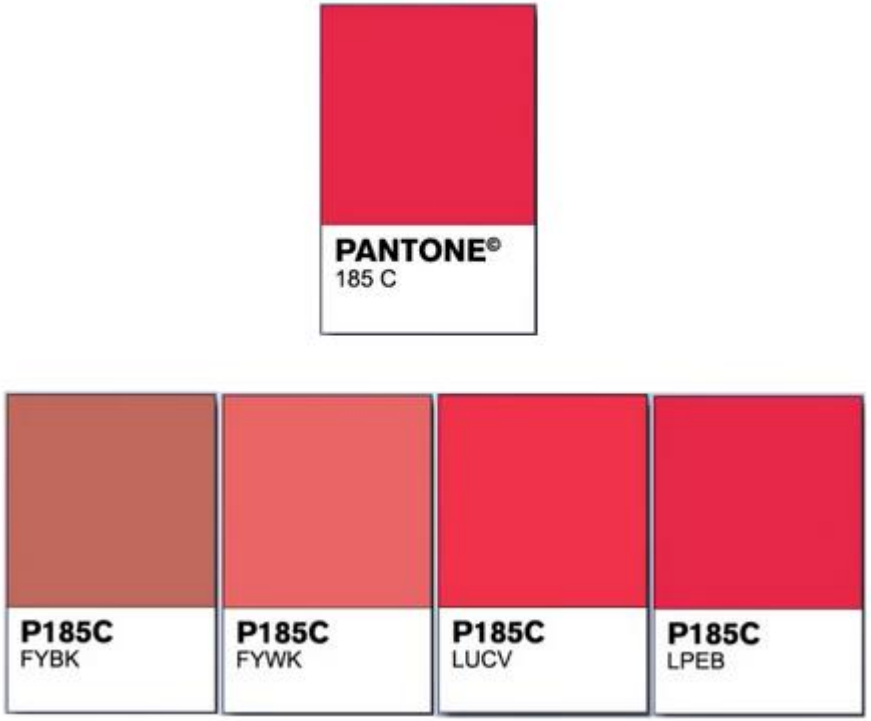
- consistent color appearance‘ is about finding and describing the visual consistency across a set of images or colors, even when exact appearance or colorimetric matches are not possible
- a consistent appearance may underlie very different rules, depending on the usecase.

- 一致的顏色外觀是關於查找和描述一組圖像或顏色的視覺一致性，即使在無法進行精確的外觀或色度匹配時也是如此
- 統一的外觀因應不同的使用情況可能有不同的規則

International Color Consortium®

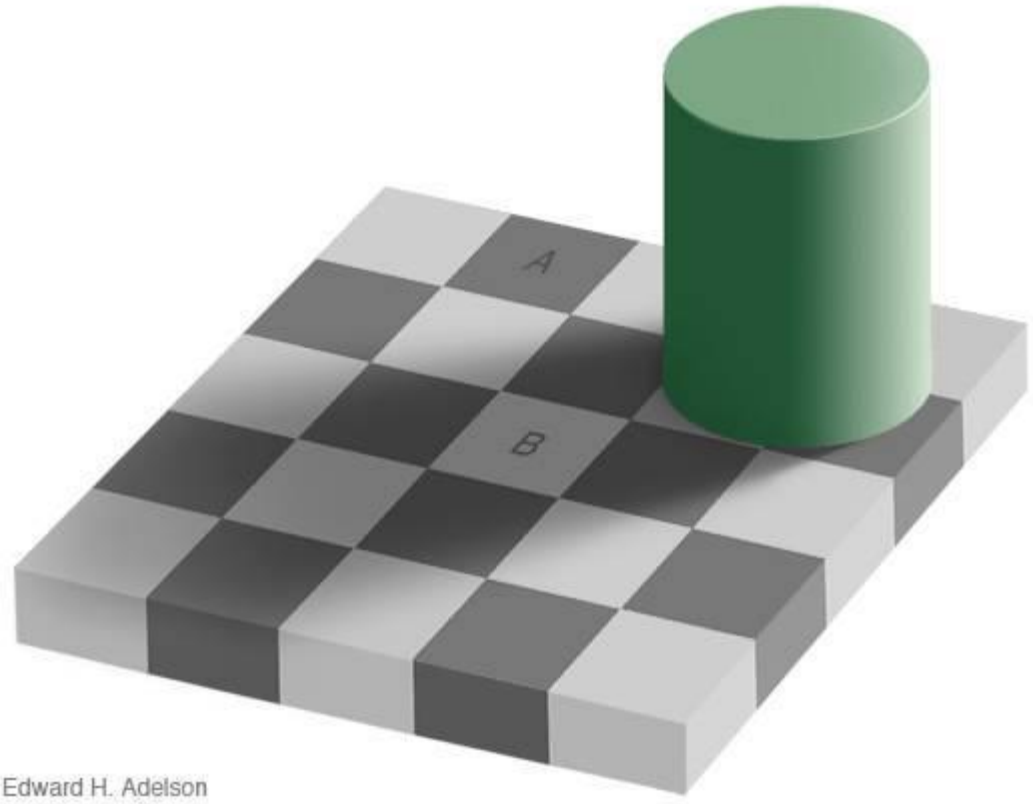
about consistent color appearance
有關色彩外觀

about consistent color appearance
有關色彩外觀



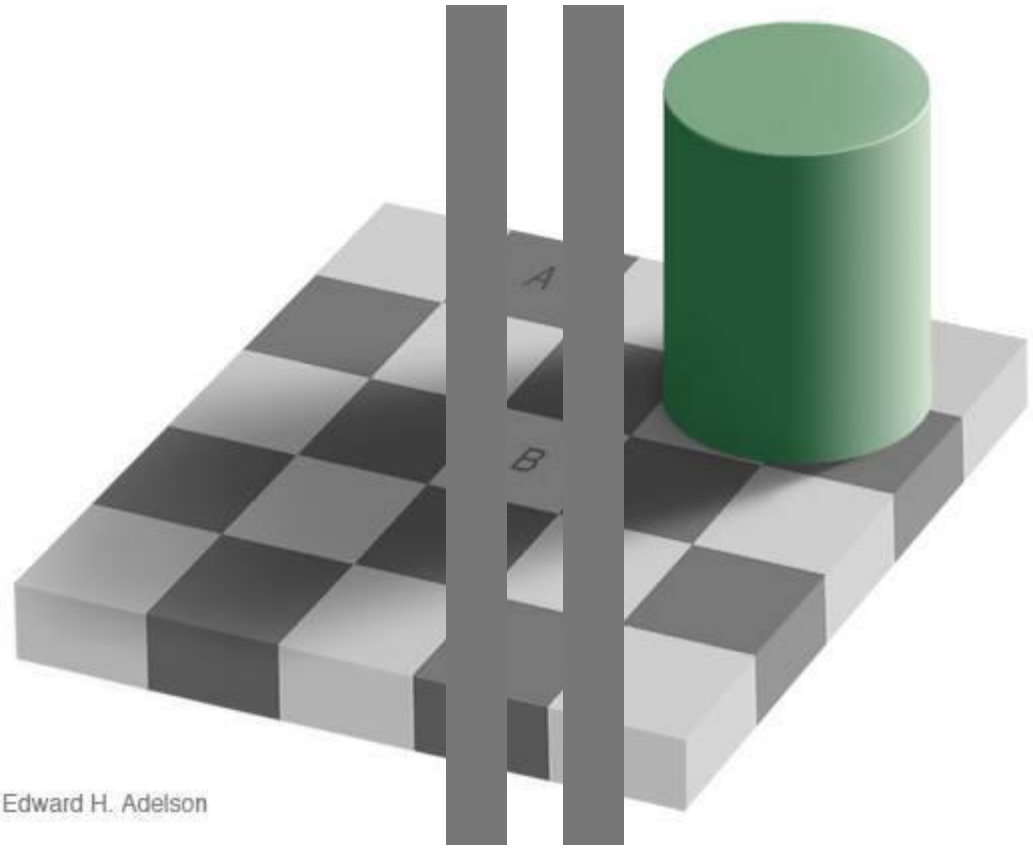
source: https://www.xrite.com/blog/color-consistency-with-pantonelive

about consistent color appearance
有關色彩外觀

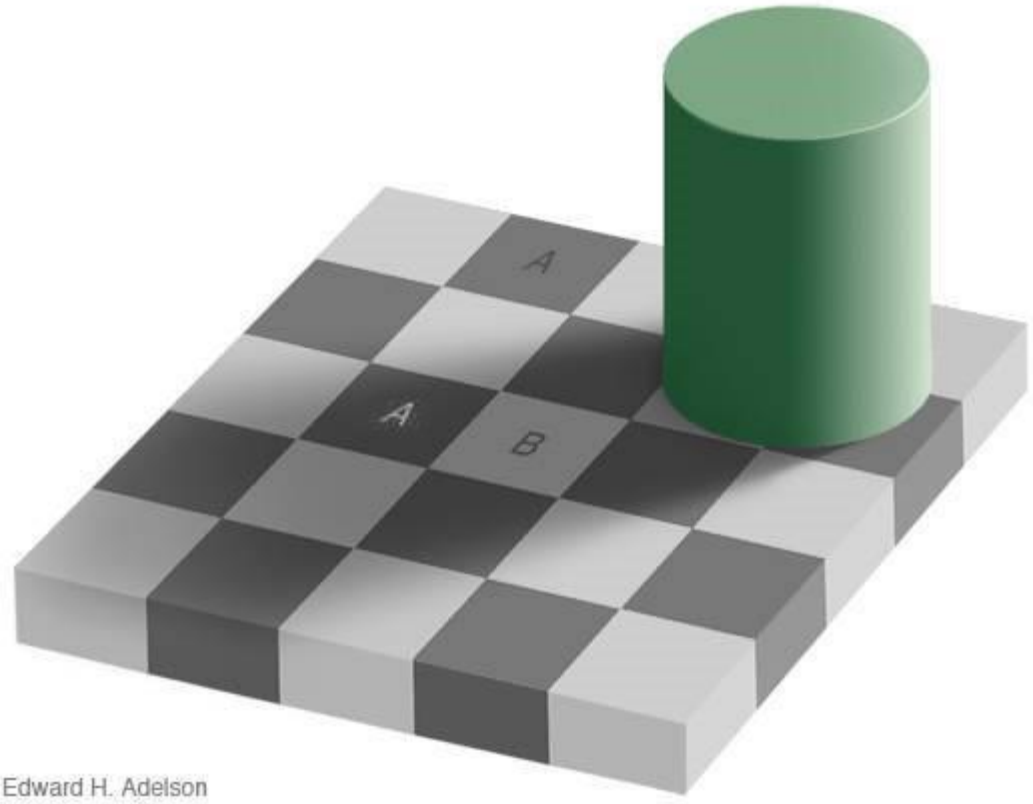


Edward H. Adelson

about consistent color appearance
有關色彩外觀



about consistent color appearance
有關色彩外觀



Edward H. Adelson

about consistent color appearance
有關色彩外觀

about consistent color appearance
有關色彩外觀

Set A

Set B

Source: Craig Revie, CIE TC 8-16 Consistent Colour Appearance

research 研究

CIE Technical Committee TC8-16

research 研究

CIE Technical Committee TC8-16

Research projects:

山形大学 YAMAGATA UNIVERSITY

R·I·T

The Norwegian Colour and Visual Computing Laboratory

Fogra

research 研究

Yamagata University, Japan

- comparing different rendering strategies on different small, medium and large gamuts
- comparing the results to a trendline for the most consistent color reproductions

Yamagata University, Japan

- 比較不同大、中、小色域的不同轉換方法
- 將結果與最一致性的色彩複製的趨勢作出比較

山形大学 YAMAGATA UNIVERSITY

research 研究

Yamagata University, Japan

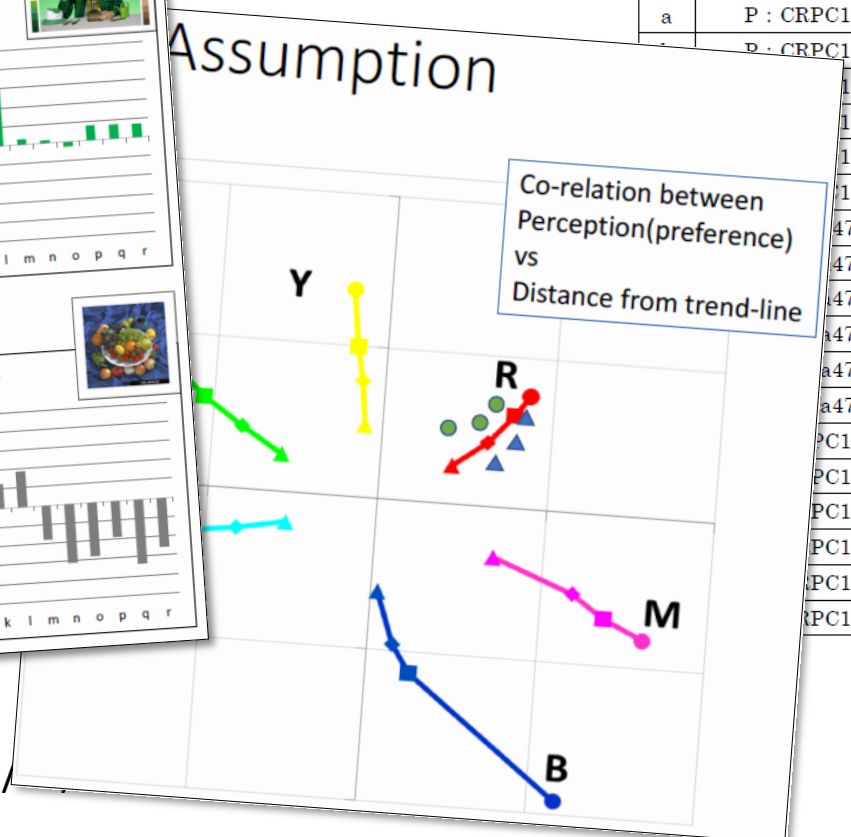


表 4 18 通り全組み合わせ

	Small	Medium	Large
a	P : CRPC1	P : SC_paper	P : eciCMYK
	P : CRPC1	P : SC_paper	C : eciCMYK
	1	P : Japan Web Coated	P : eciCMYK
	1	P : Japan Web Coated	C : eciCMYK
	1	C : SC_paper	P : eciCMYK
	1	C : SC_paper	C : eciCMYK
	47	P : SC_paper	P : eciCMYK
	47	P : SC_paper	C : eciCMYK
	47	P : Japan Web Coated	P : eciCMYK
	47	P : Japan Web Coated	C : eciCMYK
	a47	C : SC_paper	P : eciCMYK
	a47	C : SC_paper	C : eciCMYK
	PC1	P : SC_paper	P : eciCMYK
	PC1	P : SC_paper	C : eciCMYK
	PC1	P : Japan	P : eciCMYK
	PC1	P : Japan Web Coated	C : eciCMYK
	PC1	C : SC_paper	P : eciCMYK
	PC1	C : SC_paper	C : eciCMYK

research 研究

Rochester Institute of Technology, USA

- verifying and describing the commonality between the several CRPCs from ISO/PAS 15339-2
- variations in tonality, contrast and greybalance are compared against the original CRPCs

Rochester Institute of Technology, USA

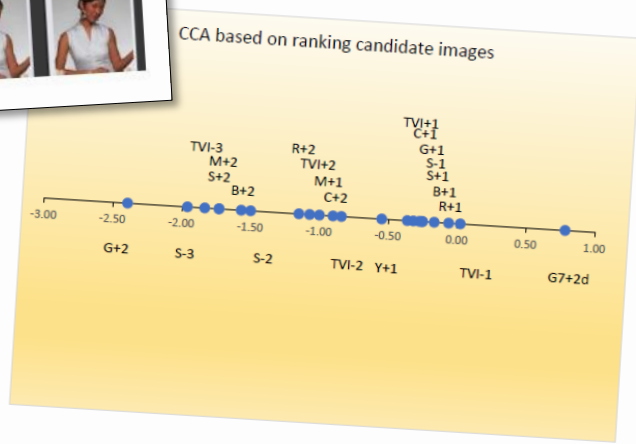
- 核實和描述在ISO/PAS 15339-2內多組不同CRPCs的共通性
- 與原本的CRPCs比較色調、反差和灰平衡的變化

research 研究

Rochester Institute of Technology, USA

anking images for the best

GB G+1d	-0.25
GB C+1d	-0.27
TVI+1d	-0.32
GB Y+1d	-0.36
TVI-2d	-0.55
GB C+2d	-0.84
GB M+1d	-0.90
TVI+2d	-1.00
GB R+2d	-1.07
S-2d	-1.15
GB B+2d	-1.50
S+2d	-1.57
GB M+2d	-1.73
TVI-3d	-1.73
S-3d	-1.83
GB G+2d	-1.96
	-2.40



Color Consistency scale based on Thurstone's Law of Comparative Judgement, Case V (Thurstone, 1927)

research 研究

NTNU ColourLab, Norway

- visual comparison of different rendering strategies to a small, medium and a large gamut, focusing on color
- variations in L, C and H
- comparison on screen, ranking by observer

NTNU ColourLab, Norway

- 以目視比較大、中、小的色域的轉換方法，並著重顏色表現
- L、C及H的變化
- 由觀察員在螢幕上的比較

research 研究

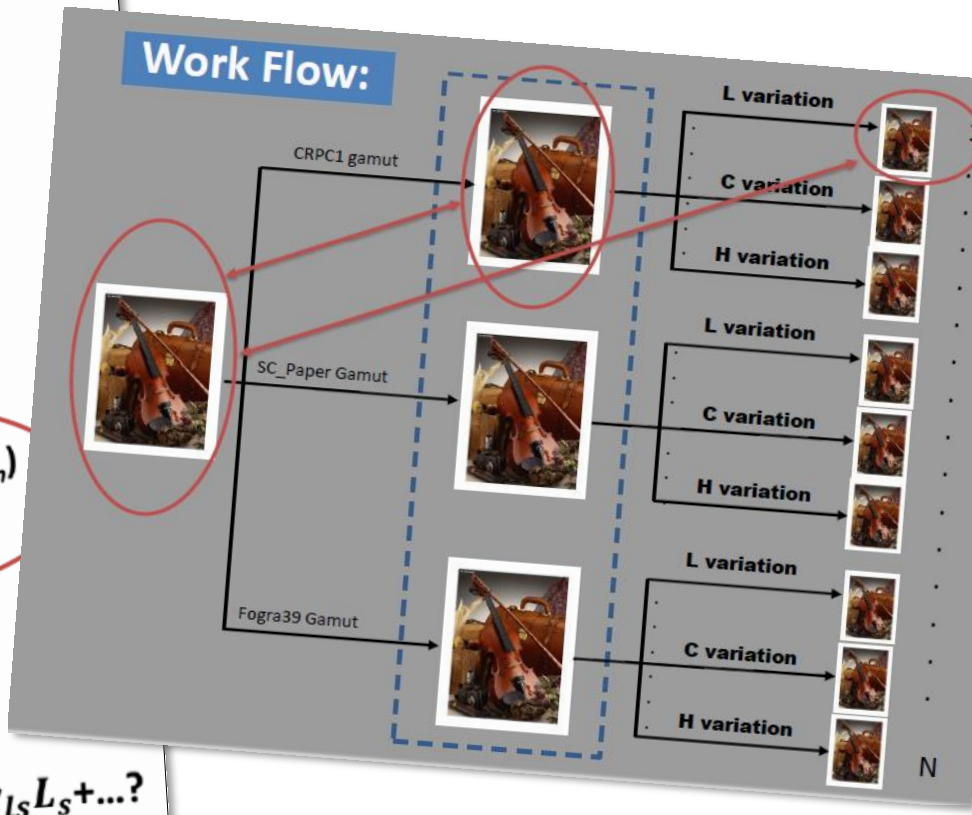
Definition of CCA:

Common Colour Appearance (F_{cca})

- Tone
  - Image complexity (I_c)
  - Smoothness (S_m)
- Color
  - Color balance (C_b)
  - Gamut mapping (G_m)
  - Color rendering (C_r)
  - Light source (L_s)
  - Others...

$$F_{cca}=w_{ic}I_c+w_{sm}S_m+w_{cb}C_b+w_{gm}G_m+w_{cr}C_r+w_{ls}L_s+...?$$

Work Flow:



research 研究

Fogra, Germany

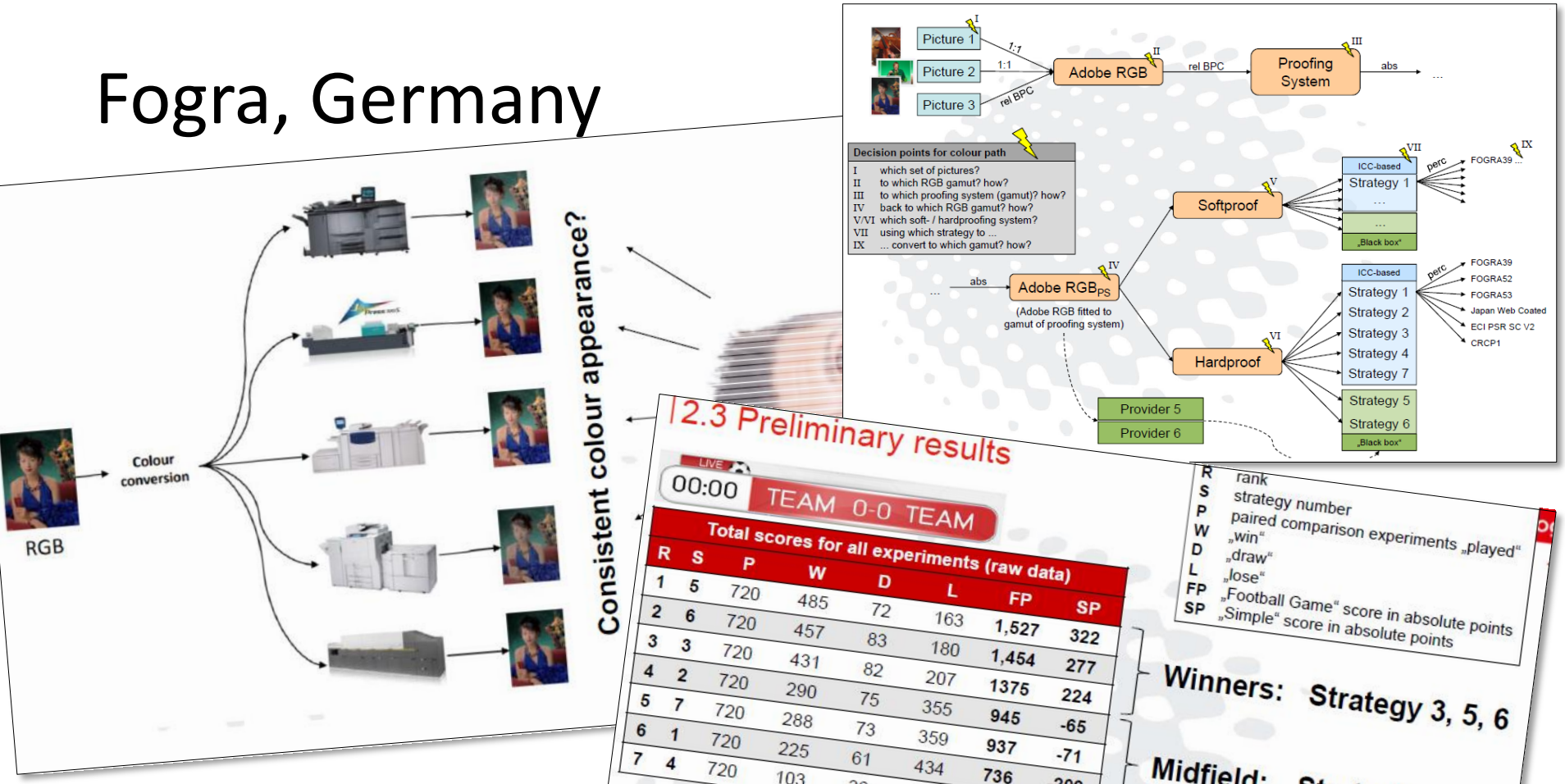
- comparing the quality of 7 different rendering strategies using 6 different color gamuts
- “does consistent color appearance exist?”
- “develop a metric to describe consistent color appearance”

Fogra, Germany

- 使用6個不同色域，比較使用7個不同的轉換方法的效果
- 色彩一致是否存在?
- 研究一個方法以描述一致性的色彩外觀

research 研究

Fogra, Germany



R	S	P	W	D	L	FP	SP
1	5	720	485	72	163	1,527	322
2	6	720	457	83	180	1,454	277
3	3	720	431	82	207	1375	224
4	2	720	290	75	355	945	-65
5	7	720	288	73	359	937	-71
6	1	720	225	61	434	736	-209
7	4	720	103	36	581	345	-478

research 研究

intermediate findings:

- there are significant quality differences between the many different samples that were compared.
- those differences seem to be systematic
- with systematic differences, a metric to describe the quality might be possible.

- the different research approaches are now going to be shared and repeated on other locations with more test persons

中期發現：

- 在比較很多的樣本中，具有重大的質量上的分別
- 這些分別似乎是有系統性
- 鑑於此系統性的分別，需要找出一個方法去描述質量

- 現將會為大家分享不同的研究方法及利用更多的人士在其他地區重覆進行測試

technologies 技術

- a near neutral process calibration improves the consistency in appearance
- color consistency requires consistent color rendering
- ICC profiles provide different renderings whichsoever has a strong impact on the appearance

- 中性校準可提高外觀的一致性
- 顏色一致性要求顏色呈現一致
- ICC特性檔提供不同的轉換，但對外觀有很大的影響

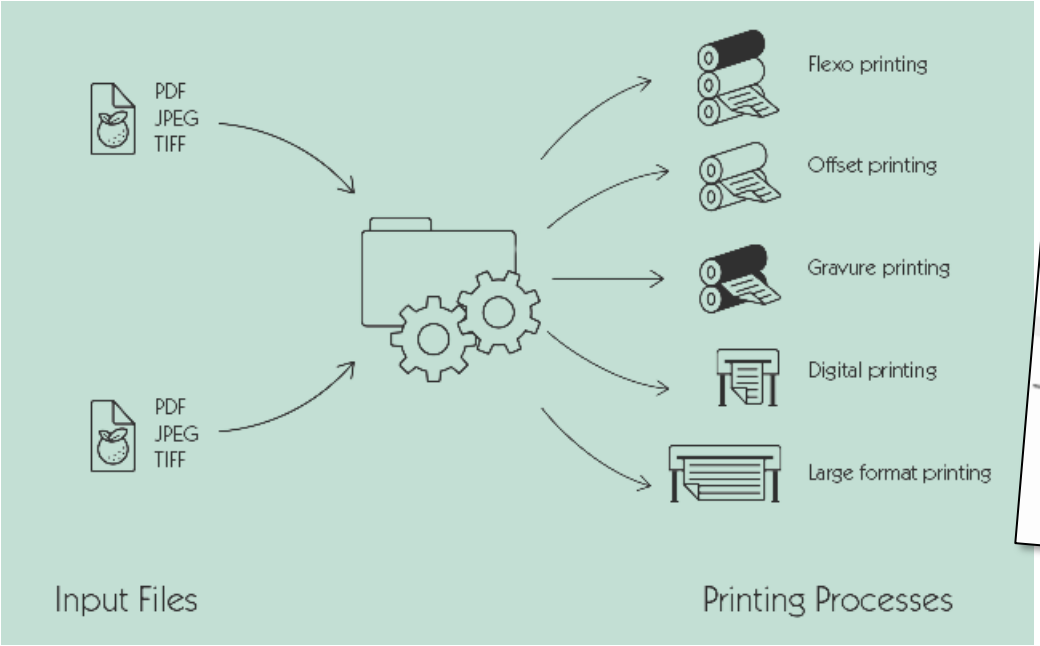
technologies 技術

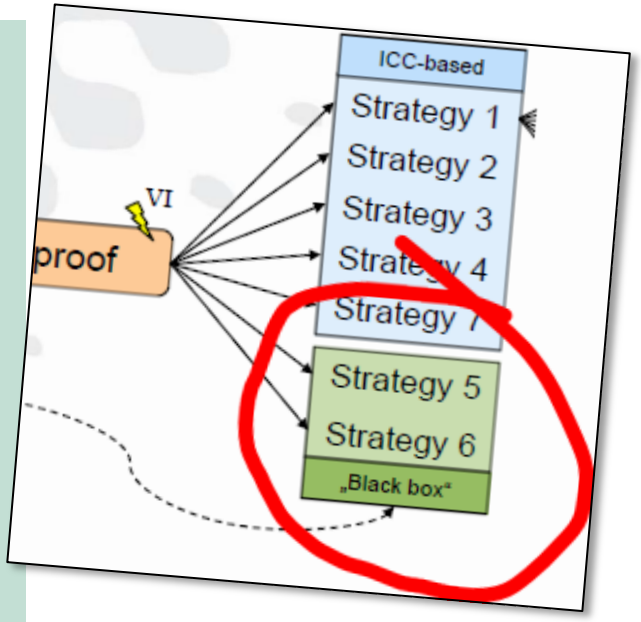
- ICC-handling for a consistent color appearance is usecase-dependent.
- iccMAX provides many additional attributes for a usecase specific rendering.
- color consistency comes from the used profiles, not from the rip.

- 用於一致顏色外觀的ICC處理依賴於用例
- iccMAX為特定於用例的呈現提供了許多其他屬性
- 顏色一致性來自使用的特性檔，而不是來自rip

technologies 技術

- some proprietary devicelink-profiling strategies perform very well.
  一些專有的devicelink-profiling策略表現非常好。





technologies 技術

tools 工具

- any tool that allows you to convert color on your data, using either ICC or devicelink profiles can help to automate your color workflow.
- Photoshop scripts can be used to automate colorspace transformations on image level.
- color transforms on pdf needs a color server function in your workflow.

- 任何允許您使用ICC或devicelink特性檔轉換數據顏色的工具都可以幫助您自動化顏色工作流程。
- Photoshop程式可用於在圖像級別自動化顏色空間轉換。
- pdf上的顏色轉換需要工作流程中的顏色服務器功能。

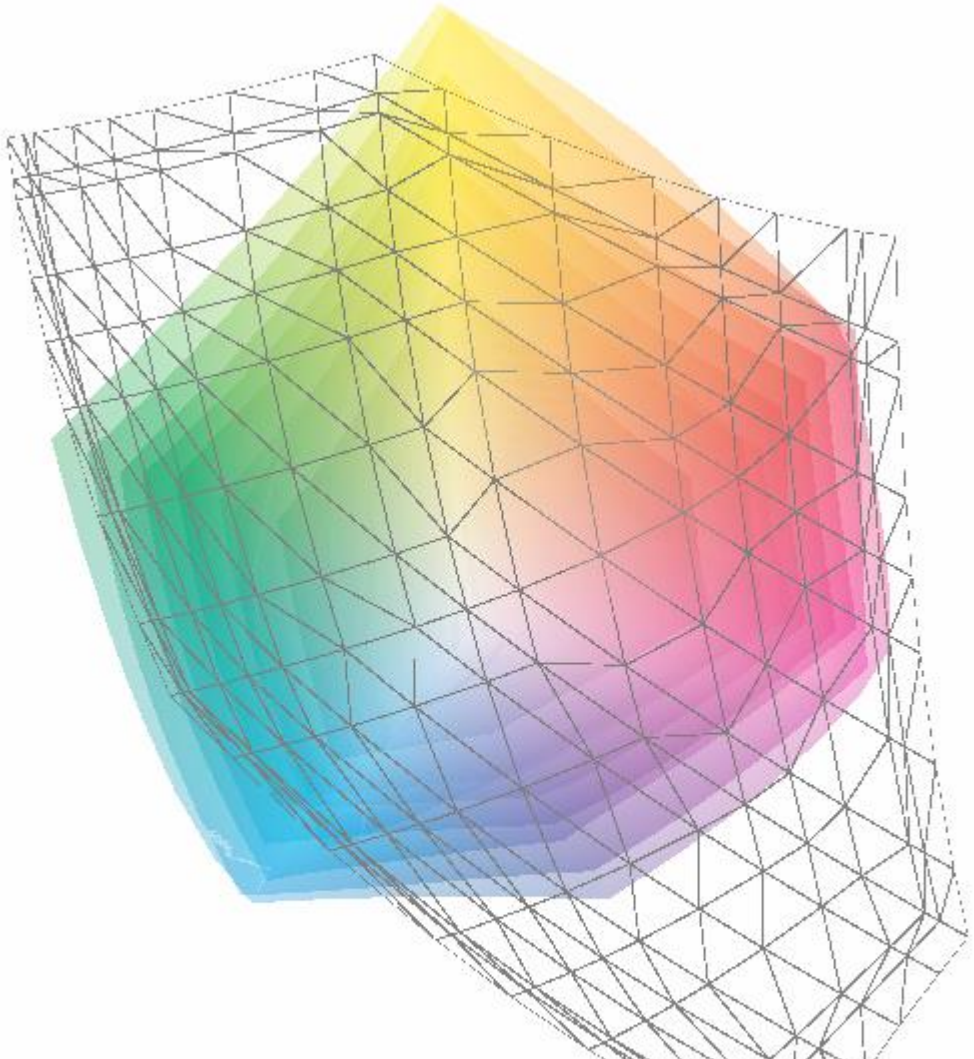
complexity 複雜性

- actual research only on CMYK-colorspaces.
- adding RGB or ECG or spotcolors is adding complexity

- 僅對CMYK顏色空間進行實際研究。
- 添加RGB或ECG或專色會增加複雜性

complexity 複雑性

complexity 複雑性

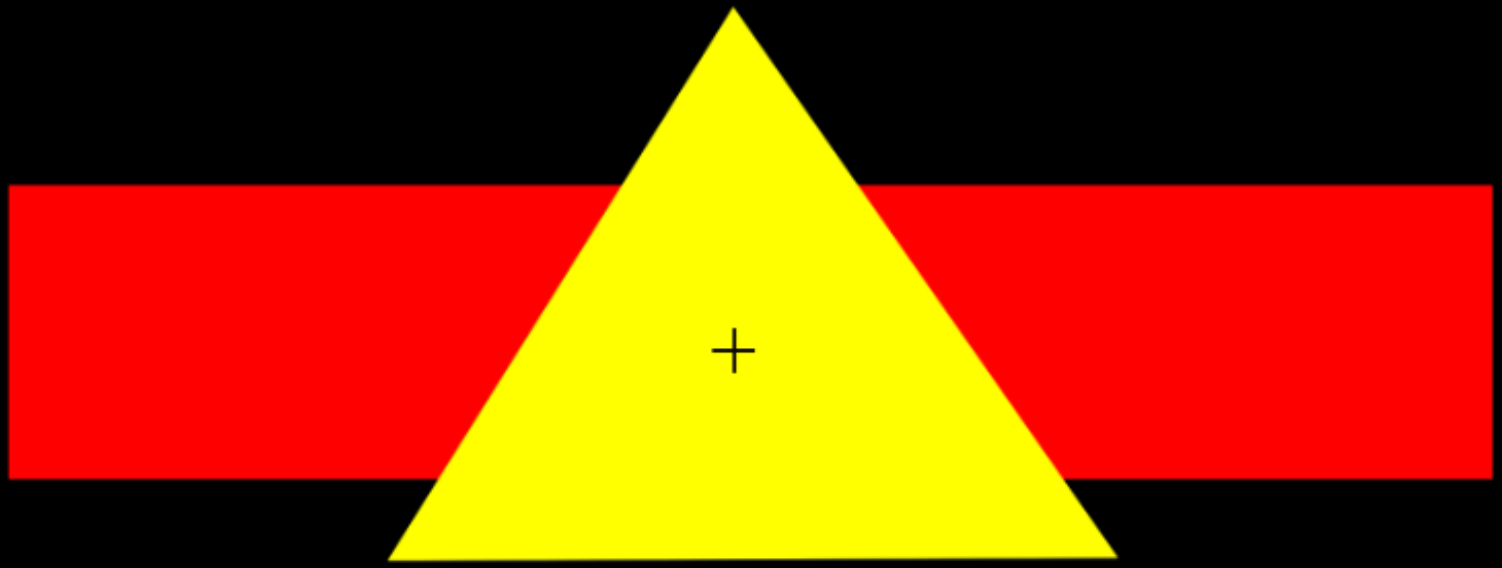


status quo 現狀

- there is no standard that describes consistent color appearance rules.
- a lot of research is going on.
- automated color consistency can already be achieved with a careful and consistent setup.

- 沒有標準用以描述一致的顏色外觀規則
- 很多研究正在進行中
- 通過仔細一致的設置，已經可以實現自動顏色一致性

color appearance



Thank you
謝謝

www.gmgcolor.com
juergen.seitz@gmgcolor.com