

Comparative Study of Original, Photocopy and Colored Copy of Handwritten Documents Using a Stereo Microscope

Hashakimana Clare¹, Singh Ranjeet Kumar¹, Sharma Mahesh¹ and Tarannum Afreen¹

Received 7th September 2018 | Revised 11th November 2018 | Accepted 23th December 2018

Abstract:

Currently, numerous tools are used to create forged documents and forgers are successfully making the fabricated documents with these tools. Photocopier is one of such tool often used to reproduce the original documents; therefore the document examiners must find some empirical method to prove the authenticity of the documents in the court. In this paper, a comparative study has been done to compare the original with photocopied colored and black and white handwritten documents irrespective of the ink for all possible striking features. Stereo microscope gives a 3-dimensional view of the strokes and in this paper an effort has been made to compare the handwriting present on the original document and photocopied document irrespective of the ink and paper used with the aid of stereo microscope to differentiate whether the document is original or photocopied.

Keywords: Photocopied Document, Colored Document, Stereo microscope

Authors:

1. Sherlock Institute of Forensic Science India, New Delhi, INDIA

Introduction

Forensic Document Examiners often receive photocopies (monochrome and color copy) for examinations because they can easily be obtained and transported or when the original documents no longer exist. Photocopied documents can be examined accurately and a conclusive opinion made. In the absence of the original document, a first generation copy (first copy of the original document) is preferred to a copy of a copy (copy of multiple iterations).

The estimations analyzed in the forensic examination of handwriting and document frequently turning point on features that are large in significance but found small in size small. The examiner commit to observe evaluate and record the evidence. The estimation of evidence appeals upon experience, knowledge and decision of the examiner, but also, to understand as well as record it for which the examiner desires tools. The utmost significant instrument an examiner of document has, apart from his or her own preliminary examination and thought procedure and that tool stated as the microscope which helps for the purpose of to understand and record moreover the obvious to the unassisted eye (**Will, 2000**).

Black, 1952 published an article on the microscope in document examination. He wrote that the microscope is no doubt the most widely used optical research instrument. In recent decades the microscope has added its important contribution to the administration of justice, specifically through its application to the examination and interpretation of physical evidence and the presentation of the findings in court.

The significance of the microscope has been well exploited in the field of questioned documents in the identification of handwriting, analysis of paper and inks, typewriting and other elements of documents. **Black, 1952** further described microscope as one of the instrument which found it possible to understand the physical evidence on documents which would or

else endure imperceptible and impractical. The average unaided human eye can distinguish only 250 separate lines to the inch. This can be better understand that any less details which include separations as well as dimension of less than 1/250th of an inch are misplaced to the eye, which sees them as a connected, solid mass. These small details are often of utmost importance in the determination of questions respecting the authenticity or spuriousness of documents. The evidence of the microscope is conclusive and irrefutable. The microscope has therefore become indispensable to the examiner of questioned documents.

The stereo-microscope provides a 3-dimensional view of an area of interest. In document examination, the Stereo microscope is applied in sequencing of strokes, detection of additions and alterations in holographic wills, ink analysis and determining pen used, , paper fiber analysis, assessment of depth where an ink line crosses a fold in the paper, demonstrating evidence in court, assessment of tremor in simulated forgeries, the unnatural retouching or patching; pen lifts, irregular ink distribution -characteristic of forged signatures which to the unaided eye may appear to be naturally written, and ink line morphology.

Where a problem involving differences of color or depth of vision is concerned, the microscope may often be utilized to better effect than photographic demonstrations. In a probate trial the author was able to show the judge through the use of the microscope that three different shades of blue ink were involved in the fraudulent change of the date of a holographic will, the effect of which would have been to invalidate an actually later genuine will. The document was denied probate (**Black, 1952**).

In a criminal case of falsification of documents, after the death of a landlord, the tenant altered the terms of payment in the original agreement bearing a handwritten signature of the landlord; he then made a coloured copy and presented it to the wife of the late as an original document. The wife being

suspicious of the document, she presented the disputed document to a document examiner together with black photocopy of the original genuine agreement, after thorough examination, the document examiner established that the disputed document a coloured copy with a genuine signature and had misalignment of words in a sentence.

There is lack of empirical evidence regarding document examiners' ability to give opinion on photocopied documents compared to original documents (Koppenhaver, 2015).

In court, the judge, jury and lawyers and any other layman do not understand how document examiners come to conclusions in the examination of handwriting comparisons of photocopies (monochrome and coloured copies) and original documents; this study is aimed at verifying the evidence used by document examiners to give opinion in handwriting examination of original and photocopied documents.

Materials and Methods

Sample Preparation

Three different colour ballpoint pens (blue, black and red) were used to write three paragraphs with each different ball point pens on four different types of paper of varying quality. The types of paper used are; plain A4 sheet of paper, plain cream Bond paper, Ruled paper with grey lines and plain yellow B-6 paper.

Black photocopies and coloured copies of each of the different paper types were made from good quality photocopiers; thus good quality first generation photocopies were used for the study.

Instrument Used

Stereomicroscope: It is considered as microscope i.e. optical which deals with a 3D knowledge of the

samples. The samples are illumined with the use of spot light lamps. Stereomicroscope deals with the reflected light as an alternative of transmitted light. The investigation started from little magnification to heavy magnification. The examination was approved out at the precise and applicable area. The original samples, coloured copies and the monochrome copies were examined by visual observations (unaided eye) first and then examined under the stereomicroscope. The macroscopic and microscopic observations made were recorded in table format categorized by the different types of paper.

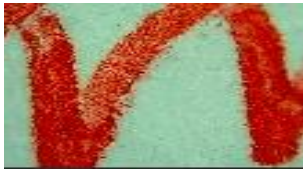
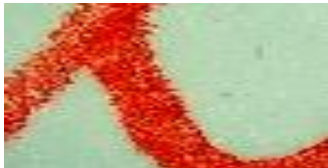
Result and Discussion

Results were obtained after examining the original handwritten samples with the black photocopies and coloured copies. The observations were then recorded and categorized in table form by paper type. The observations made show the evidential differences in the original samples, black photocopies and coloured copies.

Original Samples

The original handwritten samples showed the actual/standard colour of the different ballpoint pens in both the macroscopic and microscopic observations. Only one single original colour of the blue and red ballpoint pens was seen. The black ballpoint pen had a few dots of a brownish/yellowish colour pigment. The paper type did not have any effect on any of the original handwritten samples. The ink stains are only on the raised paper fibers and does not flow into the paper. Grooves in the pen stroke, Gooping of ink or ink blobs, skipping and irregular ink deposits are observed and these are characteristics of ballpoint pens. The ink goops/ ink blobs of the blue ink were at times interpreted as black ink goops.

Table 1: Illustration of original sample documents under stereo microscope

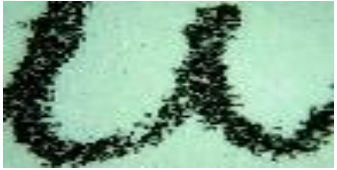
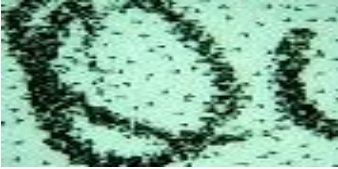
Types of Paper	Blue Ballpoint Pen	Black Ballpoint Pen	Red Ballpoint Pen
A4 Paper			
Bond Paper			
B-6 Paper			
Ruled Paper			

Black Photocopy

The macroscopic examination of the blue and black colour ballpoint pens in black photocopy revealed black toner in the form of single solid toner depositions to form the strokes but under the stereo microscope, black toner dot depositions were seen; they are individual dots not as single solid toner deposition and the black photocopy the black and blue ball point pens seem to be of the same shade of black toner ink and cannot be differentiate as being

from two different colour pens. The black photocopy of the red colour pen was seen as a faded black or grey in colour with less toner dot depositions in the microscopic observation under the stereomicroscope. There was more splattering of toner dots in the ruled paper as compared to A4 paper and Bond paper. The splattering of toner dots/toner overspray is less detectable in black photocopy of the B-6 paper due to the original colour of the paper.

Table 2: Illustration of black photocopy samples under the stereo microscope

Types of Paper	Blue Ballpoint Pen	Black Ballpoint Pen	Red Ballpoint Pen
A4 Paper			
Bond Paper			
B-6 Paper			
Ruled Paper			

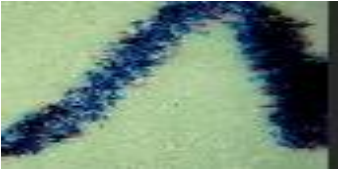
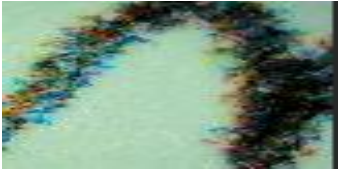
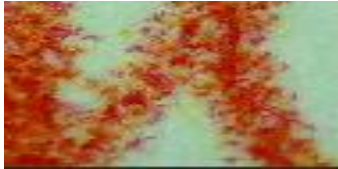
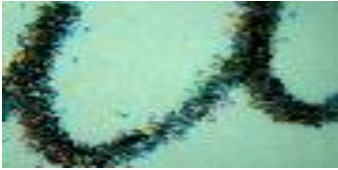
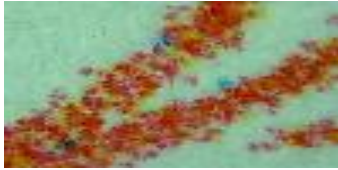
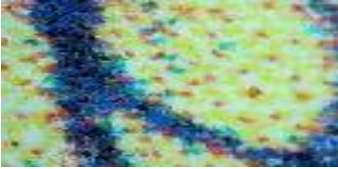
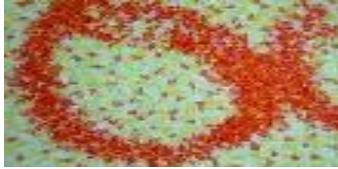
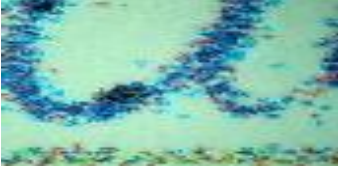
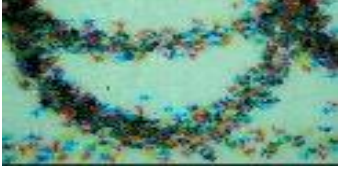
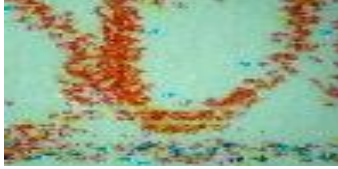
Coloured Copies

Generally, the macroscopic observation of the coloured copies revealed the handwritten strokes to be of the same colour with the respective original colour but with a fainter or lighter shade of the original colour i.e. blue, black and red. Small tiny multi coloured toner dots along the edges of the strokes were more evident in the ruled paper and the B-6 paper with unaided eye. There was more toner overspray of multi-coloured dots in the ruled and B-6 paper compared to A4 paper and Bond paper.

The microscopic observation of the blue coloured copies revealed multi-colored toner ink dots in blue, light blue, pink, blue-black and scanty yellow along the edges of the strokes with little overspray in A4

paper and Bond paper but with more overspray in Ruled and B-6 papers. The black coloured copies revealed small multiple colours toner dots in black, blue, green, pink and yellow. Over spray/ splattering of ink dots beyond the edges of the strokes was more in ruled and B-6 papers compared to A4 and Bond paper. Red colour copies showed yellow, red, pink and scanty black and blue toner dots and uneven edges of the strokes. There was more toner splattering in ruled paper as compared to A4 and Bond paper. B-6 paper had a yellow, pink, red background colour thus toner over spray was not easily detectable. The horizontal lines in the ruled paper contributed to more over spray/ splattering of toner dots. Thus, it indicates that paper type has an effect of the coloured copies of handwritten documents.

Table 3: Illustration of coloured copy samples under stereo microscope

Types of Paper	Blue Ballpoint Pen	Black Ballpoint Pen	Red Ballpoint Pen
A4 Paper			
Bond Paper			
B-6 Paper			
Ruled Paper			

Conclusion

Original handwritten samples can be differentiated from black photocopy and coloured copies irrespective of the ink pen colour used to make the

original document and irrespective of the type of paper used; thus illustrates empirical evidence that is used by document examiners to give opinion regarding examination of original, coloured and black photocopy.



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