24.1 Overview of Sequence Examinations

Examinations to determine the sequence of line strokes, printed matter, or a combination of these two mediums involve many facets. Limitations can be placed upon these examinations by influences such as the type of writing instruments or printing processes involved, the substrate and its condition, and influences such as folds or influences affecting the writing, printing or substrate. Sequence examinations are conducted a variety of visual, microscopic and instrumental techniques to assist in the determination. Analysis schemes for each case will be implemented depending upon the type of evidence presented.

Research literature should be reviewed carefully and extensively prior to undertaking this type of examination. Facets of this type of examination can be misleading and the problem should be approached with extreme caution. Research has shown that conclusive opinions can be reached with some types of medium. In other instances, conclusions may not be possible. Specific research and experimentation with known materials, if available, may also be conducted to attempt to determine if reliable, reproducible results of a sequence can be obtained.

24.2 Sequence of written lines

1) In many cases, it is impossible to come to an accurate conclusion. At present, there is no infallible method or technique for determining the sequence of lines.
    a) It is a problem that requires the utmost caution.
2) Influencing factors that warrant consideration and caution:
    a) Fluidity and drying time of the inks writing materials involved.
    b) Time intervals between production of the lines.
    c) Relative pressures involved in producing the lines.
    d) Colors involved---dark lines usually appear to be on top, even when they are not.
3) Preliminary considerations and determinations:
    a) Type of materials involved, such as:
        i) Nature of the inks or deposits (fluid, dry, wax, graphite).
        ii) Nature of the paper surface (soft or hard, smooth or fibrous, closed or porous).
    b) Amount of pressure in each line.
    c) Direction of each line.
    d) Other line intersections where they occur normally on the document.
    e) Conduct experiments to reproduce the questioned intersections.
4) Characteristics to look for:
    a) Dragging or drawing ink or deposits from the first line along the second line.
    b) Dragging, drawing or disrupting paper fibers in the direction of the second line.
    c) Various effects caused when the second line jumps the channel or groove of the first line:
        i) Narrowing the second line.
        ii) Break in the second line.
        iii) Globbing or gooping of the writing material along the edge of the channel.
5) Observation and examination techniques:
    a) Magnification:
        i) With the microscope angled at 30·40 degrees.
        ii) With grazing light (caution: can be misleading).
    b) IR-UV lighting and filtering equipment:
        i) Usually works only when different inks or writing materials are involved.
        ii) Can show elements of one ink dragged along the second line.

c) Lifting techniques:
   i) Utilizes transparent cellophane adhesive tape for Kromekote paper.
      (1) Lifting medium is anchored over the line intersection and rubbed with a blunt instrument.
      (2) When peeled off, will show continuous edges of tape line.
   ii) Warnings:
      (1) This method has proven unreliable for fluid ink and pencil strokes.
      (2) Acceptable lifts of ball pen ink cannot be obtained with increased passage of time (over one hour after writing)
      (3) When lines are drawn with varying degrees of pressure, incorrect interpretations of line sequence result.

d) Lines over folds in the paper:
   i) One line may be broken by the crease, indicating it was there before the folding.
   ii) The other line may show indications of having been written after the document was folded.
      (1) Skipping or globbing as the pen jumps the fold or crease.
      (2) Some inks may flow or leach out into the broken paper fibers along the fold or crease.

e) Writing or marks on the backside of the document may indent or be indented by the lines on the front side, indicating which was there first.

24.3 Sequence of written lines and printing

Examinations to determine the sequence of line strokes and/or printing involves many facets. Limitations can be placed upon these examinations by influences such as the type of writing instruments or printing processes involved, the substrate and its condition, and influences such as folds or influences affecting the writing, printing or substrate. Sequence examinations are conducted a variety of visual, microscopic and instrumental techniques to assist in the determination. Analysis schemes for each case will be implemented depending upon the type of evidence presented.

Research literature should be reviewed carefully and extensively prior to undertaking this type of examination. Facets of this type of examination can be misleading and the problem should be approached with extreme caution. Research has shown that conclusive opinions can be reached with some types of medium. In other instances, conclusions may not be possible. Specific research and experimentation with known materials, if available, may also be conducted to attempt to determine if reliable, reproducible results of a sequence can be obtained.

24.4 Obverse-reverse techniques

Examinations to determine the sequence of line strokes and/or printing utilizing obverse-reverse techniques involve many facets. Limitations can be placed upon these examinations by influences such as the type of writing instruments or printing processes involved, the substrate and its condition, and influences such as folds or influences affecting the writing, printing or substrate, and the quality of the ESDA lift (if this instrument is used). Sequence examinations are conducted a variety of visual, microscopic and instrumental techniques to assist in the determination. Analysis schemes for each case will be implemented depending upon the type of evidence presented.

Research literature should be reviewed carefully and extensively prior to undertaking this type of examination. Facets of this type of examination can be misleading and the problem should be

approached with extreme caution. Research has shown that conclusive opinions can be reached with some types of medium. In other instances, conclusions may not be possible. Specific research and experimentation with known materials, if available, may also be conducted to attempt to determine if reliable, reproducible results of a sequence can be obtained.

REFERENCE

ESDA2 Users Manual

ASTM International:

E2325 Standard Guide for Non-Destructive Examination of Paper

E2291 Standard Guide for Indentation Examinations

E2765 Standard Practice for Use of Image Capture and Storage Technology in Forensic Document Examination