Network-Mediated Peer Group Image Measurement

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Abstract

Digital electronic communications through the internet, text messaging, and social media have created new opportunities for measuring and controlling printed images. This paper will discuss the results of a study of a new field of research, namely testing and applying "Network-Mediated Peer Group Image Measurement." Network-mediated peer group image measurement makes an enhanced use of email to remotely test printing presses, then uses internet communication technologies to establish a meeting of the press operators and owners during which they can make a detailed print image assessment. The operators and owners use the assessment to enhance their printing operations.

Basic Process Experimentation and Benefits

Once press image assessments take place (as discussed and defined shortly), measurement data is shared anonymously by electronic communications among a peer group of participants. Reports are generated for use in the peer group meeting. Benefits to group members are many and include:

- Letting peer members know where they and their press stand compared to others who use similar print technology.
- Determining what to avoid.
- Learning how to measure and correct press output.
- Improving color knowledge and providing detailed descriptions to the press vendors for use in servicing and remedying press issues.
- Sharing economic performance information.
- Enhancing and tuning press operational capability on the plant floors. Many more benefits result from the online peer group.

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The following sections describe how the image assessments were performed and communicated, how information was displayed and shared between peer members, and offer some additional observations.

To be Discussed

To place this paper in context, we first look at some unique elements of electronics and printing production, the dangers and threats of a "Super Substitution," the use of electronics for print, and ways that electronics actually multiplies print. We will examine how group techniques may be applied to test a printing press, and describe the dawn of "Group Therapy for Imaging," a real byproduct of our peer group research. Finally, to set the stage for the next wave, we will discuss using electronic communications in a peer forum to optimize the manufacture of print imagery.

Quick Selective History of Electronics and Print

The printing industry was taking good advantage of digital communications way before the advent of the internet, text messaging, and social networking. Electronic file transfer from customer to printer facilitated the rapid delivery of artwork to the printing plant; the information was transferred at the speed of telecommunications, not of physical transportation.

In 1989, US Patent 4,839,829 was issued for Automated Printing Control of pricing, print instructions, file exchange, and cost. The patent also covered digital reporting and creation of downloaded software instructions to the plant using an AI heuristic rules base to produce the printed work automatically.[1] So while some people may view the printing industry as a traditional trade and craft business, it is nothing of the kind. In many cases the industry is the leader in technological applications.

Electronics for Paper is a "Super Substitution"

Today it is well recognized that paper based communications are under challenge by electronic alternatives such as email advertising, social networking with targeted ads, eBooks, downloadable audio books, and on and on. If one follows classical economic substitution theory, the utility of print has been supplanted by electronic communications in several areas.

What is unique about the substitution of electronics for print is what we would call a "super substitution." With electronics replacing print in some applications, not only is the technology substituting pixels for paper, ink, and press, etc., but at the same time physical transportation of printed material is being eliminated. So in this unique case, one observes multiple simultaneous and conjoined substitutions for both the printed works as well as the physical movement thereof.

In economics, the strength of a substitute is in the improved utility it provides. As we can see here, printing faces a "Super Substitution" with an above-average

exchange utility provided by the substitute. Researching the topic of substitution in economics as well as discussing the topic with several professors of economics, it does not appear that discussion of a Super Substitution as discussed here has been identified by others.

Multiplier Effect – Electronic Communications Increases Print Now

However, contrary to public perception, print is growing and thriving in many areas. It has been said "you can't wrap an iPad around milk, make it into a carton, and ship it to a store." Packaging technology is a growth area; sophistication brought on by electronic printing, in ever-increasing ways, is expanding print. The use of electronics to create automated ordering of all products increases their printed components. Most importantly, the use of print in advertising has still not been surpassed as to response. In fact, print advertising sends people to electronic systems.

Electronics has a multiplier effect on print. After all, didn't a printer discover electricity? (One could argue that Ben Franklin discovered the first electric light when his lightning experiments illuminated a key in a jar. Likewise, arguably the first use of an industrial electric light was a carbon arc to expose a printing plate emulsion. The first air conditioning system commercially delivered by Carrier was used to reduce humidity in a printing facility.)

Print is so pervasive today it gets overlooked. The handheld displays and televisions people watch today are printed using ink jetted OLEDs and use circuitry printed on a glass surface. The circuitry that moves electronic communications is printed. It took a very special printing company to become the world leader in these areas. Dai Nippon Screen coats the vast majority of Intel's microprocessor wafers, akin to an emulsion on a round printing plate. OLED television screens jetted to glass are produced by that same "printing company." Coat and expose plates/wafers is the rule and this process came from print. So, in many cases what would appear as a substitution for print is actually printed. Talk about a contradiction! Now let's see how electronic communications can improve print image quality.

How Images are Measured within the Peer Group

So to make printed image measurement a reality for the Peer Group, Image Test Labs (ITL) ImageGraderTM - www.imagetestlabs.com was applied. This patented technology was recently a recipient of the PIA/GATF InterTech Award. ITL has the largest adoption of any graded image measurement process. The parameters will be defined below. The result of the wide adoption of the ITL ImageGrader was the compilation of the largest graded printed image database in the world.

As you will see later in this paper, running a given press scenario of a peer member against each other as well as the entire press data population reveals a massive amount of information not known before.

What ITL invented is a predictor of customer acceptance/approval as opposed to accuracy. The data produces an ACCEPTANCE score or predictor for the printer's output. A peer group member simply prints a PDF file and mails the prints to ITL, which evaluates and grades the imagery. The printing process takes seven minutes on a digital press, and does not disrupt production plant operation. Grading typically takes place with existing settings, materials, and processes.

Three Minor Miracles Open a World of Graded Image Data

For Image Test Labs (ITL) to develop this capability, three minor miracles needed to be accomplished:

1. Development of a "drop and play" PDF file capable of running on any device and delivered by email.

2. Ability to comprehensively assess imagery in both additive and subtractive color on all devices and workflows in an independent, evenhanded, and authoritative manner, and

3. Have the results be clear enough to be understood by someone with a high school education.

How Image Test Labs Assembled Peer Group Printed Image Test Data

The ITL ImageGrader provides an easy-to-understand appraisal of press and print quality that can be used by businesses of all sizes. It assesses the acceptability of print system image quality by analyzing pages printed under normal press conditions; extracting and grading image attributes; and combining the grades into color, solids, and line/text attributes and then into an overall grade.

The customer prints a PDF file provided by ITL using existing press settings, paper, and ink/toner. After analyzing the printed output, ITL delivers a set of reports that assigns a letter grade to various aspects of image quality and also shows the customer how his or her press compares with others.

In general, the ITL ImageGrader evaluates the results of the entire print workflow, not individual process parameters—the "what" of image quality, not the "how." The scores are independent of the printing process and the size and/or speed of the press and have been exercised all the way from desktop printers to large offset presses and wide-format printing units.

The ITL ImageGrader can grade any equipment that can print a PDF. The reports are authoritative, extremely easy to understand, and do not require technical knowledge—they are as easy to read as a school report card.

Special ITL ImageGrader applications can also be used to compare performance before and after service or when equipment is moved to look at press history over time; to compare different settings on the same press; or to compare several presses at the time of a planned business transaction. The ITL ImageGrader can also be used as an advanced Virtual Press Simulator to aid in developing new printing presses, showing how they will compare to existing print presses.

The following discussion will address in more detail how individual presses are assessed as well as how a press is compared with a group of presses.

Image Test Labs (ITL) Grading Principles and Techniques

The eye senses Color as three signals loosely call red, green and blue. The brain immediately converts this in to three other signals closely related to the three scientific components – the Color (Hue), the Saturation (Chroma), and the Lightness, all of which can be measured by instruments.

Then, the human brain interprets (assesses) these "colors" in a complex, non- linear manner. The eye can tolerate different levels of color mismatch, depending on the color viewed. For example, the eye is very sensitive to slight changes in blue but can tolerate much larger changes in yellow. The ITL Image Grader grades color in the same way as a person does, namely, by primarily using our eyes - complemented with instrument readings.

As with color grading, ITL grades a press based on the acceptability of its prints to customers using a methodology combining instrument measurement with visual assessment. This is not a simple "how much do you like this print?" - A, B or C. There are so many variables and so much subjectivity in a single assessment that such scoring would not be repeatable and, more importantly, would not point to corrective actions for the print system.

After grading, the attribute scores are rolled up into three category scores: Color, Solids and Lines & Text. The Category scores are rolled up into an overall grade for the press. In some categories, the print accumulates points by doing good things, but in more cases, the print accumulates demerits because the customer expects to see no streaks, smooth solids, real blue skies, and neutral neutrals. Thus, some "roll ups" are weighted averages of the attribute grades while others

use an adaptive algorithm which penalizes low scores more than it rewards high scores, mimicking our own perceptions of print image quality ITL grading

is independent of the printing process. Ink jet, electrophotographic, offset and other print technologies exhibit very different micro-structures and must conquer different technical challenges, but a customer's eye steps back and looks at the big picture, not the micro-structure or how the technical challenges were contained. The attribute grading mimics the human eye--and in most cases is a real human eye--in how it looks at images.

ITL attributes and grading avoid specific preferences like gloss, texture, and gamut, which are application specific and under the printer's control with ink and paper selection and post treatment.

Of most importance is fulfilling the requirement that a typical printing plant production person can follow and fully understand the press image performance.
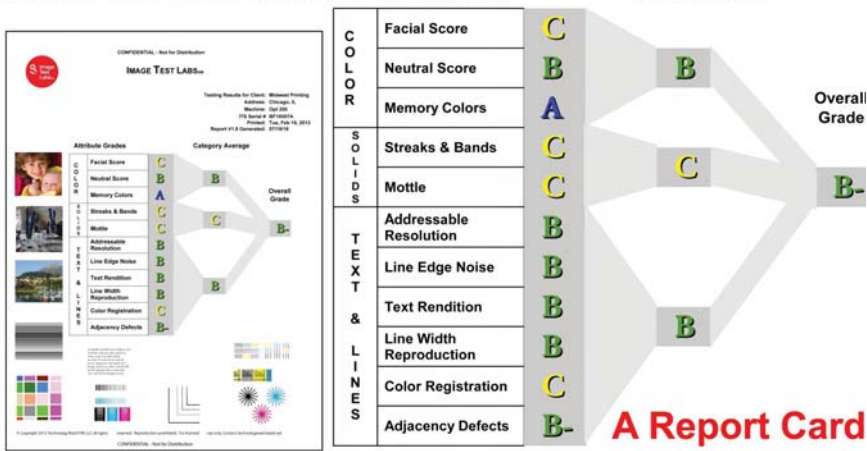

Grades for each individual group member are reported as shown above. The metaphor is a report card. Having successfully delivered over 300 such report cards to different printers and their presses, it can be confirmed that the process works and users understand their press color in a new way. In addition, the grading sheet makes it possible for the customer to communicate print quality using a common reference with all the print shop workers.

The grading report also shows the members how their press performs relative to other presses of the same type as well as to all press process types
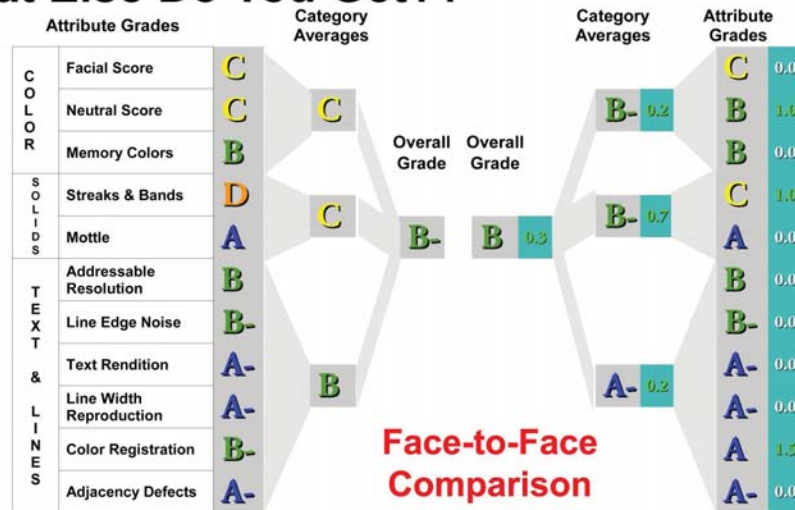
Is This Good or Bad??

Strengths
Memory Color

Weaknesses
Color Registration
Adjacency Defects
Streaks & Bands
Mottle
Facial Score
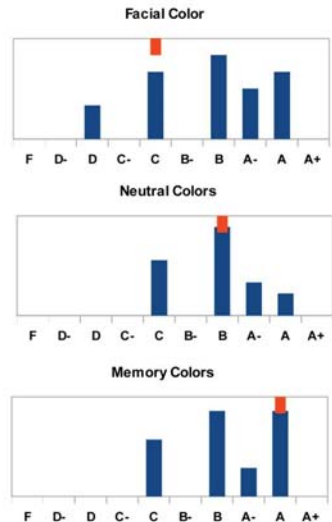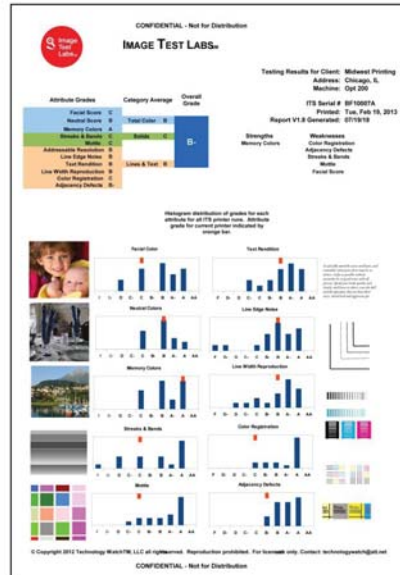
The red bar in the charts above denotes the specific press being graded compared to the performance of all other graded presses.

What Else Do You Get??

In addition, a Head-to-Head comparison of a given press with any other is possible in a variety of scenarios. It is this type of comparison that created the basis for the group imaging report we will discuss shortly.

The Development of Press Image Group Therapy

A press communicates by the image it produces (as assessed by the image grading process discussed earlier) and this image is its individual and only voice to the peer group of people participating. One can clearly see in the above Face to Face Comparison exhibit that the press in the left hand column is worse than the one in the right. Noteworthy in this example are issues common to both presses including facial color, banding, and streaking.

Borrowing from significant human group therapy research performed by Wilfred Bion, a British psychiatrist, it is possible to treat presses in a somewhat similar way. At the end of World War II, shell-shocked military troops were in need of significant psychiatric treatment but there was a shortage of psychiatrists. One approach that showed good results was assembling the shell shocked people into a group.
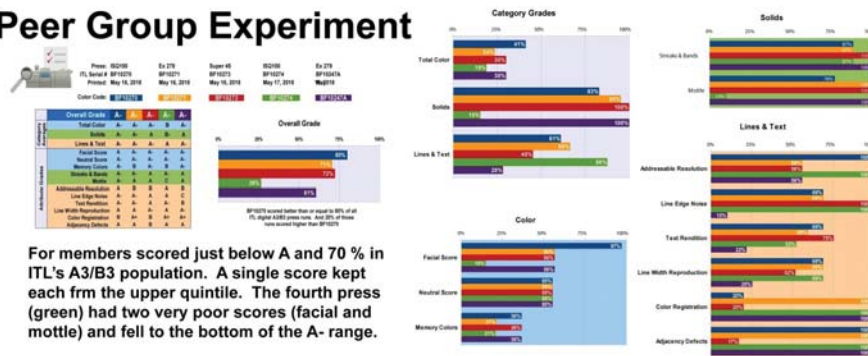
By placing Adirondack style chairs on a beach in a circle and having each soldier needing treatment sit in one of the chairs, each member could face all of the others. This was the beginning of group therapy.

Bion observed that soldiers who, due to their conditions, initially were silent, eventually started to talk as a result of the group setting. The soldiers participating in the group made progress more quickly than those receiving one on one therapy.

It is possible to model some aspects of this with peer group members discussing their press maladies as shown in the grading and those without such maladies, and why and how they resolved them.

The following illustration shows one aspect of a report that is shared with peer group members before a group meeting takes place and then is used to address each member's presses in the group meeting. Note at this level of discussion members do not know whose press is whose other than their own.

Peer Group Experiment

For members scored just below A and 70 % in ITL's A3/B3 population. A single score kept each frm the upper quintile. The fourth press (green) had two very poor scores (facial and mottle) and fell to the bottom of the A- range.

The first thing a group member sees is how his or her press compares to the others. In addition they also can see how serious any issues with the press are compared to the peer group. In fact, it is also possible to create a specific group score. This enables large organizations with many printing facilities to have a new way to compare presses and optimize their operations.

Conclusion

The ability to easily and rapidly measure press imagery and communicate this to people offers the ability to extend this ability over a communication network.and to assemble participants as peers in a review group of such press imagery. And, as a result, to perform this research and experimentation assembly of an actual network mediated peer group to measure and discuss press imaging occurred. Using group dynamics from behavioral studies and the concept that imaging can be managed by a production printing peer group occurred.

Theories have been tested and experimentation was successful. All peer group participants could comprehend the image assessment process and interchange Image data easily. Factual and specific press imaging observations and discussion relating to presses between members occurred. All stated they have never seen their press as compared as in the testing process. The following examples are but some of the immediate benefits derived from the experimentation.

- Establishment of a common, understandable and referenceable nomenclature to discuss press imaging.

- Definition of the status if the press imaging performance overall within the class of technology it uses to print.

- Peer group participants know where they stand in image quality as compared to other group members.

- Press operators and owners see where they can improve with their vendor, typically covered in their existing maintenance program.

- Allows for an economic and business discussion to match the presses with their costs and relate this to image quality.

- Ability to have a uniform communication with press vendors to improve the performance of a press.

References

The Integration of E-Commerce Enabled Expert Systems for Automated Control Networked in Printing and Publishing, TAGA Proceedings 2002, Document 20437, Freedman, Henry Note: This paper originally accepted for TAGA Stockholm, Sweden's "Future if Information Systems in Printing & Publishing Conference."