Interesting Applications of the Color Toolkit

William B. Birkett
Leyda Brain Trust
February 2016

doppelgänger LLC

What Do We Really Know?

"When you can measure what you are speaking about, and express it in numbers, you know something about it, when you cannot express it in numbers, your knowledge is of a meager and unsatisfactory kind; it may be the beginning of knowledge, but you have scarcely, in your thoughts advanced to the stage of science."

— William Thomson (Lord Kelvin)

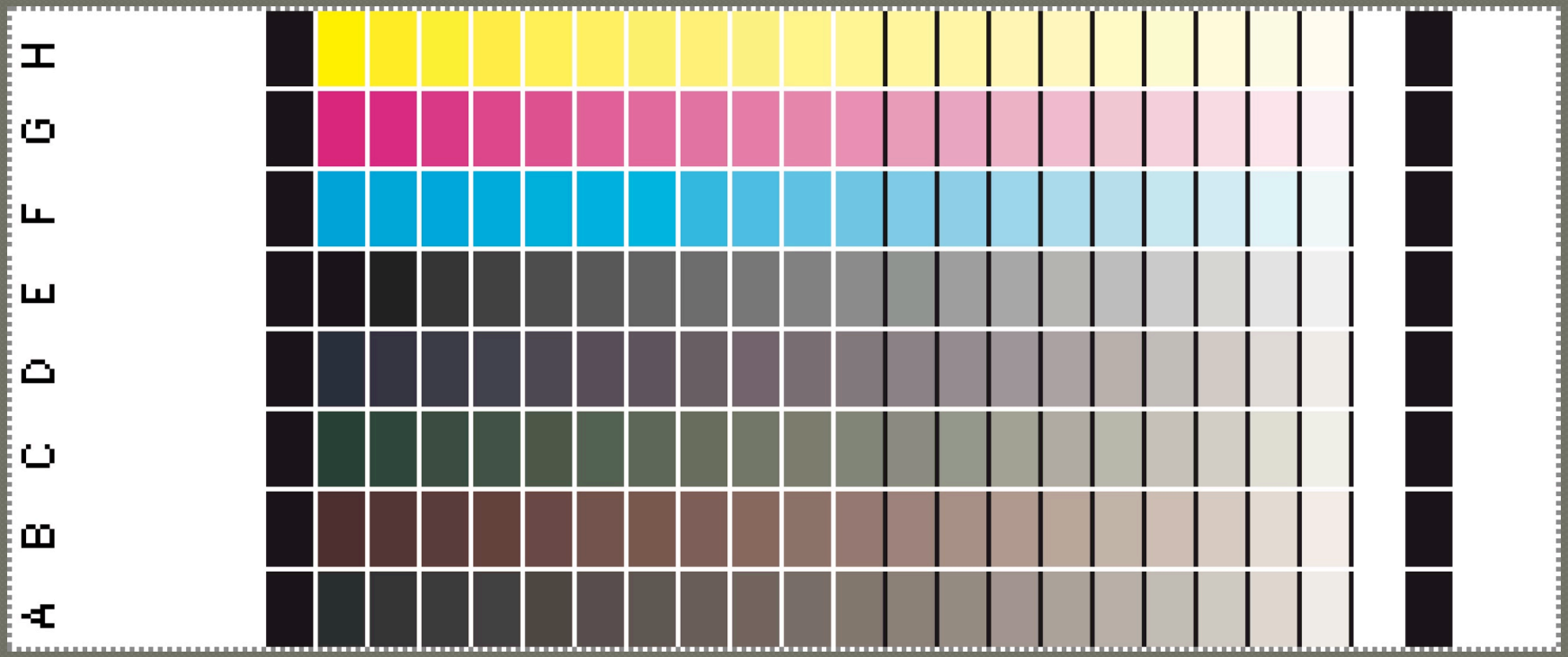
Origin of the Color Toolkit

- An important client was having difficulty matching our Kodak Approval proofs on press (Fall 2003).
- We had them print a test form, and built TVI-based tone curves using the Scitex Brisque software tool.
- The color match of the new proof was worse than before!

Origin of the Color Toolkit

- Out of desperation, we built some curves based on the CMY overprint.
- Idea came from the RIT TRAND method used to calibrate color scanners.
- Results were promising, but required a lot of work to compute the curves.
- I wrote a crude software tool called PressCal to make this easier.

Origin of the Color Toolkit



Original PressCal Target – December 2003

Origin of the Color Toolkit

- Many revisions (86) to PressCal over the next 6 years.
- Several other projects were derived from the PressCal code.
- My programming skills improved a lot and I wanted to clean up this code.
- Started ICC::Profile toolkit in February 2010.

Color Toolkit – What Is It?

- A set of object-oriented software modules for solving color problems.
- Interactive writing and testing of programs for very quick development.
- Based on standards wherever possible.
- Complete implementation of ICC v4.3 standard – reading and writing profiles, and transforming data.

Color Toolkit – What Is It?

- Support module for reading and writing color measurements in CGATS and CxF3 formats, TIFF charts, and Adobe .ase color exchange files.
- Support module for CIE colorimetry, with all color matching functions and illuminants, using either CIE or ASTM methods.

Color Toolkit – What Is It?

- Support modules for Akima spline and Bernstein polynomial curves, with output of tone curves in various CtP formats.
- Support module for n-channel polynomial interpolation.
- Support module for n-channel spectral color mixing model.

Color Toolkit – What Is It?

- Support modules for neural networks.
- Support module for integration of the LAPACK and BLAS libraries, as used in MATLAB.
- Support module for Levenberg-Marquardt optimization (levmar).

Color Toolkit – What Is It?

- Numerous example programs
- Extensible (see CPAN.org)
- Approximately 40,000 lines of code
- All code is completely annotated
- Some documentation is complete
- Still much work to do
- Open source license
- Seeking users and contributors

Some Current Applications

- Spectral modeling of printing process
- Spectral modeling of the OBA effect
- Accurate color image capture
- Abstract profiles for colorizing images
- Measuring UV in viewing illuminants

Calculating vs. Optimizing

- Printing is a highly variable process
- Measurements are not all that certain
- Calculations based on a few measurements are not that reliable
- It is generally better to optimize using a large number of measurements
- Levenberg-Marquardt is a widely used algorithm for optimization – slow but always reliable

Adapting to Change

- As old problems are solved, or become unimportant, new problems appear
- Your technical training and knowhow can be applied to these new problems
- Solving new problems is very satisfying and keeps your mind fit
- Your knowledge and experience can be passed on to younger people
- This is an urgent matter