Designing in Full Color: Optimizing Files for Nanographic Printing

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Abstract

Landa printing presses are at the forefront of B1 digital printing and offer a color gamut and visual richness that far exceeds four color process offset printing. Despite advances in production digital printing, many graphic designers—both students and professionals—remain unfamiliar with contemporary print technologies and often lack an understanding of the types of projects that are best suited for nanographic printing, as well as the proper workflow required to prepare files optimized for Landa presses.

This paper examines Landa's nanographic printing technology through a designer's lens, with the aim of identifying the technical knowledge and practices that graphic designers need to incorporate into their design process—from initial concept to final production—for this type of printing. It explores nanographic printing and how it differs from offset and other digital printing methods; how designers can develop projects and prepare files that fully leverage its capabilities; and whether these technical considerations should be incorporated into undergraduate design education, which often prioritizes conceptual thinking and human-centered design over production-focused pedagogy.

Introduction

Much of the industry literature about Landa printing presses focuses on the technical capabilities of their nanographic machines and claims about color gamut and printing efficiency, without addressing how designers can prepare files most effectively and determine appropriate projects for this type of printing. Many professional designers rely on production artists and printers to transform their documents into print-ready files and take a hands-off approach to print production. Without an adequate understanding of current advances in digital printing, designers may be missing opportunities to conceptualize and create projects that take full advantage of nanographic printing, with its seven-color palette and impressive image reproduction capabilities. In addition, undergraduate design education tends to ignore print production as a key skill for graduates.

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There is a prevailing assumption that such technical skills can be acquired in the workplace, and that many contemporary design students may never engage in professional print work, raising the question of whether production skills should be taught at all.

Research for this paper is intended to address the needs of designers and design educators, who may be unfamiliar with nanographic print technology. Print tests were conducted on a Landa S10P press to compare the results of files set up in different color spaces and to determine how various file formats and ICC profiles affect print quality. Different tools for working with color swatches were also examined to determine best practices for specifying colors for the Landa press.

Understanding Nanographic Print Technology

The Landa S10P press, a 7-color production digital printing press, uses a water-based pigment composed of highly concentrated pigment particles. These ultra-small particles consistently produce extremely round dots with super-sharp edges (Quantum Group, 2024). The seven ink colors—cyan, magenta, yellow, black, orange, green, and blue-violet—provide an extended color gamut that is one of the largest of any production press.

Prepress for the Landa machine is similar to preparing file for offset printing. A prepress operator prepares files that are sent to a Fiery RIP which is embedded in the press. The process is fully digital and there are no plates. Like an ink jet printer or most digital presses, the machine can make just one finished print, so it is practical for short-run, high quality printing; it is also capable of variable-data and variable-image printing where every sheet is unique (Lawler, 2022a).

The printing process works by transferring an ink image from a heated conveyor blanket to a substrate. The image is created when tiny droplets of ink are ejected onto the blanket and passed under a row of driers, causing the water in the ink image to evaporate, transforming it into an ultrathin film. This film is 500 nanometers thick, or 0.0005 millimeters (Landa Digital Printing, 2012). According to Landa, this is the thinnest ink image of any printing process. As the substrate is passed between the conveyor blanket and the impression cylinders, the nanofilm image instantaneously bonds to the substrate. The quality of the print is affected by this process because there is no surface penetration or bleeding like you would get in an inkjet print. There is also no ink spread like you see in conventional offset. This provides a level of clarity and detail that is not achievable through either of those processes. The press also has a perfecting cylinder, which can flip the sheet and feed it under the blanket a second time. The ink image for the backside is transferred by another impression cylinder, allowing for double sided printing in a single pass (Lawler, 2022a). Below is a simplified visualization of the printing process.

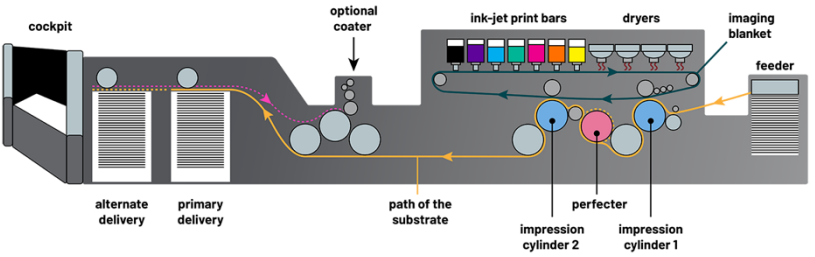


Figure 1: Illustration of Landa S10P press by Charmaine Martinez

Conceptualizing Projects

For graphic designers working on print projects, nanographic printing opens a world of possibilities. The Landa press can print on a wide range of untreated papers and boards on sheets as large as B1 size (27.83 x 39.37 inches / 707 x 1000 mm). It can also print on most plastic packaging film or label stock (Bigger Dot, 2026). The S10P can print 6,500 impressions per hour; Landa's latest model, the S11P, is said to have the ability to print 11,200 sheets per hour (landanano.com). This method of printing is appropriate for diverse projects, including books, packaging, direct mail, POP displays, and more.

In terms of sustainability, with the elimination of plates, there is no need for the harsh chemicals or solvents that are used in plate cleaning. The ability to print short runs in exact quantities reduces waste. NanoInk® colorants are supplied as concentrates and are mixed with water onsite, so there is no unnecessary shipping of heavy liquid inks (Quantum Group, 2024). The ability to print on almost any substrate gives designers the option of selecting off-the-shelf recycled papers, potentially avoiding supply chain disruptions, while also providing the ability to select a paper product that aligns with clients' sustainability goals (Quantum Group, 2024).

Design Process: Imagery

One key aspect of leveraging innovations in printing is understanding not only what types of projects can potentially be printed, but also how to set up files for optimal results. Because of the extended gamut that the Landa press affords, the types of imagery that can be successfully reproduced is far greater than in offset lithography. Content that can be notoriously difficult with 4-color process and conventional halftoning—a wide range of skin tones, extremely vibrant colors, and soft and subtle transitions in value—are achievable through nanographic printing. The Landa press uses a stochastic halftone screen method to image

photos and graphics, avoiding the technical issues of traditional halftones, such as rosette patterns and moirés (Lawler, 2022a).

From a non-technical perspective, this means that designers and clients will be less disappointed when comparing their printed materials to digital assets, allowing for more robust color palettes and greater consistency across media. Where an offset job might require CMYK and the addition of one or more spot colors to achieve skin tone accuracy or brand identity color matching, the Landa's 7-color ink process creates impressive reproductions of photos and graphics. The result is that designers can be less concerned about color limitations when creating or sourcing images and while building files.

Design Process: Color

Choosing color palettes and selecting colors for print projects has become increasingly complex with recent advances in digital printing. Many digital color tools use AI and are primarily focused on UX/UI and design for screens. These color swatch generators can create palettes based on hue features, color relationships, descriptive adjectives, and current trends. What these color pickers cannot do is create a palette driven by concept, communication goals, and information hierarchy.

The Pantone Color Bridge system was introduced over 20 years ago and the swatch books show CMYK conversions of spot colors that are, unsurprisingly, dull and poorly matched to their corresponding spot colors. To address some of shortcomings of translating spot colors to CMYK equivalents, the Pantone Goe system was introduced in 2007 and had a 10-year lifespan until it was discontinued in 2017. The intention of Goe was to incorporate the full digital color gamut into offset printed pieces. Goe was augmented with software called myPANTONE Palettes which offered designers several ways to make color selections (Shapiro, 2007).

Between the demise of Goe, the continuing and the somewhat unpredictable evolution of Pantone, and the rise of AI-driven color tools, designers are left without a clear means to specify colors for high-end digital printing.

Test Sheets

To gain insights into how a designer might approach imagery and color selection for nanographic printing, test sheets printed on a Landa S10P were analyzed to determine best practices for saving images and to demonstrate the capabilities of the machine. The test sheets showed some interesting results, especially in terms of color gamut between RGB and CMYK files. Embedded profiles also performed unpredictably.

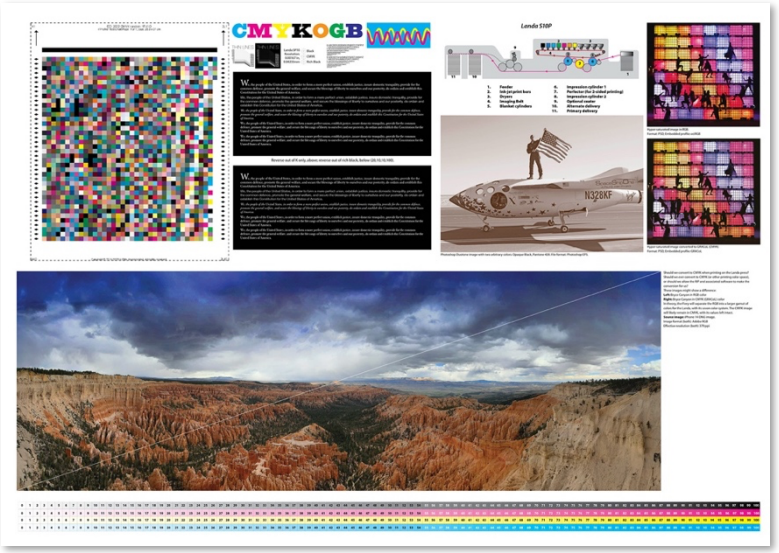


Figure 2: CMYK test sheet printed on Landa S10P. Brian Lawler

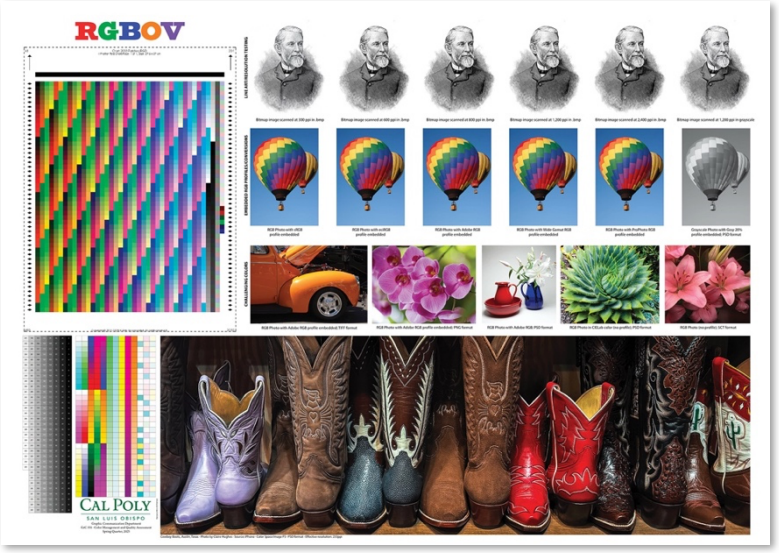


Figure 3: RGB test sheet printed on Landa S10P. Brian Lawler

The test sheets included:

- Color profile test targets – both RGB and CMYK

- Color images in RGB, CMYK, bitmap (line art), and duotone color spaces
- Embedded profiles – a wide variety from sRGB to ProPhoto RGB
- Color file formats: PSD, TIFF, SCT, PNG, Lab, EPS
- Grayscale file format: PSD
- Duotone image, saved as Photoshop EPS, with three select Pantone colors
- Very small type
- Very fine lines – positive and negative
- Line art scans of very fine line engravings at 300, 600, 800, 1200 and 2400 ppi
- 0-255 grayscale ramp in RGB
- 0-100% ramps of Cyan, Magenta, Yellow and Black, separately, with linearity analysis
- A named Pantone color
- A color trapping opportunity (four colors all intersecting) to test trapping and register
- Rich black and single-color black
- Subtle pastel colors in RGB and CMYK
  (Lawler, 2025a)

Image Test Results: ICC Profiles + Color Gamut

A profile was made of the seven-color output on the Landa press, taken from the RGB test patch set of 2,033 color patches. This was compared to a profile of the CMYK target (printed with all seven colors) using the ECI 2002 CMYK random patch set. In both cases, the output was measured with an X-Rite i1iSis 2 XL spectrophotometer (Lawler 2025b). Once the profiles were made, they were analyzed in ColorThink Pro 4 from CHROMiX (Lawler 2025b). Using the CIELab color space for these tests, the RGB results were then compared to a print from an Epson P9000 ink-jet printer on Epson glossy photo paper. Though completely different in size, capability, and type of ink, the two machines share an expanded color gamut that allows for much greater volume of color than any CMYK device (*see figure 4*). The Landa does have a smaller gamut than the Epson, which is a 12-ink machine, however, the P9000 or a similar Epson printer could potentially be used during the design process to proof colors for nanographic printing.

One curious result of this analysis is that it shows there are colors exclusive to both RGB and CMYK files. As one would expect, there are more colors exclusive to RGB than to CMYK. What is surprising is that a substantial amount of CMYK mixed colors are out of the RGB gamut (*see figure5)*. This is a mystery. The gamut of colors of the Landa S10P seems to be limited to, or very closely aligned with

the sRGB color space; great compared to the gamut of CMYK but below the largest common RGB color space in the industry (Lawler 2025b).

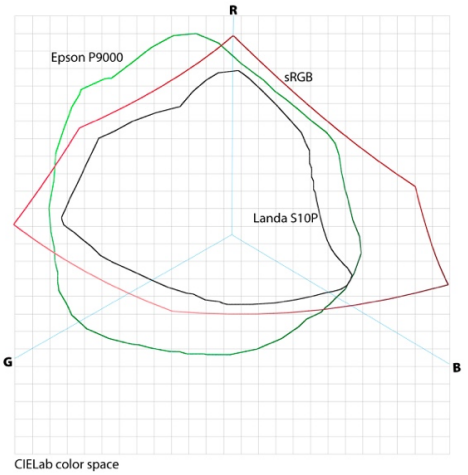


Figure 4: The chart above shows how the S10P press prints colors from RGB source files compared to the color gamut of an Epson P9000 and superimposed on an sRGB color space. Brian Lawler

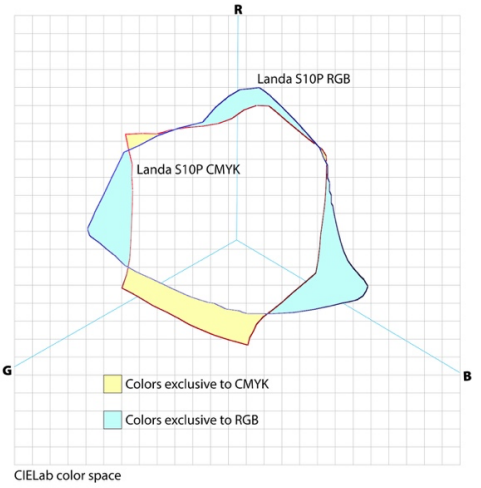


Figure 5: The chart above shows colors that are exclusive to the CMYK and RGB gamuts of the S10P press. Brian Lawler

Image Test Results: Dot Gain

To test dot gain, the X-Rite spectrophotometer was used to read 400 patches for tone value. The results showed that the Landa press has significantly less dot gain than an offset press. The peak increase on the Landa is magenta at 16.8 percent.

On an offset press this would be over 22 percent. It appears that there is little to no wet trapping on the Landa—most likely due to the immediate drying process. There is also no squeeze of the ink by the impression cylinder pushing the ink from the plate to the substrate. While dot gain is less on the Landa than on an offset press, there appears to be no need to change the default dot gain settings in Adobe programs, because, to the naked eye, the test sheets look acceptable in terms of both image quality and legibility of small text.

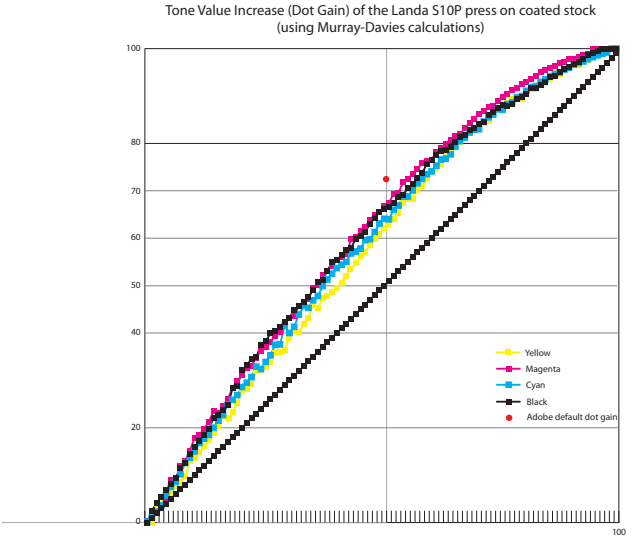


Figure 6: Tone Value Increase (Dot Gain) on the Landa S10P (Murray-Davis calculations).
Brian Lawler

Image Test Results: Resolution

The resolution of the Landa S10P is much lower than an offset press—600 spi, or machine spots per linear inch—yet fine lines and tiny details print remarkably well (Lawler, 2025d). Why? The Landa uses Fujifilm Dimatix ink-jet heads and the resolution of those heads is 600 machine spots per linear inch. The Landa draws twice as many machine spots in the direction of travel (left-to-right) and 600 in the lateral direction (Lawler, 2025c). Technically, the resolution of the Landa is 1,200 x 600 dpi or an alleged 1,200 x 1,200 dpi with Landa's proprietary "PrintAI Module" (landanano.com). The machine spots created by the ink-jet heads are remarkably sharp, and there is no degradation in sharpness as the ink is transferred to the substrate.

Under magnification it is possible to see an obvious resolution shortcoming is a reproduced engraving (hi-res line art from the test sheet which was saved as a bitmap (.bmp) image). Without magnification and to the average viewer, the same

reproduced engraving, saved as a lower resolution grayscale Photoshop file (.ps vs .bmp) looks acceptable, but not as sharp and high quality as a hi-res engraving image printed on an offset press. For printing photographs and tonal graphics, the Landa press can produce images that are comparable to offset printing with a much higher resolution (Lawler, 2025c).

Image Test Results: Thin Lines, and Tiny Type

Thin line tests show that very fine lines reproduce well up until a point. As the stroke weight gets smaller, the line is created with the closest number of ink droplets. The Landa press can draw a stroke as thin as about a tenth of a point (0.1 pt.)—a stroke weight thinner than Adobe's hairline default of .25 pt. Anything below that threshold cannot be rendered, so the Fiery RIP will render any strokes under that size at the minimum thickness in order to avoid printing no line (Lawler, 2025c).

Tests of serif and sans serif type from 8pt. down to 1pt. demonstrate that the Landa's rendering of type is excellent. With reversed out type, there is no need to use Rich Black as single color black has enough density to look satisfyingly dark and even. Without magnification, text reversed out of Rich Black does not appear as crisp and bright white as text reversed out of single color black (Lawler, 2025c).

Based on these tests—and magnification of register marks—the takeaway is that any style of typeface should be successfully rendered on the Landa. Formal scripts, typefaces with super thin serifs, and hairline styles will likely maintain legibility. To test this theory, the next print test should include different styles of type set in different colors and reversed out of colored backgrounds.

Image Test Results: Embedded Profiles for Photos

Perhaps the most surprising result of the print test was how embedded profiles affected full color images. Samples were printed that represented the smallest gamut to the largest gamut—sRGB, eciRGB, Adobe RGB, Wide Gamut RGB, and ProPhoto RGB. On the test sheet, they appear to do the inverse of what one would expect: the sample with the smallest color gamut, an RGB image with an sRGB profile embedded, prints as the most vibrant image—the one that comes closest to matching the image on screen. The image saved with the highest gamut profile, the ProPhoto version, looks dark, dull, and muddy. The image with the Wide Gamut embedded profile also looks washed out. These anomalies require further investigation to determine why the large gamut images do not look better in print.

Based on this test, the sample image (a photograph of a hot air balloon) with the sRGB profile embedded appears to perform the best; the Landa machine, and its Fiery front-end, did not appear to manage the color in the Wide Gamut or

ProPhoto spaces adequately (Lawler, 2025b). Adobe RBG and eciRGB look acceptable, but in the sample image, not quite as bright or as saturated as the sRGB version. This is most noticeable in the blue sky and the red and purple parts of the balloon (*see figure 7*).

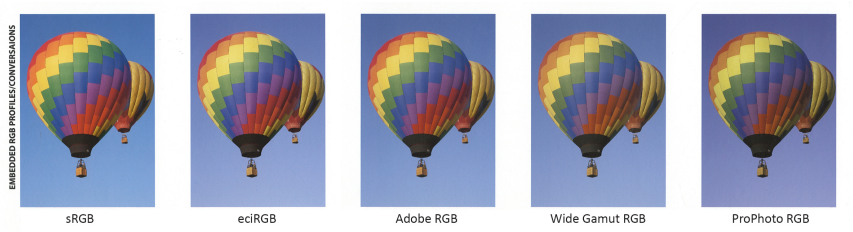


Figure 7: Scan of the embedded profiles test printed on a Landa S10P showing that sRCB (far left) results in the best color match to the digital file

Color and the Pantone problem

Working in a RGB color space makes sense when designing for digital printing, but how can designers take full advantage of the capability to reproduce such a wide color gamut? What tools does it make sense to use when creating design elements and graphics in various Adobe programs? Online tools offer a variety of ways to create color palettes but do not provide the accuracy of Pantone swatches, which can be sent to clients and printers to ensure that colors specified in a file will match a physical sample. With Pantone's recent move to a paid subscription model, Pantone color libraries are no longer accessible in Adobe programs without a Pantone Connect subscription. Is there any advantage to using Pantone libraries when preparing files for digital printing?

Landa claims that their presses can print 96% of all Pantone colors—although the definition of "Pantone colors" is vague, as Pantone keeps expanding their libraries. Pantone's Extended Gamut library uses the same base colors as the Landa press: CMYK, with the added three colors of orange, green, and violet. The Pantone Extended Gamut system could potentially provide an approximation of how colors translate from screen to print, however, Pantone has discontinued these fan books. Ironically, extended gamut is described on Pantone's website as "the latest development in process printing technology" (Pantone.com). With the proliferation of increasingly high-quality digital presses, perhaps swatch and fan books designed for offset printing are no longer viewed as relevant for many contemporary print projects.

Since digital presses use various proprietary ink systems that are not manufactured by Pantone and with Pantone's departure from the Adobe ecosystem, many design education programs will provide very limited, if any, exposure to Pantone as a tool for students. What is potentially lost in design education is a technical

understanding of how color works in the physical world, how colors interact with one another, and how digital color mixing works—creating general confusion about how best to work with color in Adobe programs, especially for students who are new to working with color swatches and libraries.

For nanographic printing, there is currently no industry-standard method for selecting colors, for determining color accuracy, or anticipating how digital colors will translate to print. One potential solution is for Landa (or print companies using this press) to create a palette of colors in an Adobe Swatch Exchange (.ase) format with a companion printed swatch book. This would provide designers and production artists with a library of pre-made swatches that are optimized for the capabilities of Landa presses.

Summary of Findings

Landa's nanographic printing process offers an expanded color gamut and high-quality image reproduction in a fully digital production press. Based on analysis of two tests sheets printed on the Landa S10P, here is a summary of the findings and recommendations for file prep:

Print Quality

- Landa prints are high quality, especially in terms of reproducing photographic imagery, tonal graphic, and a wide range of colors.
- The color gamut of printed samples appears to align to sRGB.
- Images print remarkably well in terms of color accuracy and far exceed what is possible with 4-color offset printing.
- Although it has a wider gamut than the Landa S10P, an Epson P9000 inkjet printer (or similar inkjet machine) could potentially be used as a preliminary proofing device, because color imagery is similar in quality to the Landa.

File Set-up

- When setting up files, the color mode in all programs should be RGB.
- Images should be saved with either sRGB or Adobe RGB embedded profiles, without any image compression.
- Bitmap (.bmp) line art images should be avoided. Black and white images can be saved as grayscale or RGB Photoshop files.
- There is no need to use Rich Black because single color black provides dense, saturated coverage.

Registration and Typography

- Registration is precise and the press can reproduce fine details and thin lines
- Legibility of very small type is excellent.

- Further testing is required to determine the Landa's performance with colored text and knock-out text on colored backgrounds.

Creating and Specifying Colors

- Currently, there is no existing palette of swatches in Adobe programs that is designed to be used with this type of printing.
- Given the expanded gamut, colors should be created in RGB with the expectation that most onscreen colors will look acceptable in print.

Conclusion

After years of handwringing over the impending death of print—especially in the design industry—innovations in print technology are meeting the needs of designers and their clients who want flexibility, short to medium runs, and fast turnaround times. In many graphic design programs—in addition to digital/interactive design—students learn the challenges and excitement of creating physical things, such as packaging designs, wayfinding projects, and printed books. Educators in graphic design, visual communication design, and graphic communication are well positioned to help students understand the diverse and evolving nature of careers in the creative industry. Far from being dead, the print industry is at the forefront of innovation, and nanographic digital printing has the potential to transform the ways in which designers approach print projects. Design careers in interactive media and UX/UI have not replaced the need for designers who can create physical products and printed media. A well-rounded design education should include both historic and cutting-edge printing methods, equipping students with the insight and skills needed for professional success. Processes like nanographic printing demonstrate not only how the industry is evolving, but also the enduring and often overlooked creative potential of print

Selected Bibliography

"EFI and Landa Collaborate to Develop New Technology for Nanographic Printing Solution." 2014. *Progressive Digital Media Packaging News*, Jan 23.

"The Future of Printing is Here. Landa Digital Printing." 2026. Bigger Dot. Retrieved March 1, 2026 from https://www.biggerdot.com/dispatches/landa-digital-printing

Hagen, Eddy, March 7, 2025."Landa Nano: The Good, The Bad, The Ugly And The Alternative." Insights4Print. Retrieved February 7, 2026 from https://www.insights4print.ceo/2024/06/landa-nano-the-good-the-bad-the-ugly-and-the-alternative/

landanano.com. Retrieved February 2, 2026. https://www.landanano.com/

Lawler, Brian.
2022a. Working with the Landa Nanopress. thelawlerscom. https://thelawlers.com/Blognosticator/?p=3251

2022b. Printing on the Landa Nanopress. thelawlerscom. https://thelawlers.com/Blognosticator/?p=3258

2022c. Running the Landa Nanopress. thelawlerscom. https://thelawlers.com/Blognosticator/?p=3274

2025a. Exploring the capabilities of the Landa S10P press. thelawlerscom. https://thelawlers.com/Blognosticator/?p=4118

2025b. Not printing colors that the press can print. thelawlerscom. https://thelawlers.com/Blognosticator/?p=4135

2025c. Printing high-resolution line art on the S10P. thelawlerscom. https://thelawlers.com/Blognosticator/?p=4156

2025d. Thin lines and fine type. thelawlerscom. https://thelawlers.com/Blognosticator/?p=4170

Landa Digital Printing. May 7, 2012. The Landa Nanographic Printing® Process (Official Video). YouTube. https://www.youtube.com/watch?v=EVrCvocyC2o

Pantone.com. Retrieved January 10, 2026. https://www.pantone.com/products/graphics

PrintWiki. Stochastic Screening. https://printwiki.org/Stochastic_Screening

Shapiro, Ellen. 2007. "Pantone Launches Goe System." *Communication Arts*. Retrieved January 10, 2026, from https://www.commarts.com/columns/pantone-launches-goe-system

"Sterling Packaging Adds Landa S10 Nanographic Printing Press." September 02, 2023. *Global Data Point.* Retrieved January 10, 2026, from https://www.proquest.com/wire-feeds/sterling-packaging-adds-landa-s10-nanographic/docview/2859822255/se-2

"What Does Nanographic Printing Have to Do with Sustainability in Print?" February 13, 2024. Quantum Group. Retrieved January 24, 2026, from https://blog.quantumgroup.com/what-does-nanographic-printing-have-to-do-with-sustainability-in-print

Wikipedia. 2026. "Pantone." Wikimedia Foundation. Last modified March 6, 2026. https://en.wikipedia.org/wiki/Pantone

Zwang, David. 2023. "Landa: Hitting Its Stride." WhatTheyThink. Retrieved February 13, 2026, from https://whattheythink.com/articles/116919-landa-hitting-stride/

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