

## TECHNICAL NOTE

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### A Look at Newer Photocopiers

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**REFERENCE:** Morton, S. E., "A Look at Newer Photocopiers," *Journal of Forensic Sciences*, JFSCA, Vol. 34, No. 2, March 1989, pp. 461-467.

**ABSTRACT:** Beginning in the early 1970s, office copiers came into widespread use. Their products posed grave difficulties for document examiners. The prevailing feeling came to be that no definite opinion as to handwriting identification or elimination should be based on a copy. In the intervening years, office copiers have greatly improved and document examiners have become more familiar with their limitations. The products of several copiers are examined in this paper to determine whether it is now advisable to base definite findings on machine copies.

**KEYWORDS:** questioned documents, photocopiers, signatures, handwriting

In the 1970s, office copiers began to abound, replacing earlier cumbersome methods of reproduction such as photostats. Initially, there were many different processes, some using fluid solutions, the others coated papers. As these copies became widespread in business and government offices, inevitably some came into question. Document examiners were faced with a new problem—examination of machine copies. Some of these copies were of very poor quality and posed great difficulty for the document examiner. Received wisdom was handed down that all machine copies must be viewed with great caution and that definite findings should never be based upon them. The theory was that a copier could either mask evidence of forgery or introduce artifacts that could resemble evidence of forgery.

To this day, some document examiners refuse categorically to perform examinations based on machine copies. This attitude seems somewhat unrealistic in view of the prevalence of copies in our society.

Furthermore, nearly two decades have passed since the first questioned document horror stories were told. During that time, office copiers have greatly improved. It seems an appropriate time to look at the newer copiers in use and evaluate their products.

#### Materials

The study consisted of two sets of samples, one featuring signatures and the other extended writings. For the signature portion, six writing instruments and four types of paper were selected:

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- Writing instruments:** blue and black ballpoint pens  
 blue and black roller ball pens  
 blue and black fiber tip pens
- Paper:** 25% rag bond  
 white copier paper  
 yellow copier paper  
 green safety paper

The author's own signature was chosen as a sample because it is moderately difficult to forge. Great speed and very light pen pressure are used, but letter forms are simplified or sloughed off (Fig. 1). (The author's student describes this as "degenerated." The author is seeking a new student.)

On each of the four sheets of paper a genuine signature was written with each of the six pens. Each of these signatures was then traced using each pen. A freehand simulation was then made with each pen by a colleague.

For the extended writings, four writing instruments and two types of paper were used. The papers were hard-finished, lined tablets, one white, one yellow. The writing instruments were (Fig. 2): a sharp, hard lead mechanical pencil; a dull, soft lead pencil; a red fiber tip pen; and a green plastic point pen.

These six sheets of paper were then copied on seven plain paper office copiers. All were on the normal contrast setting. These machines were: IBM Copier II (in poor adjustment), Kodak Ektaprint 200, Panasonic 3010R, Ricoh Ripro, Royal 1803, Xerox 1090, and IBM 6670 laser copier/printer.

GREEN SAFETY PAPER			
	GENUINE	TRACED	FREE HAND SIMULATION
BLUE BALL POINT			
BLACK BALL POINT			
BLUE ROLLER PEN			
BLACK ROLLER PEN			
BLUE FIBER TIP			
BLACK FIBER TIP			

FIG. 1—Example of a page of signature samples, genuine, traced, and simulated with six different pens.

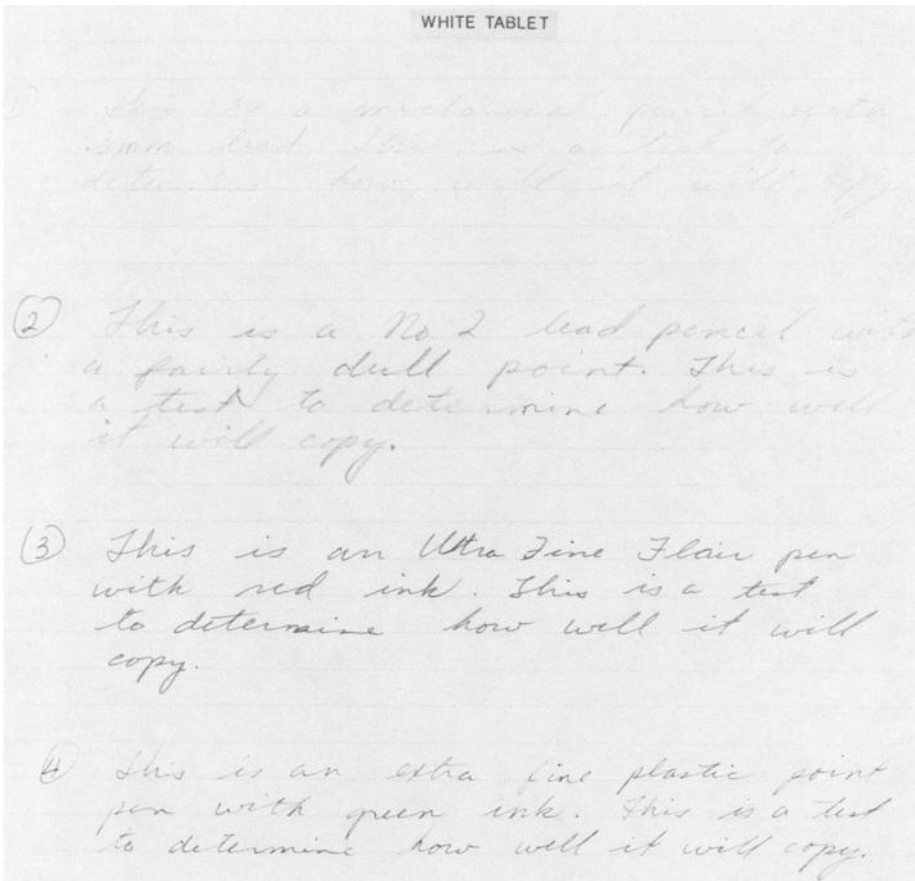


FIG. 2—Tablet paper sample with four different writing instruments.

### Observations

The vast majority of office copiers in use today are plain paper copiers. Thermographic, coated paper, and wet solution processes seem to have fallen by the wayside. A few may be in use in specialized places such as microfilm reader/printers. However, the overwhelming majority of copies presented for examination will be of the plain paper variety. In view of this fact, it now seems safe to resume use of the term "photocopy." For many years document examiners have taken care to use the term "machine copy" since some of the earlier processes were not light activated. The xerographic process used by plain paper copiers is light activated. Thus the term "photocopy" becomes acceptable. Since this is the term used and understood by the general public, it would seem preferable.

The quality of the copies produced varied somewhat. The large, high-speed machines (Xerox 1090 and IBM laser printer) produced the poorest copies relative to the detail of handwriting. These machines seem to have sacrificed quality for speed (Fig. 3). The smallest copiers, a desk-top Ricoh Ripro, reproduced the handwriting quite well, but deleted all background. Thus the lines on the tablets disappeared, as did the pattern of the safety paper (Fig. 4). Such background could be crucial in certain cases. The crisp quality of the copied writing might beguile a document examiner into failing to realize that detail had been lost.

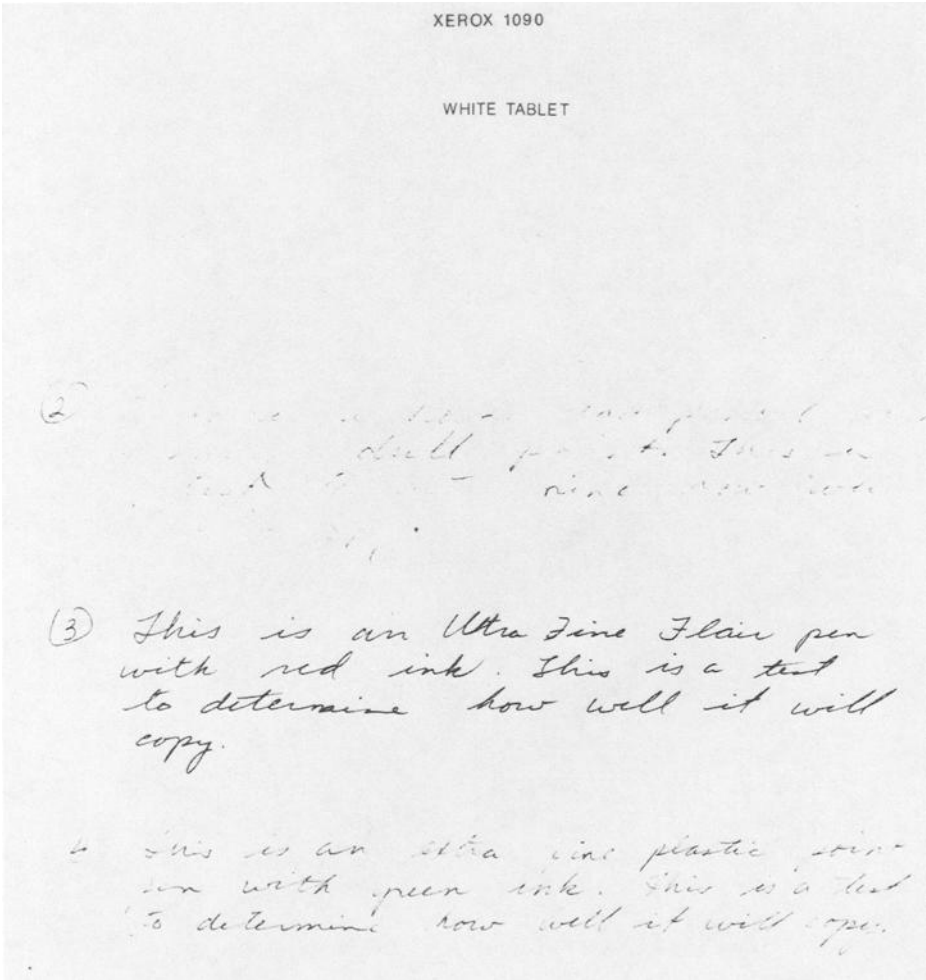


FIG. 3—High speed Xerox copier has deleted much detail.

Most of the copiers reproduced the signatures, genuine and forged, well enough for a fruitful examination. All of the tracings are obviously forged. The freehand simulations, as expected, are better. However, these, too, can be judged forgeries. Some of these are a bit thornier than others but are no harder to evaluate on the copies than they are on the original documents (Fig. 5).

Some of the copiers had trouble reproducing the genuine signatures written in light-blue ink. No artifact was produced that could be taken to indicate forgery, however. The signatures were simply badly copied with the characteristic broken appearance of a poor quality photocopy (Fig. 6). The forgeries reproduced much better, since they have had more uniform and heavier pen pressure (Fig. 7).

**Conclusions**

Advancements in technology have vastly improved the quality of the image produced by plain paper copiers. Poor copies may now be recognized for what they are; good copies may

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BLUE FIBER TIP			
BLACK FIBER TIP			
		RICOH RIPRO	

FIG. 4—Low-speed Ricoh has copied writing well but completely deleted green basket weave background.

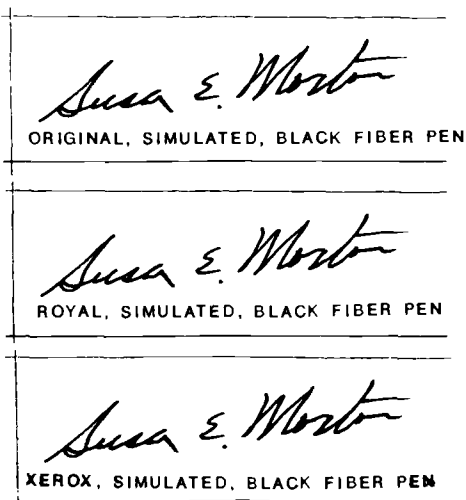


FIG. 5—Freehand simulation done with a black fiber tip pen—one of the worst case scenarios for making an examination from a photocopy. Yet both Xerox and Royal copiers have picked up enough detail to send up red flags.

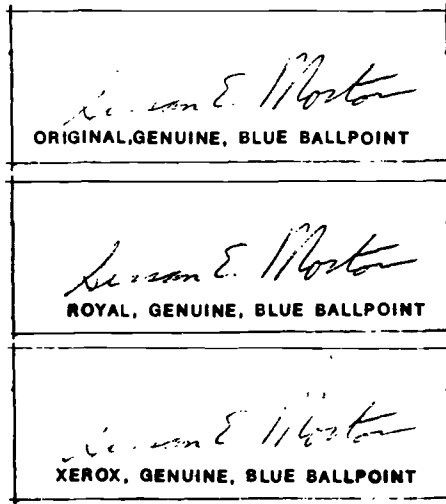


FIG. 6—Xerox 1090 has done a rather poor job of reproducing genuine signature in light-blue ink. However, it has not introduced evidence of forgery. Slower Royal copier has reproduced signature more accurately.

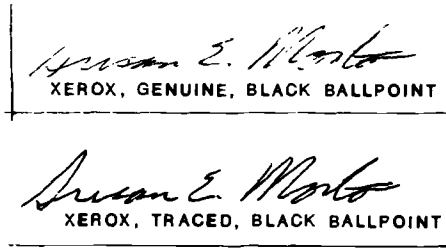


FIG. 7—Tracing produced a more legible photocopy than genuine signature.

be relied upon to reproduce very fine detail and not to introduce confusing artifacts. Photocopies, even of good quality, do pose some pitfalls to be considered. The modern copiers lend themselves very well to cut-and-paste fabrications. The document examiner must consider the possibility of such manipulations. Often, however, the circumstances of the case or the type of evidence under consideration preclude this possibility.

Having satisfied himself that he is dealing with a good quality copy and that he need not be concerned with fabrication, the document examiner must then consider a particular copy on its own merits. Obviously a photocopy cannot reproduce all of the detail of the original document. However, there are other circumstances that pose similar restrictions. Limitations imposed by examination of a copy are no different in kind or severity to those imposed by examining writing feathered by water or other solvents, written with a broad-point writing instrument, or obscured by bank stamps. Sometimes such factors do preclude definite findings, but often they do not. Each case is evaluated on an individual basis. Photocopies may be admitted to the same type of consideration, rather than given blanket rejection, as has been the case in the past.

As always, original evidence is the best evidence. However, ideal situations do not always exist and the document examiner must sometimes make do with what is available. Evaluation of the work of some modern office copiers indicates that, under certain circumstances, it is possible to reach definite findings based on photocopy evidence.

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