Printers Performance Diagnostic Images for Image Quality, Durability and Mechanical evaluation

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Abstract

Evaluation of Printers Performance and the reaction between media and ink for new solutions takes to users and manufacturers long time, several tests and resources to get the needed confidence.

In this paper is proposed 1 print (Dr House Diagnostic Plot) to diagnostic the printing system (Printer/media/ink) performance in a quick, robust and easy way.

Proposed methodologies in this plot innovates with dynamic diagnostics which captures the breakpoint and margin to the limit of the technology or application, patterns for multi risks evaluations which include the evaluation of Mechanical components and memory colors for user color perceptual evaluation which improves the usability for non expert users.

As example some of the attributes evaluated are Banding, Color Accuracy, Ink Artifacts like Bleeding, Coalescence, Patterning's, Color Gamut, Color perception, Grey Neutrality, Transitions, Linearization, Paper Advance banding, Scan Axis performance, durability....

Problem Statement

Current Print System Evaluation methodologies implies hard work time and machines to get an assessment of the IQ status and performance, evolution, improvements or comparison vs competitors

- How to get confidence on system performance and representativeness: Too many Samples needed, Time & Resources

- Constant
  Changes in Product Life Cycle related to FW, SW, WS, HW, Supplies lots, force constant re-evaluations…
- Not only IQ Evaluation but System also (ME, Media Ink Interaction)

- Dynamic vs Static Evaluation – What's the limit to Margin of the system/technology? How to get confidence system works in several conditions?
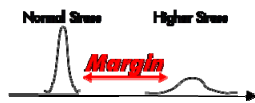
Plot Innovations to Print System Evaluation performance

This Diagnostic Plot contains a collection of classical IQ evaluations (Banding, Bleeding, Color…) plus:

- **Dynamic break** points to see the margin to ink limits, line resolution…

- **User Centered**: Some Color and evaluations are closer to user point of view (easy diagnostics, detailed info and multiple tests, memory colors…)

- **Measures for HW Performance: X-Axis & P-Axis**

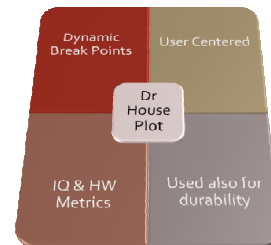- **Durability** tests: Ink Rub, scratch ability…

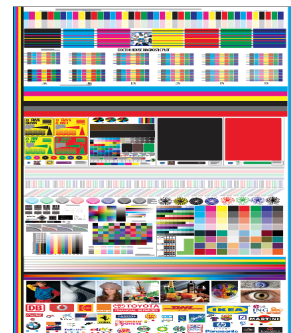Figure 1: Dr House Diagnostic Plot (KCMY native)

Figure 2

Areas of evaluation/diagnostic:

Main areas of diagnostic are:

1. IQ Break Points for areafills, lines,

2. Mechanical performance across Paper and Scan Axis.

3. Color Performance and influence of Ink System, Color Maps, and Writing System.

4. Ink interaction with Media

1. Dynamic Break Points
- Bleed at different Ink Limits. Bleed at different colors and breakpoint of severity vs. are fills
- Line Feed Accuracy and Breakpoints at different resolutions, widths with lines, circles patters…
- Text Accuracy breakpoints at different font sizes, fonts, backgrounds…
- Patterns Resolution breakpoint. Patterns of different matrix at different dpi resolution.

2. System IQ Performance
- Evaluation of banding/bleed at Scan Axis and Paper Axis directions
- Evaluation of KCMY Bands along X-Axis. Also fine patterns to detect variations of IQ due Encoder or small signals or Dot placement errors. (e.g. due PPS variations…)
- Pen Alignment variations vs. X- Axis. Diagnostics lets understand contribution from X-Axis ME System or Media Expansion or Pen Alignment/Health Issues.
- Vertical Bands/artifacts in area fills across X-Axis Direction
- Pen Health and pen Alignment, dpe across X-Axis and P. Axis.

3. Color
- Color Measures: Patches to evaluate worst cases of colors for banding.
- Big Patches to evaluate Artifacts like bleed coalescence, patterning, gloss uniformity…
- Patches (it8) to measure color with spectrophotometers.
- Memory colors: Images & Memory colors to do perceptual evaluations of color gamut/saturation/accuracy.

4. System Interaction (Ink-Media)
- Bands and Patches to evaluate interactions like Haze, Coalescence, Bleed, Dry Times, Durability, Cockle,
- Patches to evaluate Durability Specs like Scratch ability, Dry-Wet Rub and Light fastness
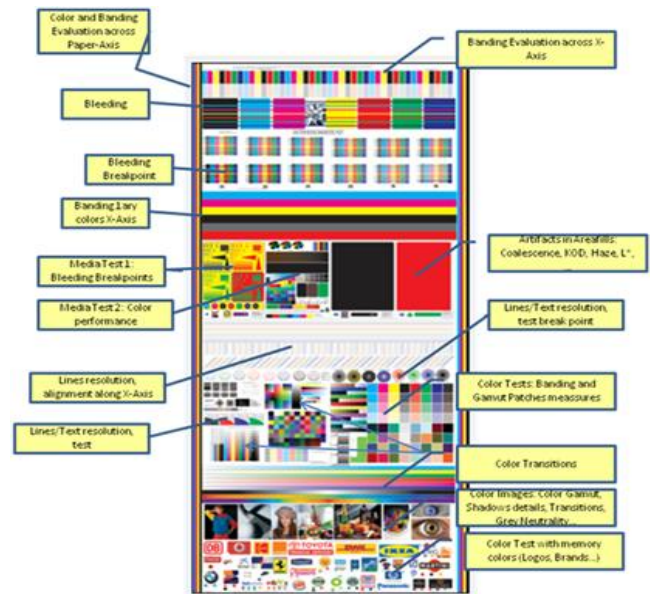

Figure 3

Examples and success histories
- 1 day needed to evaluate performance of Ink/media/writing systems and/or Printer System vs. old systems which required >300 plots, 1 week of testing.
- $1/10^{th}$ of resources needed (vs. previous tests techniques) to evaluate performance of Ink/media/writing systems and/or Printer System
- Possible to capture margin of design In front of design/media/ink/printer system changes.
- Possible to compare with competitors using 1 plot
- Quick traditional Printers issues detection: Color Maps Transitions, Banding, Artifacts, Media Lots variability, Influence of Beginning of Roll vs. End of Roll…
- Characterization of new medias (Ink Limits, Saturation levels, Printers artifacts, Printer controls to adjust IQ)
- Switched C-Lc Tubes captured with linearization plot
- Bad Color Maps captured trough linearization patches, transitions bands
- Vertical Worms detected in horizontal bands
- Encoder Issues due friction-wear detected in Horizontal bands, Lines patterns
- Color Maps trough memory color patches
- Color Saturation
- Coalescence in some medias
- Time to spend to qualify medias ~1/2 day
- Possible to compare multiple IQ attributes vs. competitors in same conditions

Author Biography
Marc Parpal has degree in Mechanical Engineering in the UPC (University of Catalonia-Spain) and also degree of Engineering with the specialty of Quality and Business management. He has been working in the Textile Institute of Research and in Hewlett Packard since 1997. Currently he is working in the Quality and Customer Experience department and acting as quality lead in Printers Development programs.