TECHNICAL NOTE

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An Accurate Method of Focusing for Infrared Photography

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ABSTRACT: A method of accurately focusing for infrared photographs with the aid of an infrared image converter is described. The method is tested with a series of photographs and produces sharper photographs than conventional methods.

KEYWORDS: questioned documents, image enhancement system, photography, infrared photography

Any individual attempting to capture an infrared image on photographic emulsion is plagued by problems inherent with the technique. Mainly, it is difficult to focus the infrared image accurately because infrared radiation and visible light are refracted by the glass elements in the lens to different angles, and therefore, form an in-focus image at different planes relative to the lens. Methods have been developed to combat this problem such as focusing the camera in the visible region and then shifting the index mark on the lens to a preset position that is usually denoted by a small red dot on the lens; focusing the camera with a red filter over the lens to approximate the infrared focus; or by conducting focusing tests as described by Kodak [*1*]. Because of the inaccuracy of these methods, the aperture of the lens needs to be small to insure sufficient depth-of-field for an "in-focus" image. Unfortunately, the small aperture required does not guarantee a critically sharp image, and in the case of a document examiner attempting to photograph infrared luminescence, mandates exposure times of several minutes.

Operating under the constraints mentioned above will produce photographs of acceptable quality for maintaining a record but not for comparison purposes. The case in study here involved an attempt to "separate" two ink lines contained on the face of a forged check based upon their reaction to infrared radiation. If the inks could be separated the next question would be whether either of these ink lines was freely written. This determination would require critically sharp infrared photographs. Therefore, an attempt was made to develop a more accurate technique of focusing the infrared image.

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Method

The allegedly forged check and known handwriting were received at the laboratory along with a request for a handwriting comparison. Initial examination of the check revealed a felt-tip writing line that followed an underlying ink line. Use of an infrared image converter revealed the underlying ink line but did not provide the resolution necessary to examine the line quality of the underlying line.

It was theorized that the focus could be set more accurately if the infrared image converter could be used to "see" the image on the focusing screen of the camera. This was attempted by mounting the video camera from the infrared image converter on a tripod with its lens focused on the focusing screen of the camera used to record the infrared photograph. The apparatus is shown in Fig. 1 and consists of a Panasonic video camera connected to a Panasonic black-and-white video monitor, a Nikon model F3 35-mm camera body equipped with a micro-NIKKOR 105-mm f/2.8 lens, a waist-level viewfinder, and a split image focusing screen. The infrared barrier filter is a Foster-Freeman 52-mm screw thread filter with a cut-off wavelength of 780 nm, and the film used is Kodak High Speed Infrared film.

To test the technique a series of infrared photographs was taken alternating between a conventional focusing technique and the video focusing technique. Specifically, the camera was focused with a red barrier filter over the lens, the filter was then replaced with the infrared filter and three exposures were made at two stop intervals. Next the camera was focused using the split-image focusing screen as seen on the monitor of the infrared image converter and three more bracketed exposures were made. All exposures were made with a lens aperture of f/2.8 to accentuate differences in sharpness of the resultant image. This series of six exposures was repeated four times to reduce the chance of operator error. The film was developed according to the information sheet provided with the film, prints were made, and then examined for differences in sharpness.

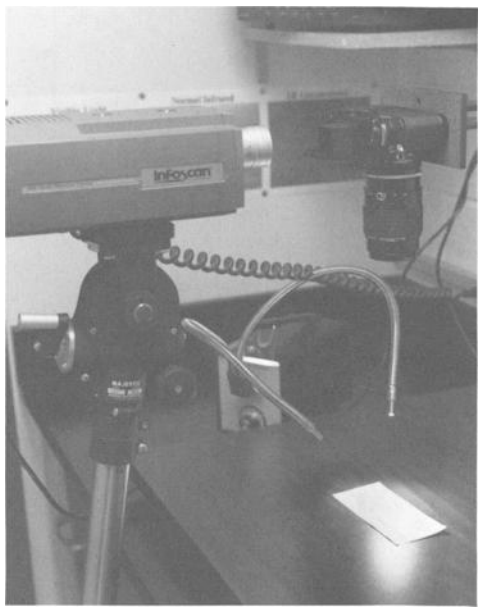

FIG. 1—*Video focusing apparatus.*

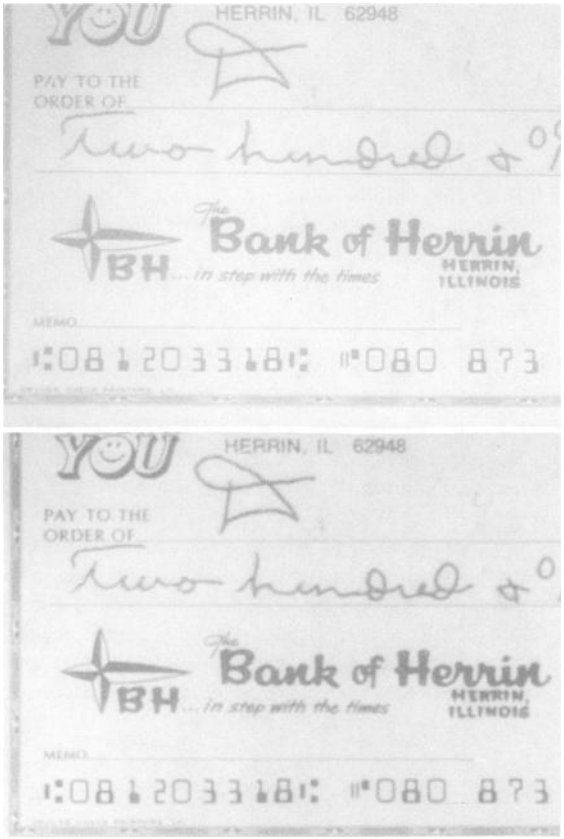

FIG. 2—*Comparison of sharpness using video focusing technique* (top) *and conventional focusing technique* (bottom).

Conclusions

1. The video focusing technique produced sharper photographs than the conventional method (see Fig. 2).
2. The video focusing technique produced more consistent results than the conventional method.
3. Critically sharp images were recorded that allowed the examination of the two ink lines on the forged check in study here.
4. The large lens aperture allowed by the video focusing technique significantly reduced the exposure times required for infrared luminescence photography.

Reference

[*1*] "Applied Infrared Photography," Eastman Kodak Company, 1977 edition, 1981 printing.

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