*IQ*colour

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What if I were to tell you...

...it's possible to do more accurate color management with less hassle, giving better color?

...you can pull out of your presses a wider range of colors than you've ever seen before?

...ANY number/combination of inks can be color managed, easily and very accurately?

...you can factor in and correct for the color cast of the paper in printing neutral greys?

...make-ready can be both faster and more precise?

...you can have almost magical improvement printing pastel tones, yielding spectacular resolution and fidelity?

...High Key, Low Key, Wide Range Chromatic, Duotones, Quadtones—no matter what the image...

...it prints better than ever, giving you (and your customer)...

...speedier turnaround, reduced costs, increased use of existing assets, improved customer satisfaction, and reduced frustration...

...giving us more of everyone's favorite color...

Green!

You can.

The Evolution of Workflow

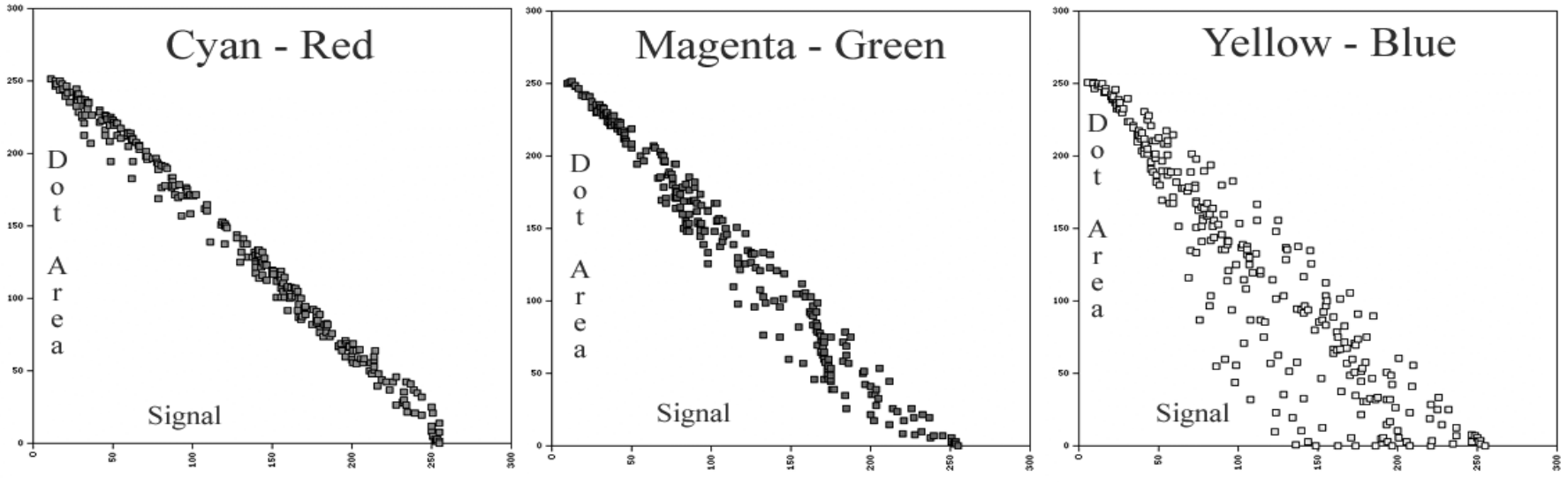
Workflow Today

- Device Independence
- Uniform Color Space
- Profile Connection Space (PCS)
- Profiles – A to B – B to A
- Simplified Workflow

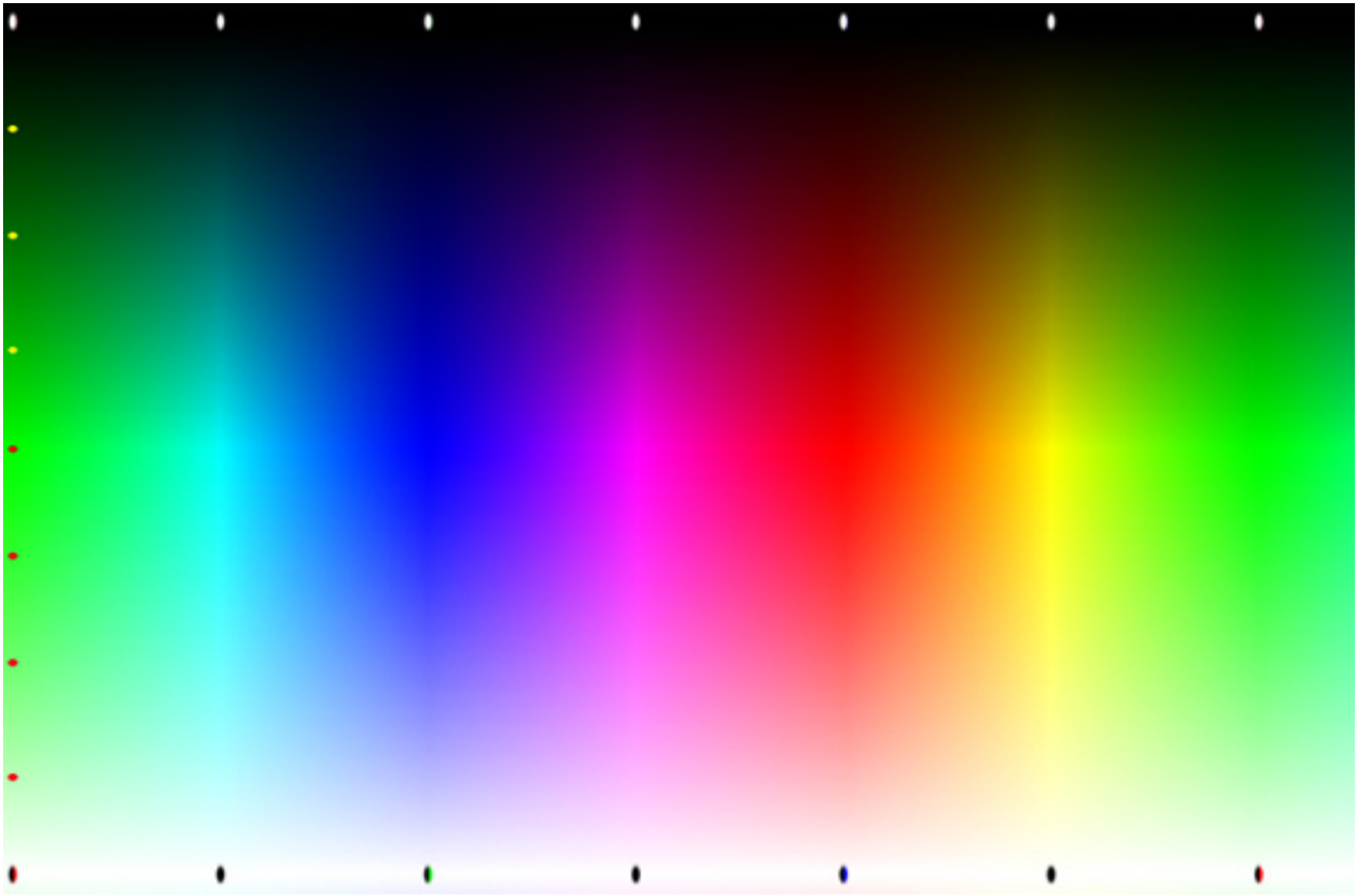
WHERE ARE WE NOW?

- Apply a Stimulus and Measure the response
- Convert the Response to XYZ or L*a*b*
- Sample a Colorimetric Volume
- Create 3-D Profile in Equal Appearance Steps
- Separations Based on Photomechanical Methods

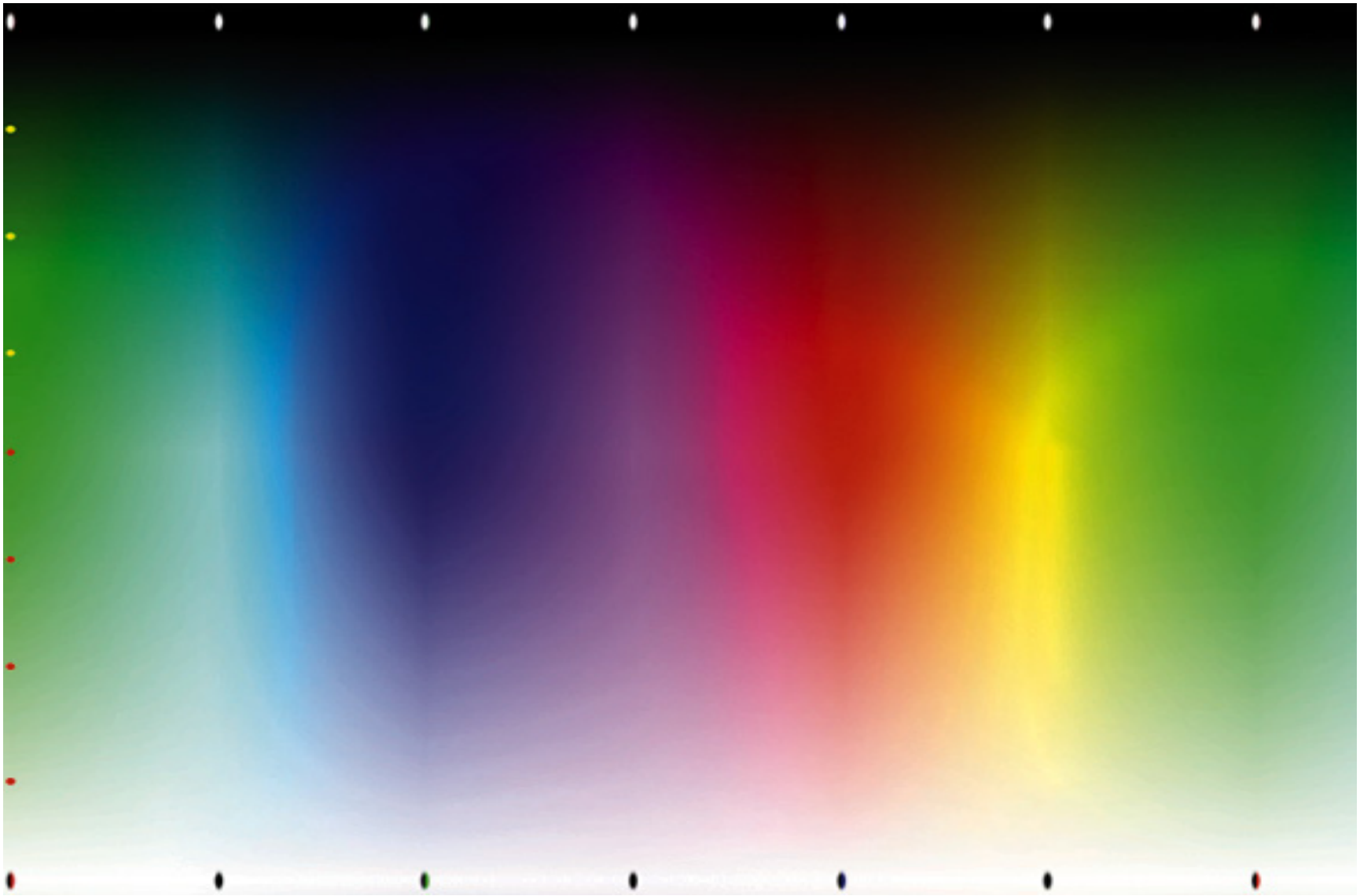
We’re Back Where We Started



RAINBOW RGB TEST TARGET



B to A – A to B TRANSFORMATION



The **Problem** is still a **Problem**

Why is color management difficult?

- De-centralizes color transformations

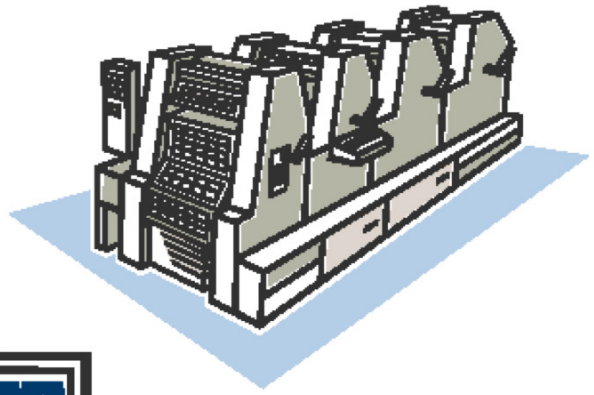
  Good: Allows more flexibility, solves many problems

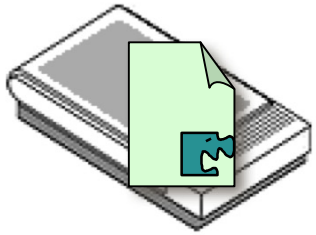
  Bad: Makes unclear who converts colors and when this should be done

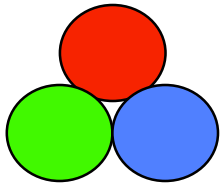
- Apps must offer multiple workflows
- No single metaphor

Four Models of Workflow

- 1. Output-centered
  - (the “CMYK” workflow)
- 2. Monitor-centered
  - (the “wysiwyg” workflow)
- 3. Input-centered
  - (the “embedded” workflow)
- 4. Working-space-centered
  - (the “tagless” workflow)

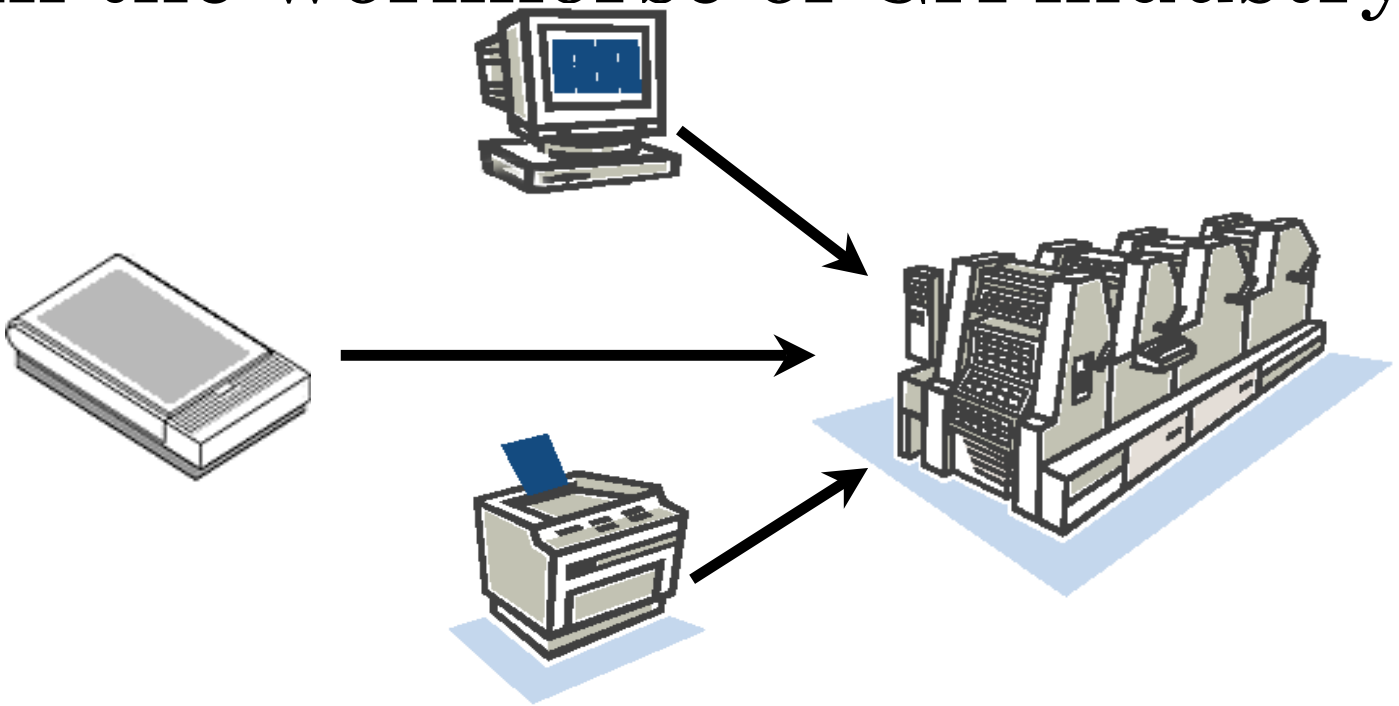






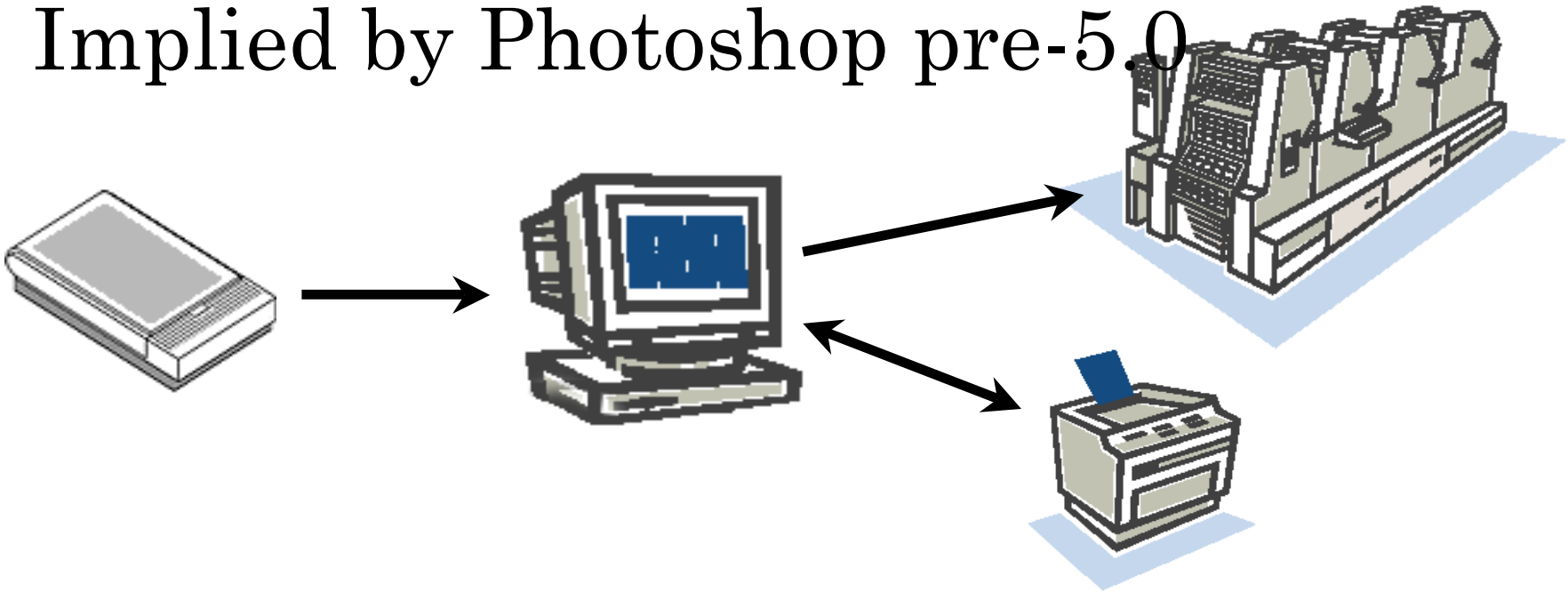
1. Output-centered workflow

- Commonly called “CMYK” workflow
- Still the workhorse of GA industry



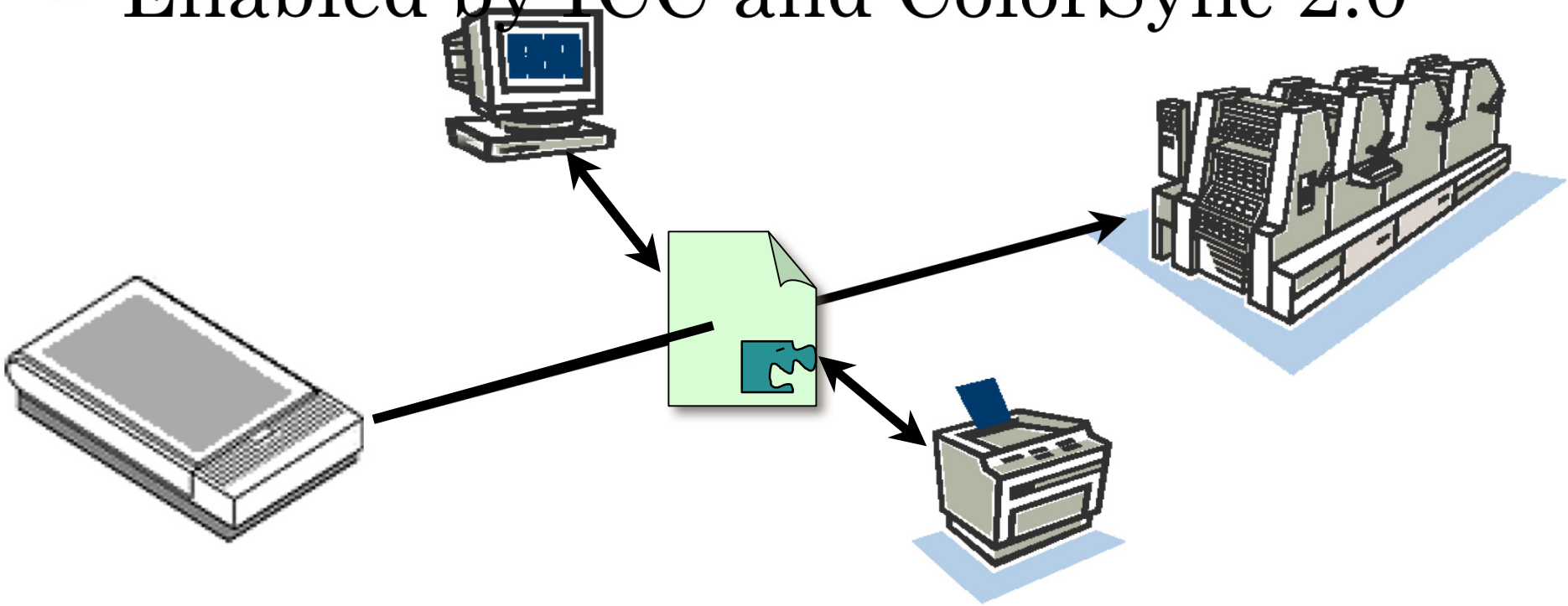
2. Monitor-centered workflow

- Commonly called the “wysiwyg” workflow, or “naïve color management”
- Implied by Photoshop pre-5.0



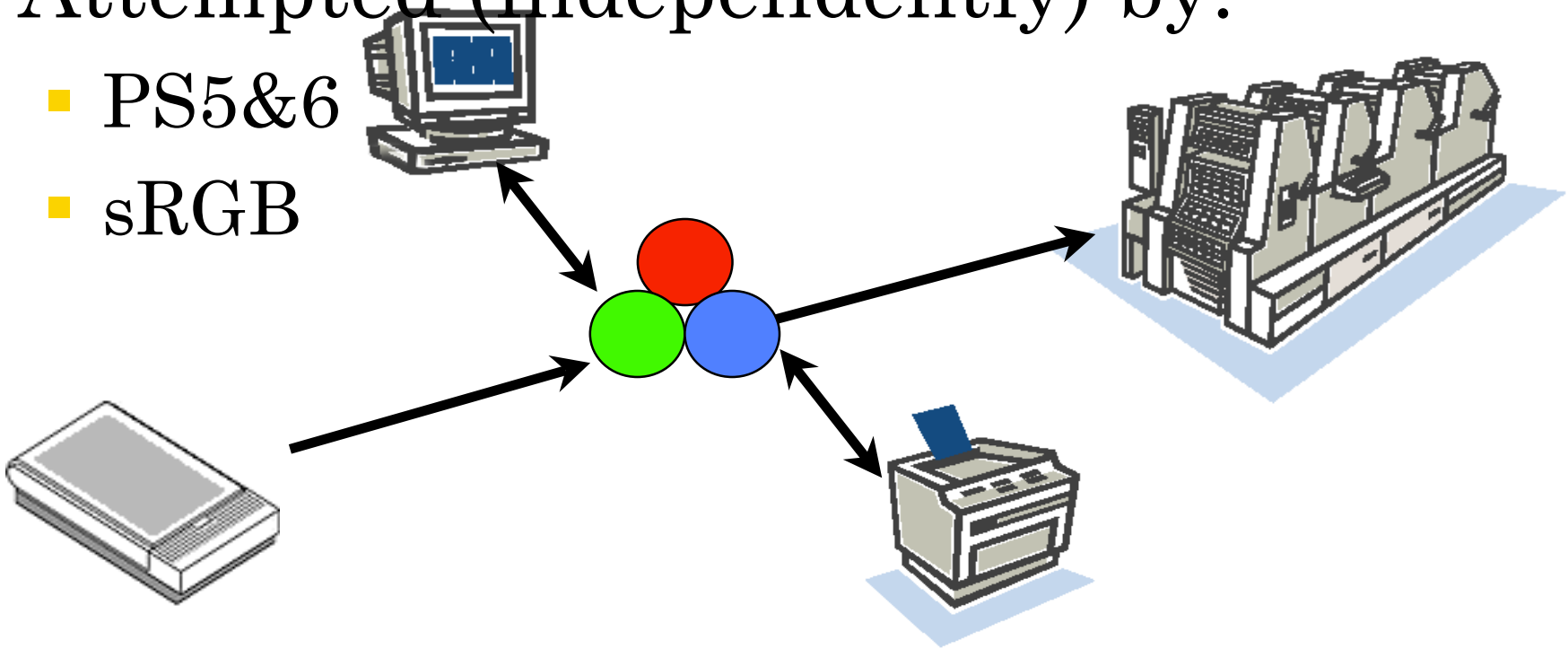
3. Input-centered workflow

- Also called the “embedded” workflow
- Enabled by ICC and ColorSync 2.0



4. Workspace-centered workflow

- Also called the “tagless” workflow
- Attempted (independently) by:
  - PS5&6
  - sRGB

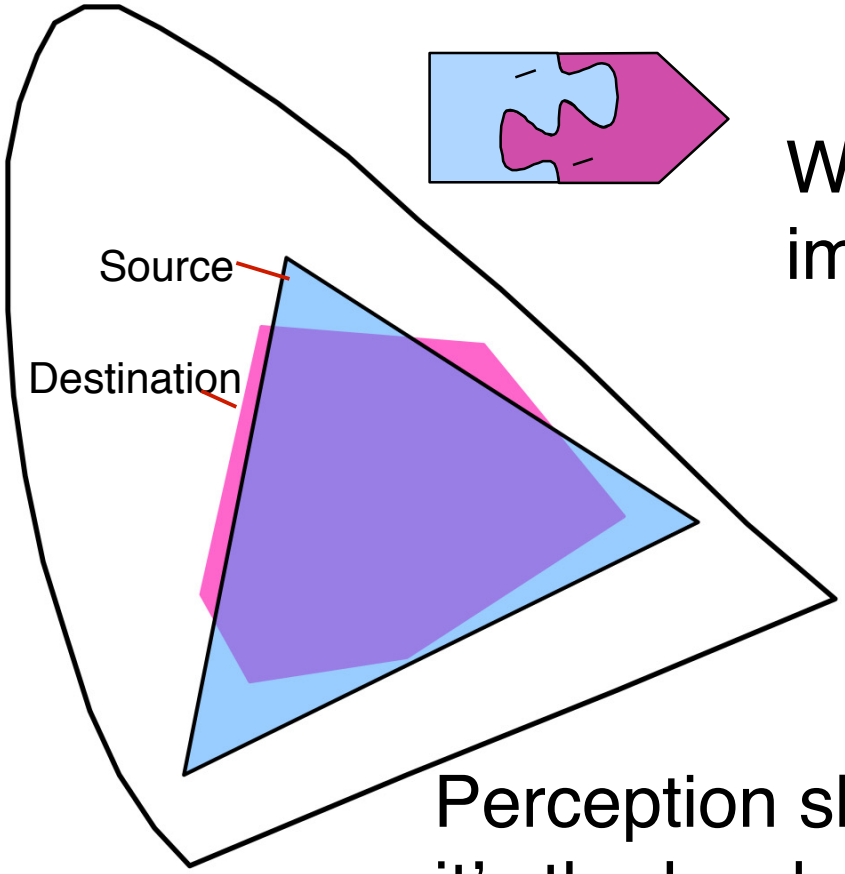


The Rendering Intent

- “Rendering” as in “artistic”
- “Intent” as in “intentionality”

Rendering Intent

The problem:



What information is most important?

- Perceptual *relationships*?
- Colorimetry?
  - White point?
- Saturation *relationships?*

Perception should be the ideal … but it's the hardest to define.

Rendering Intent

- Q: Where to set it (with source or dest)?
  - On one hand: Related to the “type” of the conten (image, vector, bus. Graphics), so would seem to related to **source.**
  - On the other hand: Related to what you’re doing with it (proofing, catalog, packaging) so seems related to **destination**.
- A: Neither. Rendering intent applies to a *color match* between source and dest.

Rendering Intent

- Q: How to choose?
- A: See rules of thumb (next).

- Q: What to call them?
- A: Use ICC terms (unfortunately).
  (See *exceptions* to rules of thumb.)

Rendering Intent
Rules of Thumb

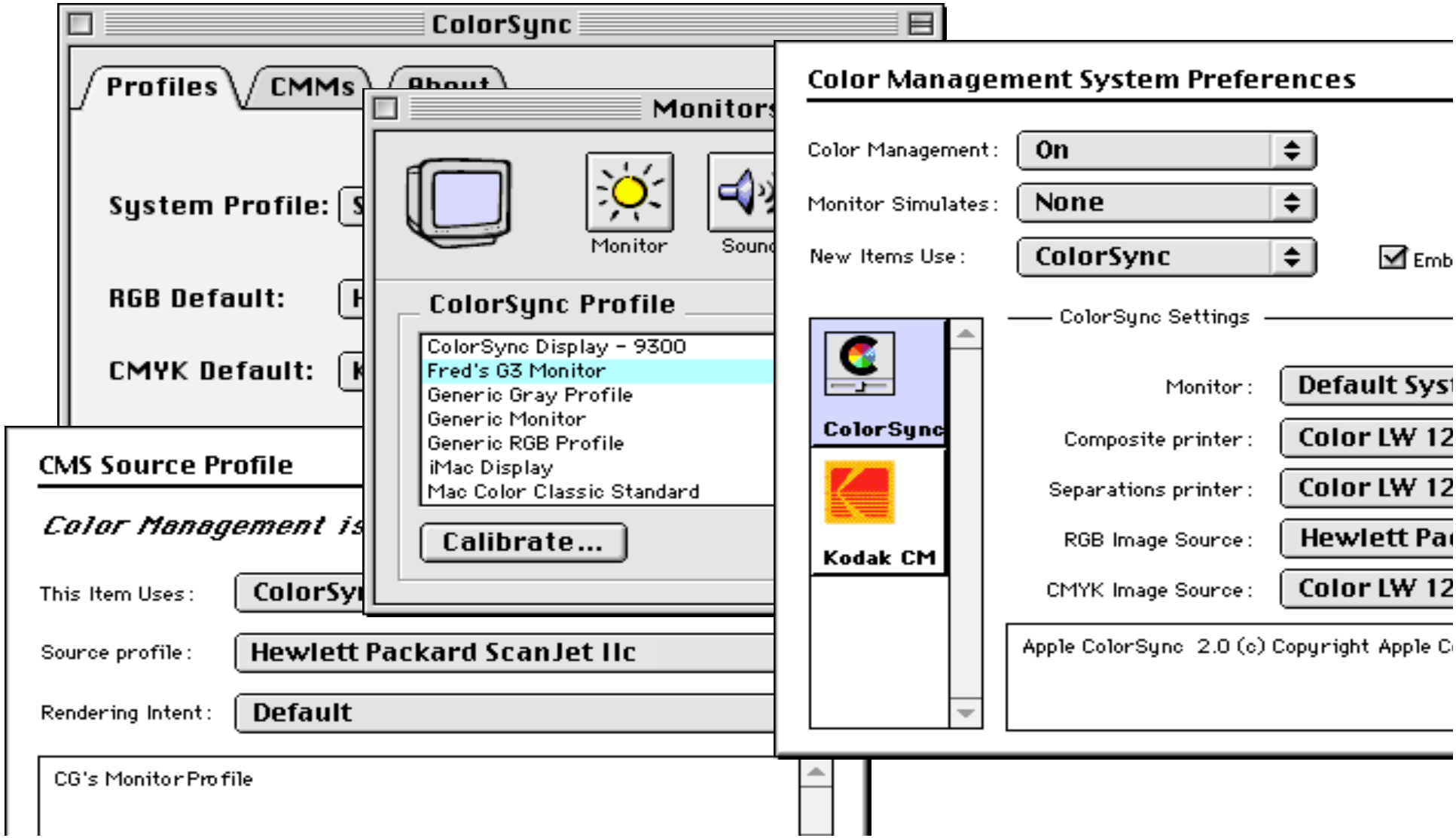
- "Colorimetric" often best for vector
  - Exception: spot colors that must relate to images
- Choose "Relative" before "Absolute"
  - Exceptions: catalog swatches, proofing, or viewing conditions where adaptation is deliberately thwarted

Rendering Intent
Rules of Thumb

- "Perceptual" often best for images.
  - Exception: small source/large destination
- "Saturation" used for business graphics.
  - Exceptions: sometimes renders good images too.

Color Management Workflow: The Practice

Once you have profiles, how to set bewildering array of options

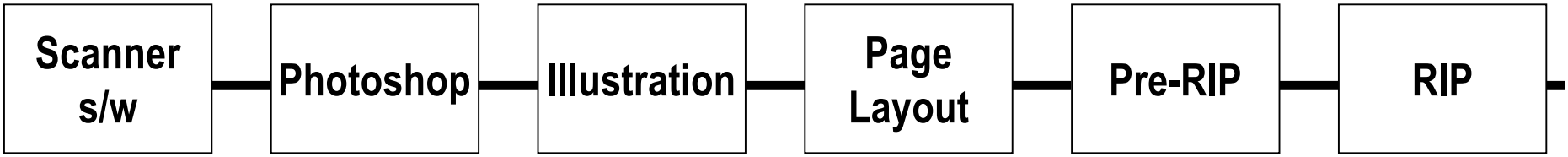


Q: Why all the settings?

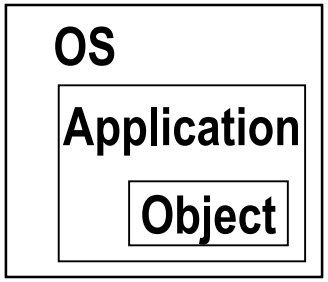
- Remember: Every time an app does a color match it needs 4 ingredients:
  - Source; Destination; CMM; Rendering Intent
- Each app must know what these are without asking you every time.
- Each app must support many workflows.
- Each app must fix upstream problems and anticipate downstream problems.

Locating Workflow

- Horizontal: Where in workflow do color matches happen?



- Vertical: At what level do you set the 4 parameters that control color matching?



General Principles

- 1: Every color match needs 4 ingredient Source, Destination, CMM, Intent.
- 2: Working-space workflow *within* apps.
- 3: Embedded workflow *between* apps.
- 4: Set up fall-back working-space workfl *between* apps as well.

The utopia of the “tagless” workflow?

- Consolidating embedded workflow with working-space workflow
- “Color mgmt performed by peripherals”

- User need not worry about embedding
  - May even be unaware of “profile”

Color Management Workflow: The Future

The future of color management

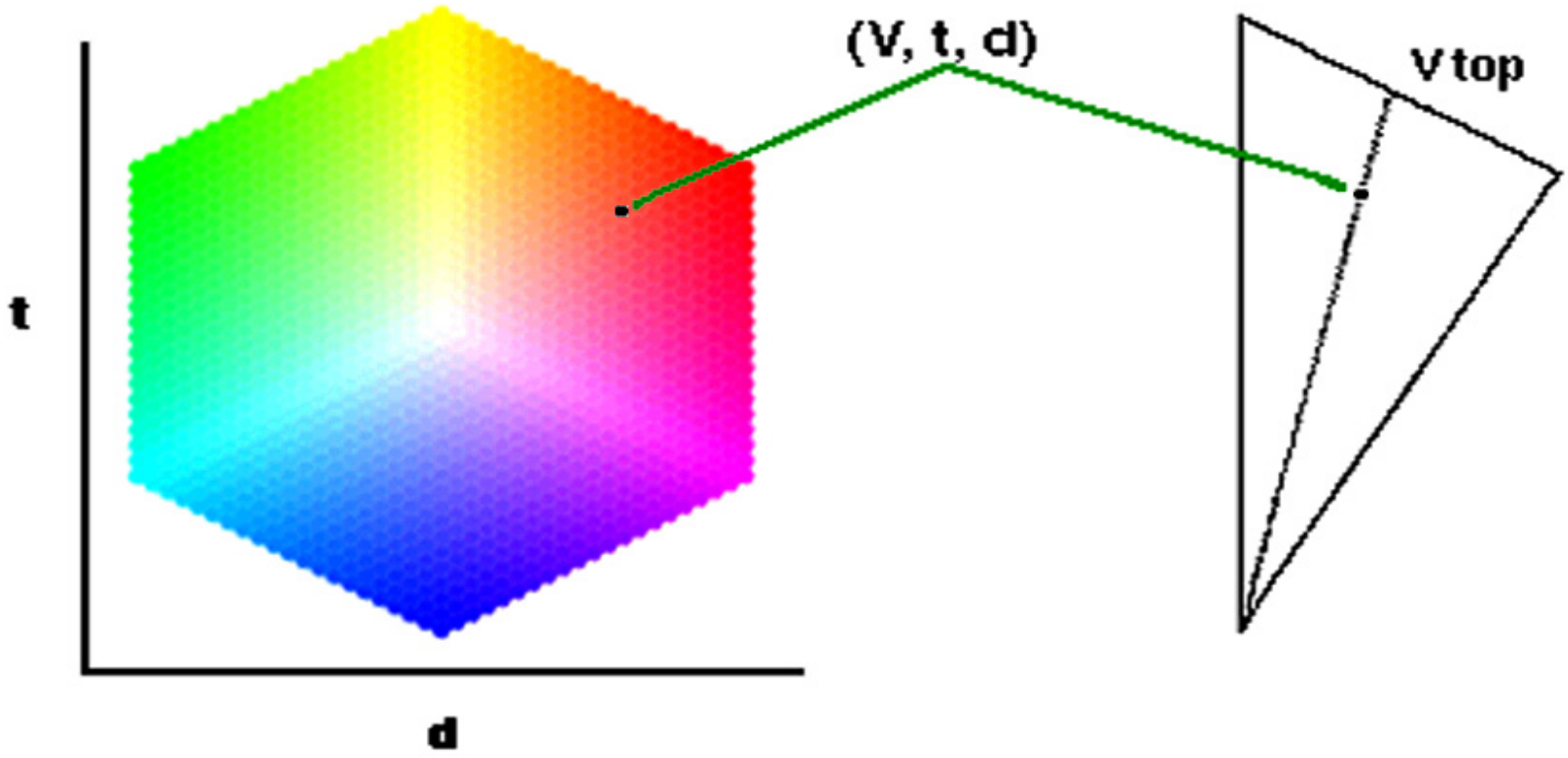
- Profiles will have greater resolution
- Appearance modeling
- Better workflow-oriented tools
- Vendors standardize on color space

The utopia of the “tagless” workflow?

- Nice simple workflow
- … But some problems to solve first
  - Can’t swap out conversion engine (profiling requires control of marking engine)
  - Can’t fine-tune results of conversion engine on image-by-image basis using experience
  - How to proof device (emulate its gamut on anoth device). Why? Because profile is proxy for gamu

Color Management Workflow: /Qcolour a new Metaphor

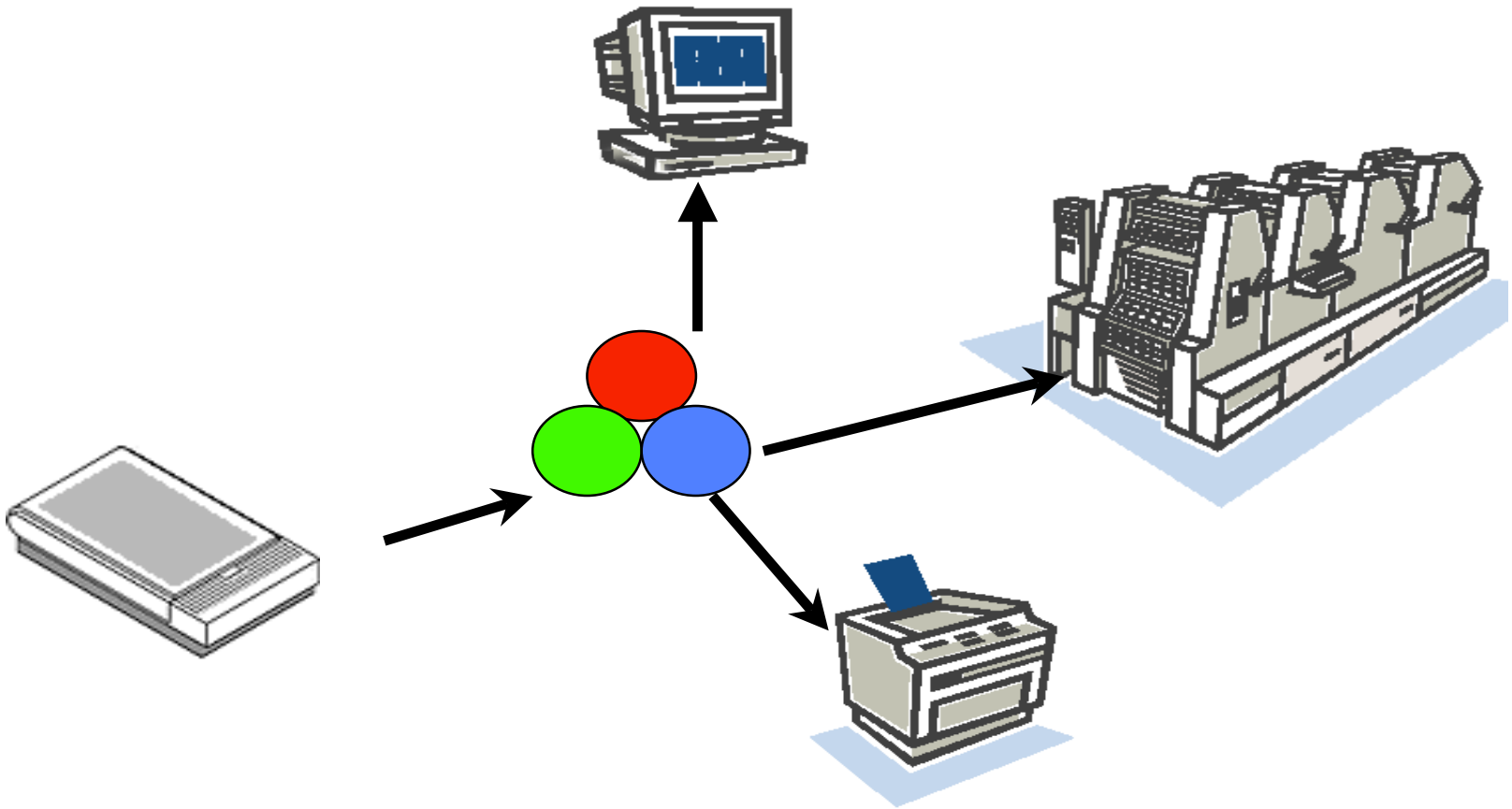
/Qcolour System



/Qcolour CMM

- Input
  - Linear
  - Color Mixing Functions
  - No Color Gamut Limits
- Display
  - Linear
  - Additive Color
  - Primaries Limit Color Gamut
- Output
  - Nonlinear
  - Subtractive

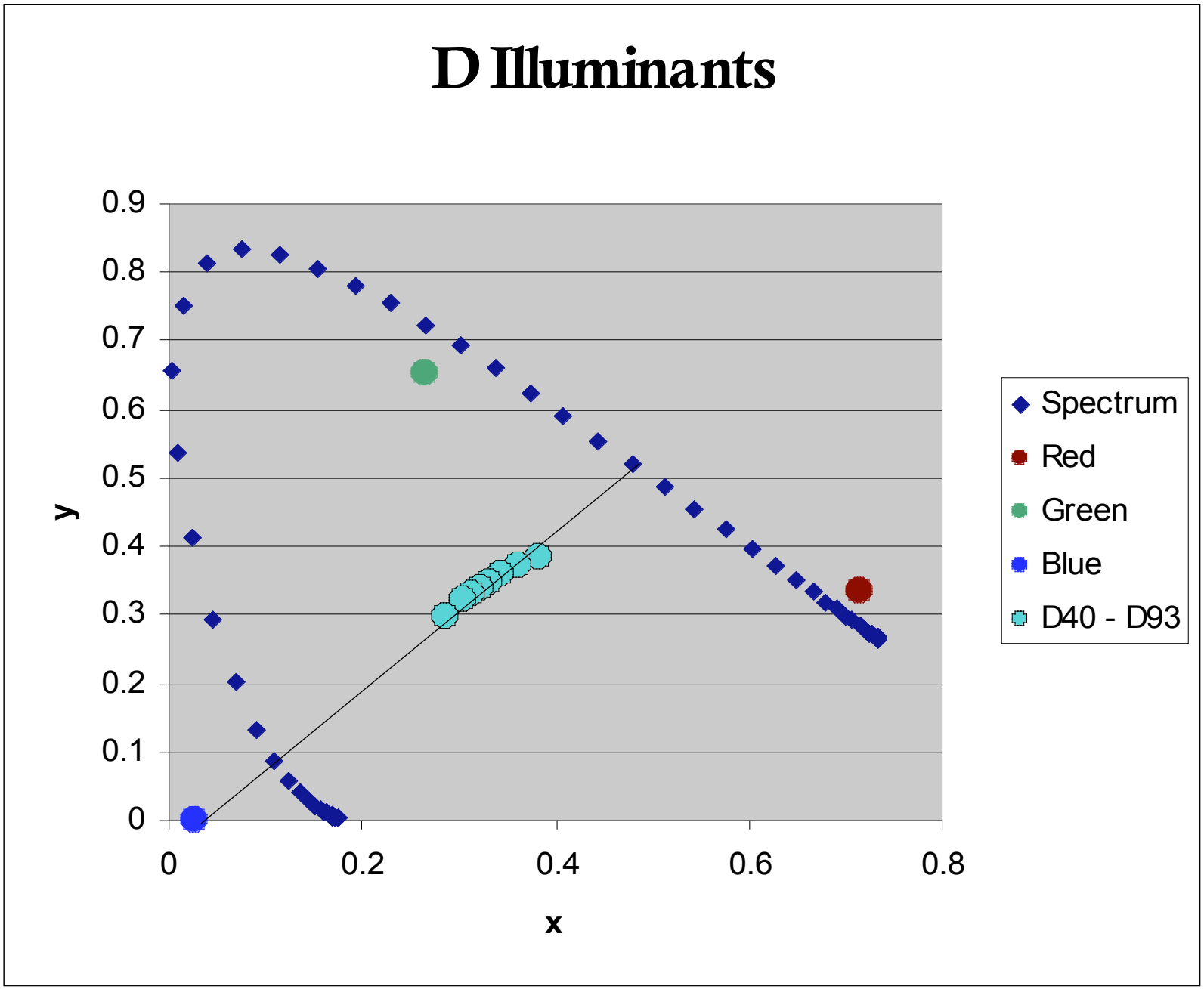
Workspace-centered workflow



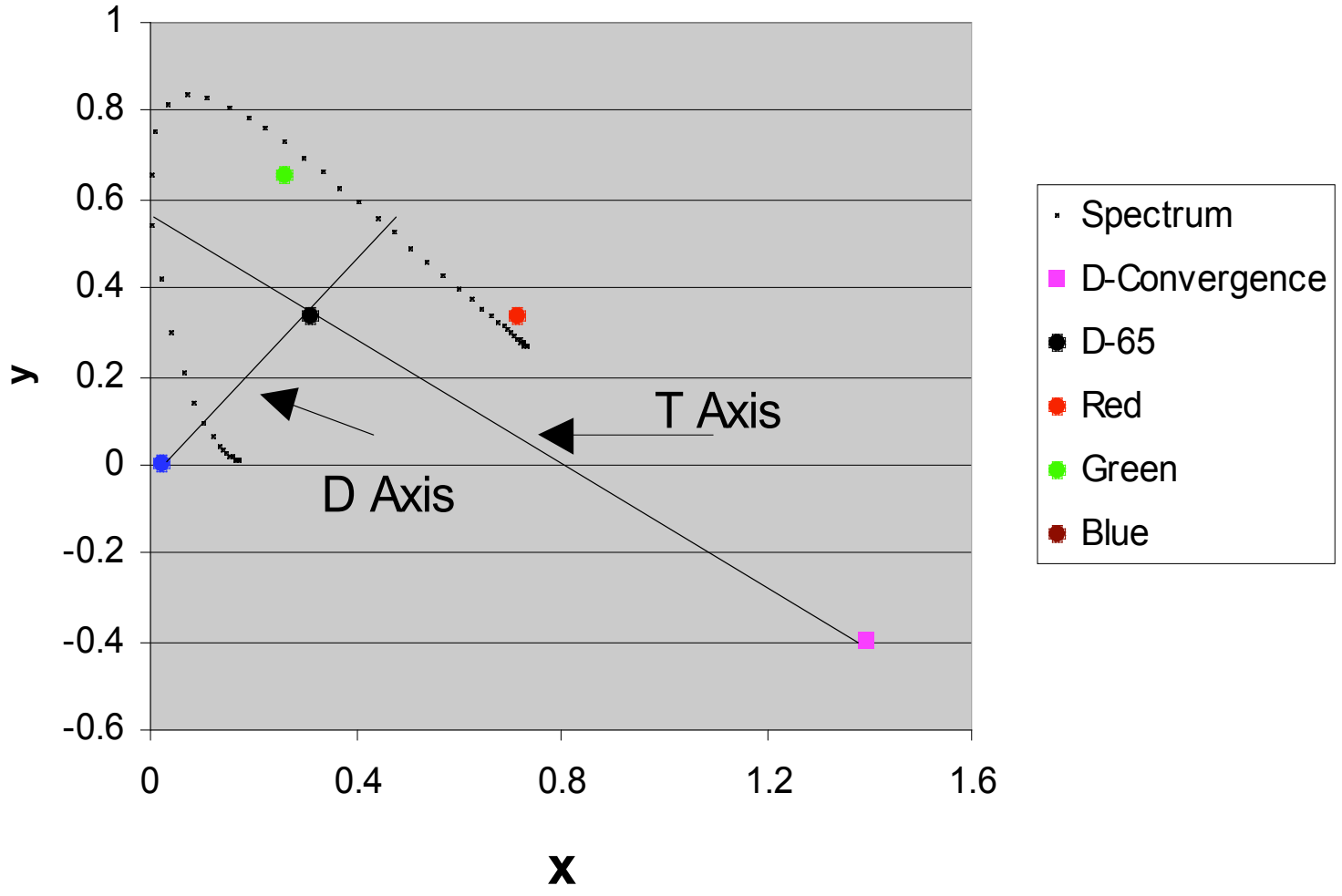
*IQ*RGB

R	|	4.917	– 2.104	.3883	|	X
G =	|	-1.976	4.487	-.4579	| *	Y
B	|	-.1349	.0577	2.427	|	Z

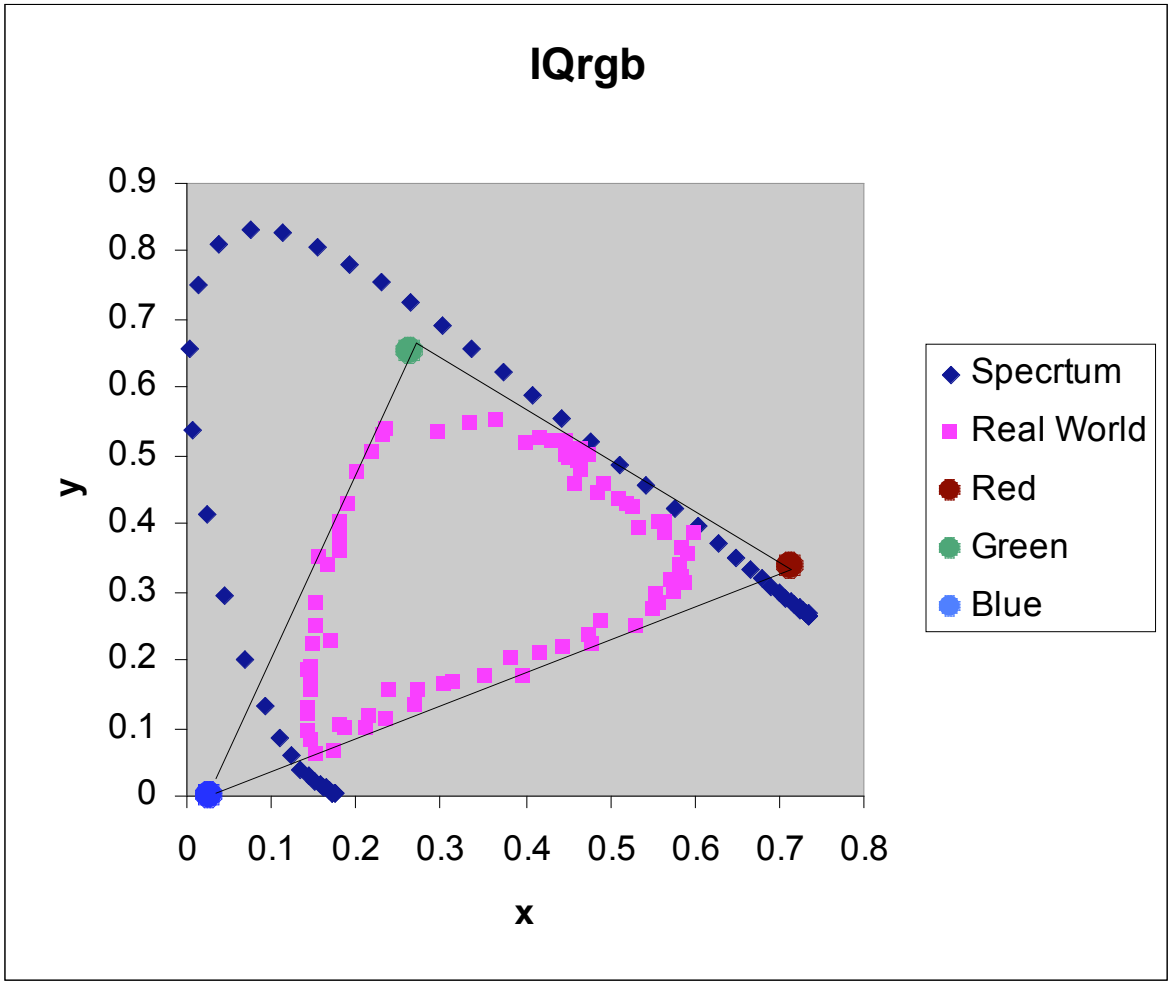
D Illuminants



Meta Primaries



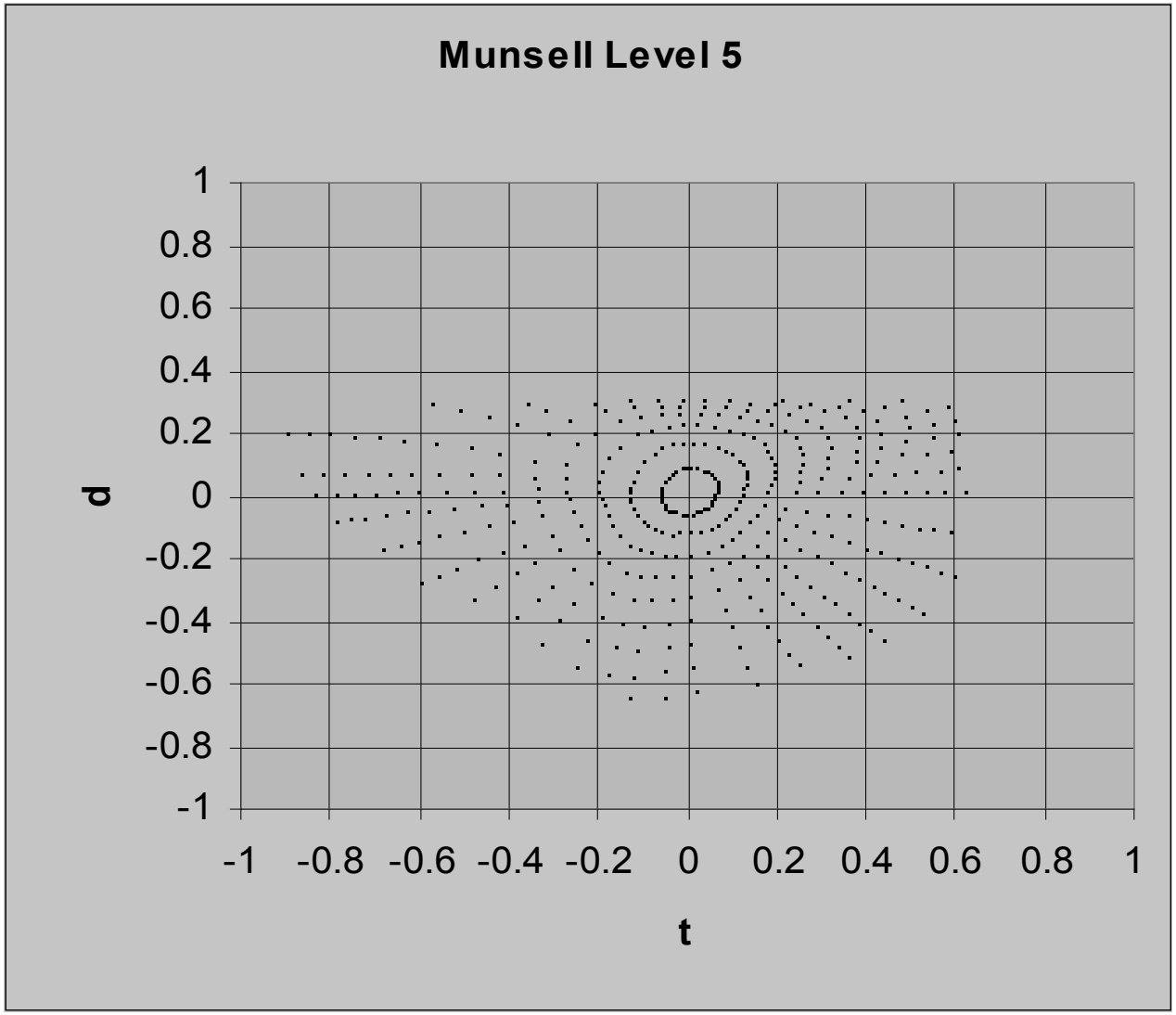
*I*Qrgb PRIMARIES

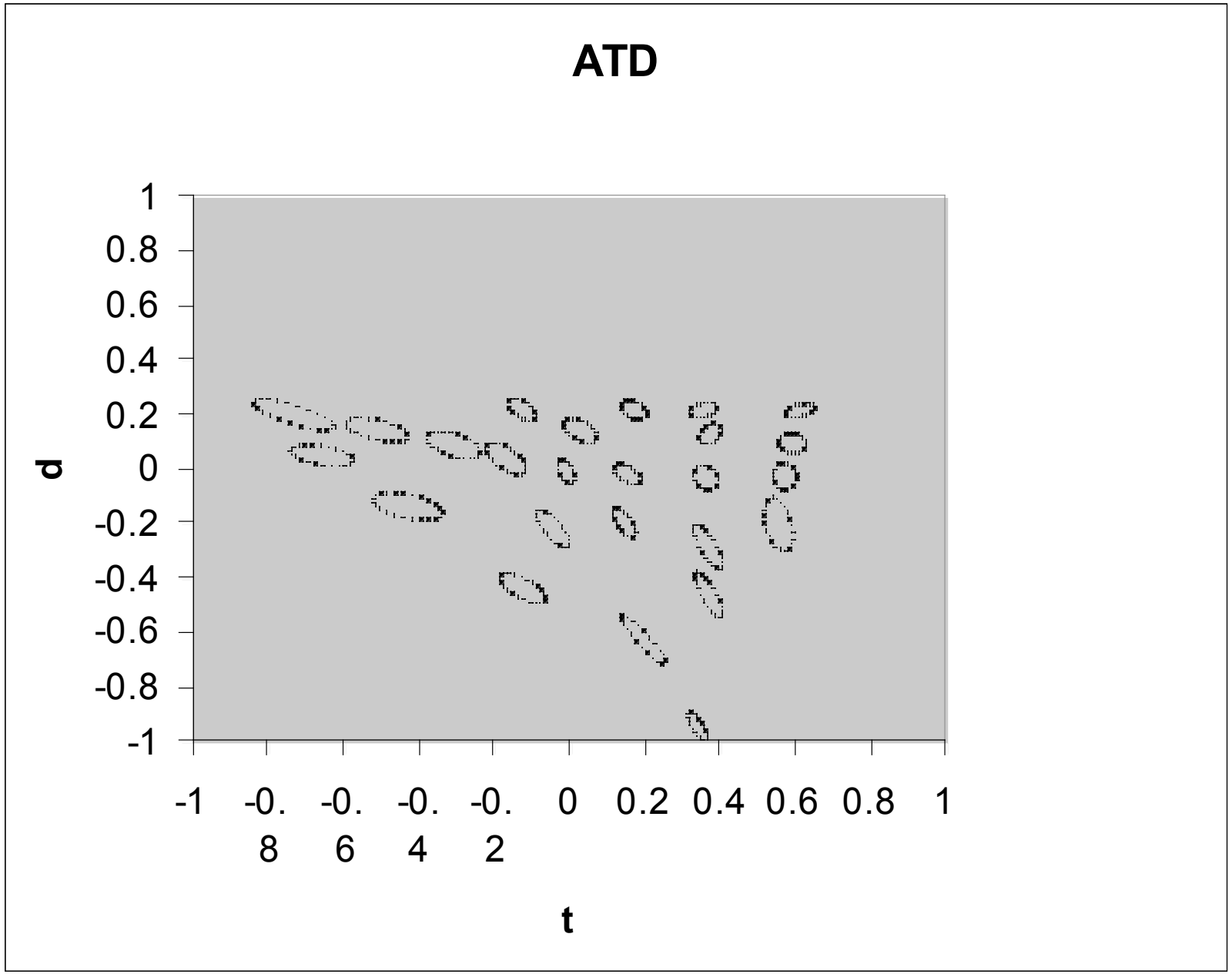


/Qcolour Space

- $A = (R + 3*G)$
- $T = R - G$
- $D = (R + G - 2*B) / 2$
- $Q = A + (T - D) / 2$
- $t = T / Q$
- $d = D / Q$

COLOR SPACE UNIFORMITY




ATD
d
t
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1

*IQ*rgb becomes the Universal Language of Color Printing

- *IQ*rgb Primaries
- *IQ*colour Space
  - Integer math
  - Linear chromaticity space
  - Approximates Munsell color space for the range of illumination used in printing

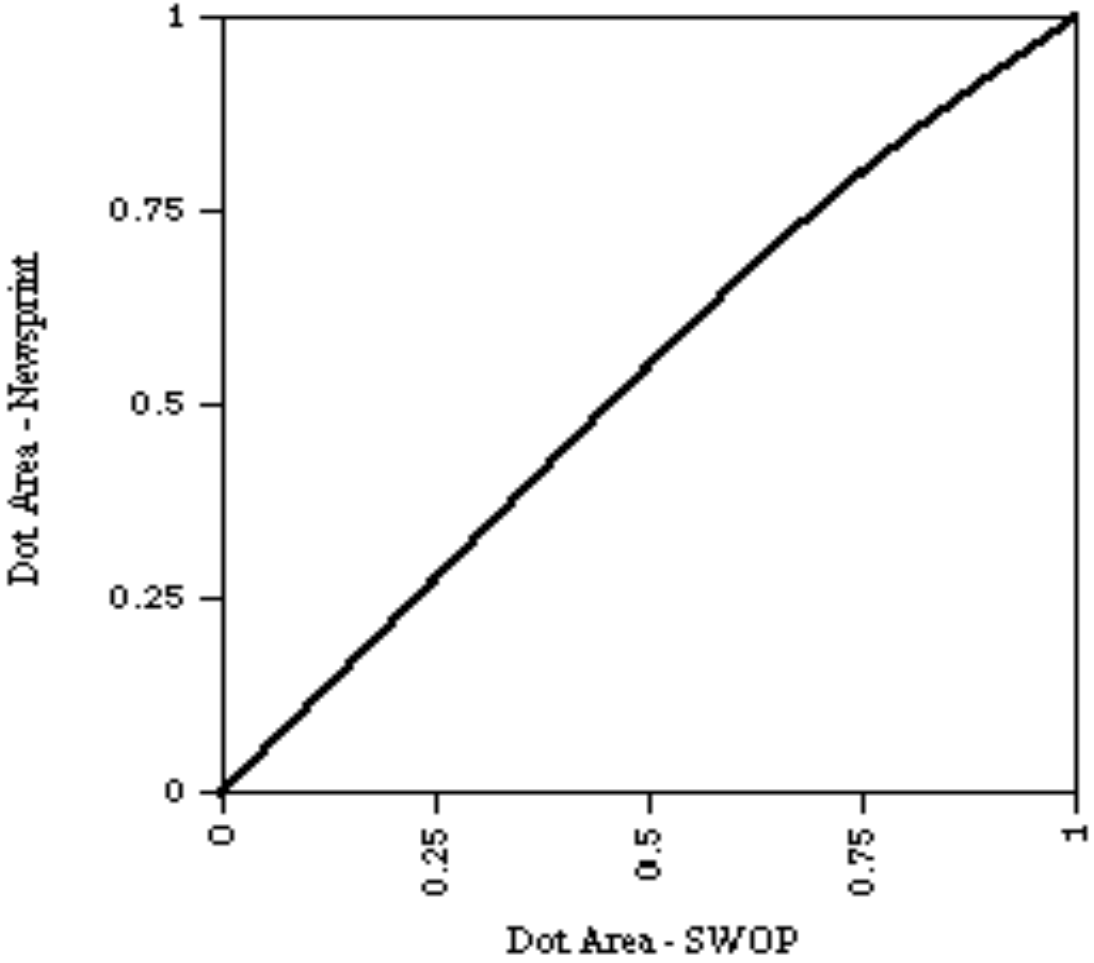
Breaking the Rules

- Color Gamuts

/Qcolour Gamut Mapping

- Gamut mapping is achieved by adjustment of tone scale

Newsprint Tone Scale



Original

Low Covering Power

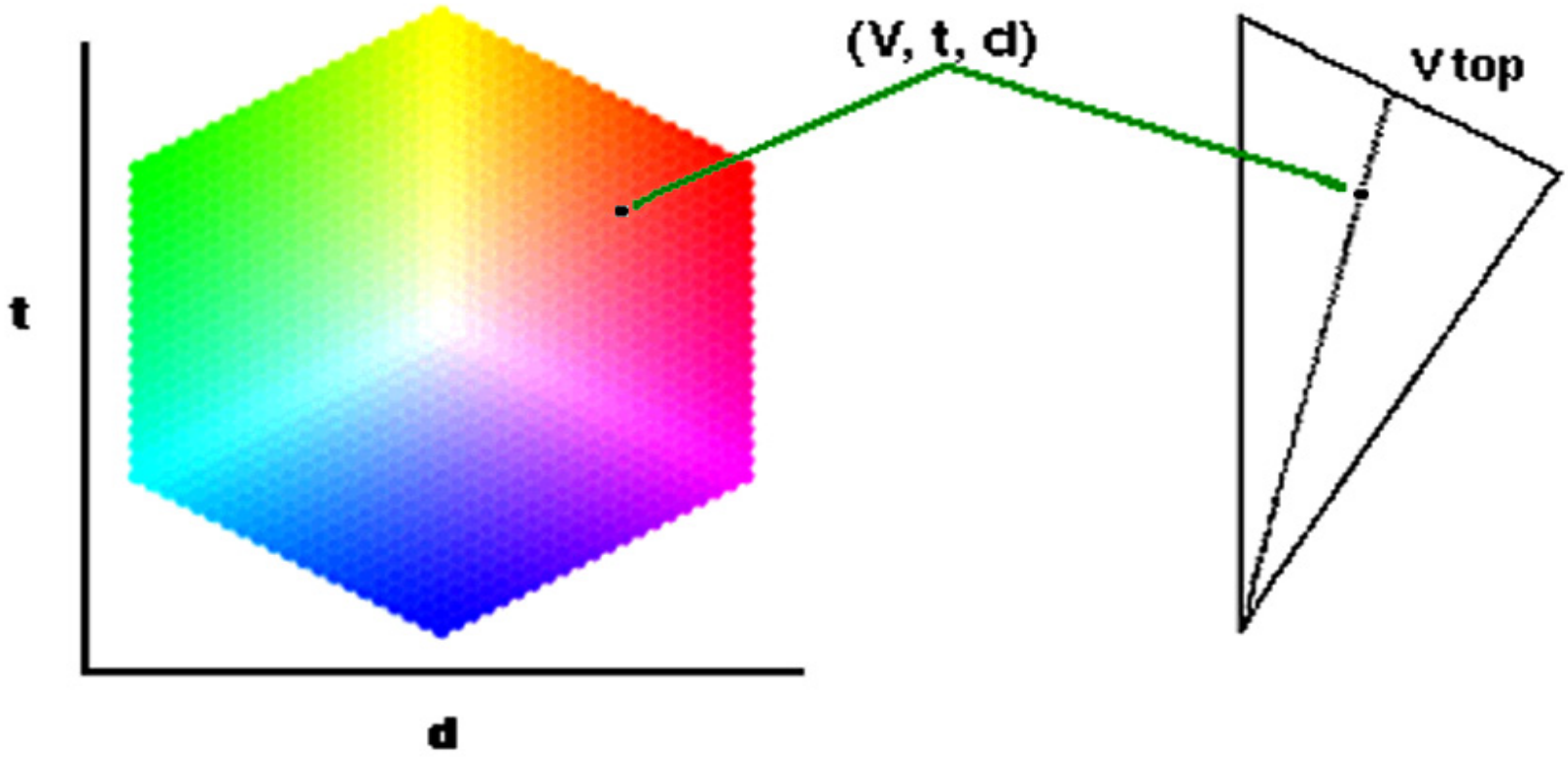
Low Covering Power Plus Adaptation

Original

Low Brightness Paper
Low Covering
Power ink

Low Brightness Paper
Low Covering
Power ink Plus
Adaptation

/Qcolour System



Breaking the Rules

- Neutrals

/Qcolour Black Model

- Choice of black model is no longer based on Photomechanical Separation
- Image Key Problems are Eliminated
- Paper can be integrated into the darkness model

/Qcolour Black Model

- The black model can be made up of any combination of colorants
- The amount of each colorant used at any level can be adjusted to build a neutral scale that has 1000 tone values
- The neutral scale is used to darken all colors in the bright chromatic pallet

/Qcolour Value Proposition

Input Display Digital Printer Press

Images perceived as identical

SUMMARY

- Spectral data is used to control devices
- Devices are truly independent
- *IQ*rgb is a superset PCS
- *IQ*colour uses fast integer computation
- “Natural” appearance map to all output devices
- No attached profiles
- Expands Pantone use to all media