THE PROS AND CONS OF SCREENLESS PRINTING

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Abstract: Screenless printing is both praised and condemned by photolithographers. The process can print high-fidelity images, but it is difficult to control and requires care and precision. Screenless printing is a good alternative to halftone printing when maximum definition and color fidelity are required.

Screenless printing continues to be developmental; even with the improved consistency of the plates and chemicals, many difficulties remain to be overcome before the process can be a practical procedure for the average lithographer. The U.S. Geological Survey is reproducing selected image maps by screenless lithography and is closely monitoring the procedures to determine if the improved quality justifies the additional effort and cost.

Introduction

Screenless printing, often criticized for being too difficult to control and too expensive for production printing, is being used as a normal printing procedure for selected image maps at the U.S. Geological Survey. These screenless maps, although monitored and evaluated more closely than our other image maps, indicate that screenless printing is a predictable and high-quality process, suitable for the printing of monochrome and duotone image maps.

Good screenless printing requires both positive-working pressplates processed under photographic-film laboratory conditions and the use of lithographic presses in excellent condition by highly skilled operators. The photolithog-

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rapher should realize that screenless printing is not a replacement for halftone printing, but an alternative process used to enhance particular types of printing where color fidelity and fine definition are required.

Background

The ultimate dream of the photolithographer has been to print continuous-tone images without converting to a binary dot system of reproduction, such as halftone printing. Alphonse Poitevin (1819-1882), the father of photolithography, first invented the Collotype process of printing in 1855. Collotype was an early form of screenless printing, using gelatin on substrate to carry a continuous-tone image directly to paper. This screenless process has been used since its discovery as a way of printing fine detail images and of replicating images faithfully. However, because only 1,000 - 3,500 copies can be printed from a single plate on a special press, Collotype use has been very limited. Presently, in the United States, even with new procedures and careful quality control, there are only a few companies that actively print using the Collotype process.

Halftone printing today is the industry standard for printing imagery by press. The halftone process gives the viewer the illusion of a continuous-tone image by printing varying dot sizes in proportion to the tone density of the original. The cross-line glass halftone screen, invented in 1886 by Frederick Eugene Ives, was not easy to use and required skill and patience to be used successfully. Not until the availability of the flexible film contact halftone screen after World War II was halftone photography relatively easy to accomplish. This film screen allowed many more photolithographers to use this process.

As demands have increased for finer definition of printing and closer replication of original art work, the number of halftone screen rulings per inch have increased. With the improved performance of printing presses and better quality paper, today we see 133 and 150 lines per inch as normal screen rulings for many book and magazine publications. Although control is more difficult, even finer detail can be obtained when using 175, 200, and even 300 lines-per-inch halftone screens.

Screened printing is very practical and relatively simple. However, the increased demand by users for even closer replication of tones and detail of originals has

created the need for special effect screens, such as random shape dot mezzotint and micrograin screens, with screen rulings equivalent to 250 - 300 lines per inch. Even with these specialized contact screens, the reproduction fidelity is still not acceptable for the purist who wishes to duplicate tones the way they appear in the original art form.

Screenless Printing

Not until the late 1940's, when the first diazo-sensitized pressplates from Germany were being used in the United States, was it observed that these plates could print different density tones without screens. Many plate manufacturers since have attempted to produce similar plates. In recent years, the ongoing development of screenless printing has resulted in improved process control and an awareness of how this type of printing works, thus permitting printers worldwide to begin using this process. The USGS, being interested in printing high-resolution image maps, has in the past 10 to 15 years worked with several versions of screenless printing. Although the quality of Collotype printing met the standards for printing image maps at the USGS, the cost of having plate coating baths and a special press made the process uneconomical to pursue. Strong emphasis on research was begun at the USGS in the mid-1970's using positive anodized diazo plates to print continuous-tone images in a limited production mode. Recent production refinements have helped to make screenless printing at the USGS a viable alternative to halftone printing.

Pros and Cons of Screenless

Although halftoning and screenless printing are not truly comparable, an effective way to explain the pros and cons of screenless printing is to refer to the two different printing processes. The following lists include the major advantages and disadvantages in a screenless printing production environment.

This comparison is used not only as a way to evaluate where the art of screenless printing is today, but also to indicate the weak and strong points of both systems. To compare the two systems, I have given a subjective numeric rating of the comparative points. (See figure 1, table 1).

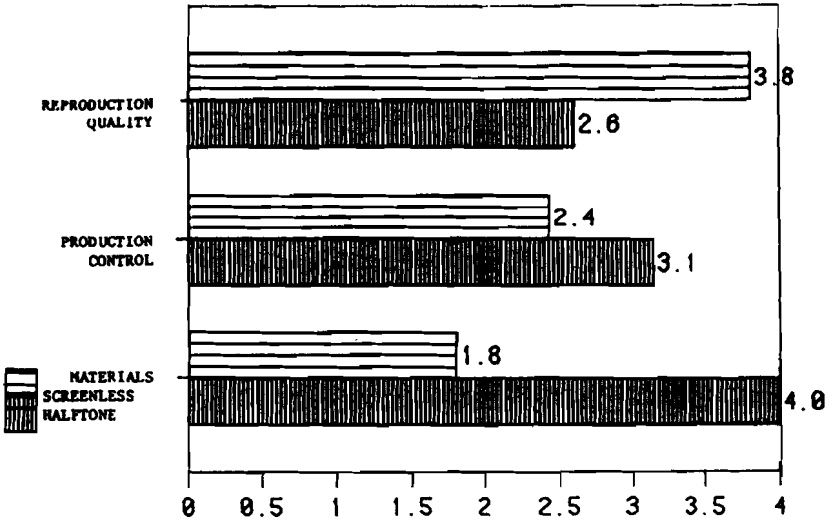
Table 1.--Comparison of screenless printing with halftone printing

(1 = barely adequate; 2 = acceptable; 3 = good; 4 = excellent; LPI = lines per inch; CT = continuous-tone)

ATTRIBUTES	SCREENLESS	PTS.	HALFTONE	PTS.
	REPRODUCTION QUALITY			
Resolution	500-600 LPI equivalent	4	Maximum 300, routine 150-175 LPI.	3
Moire	None - no screen angles to cause moire.	4	Screen angle rotation required.	2
Combining line and image on one plate.	CT, line, and halftone can be printed on one plate.	4	Line and halftone can be printed on one plate.	3
Contrast range of ink.	Solid printing density of 1.50 - 1.70.	3	Solid printing density of 1.40-1.50.	2
Quality of printing.	Excellent representation of image detail and color fidelity.	4	Halftone less than 150 LPI poor in comparison to screenless; fine detail loss in halftone.	3
	Total.....	19		13
	Average.....	3.8		2.6

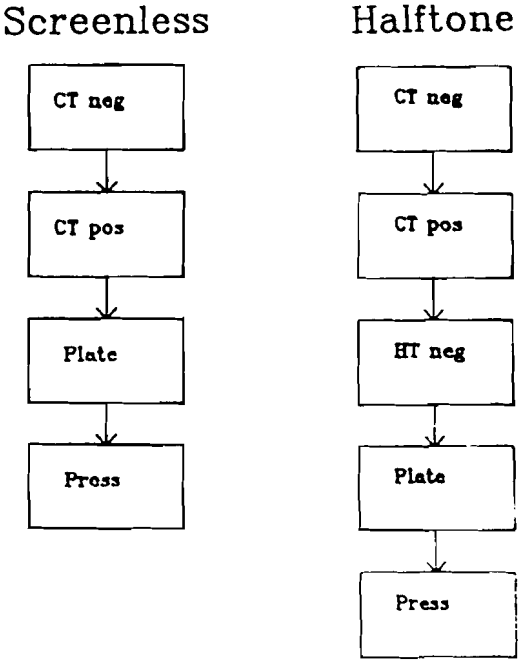
ATTRIBUTES	SCREENLESS	PTS.	HALFTONE	PTS.
	PRODUCTION CONTROL			
Film density range.	CT film density should be processed to a range of greater than .90 or less than 1.20.	3	Density in excess of 1.00 can be accommodated.	4
Required photographic steps (fig. 2).	CT film exposed direct to pressplate.	3	CT film to halftone film to litho plate.	2
Plate processing.	Extra exposure and mask required to clean non-image area with required positive working plates.	2	Negative working plates do not require extra exposure.	4
Control of tone reproduction.	Development time and plate flashing control tone reproductions.	2	Flash and bump film (no screen) to control tone reproduction.	3
Controlling press variables-ink/water balance.	Careful observations required.	2	Fine line screens (200+) require careful observation.	3
Personnel training				
a. Plate process.	Must retrain - photographic background helpful.	2	No new training required.	3
b. Press process.	Good pressmanship.	3	Good pressmanship.	3
	Total.....	17		22
	Average.....	2.4		3.1

ATTRIBUTES	SCREENLESS	PTS.	HALFTONE	PTS.
	MATERIALS			
Plate manufacturers.	Limited to 3 1. Howson-Algraphy, Inc. 2. Enco Plate, American Horscht, Inc. 3. Polychrome Corp.	2	Many manufacturers make good plates for halftone printing.	4
Availability of materials.	Limited - 2 of the 3 manufacturers are outside the United States.	2	Ample supply and competition.	4
Automatic processors.	Only Howson-Algraphy has an automatic processor designed for screenless. Converted drum film processors and dip tanks may be used.	2	Most plate processors work well.	4
Access to information on process.	Limited to plate manufacturers and a small number of publications.	2	Plate manufacturers and many graphic associations and publications.	4
Pre-Press proof.	No acceptable photographic proof.	1	Many excellent proofing systems available.	4
	Total.....	9		20
	Average.....	1.8		4.0



SCREENLESS VERSUS HALFTONE
SUBJECTIVE RATINGS

Figure 1



FLOW DIAGRAM OF
SCREENLESS VERSUS HALFTONE

Figure 2

Summary

Currently, screenless printing is approximately 24 percent more costly than halftone printing at the USGS. Recognizing this estimated cost increase of 24 percent, figure 1 illustrates that this increase can achieve an improvement in reproduction quality. In some cases, as the USGS has determined, this improvement may be worth the increased cost when high-quality image maps are needed.

With respect to the processing problems, screenless lithography is an art that requires careful attention to processing details and equipment calibration. Skill in these areas is gained mostly by the printers' own trials and errors on the job. The companies who are supplying the screenless plates provide useful knowledge of the process, but unfortunately this knowledge is not fully documented and frequently only a few people within a company are knowledgeable in procedures. Critics of the screenless process have said that it won't work in production, or that it is not profitable because of the lack of adequate materials and processing data available for the lithographer. It is worthy of recognizing that screenless printing is not a threat to halftone printing; however, it is a controllable and valuable supplement for those printers who have the requirement to do extra-fine detail printing.

Screenless printing has advanced significantly in recent years from research by plate manufacturers, and by government and private printers who have developed and made available procedures to make screenless printing a production process. To continue this advancement, collaboration between screenless supply manufacturers and printers is needed to develop the art of screenless printing to its full capability in the lithographer's arsenal of printing processes. If the successes and failures of this printing process are not more openly reported and discussed at technical meetings such as this one, then an excellent form of printing may, unfortunately, follow the path of Collotype's history and negate the printing industry's motivation to solve the processing problems.

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