

TECHNICAL NOTE

J. M. Winchester,¹ M.S.

Use of the Projectina Universal Comparison Projector in Comparing Typewriting, Photocopies, and Computer-Printed and Mechanically Produced Documents

REFERENCE: Winchester, J. M., "Use of the Projectina Universal Comparison Projector in Comparing Typewriting, Photocopies, and Computer-Printed and Mechanically Produced Documents," *Journal of Forensic Sciences*, JFSCA, Vol. 25, No. 2, April 1980, pp. 390-397.

ABSTRACT: The Projectina universal comparison projector was used to compare and examine surface detail on typewritten documents, high-speed computer printouts, photocopies, fracture matches, and mechanically produced documents. The observations made by using the side-by-side prism or the superimposition mode optical block were photographically recorded. The Projectina magnifies and projects two items so that similarities or differences can be determined.

KEY WORDS: questioned documents, typewriters, projectors, diascopic, episcopic, computer printouts, photocopies, document assist device, signature-signing machines, fracture matches, mechanical printing

The Projectina universal comparison projector is a versatile instrument capable of projecting a magnified image on a display screen. Such an instrument is useful not only to the examiner of questioned documents but also to any forensic scientist involved in the comparison and identification of evidence that must be analyzed for similarities and differences.

The Projectina is a complex optical instrument that has two primary modes: the side-by-side prism to magnify and project two objects and the superimposition prism to show whether or not two documents are in complete coincidence. One aspect of the superimposition mode uses a high-speed motor that oscillates the overlapped magnified images. If a difference in size, shape, or other feature exists between the two images, then a flickering, third image occurs, indicating dissimilarity. The other arrangement provides for the use of red and green filters. If complete superimposition occurs, the combined color is black. Those areas not in coincidence are either red or green, indicating dissimilarity.

The basic models, accessories, and uses of the Projectina have been described [1-3] for comparisons involving not only documents but also other surface analytical examinations. Figure 1 shows the basic unit for Model 8031.

Presented at the 31st Annual Meeting of the American Academy of Forensic Sciences, Atlanta, Ga., 16 Feb. 1979. Received for publication 25 July 1979; accepted for publication 21 Sept. 1979.

¹Document examiner, Florida Department of Law Enforcement, Tallahassee, Fla. 32302.

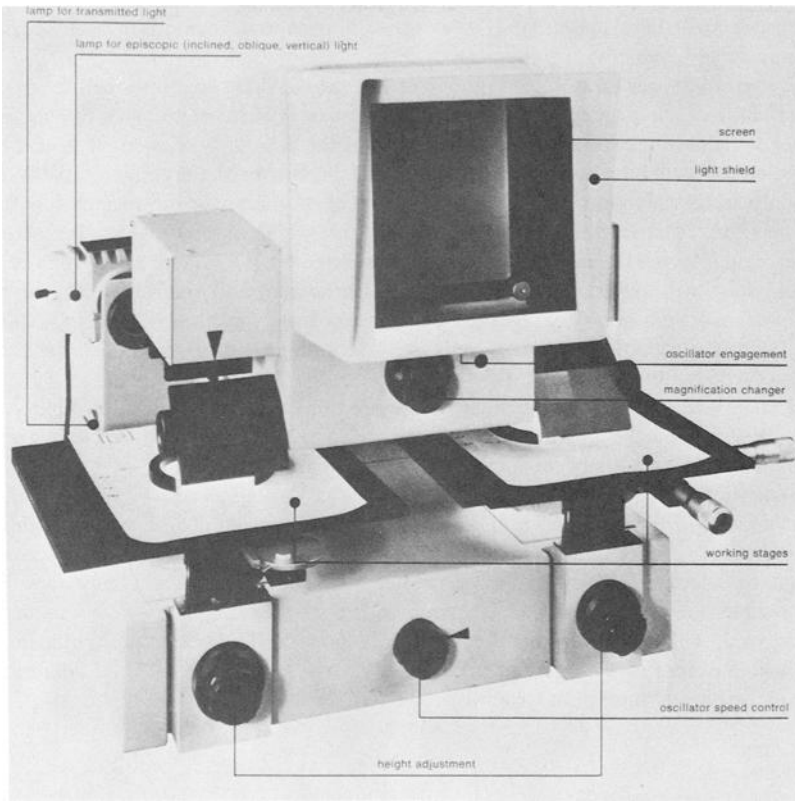


FIG. 1—*Projectina universal comparison projector, Model 8031.* (Photo courtesy of Projectina AG.)

Although the Projectina is a complex optical instrument, it is easy to operate. Some basic technical points of operation may be outlined as follows. As with any optical instrument, it may be desirable to center the filament in the lamps if the instrument has been moved or the bulbs have been replaced. The centering may be done simply by turning the outer knobs on the back of each lamp holder. A white paper should be placed in front of each mirror at the desired plane in the path of the light. The filament silhouette is then centered for alignment. It is the opinion of the author that it is more practical to leave the lamps in their holders and adjust the filament while the lamps are in the instrument. One preliminary caution is to remember not to touch the bulb as latent fingerprints will be etched into the glass, causing diffusion of the beam or premature failure of the lamp.

The light sources are quartz-iodine lamps that permit "episcopic" (reflected by oblique or vertical illumination), or "diascopic" (transmitted illumination), or a combination of light sources.

Color filters can be placed in front of each light source rather than in the path of magnification. This feature is an added advantage in that no distortion occurs in the image of the object on the viewing screen.

The collector lenses, one on each side, located between the light source and the reflecting mirrors, permit a concentrated light to be directed to each specimen. Depending on the magnification desired, 2.5 \times , 5 \times , or 10 \times , the collector lenses are placed in a specific position on the Projectina. The intensity of the light source is controlled by adjusting a dial on the transformer. The transformer, a separate unit, should be placed directly beside

the operator for ease of operation. The range of illumination focused on each specimen is continuously adjustable by the operator.

Each item to be viewed is placed on one of the stages. It is sometimes helpful to place a small specimen on a larger piece of paper. In this way, it is easier to move the larger piece of paper to achieve the initial overall placement of the area to be viewed. It is also helpful to place either a metal paperweight or a piece of glass over the specimen. In the experience of the author, for routine comparisons, a piece of glass over the specimen is the preferred method. Micrometre stages permit fine tuning and precision centering of each of the specimens. When the magnified image is projected on the screen, the specimen on the left-hand stage will appear on the right side of the screen, and vice versa. The images on the projection screen show the greatest detail when the Projectina is used in a darkened room. Each stage should be focused separately. The light source shining on the stage not being focused should be turned off.

To change the prism from the side-by-side mode to the superimposition mode, simply release the knobs on the optical prism and lift out. Special care should be taken not to put fingerprints on the front surface mirrors of the optical blocks.

The functional use of the Projectina is intriguing. Various accessories complement the basic instrument. For example, a high intensity fiber optics light tube aids in highlighting indented writing. Other options include infrared filters, ultraviolet light, and fluorescence.

When the desired magnified image, either side-by-side or superimposed, is on the viewing screen, a photograph can be made with a 35-mm single-lens reflex camera or a Polaroid back with the Projectina serving as the camera. The photographs that illustrate the following examples were taken on Kodak Ektapan® film at 0.5 with the Polaroid back. The negatives are of high photographic quality.

Discussion

The use of the Projectina as an aid in document examination may be illustrated by the following examples, which are significant for problems involving typewriting, hard-copy computer printouts, photocopies, and signature-signing machines.

Example 1

The side-by-side prism mode is illustrated in Fig. 2. The light source on the left-hand side of the instrument was placed in the diasopic position and that on the right-hand side was placed in the episcopic position. The photograph illustrates the original document and the carbon ribbon. When viewed on the projection screen, the areas of the carbon not entirely transferred to the document can be observed. The original was typed on an IBM Correcting Selectric typewriter. The area above the letter *r* (left) represents the residue from the letter *t* that was not entirely removed by the lift-off tape. The Projectina was also

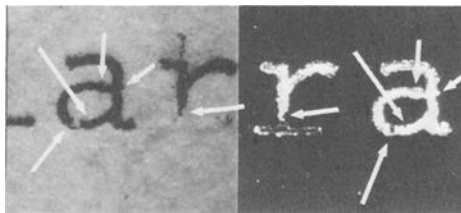


FIG. 2—Original document (left) and carbon ribbon (right) typed on an IBM Correcting Selectric typewriter. Arrows indicate areas of similarity.

used to examine and compare the lift-off tape and the letter *t* on the original document (Fig. 3). The arrows on the photographs point out some of the areas of similarity.

Example 2

The Projectina is useful in comparing individual type styles. Figure 4 illustrates two original documents typed on the IBM Office System 6/442 with a modified Qume print wheel. The information processor uses a bi-directional impact printer. The crowding of the letter *m* appears to be a class characteristic rather than an individual characteristic for that particular type style.

Example 3

The Projectina may be used as an aid in the comparison of high-speed computer printouts. It has been suggested by Winchester [4,5] that the examination, comparison, and identification of two printouts as being from a common source should be the subject of further research. However, one point of significance is that when the hard-copy printouts are examined, the comparison must be of Column 1 with Column 1, Column 2 with 2, 3 with 3, and so forth. The defects noted are then considered for class or individual significance. Figure 5 shows Column 2 as having the lower portion of the *Q* cut off. This may be caused by the hammer striking too slowly. Such defects, however can be adjusted by the field engineer, for example, by moving the backstop lever, which controls the starting position of the hammer, which in turn shortens the distance the hammer has to travel. Thus, it is important for the document examiner to understand the significance of print quality defects when comparing two hard-copy computer printouts.

Example 4

Another use of the side-by-side prism is in the examination and comparison of fracture matches. One side of the torn paper is placed on one stage and the part to be "fracture-matched" is placed on the other stage. The use of the micrometre adjustments allows the fine detail of the edge of the specimen to be viewed and optically aligned with the known



FIG. 3—Original document (left) and lift-off tape (right) typed on an IBM Correcting Selectric typewriter.

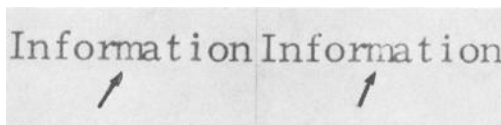


FIG. 4—Side-by-side comparison of two typewritten documents typed on the IBM Office System 6/442.

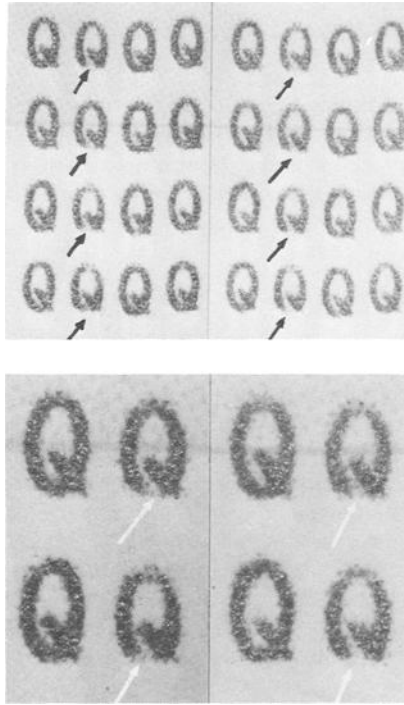


FIG. 5—Comparisons of two computer printouts: (a) at 2.5 \times and (b) at 10 \times .

piece. Thus the final examination may illustrate that the two pieces of paper were cut or torn from the same piece.

Example 5

Figure 6 shows the comparison between first-generation and fifth-generation photocopies from a Xerox 3100 copier. What can be observed is the expansion of the line, a gradual softening of the letter forms, and an upward expansion of the base line of printing. To illustrate this particular example a Burroughs printout was copied on a Xerox 3100. This copy was then copied, and so on until the fifth-generation photocopy. A ruled grid was placed over each of the copies. The expansion and distortion noted on the fifth-generation photocopy may be due to several factors. For example, a slight amount of distortion, which may be inherent in the first-generation photocopy, may be compounded with each successive copy. The initial distortion may result from one or several factors. For example, the optical system may have an aberration that causes some slight distortion, or the mechanical system may influence the registration of the paper and the path of the paper feed. The sizing of the paper may even be affected by humidity. Thus, while a slight distortion may be scarcely discernible, the effect of successive copying is to magnify the small error.

Example 6

Figure 7 illustrates the comparison of surface texture associated with two different

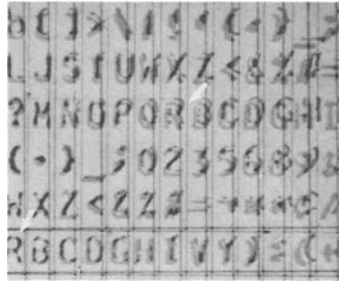


FIG. 6—Imposition of first-generation photocopy from a Xerox 3100 over a fifth-generation photocopy to illustrate expansion of the line, gradual softening of the letter form, and an upward expansion of the line.



FIG. 7—Side-by-side comparison of two different photocopy processes: (left) lead edge of light passing over original to produce the copy and (right) the beaded appearance of the light reflecting off a copy. The beaded appearance is due to the heat-fusing of the toner to the copied page.

photocopied specimens. Both copies were made on a Sharpfax copier. The photo on the left shows the letter *A* from a specimen made on the SF-810. The arrow illustrates the lighter side of the edge of the *A*, thus indicating the lead edge of the light moving across the document to produce the photocopy. The photo on the right shows the letter *A* from a specimen made on the SF-726. The surface texture is enhanced by the light reflecting off of the copy. The beaded appearance is due to the heat-fusing of the toner to the copied page, which gives a high-contrast copy.

Example 7

Figure 8 illustrates a portion of the photocopied image of document assist device (DAD) rollers. The rollers, which are a feature of the Xerox 4500 copier, are found along the upper and lower left-hand edge of the top cover. The function of each roller is to eject automatically the original document being copied at the end of the copy cycle. The DAD rollers are rubber and are susceptible to individualization and wear.

The DAD roller turns as it pushes the paper from the glass onto the paper tray. However, when multiple copies are made, the roller does not turn. Therefore, if a document to be copied is smaller than the width of the glass surface on which it is placed, the rubber roller is also photocopied simultaneously. Even after a lapse of time and numerous documents copied the same portion of the roller can again be observed, either by random occurrence or by the document examiner searching for the same pattern design and moving the DAD to the correct position for it to be photocopied (Fig. 9).

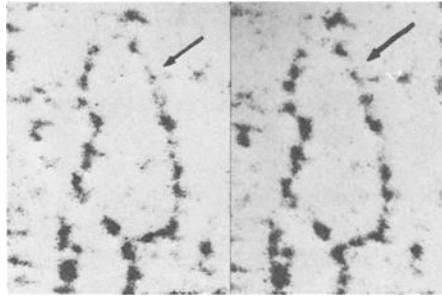


FIG. 8—Photocopied image of document assist device found on the Xerox 4500 copier.

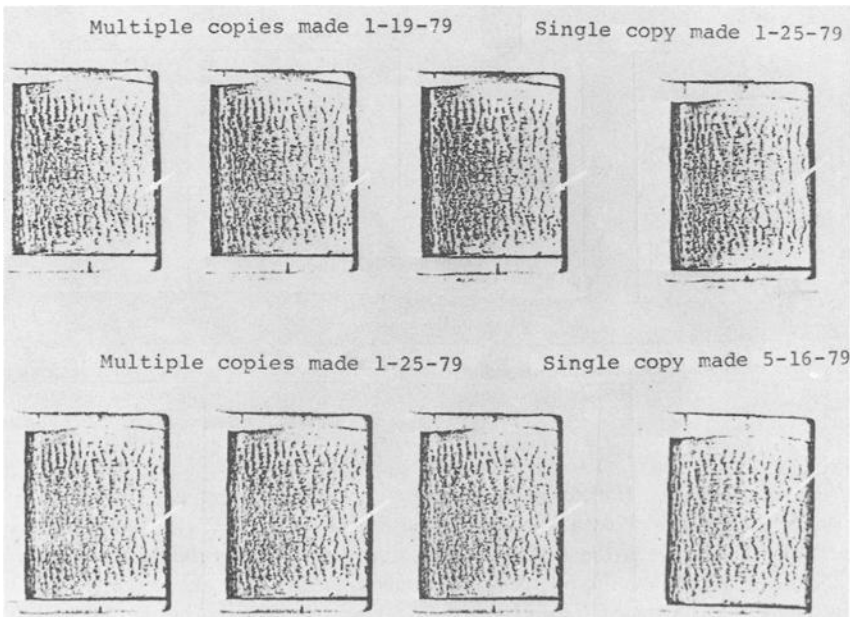


FIG. 9—Images of document assist device compared over a length of time.

Example 8

The superimposition mode of the Projectina is useful for comparing documents that have been mechanically printed or photographically offset, such as currency, motor vehicle registrations, and diplomas. This optical prism highlights the subtle differences between a genuine document and a counterfeit document. This is most easily viewed by the examiner with the use of the red and green filters. The resulting combination of the red and green filters on those areas of detail in complete superimposition is black. Thus, those line or detail portions of each document that are not in complete agreement are shown not as black but as red or green, indicating dissimilarity.

Example 9

The Xerox 5400 copier/duplicator has a textured surface band that fits across the lid, which is placed over the original to be copied. The band contains many rows of minute

dots. The possibility of comparing the dots from photocopies made either on the same machine or on different copiers may crop up as part of an investigation involving questioned and known documents. The Projectina was used to compare these dots. The use of the red and green filters in combination with the superimposition mode facilitated the examination. The resulting photocopied dots from two pages made on the same Xerox 5400 copier overlapped, thus showing black dots.

Example 10

The Projectina may be of use in the comparison of mechanically produced signatures. For example, the electronic signature processing system manufactured by Signature Systems, Inc., allows the production of four variations of the individual's signature by use of a cassette and mechanically assisted writing device. The overlap mode of the Projectina permits the viewer to observe which signature was made from a particular section of the magnetic recording by showing the complete superimposition. Again, the use of red and green filters facilitates the comparison.

Summary

The side-by-side prism and the overlap feature of the Projectina are useful to the document examiner in cases involving the comparison of genuine and counterfeit documents and the evaluation of surface detail.

The comparison method enhances the basic examination between questioned and known items by offering the enlargement of detail for evaluation of defects, color highlights to isolate differences, and an advance in the technical investigation of direct comparisons that can be visually observed and photographed.

Additional accessories that complement the basic unit of the Projectina make the instrument useful not only for the document examiner but also for other forensic scientists involved in the comparison and examination of surface detail.

References

- [1] Forster, F. and Rinderknecht, R., "Universal-Makro-Vergleichsprojektor—En neues Arbeitsgerat für dem Kriminaltechniker," *Kriminalistik*, Vol. 6, 1974.
- [2] Mathyer, J., "Universal Macro and Micro Comparison Projectors, Projectina AG Heerbrugg (Switzerland), Model 8031 and 8032," *International Criminal Police Review*, Vol. 31, No. 303, Dec. 1976, pp. 270-281.
- [3] McCarthy, J. F., "The Projectina Universal Comparison Projector," report presented to the American Academy of Forensic Sciences, Washington, D.C., 1976.
- [4] Winchester, J. M., "Computer Print Quality Defects: Significance for the Document Examiner," report presented at the combined meeting of the Eighth International Association of the Forensic Sciences Triennial Meeting and American Society of Questioned Document Examiners, Wichita, Kans., 1978.
- [5] Winchester, J. M., "The Computer Challenges the Document Examiner," report presented at a meeting of the American Society of Questioned Document Examiners, San Francisco, 1977.

Address requests for reprints or additional information to
 Janis M. Winchester
 Florida Department of Law Enforcement
 P.O. Box 1489
 Tallahassee, Fla. 32302