Forensic Photography and Its Role in the Examination of Archaeological Textiles

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Significance of Archaeological Textiles

- Artifacts which offer clues about prehistoric clues
  - Clothing
  - Pottery
  - Tools
  - Human Remains
  - Jewelry
Colorants of Textiles

Textiles recovered from archeological evacuations don’t always appear to be colored with pigments and dyes
- Charred
- Crumbled
- Degradation
- Mineralization
- Other alteration
Typically, Colorants in Textiles are identified ……

- Yarn or thread is removed from the sample
- The dye or pigment is removed by extraction from the yarn or thread
- The dye or pigment is measured to determine wavelength correspondence
Depending on color chemistry, light interacts by
- Reflectance
- Absorbance
- Fluorescence

Forensic Photography vs. Traditional examination of colorants
Definition of Forensic Photography

- Defined by basic principles of photography
  - “write with light”
  - To document, record, and write we need an instrument
  - Secondly, need a way of storing images

- Scrutinized for the accuracy of the photo of interest
Parts of a Camera

- Shutter release button
- Shutter speed dial
- Film rewind knob
- Film advance lever
- Accessory shoe
- ISO / ASA index indicator
- Film cavity
- Shutter curtains
- Viewfinder
- Film sprockets
- Film take-up spool
- Pressure plate
- Camera back
- Self Timer Button
- Camera body
- Focusing Ring
- Depth of Field Scale
- Aperture Ring

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Digital Based Imaging

- Digital Still Camera
  - Inexpensive
  - Largely available
  - Images are stored and retrieved easily
  - Red, green, and blue photodiodes collect images
Forensic Photography

- Forensic scientists use different light sources to visualize stains or fingerprints on clothing
  - Near Infrared
  - Ultra-violet
    - Direct or Reflect
    - Fluorescence
- The presence of certain dyes on fibres can be determined based on their fluorescence.
Electromagnetic Spectrum

- Eye can detect 750-380 nm
- UV region is comprised of wavelengths less than 400 nm
- The infrared spectrum is composed of frequencies of more than 700 nm.
Near Infrared Photography

- Object is exposed to light that contains IR radiation
  - Xenon
  - Tungsten
  - Photoflood lamp
- Visible portion eliminated by IR transmission filter
- IR Sensitive Film produces image
Near Infrared Photography

- IR can be used to reveal
  - underpaint
  - Retouching
  - Changes in composition
- Distinguish between pigments and dyes
- Textiles restoration
  - reflectances of vegetable oil
UV Reflected Photography

- Light source emits UV radiation to object
- UV-reflectance technique (right)
  - UV transmission filter
UV-fluorescence Technique

- Involves the discharge of electron excitation of substance when excited by UV illumination

- Subjects irradiated with ultraviolet
  - green,
  - yellow
  - pink light

- Subjects irradiated with visible light
  - infrared fluorescence
UV-fluorescence Technique

- Light source filtered with UV transmission emits UV radiation in dark room
- The camera is fitted with a barrier filter
- Technique
  - Used in manufacturing to detect defects
Applications of Forensic Photography in Archaeological Textiles
Hopewell Burial Mounds

- Located in Ohio
- Civilization practiced cremation
- Some textiles were
  - preserved due to interaction with Copper
  - Buried with a canopy
Textile Artifact #32

Observed (simulated daylight)

IR

UV

Observed (simulated daylight)
Textile Artifact #23
Pottery Using NIR
The first is Commonwealth of Virginia vs. Robert Douglas Knight. This 1991 murder case involved the enhancement of a bloody fingerprint found on a pillow case at the crime scene. A company called Hunter Graphics (no longer in business) was contacted by the Henrico County Police Department to assist in the enhancement process. Experts from Hunter Graphics used a frequency filter known commonly as a Fast Fourier Transform (FFT) to subtract the fabric pattern that interfered with the identification of the fingerprint. The fingerprint was subsequently identified as belonging to Robert Knight. After being charged with the crime, Knight’s attorney moved for a Kelly-Frye Hearing to determine the scientific validity and acceptance of the enhancement process. The determination of the court was that the techniques used were essentially photographic processes. Robert Knight pleaded guilty and was sentenced to four life terms.

State of Washington vs. Eric Hayden. This case involved the murder of a young missionary in her apartment. The murder took place in the small bedroom community of Kirkland, WA. The detective in the case requested the assistance of the King County Police (Seattle) to process the crime scene for latent fingerprint evidence. After collecting and later processing a bed sheet found at the crime scene, several faint prints were found. But, because the ridge detail was very faint and the fabric pattern of the sheet interfered with attempts to compare the prints, an identification was not possible. King County contacted the Tacoma Police Department for assistance in enhancing the latent prints. A combination of techniques, including a Fast Fourier Transform, were used to enhance a palm print and two fingerprints that had been developed on the fabric using Amido Black. All three prints were later identified as having been made by Eric Hayden.

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Kelly-Frye Hearing

- It also imposes the same requirements for digital images as those placed upon other types of evidence.
- There must be a documented and secure chain of custody maintained for every image introduced into a legal proceeding.
- Aside from testifying that an image is a fair and accurate representation of the item it depicts, the expert must also be able to document the steps taken to protect the image from tampering by unauthorized persons.
- Any enhancement techniques used must be reproducible, so that notes about the enhancement process, as well as who did the work, should be maintained.

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Conclusion

- Forensic Photography
  - Infrared
  - UV
  - Non-destructive method which could be used as an alternative for examining dyes and pigments
References


- en.wikipedia.org