Hamline University
Department of Criminal Justice and Forensic Science

Fingerprint Lab Manual
CJFS 3440: Forensic Fingerprint Examination
CJFS 3445: Latent Fingerprints

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Part I: CJFS 3440: Forensic Fingerprint Examination

Lab 1: Recording of Friction Ridges

Objective of Lab Exercise

This lab will task you with the collection of fingerprint (tenprint) records. You will experience challenges with this process, understand inking of fingerprints, and collect the record for use throughout the course.

Lab Instructions

You will be assigned a partner and asked to collect their fingerprint record on a tenprint card. Record their fingerprints using both the fingerprint ink pads; and the slabs, ink, and rollers on the stations throughout the lab. If needed, the PRINTOVER Re-Tabs can be used to re-take a fingerprint. *Note: only one re-tab can be used per finger.* Ensure that the tenprint cards are dry before stacking or placing anything on top of them. Take turns recording each other's fingerprints.

Procedure for Collecting Tenprint Sets:

1. Complete basic information on tenprint card (only name needed for this exercise)
2. Place the tenprint card in the fingerprint card holder (see Figure 1 for use.)
3. Start with Finger 1, the Right Thumb and roll the fingers in sequence for the right hand. *Note: follow the rule for rolling fingers – Fingers Away, Thumbs Toward.*
4. Once the right hand is complete, move the fingerprint card in the holder and collect the left hand.
5. Once the left hand is complete, move the fingerprint card in the holder and collect the slap impressions. For the slap impression, hold the fingers together and place on the ink together then deposit the ink from all fingers in the box at about a $45°$ angle.
6. For the thumbs, place the thumb in the ink and roll toward the finger tip. Repeat this on the card to deposit the ink from the joint rolled to the tip.

You should have a completed tenprint card. See Figure 2 for an example of what your completed tenprint card should look like.

Requirements for the Lab

This lab has three submission requirements:

1. Tenprint record collected using fingerprint ink pad
2. Tenprint record collected using fingerprint ink, slab, and roller
3. One page reflection of the exercise which includes any challenges you experienced and general observations of the fingerprint appearance

Fig. 1. Fingerprint card holder.

Fig. 2. Example of a completed tenprint card.

Lab 2: Fingerprint Markup for Comparison

Objective of Lab Exercise

Become familiar with the different types of minutiae and recognize their occurrence throughout a fingerprint.

Lab Instructions

The "Analysis" portion of the ACE–V methodology is the assessment of a print as it appears on a given substrate. The analysis of the print proceeds by systematically separating the impression into its various components; namely, the substrate, matrix, development medium, deposition pressure, pressure and motion distortion, and development medium are analyzed to ascertain the variations in appearances and distortions. An analysis of clarity establishes the levels of detail that are available to compare and the examiner's tolerance for variations. The examiner then makes a determination whether the print is sufficient for comparison.

You will be examining the enlarged/magnified fingerprints on the following pages and marking the print for comparison with all visible features. An example fingerprint has been marked up with all ridge characteristics in Figure 3. Examine and complete the following for the provided fingerprints on pages 8–12:

- Identify the pattern type (*e.g.,* Central Pocket Loop Whorl)
- Mark and label all detectable minutiae (colors may be useful)
- Provide the ridge count (if applicable)
- Provide the whorl tracing (if applicable)

Requirements for the Lab

This lab has two submission components:

1. Marked up and labeled fingerprints
2. One page reflection of the exercise which includes any challenges you experienced, general observations of the fingerprint (*e.g.,* types of level two detail, frequency of occurrence)

Fig. 3. The average fingerprint has as many as 150 ridge characteristics.

Pattern Type:_____   **Ridge Count:_____**   **Whorl Tracing:_____**

Pattern Type:_____   Ridge Count:_____   Whorl Tracing:_____

Pattern Type:_____   Ridge Count:_____   Whorl Tracing:_____

Pattern Type:_____   Ridge Count:_____   Whorl Tracing:_____

Pattern Type:_____   **Ridge Count:_____**   **Whorl Tracing:_____**

Lab 3: Fingerprint Classification Systems

Objective of Lab Exercise

Utilize the Henry and NCIC classification systems to sort tenprint cards for searching. Once you understand the existing systems, you will apply the fundamentals of classification systems to devise your own classification system.

Lab Instructions

Part I: Classification of Fingerprints

Classify both your tenprint card and the provided tenprint cards using the Henry Classification and the NCIC classification systems. Example tenprint card with both classification codes is provided in Figure 4.

Part II: Classification Systems

Devise a fingerprint classification system as a group and file the provided known fingerprints accordingly. You can use any scheme that your group chooses to organize the provided fingerprints. You will subsequently utilize the classification/filing system you devise in Lab 6: Database Searching.

Background Information

Recall the following elements of the Henry Classification System:

Primary The Primary classification is obtained through the summation of the value of the whorl type patterns as they appear in the various fingers: numbers 2, 4, 6, 8, 10 (even fingers), being used as the numerator and numbers 1, 3, 5, 7, 9 (odd fingers), as the denominator. Placed in the center of the classification line.

Secondary The Secondary classification is the type of pattern appearing in the index fingers. Finger 2 is the numerator and finger 7 is the denominator. Capital letters are used to denote the Secondary. Placed to the immediate right of the Primary.

Small Letter Group Prints in which an arch or tented arch appear in any finger, or with a radial loop in other than the index fingers, constitute the Small Letter Group. An arch, tented arch, or radial loop appearing in any finger is carried into the classification formula as a, t, or r, – and in its respective relative position. The appearance of an arch, tented arch, or radial loop in other than the index fingers and thumbs eliminates the sub-secondary classification. Designated on the classification line in their relative position to the index fingers.

Sub-Secondary The Sub-Secondary classification is the value of the ridge counts or the tracings of numbers 2, 3, 4, 7, 8, 9. Appears to the immediate right of the Secondary, only if no Small Letters are present.

Major The Major classification is the value of the ridge counts or the tracings of numbers 1, 6 (thumbs). Placed to the immediate left of the Primary.

Final The Final is the ridge count of the right little finger, if a loop. If not a loop, the left little finger is used. If neither is a loop, no Final is used. Appears to the right of the Sub-Secondary.

Key The Key is the ridge count of the first loop appearing in other than the little fingers. If none appear, no Key is used. Appears to the left of the Major, and always in the numerator.

Ridge Counting All the ridges intervening between the delta and the core that cross or touch a line from delta to core, are counted. Neither delta or core is counted. No Ridge is counted twice. Dots and fragments are counted if they are as thick and heavy as the other ridges.

Whorl Tracing Whorls are traced from the extreme left delta to the extreme right delta, dropping down at bifurcations or definite breaks in the ridge. At the nearest point to the right delta, the ridges intervening between the tracing line and the delta are counted. If there are three or more on the inside, it is an inner (I). If there are three or more on the outside, it is an outer (O). All others are meet (M). Neither tracing line or delta are counted.

Recall the following classification codes for the NCIC System:

Pattern	Classification Code
Plain Arch	AA
Tented Arch	TT
Ulnar Loop	Ridge Count (as two numeric characters)
Radial Loop	Ridge Count (add arbitrary 50)
Plain Whorl	P (followed by tracing "I", "M", or "O")
Central Pocket Loop Whorl	C (followed by tracing "I", "M", or "O")
Double Loop Whorl	d (followed by tracing "I", "M", or "O")
Accidental Whorl	X (followed by tracing "I", "M", or "O")

Requirements for the Lab

Part I Completed Henry and NCIC classification for each tenprint card.

Part II Explanation of the classification system your group devised.

Combined One page reflection of the lab exercise classifying tenprint cards. Be sure to include: (1) your opinions on the different classification systems and whether you have a classification system preference; (2) how you think they are beneficial for indexing fingerprints in databases; (3) successes or challenges in devising your own system; and (4) whether your classification system has similarities with any we have discussed.
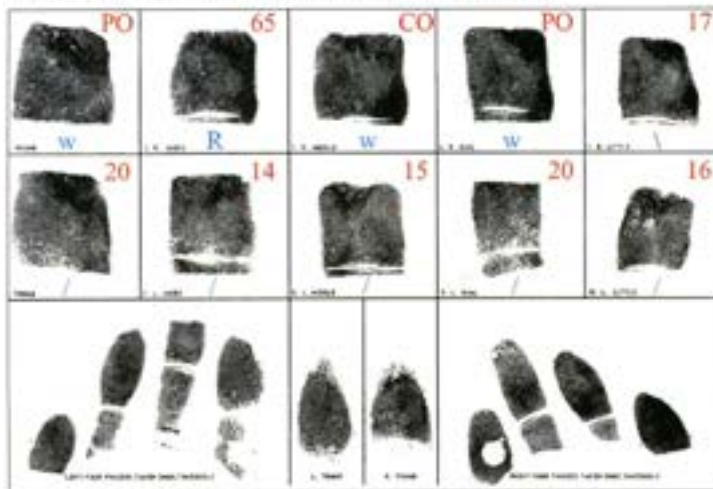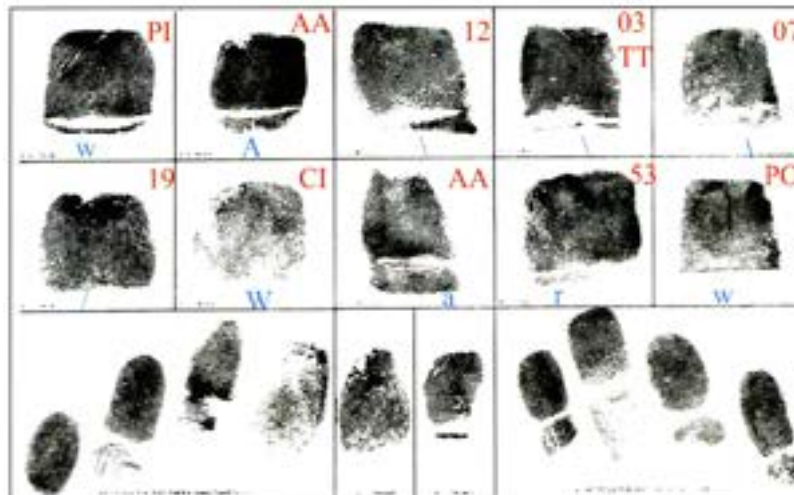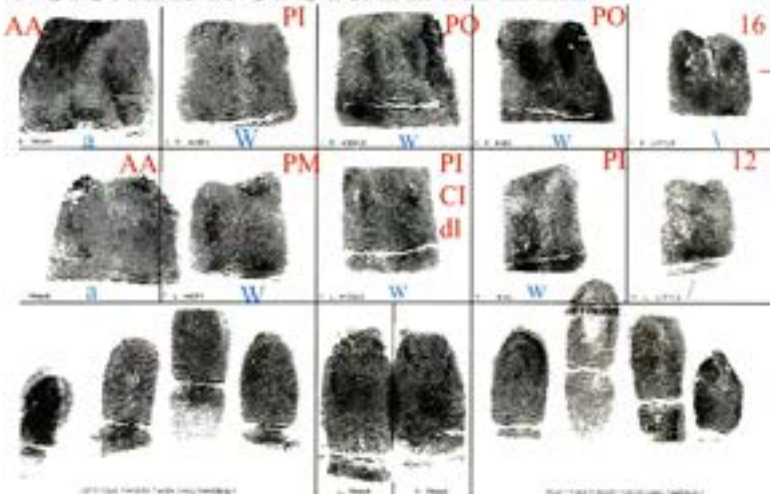
Fig. 4. Example tenprint cards with markup, Henry classification, and NCIC classification.
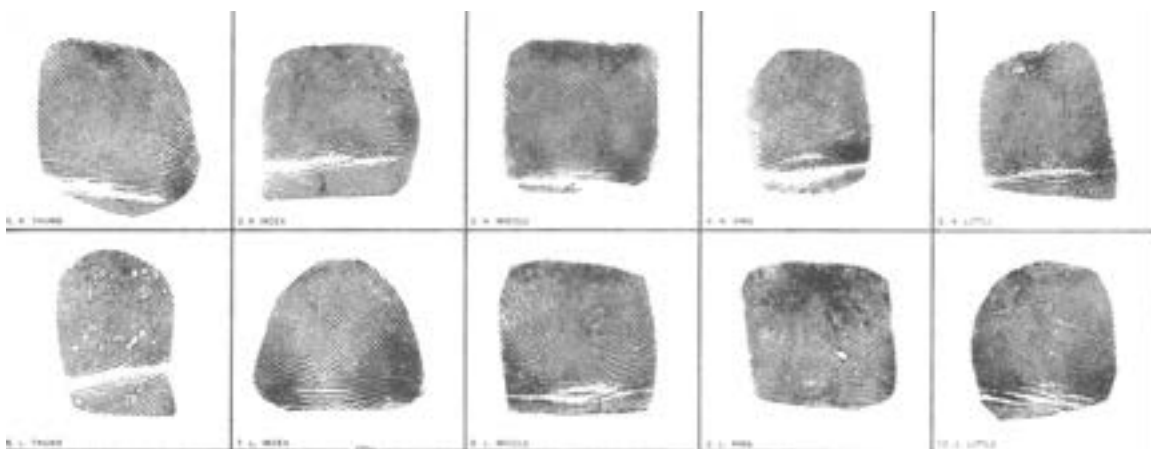
Lab 4: Fingerprint Comparisons I

Objective of Lab Exercise

Utilize the ACE–V methodology for the comparison of latent fingerprints to known fingerprints. This exercise is designed to build competency with the comparison of fingerprints. Repetition of comparison exercises is integral to the training of fingerprint examiners and ensuring performance while examining casework.

Lab Instructions

Part I: Tenprint Comparisons

Compare each singular high-quality fingerprint to the provided tenprint cards in attempt to determine origin. *Note:* It is possible for a fingerprint to be used more than once, or not at all. Take care when you draw your conclusions and adhere to the best practices for fingerprint examination. Place your answers in the answer sheet provided.

Part II: One to One Comparisons

This section has six known to questioned (K-Q) comparisons. Compare each provided singular latent fingerprint to the provided rolled fingerprint in each pair and reach a conclusion of 'identification' or 'exclusion.' Place your answers in the answer sheet provided.

Part III: Latent Comparisons

Compare each latent fingerprint to the provided tenprint cards in attempt to determine origin. *Note:* It is possible for a fingerprint to be used more than once, or not at all. Take care when you draw your conclusions and adhere to the best practices for fingerprint examination. Place your answers in the answer sheet provided.

Requirements for the Lab

This lab has two submission components:

1. Completed answer sheet.

2. One page reflection of the exercise which includes: (1) successes or challenges you experienced searching for fingerprints; (2) successes or challenges you experienced comparing fingerprints; and (3) lessons you learned or changes you would make to your approach comparing fingerprints through the completion of this comparison exercise.

Name: Date:

Answer Sheet for Lab 4: Fingerprint Comparisons I.

Part I: Tenprint Comparisons (3 pts. each)

Questioned Print	Name	Finger
Example Q–X	Hennessy	1 / R. Thumb
Q – 1		
Q – 2		
Q – 3		
Q – 4		
Q – 5		

Questioned Print	Name	Finger
Example Q–X	Exclusion	–
Q – 6		
Q – 7		
Q – 8		
Q – 9		
Q – 10		

Part II: One to One Comparisons (3 pts. each)

Comparison 1. ☐ Identification   ☐ Exclusion

Comparison 2. ☐ Identification   ☐ Exclusion

Comparison 3. ☐ Identification   ☐ Exclusion

Comparison 4. ☐ Identification   ☐ Exclusion

Comparison 5. ☐ Identification   ☐ Exclusion

Comparison 6. ☐ Identification   ☐ Exclusion

Comparison 7. ☐ Identification   ☐ Exclusion

Part III: Latent Comparisons (4 pts. each)

Questioned Print	Name	Finger
L – 1		
L – 2		
L – 3		
L – 4		
L – 5		
L – 6		

Questioned Print	Name	Finger
L – 7		
L – 8		
L – 9		
L – 10		
L – 11		
L – 12		

Lab 5: Fingerprint Comparisons II

Objective of Lab Exercise

Utilize the ACE–V methodology for the comparison of latent fingerprints to known fingerprints. These exercises are built to closely mimic daily casework and repetition of comparison exercises is integral to the training of fingerprint examiners and ensuring performance while examining casework.

Lab Instructions

You will be completing the Ron Smith & Associates Latent Print Comparison Practice Exercise 100 set. This is the first comparison exercise in the RS&A series and is meant as a beginning exercise. It contains 8 sets of known fingerprints and 30 latent prints. These latent prints become progressively smaller, however, each contains a good anchor point for searching.

Compare each latent fingerprint to the provided tenprint cards in attempt to determine origin and place your answers in the Ron Smith & Associates Latent Print Comparison Practice Exercise 100 Answer Sheet. *Note:* It is possible for a fingerprint to be used more than once, or not at all. Take care when you draw your conclusions and adhere to the best practices for fingerprint examination.

Requirements for the Lab Report

Record your answers on the answer sheet for the Ron Smith & Associates Latent Print Comparison Practice Exercise 100 *(see next page)*.

Name: Date:

Answer Sheet for Lab 5: Fingerprint Comparisons II.
Ron Smith & Associates Comparison Practice Exercise 100.

Latent Print Number	K – # or Exclusion	Specific Finger	Latent Print Number	K – # or Exclusion	Specific Finger
Example L–xx	K–20	Right Thumb	Example L–xx	Exclusion	
L – 1			L – 16		
L – 2			L – 17		
L – 3			L – 18		
L – 4			L – 19		
L – 5			L – 20		
L – 6			L – 21		
L – 7			L – 22		
L – 8			L – 23		
L – 9			L – 24		
L – 10			L – 25		
L – 11			L – 26		
L – 12			L – 27		
L – 13			L – 28		
L – 14			L – 29		
L – 15			L – 30		

Lab 6: Database Searching

Objective of Lab Exercise

Understand the searching of a database and the 'one-to-many' comparison of fingerprints utilizing the classification system your team developed in Lab 3: Fingerprint Classification Systems.

Lab Instructions

Using the fingerprint classification system/filing system you developed in Lab 3: Fingerprint Classification Systems, search for the provided questioned fingerprints.

Requirements for the Lab Report

This lab has two submission components:

1. Answer sheet recording your conclusions.

2. One page reflection of the exercise which includes: (1) successes or challenges you experienced searching your database; (2) whether you found your classification system effective; and (3) any changes you would make to your database structure.

Part II: CJFS 3445: Latent Fingerprints
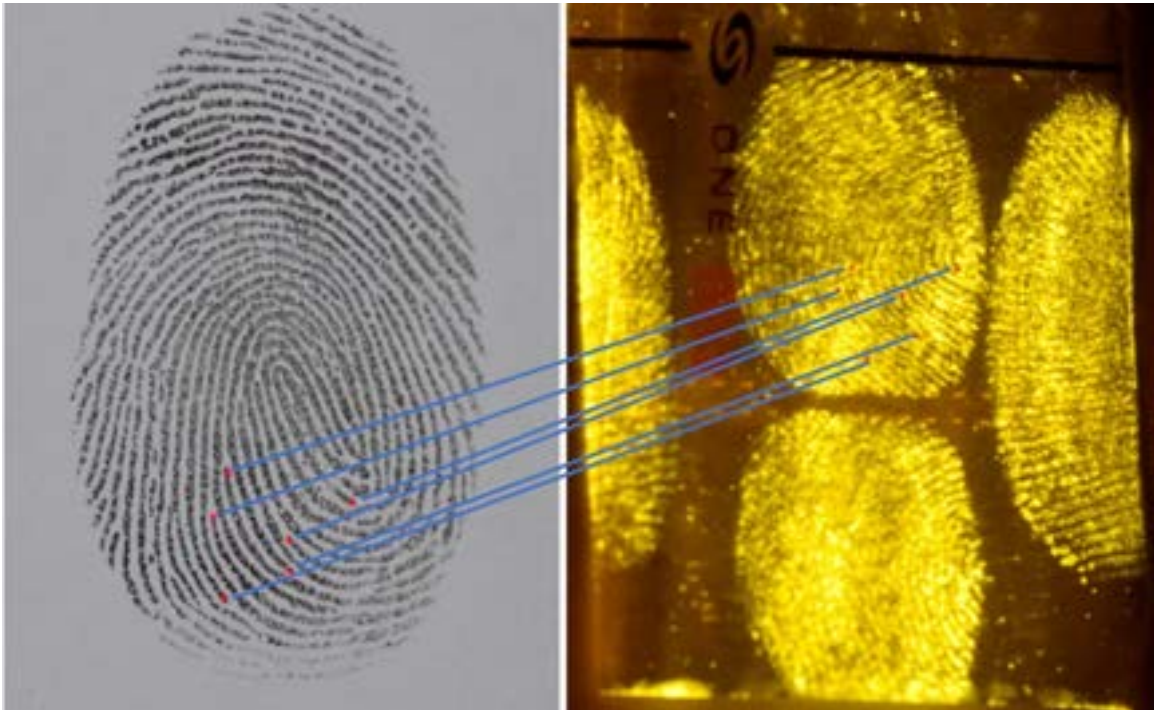
Lab 1: Latent Fingerprint Comparisons

Objective of Lab Exercise

Utilize the ACE–V methodology for the comparison of latent fingerprints to known fingerprints. These exercises are built to closely mimic daily casework and repetition of comparison exercises is integral to the training of fingerprint examiners and ensuring performance while examining casework.

Lab Instructions

You will be completing the Ron Smith & Associates Latent Print Comparison Practice Exercise 101 set. This is the second exercise in the RS&A series and consists of 8 sets of known fingerprints, 4 sets of known palm print cards, and 50 latent prints developed with various processing methods. The latent prints contain significant orientation clues. Some of the latent prints do contain a small amount of distortion, but they are suitable for trainees in the earlier stages of training.

Compare each latent fingerprint to the provided tenprint cards in attempt to determine origin and place your answers in the Ron Smith & Associates Latent Print Comparison Practice Exercise 101 Answer Sheet. *Note:* It is possible for a fingerprint to be used more than once, or not at all. Take care when you draw your conclusions and adhere to the best practices for fingerprint examination.

Requirements for the Lab Report

Record your answers on the answer sheet for the Ron Smith & Associates Latent Print Comparison Practice Exercise 101 *(see next page)*.

Name: Date:

Answer Sheet for Lab 1: Latent Fingerprint Comparisons.
Ron Smith & Associates Comparison Practice Exercise 101

Latent Print Number	K – # or Exclusion	Specific Finger	Latent Print Number	K – # or Exclusion	Specific Finger
Example L–xx	K–20	Right Thumb	Example L–xx	Exclusion	
L – 1			L – 26		
L – 2			L – 27		
L – 3			L – 28		
L – 4			L – 29		
L – 5			L – 30		
L – 6			L – 31		
L – 7			L – 32		
L – 8			L – 33		
L – 9			L – 34		
L – 10			L – 35		
L – 11			L – 36		
L – 12			L – 37		
L – 13			L – 38		
L – 14			L – 39		
L – 15			L – 40		
L – 16			L – 41		
L – 17			L – 42		
L – 18			L – 43		
L – 19			L – 44		
L – 20			L – 45		
L – 21			L – 46		
L – 22			L – 47		
L – 23			L – 48		
L – 24			L – 49		
L – 25			L – 50		

Lab 2: Black and Magnetic Powder Development

Objective of Lab Exercise

You will practice the powder development and lifting latent fingerprints.

Lab Instructions

Part I: Powder Types

Develop and lift four fingerprints from *Glass* using black fingerprint powder and place the recovered fingerprints in the boxes below. Record observations in the space provided.

Observations

_____

_____

_____

_____

Develop and lift four fingerprints from *Glass* using magnetic fingerprint powder and place the recovered fingerprints in the boxes below. Record observations in the space provided.

Observations

_____

_____

_____

_____

Part II: Different Non-Porous Substrates

Develop and lift four fingerprints from **_Plastic_** using black or magnetic fingerprint powder and place the recovered fingerprints in the boxes below. Record observations in the space provided.

Observations

_____

_____

_____

_____

Develop and lift four fingerprints from **_Aluminum cans_** using black or magnetic fingerprint powder and place the recovered fingerprints in the boxes below. Record observations in the space provided.

Observations

_____

_____

_____

_____

Part III: Types of Lifting Tape

Develop and lift three fingerprints from any substrate using either black or magnetic fingerprint powder and using clear lifting tape as before, place the recovered fingerprints in the respective boxes. Repeat this process on the same substrate with the same powder, however, use frosted and packaging tape. Place the lifts in the respective boxes. Record observations in the space provided. Ensure to compare and contrast benefits (if any) of each tape.

Clear FP Tape		
Frosted FP Tape		
Packaging Tape		

Observations

_____

_____

_____

_____

_____

_____

Lab 3: Powder Development II

Objective of Lab Exercise

This lab is an extension of Lab 2: Black and Magnetic Powder Development where you will practice the development and lifting of latent fingerprints from non-porous surfaces. However, in this case, you will not know where the fingerprint is located and search using lighting and powder development.

Lab Instructions

You will be provided with and tasked with locating pieces of evidence yourself. Firstly, go out and retrieve *at least* two pieces of "evidence" and search the recovered items for latent fingerprints using powder development. You will need to retrieve four fingerprints from this evidence. *Visible ridge detail with at least 5 minutiae points must be present, smudges will not count.* Place the recovered lifts in the boxes below.

Next, you will be provided with two items of evidence. Develop and recover any fingerprint evidence using powder dusting. Place four recovered lifts in the boxes below. *Visible ridge detail must be present, smudges will not count.*

Finally, provide a one page reflection of this exercise. Ensure you include any challenges you experienced and general observations of the recovered fingerprints.

Lab 4: Imaging and Image Enhancement Techniques

Objective of Lab Exercise

Become familiar with the operation of a DSLR camera and learn the proper methodology of documenting and preserving a fingerprint through photography.

Background Information

The images you capture should accurately depict the evidentiary object as they appear. It is imperative that your images are properly exposed, in focus, have an appropriate depth of field, and accurate color depiction (white balance). External flash units are helpful tools, however, one must be mindful of the reflections that can occur due to the directionality of the flash and the position of the subject matter. Otherwise, hotspots can appear in the image as overexposed areas.

Several common errors associated with the digital imaging of fingerprints are presented in Figure 5. The following paragraph is intended to expose you to several common mistakes as well as present a critique of these images similar to the scrutiny your images will face. The top left image exhibits an example of the sensor plane positioning. The proper position where the sensor is parallel to the plane of interest is shown and the resultant image is an accurate depiction of the circle. However, when the sensor plane is not orthogonal to the object plane, a distortion is observed. The bottom left image demonstrates depth of field. Notice that the scale on the right of this image is in clear focus, whereas only the center of the scale on the left is in focus. The image on the right demonstrates several problems. First, the image has a hot spot from the additional lighting, it washes out the ridge detail. The image is also clearly out of focus image in the area of the fingerprint, the plastic bag rises in this area out of the depth of field. Additionally, this close up image does not contain a scale properly positioned in the same plane as the item of interest and could not be resized or scaled later.

The direction at which light is applied to a subject is an enormously important aspect of flash photography. The directionality of light can affect shadows, reflections, and the harshness or softness of the light recorded. Light produced by a flash can be bounced off surfaces, such as a wall or ceiling, in order to change the directionality of light and thus have a tremendous effect on the final appearance of a photograph. For photography of fingerprint evidence, start with oblique lighting so that shadows are cast by the ridge detail as it will increase the contrast of your image.

Several images have been provided in Figure 6 which demonstrate photos that properly document and preserve fingerprint evidence. The top left and top right images illustrate the preservation of black powder prior to lifting. These images demonstrate: scales in the same plane as the fingerprint, filling the frame, appropriate depth of field, and clear focus of the ridge detail. The bottom left image documents a 3D impressed plastic fingerprint and illustrates lighting used to cast shadows across the impression in the furrows. The bottom middle image is an undeveloped fingerprint of perspiration on metal which has
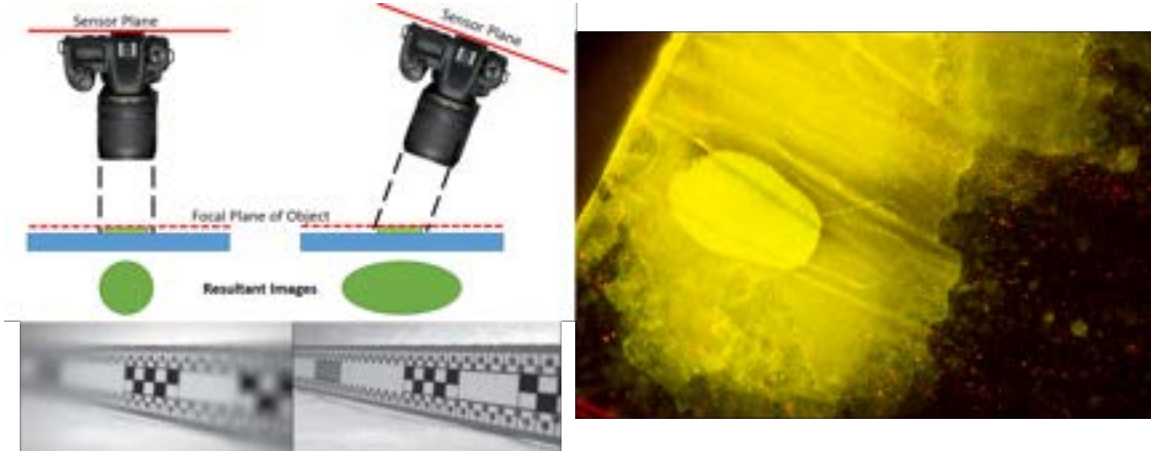
Fig. 5. Illustration of potential errors that can arise through the photography of fingerprint ridge detail.

been partially obstructed with ink. This image demonstrates lighting on a metallic surface which illuminate the fingerprint but do not create reflective hot spots. Another quality feature of this image is that the totality of the obstruction is documented for the ACE–V process. Finally, the bottom left image is a good example of development using fluorescent powder to highlight the fingerprint instead of the colored background. This is advantageous to eliminate some of the background, for reference, compare with the top left image.

Lab Instructions

Part I: Imaging Techniques

In this section of the lab you will be working with a partner to image a variety of fingerprints on different substrates. You may work in any order but capture the following:

1. Two different images of fluorescent powder on a non-porous surface
2. One image of a plastic fingerprint
3. One image of a ninhydrin developed fingerprint
4. One image of a patent fingerprint left in blood
5. One image of an undeveloped fingerprint on a glass slide
6. One image of a fingerprint on a metallic surface

Part II: Imaging vs Scanning

In this section of the lab you will be comparing two method of preserving fingerprint evidence; imaging and scanning. Follow the procedure below:

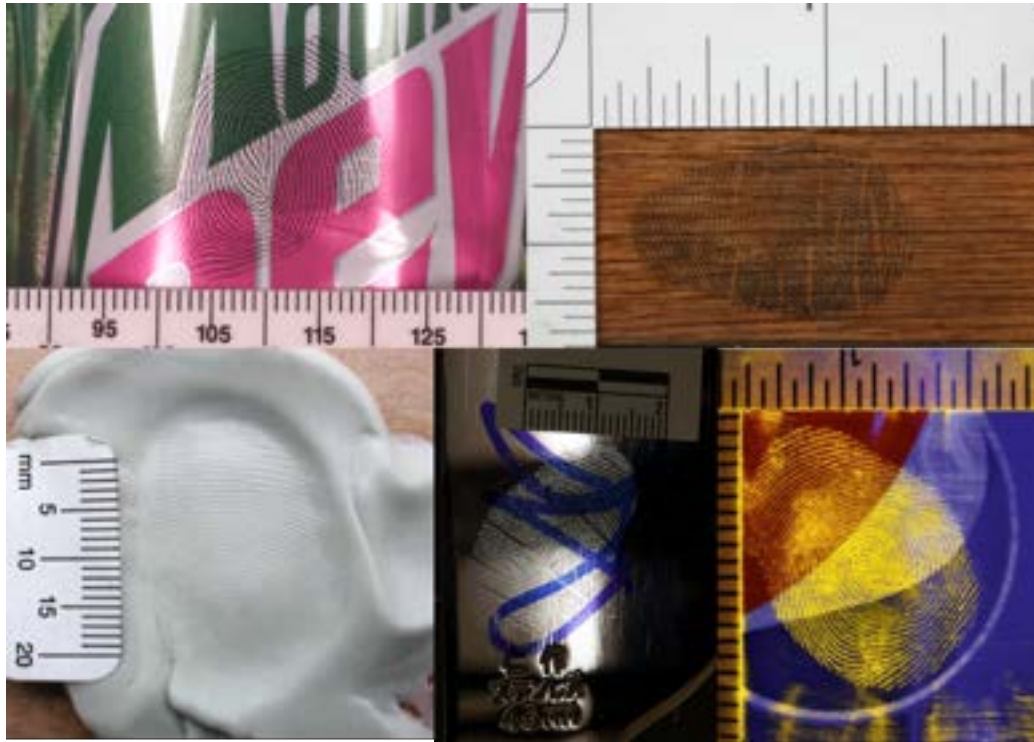1. Place a fingerprint on a non-porous substrate.

Fig. 6. Reference images illustrating proper preservation of fingerprints using photography with a variety of substrates and development methods.

2. Attempt to image the latent fingerprint.

3. Develop the latent fingerprint using black or magnetic powder.

4. Image the developed fingerprint.

5. Lift the fingerprint using a lifting tape of your choice and place the fingerprint lift on a backing card.

6. Image the lifted fingerprint.

7. Scan the fingerprint lift using the Epson Perfection V–600 scanner at 1000 ppi.

8. Compare the scan and image of the fingerprint in terms of quality.

Part III: Imaging vs Scanning

In this section of the lab you will be enhancing an image (subtracting the background) of a fingerprint. You will utilize color channels and adjust contrast to help visualize the developed fingerprint. Note that this is not an exhaustive guide, nor does it cover all substrates or development techniques. However, these techniques can be applied to a variety of images on a plethora of different substrates. Also note that we will not cover image calibration or scaling. Follow the procedure below:

1. Download the "*Black_Powder_Pepsi_Can.tif*" image from Canvas.

2. Go to https://www.photopea.com/. Photopea is a web-based graphics editor which can be used for image editing, making illustrations, web design, or converting between different image formats similarly to Adobe Photoshop.

3. Open the "*Black_Powder_Pepsi_Can.tif*" image in Photopea.

4. Click Image → Transform → 90° clockwise. This will rotate the image such that it is oriented in an upright position.

5. Click Image → Adjustments → Black & White

   • Move the red, yellow, cyan, blue, and magenta sliders toward white.

6. Click Image → Adjustments → Curves

   • Click on the curve in the window to create a point of adjustment.
   • Adjust the curve such that it increases slowly upward from the bottom (0), rapidly, then slowly toward the top (256). See Figure 7 for what this adjustment should look like. Note: two adjustment points were used on the curve.
   • Adjust the curve to maximize contrast with the background. See Figure 8 for an example of what your fingerprint image should look like.

7. Save the resultant image. Draw comparisons of this image with the original and the impact on visibility, quality, and overall utility of the print for the ACE–V process.
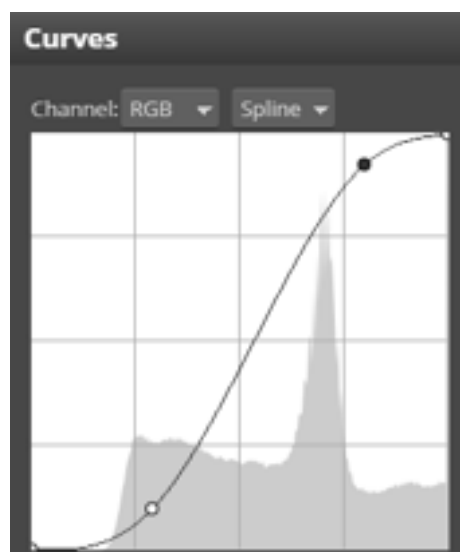
Fig. 7. Approximate curve for enhanced image contrast.
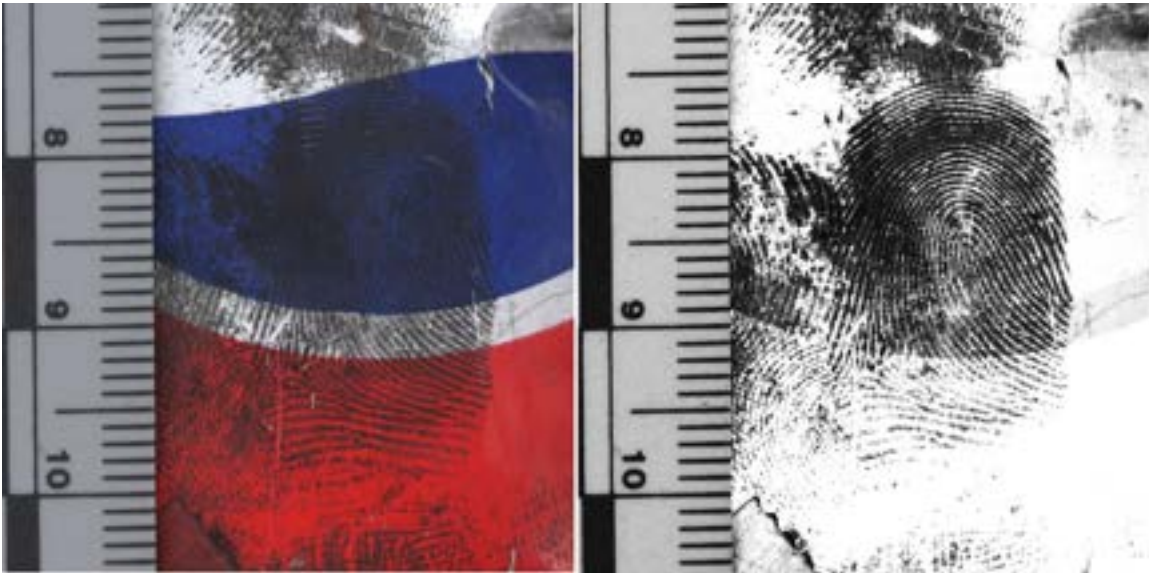
Fig. 8. Image of the black powder developed fingerprint on a Pepsi can before (left) and after color channel processing and contrast adjustment (right).

Requirements for the Lab Report

In a document, attach your images for each section of the lab. *For each image*, provide a brief reflection on your experience taking or developing the image. Be sure to include any observations you had during the lab, successes, and challenges that you experienced. See the checklist below to ensure you include all necessary images:

Part I Seven images of fingerprint on various substrates.

Part II Three images and scan of the fingerprint.

Part III The original fingerprint image and the image after your transformations.

Lab 5: Cyanoacrylate Fuming

Objective of Lab Exercise

This exercise is intended to show the technique of cyanoacrylate fuming using both a fume chamber and a portable apparatus for use on crime scenes.

Lab Instructions

Cyanoacrylate (CA) fuming is suitable for virtually all nonporous surfaces, including glass, metal, coated papers, and all forms of plastics. The method is particularly effective on rough surfaces where physical contact with a fingerprint brush tends to develop the texture of the material along with the latent fingerprints. Additionally, CA fuming can be used to develop older fingerprints because the super glue fumes only need the amino acids, proteins and fatty acids to develop the fingerprint; whereas, if the sweat has evaporated, powder is ineffective. Another benefit of CA fuming is that the developed print is semi-permanent, therefore allowing the examiner to re-dust and re-lift the print if necessary. Ideal conditions for CA fuming are: $\approx 80\%$ relative humidity; $\approx 75°$F.

Place a fingerprint on the provided objects and develop using CA fuming for use in later parts of the Exercise.

- Knife with a print on the metal
- Aluminum Foil Sheet
- Plastic Bag/ Garbage Bag
- Bottle (Glass or Plastic)
- Glass Slide

Part I: Under-Development vs Over-Development with CA Fuming

In the space below comment on the characteristics of under-developed and over-developed fingerprints that have been processed using CA fuming. Use the example provided to make comments on the overall appearance; utility of the print; potential problems; and solutions.

Observations

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_____

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Part II: Further Enhancement with Powder

Enhance the developed fingerprints from the *knife* and *bottle* using either black or magnetic powder. If applicable, use white powder on darker areas of the object. Before lifting, make observations in the space provided with respect to the appearance of the print, the visibility, and visibility with oblique light. Lift and place the fingerprints in the spaces provided. Also, using the same finger that left the latent print, deposit a known fingerprint in the corresponding box for comparison to the developed latent fingerprint.

Knife Lift	Inked Print	Bottle Lift	Inked Print

Observations

_____

_____

_____

_____

Part III: Replicate Lift of Latent with Powder

Enhance the developed fingerprints from the *glass slide* using either black or magnetic powder. Place a tape lift of the developed fingerprint in the first box provided. Without applying more powder, re-lift the developed fingerprint and place that lift in the second box. Make observations in the space provided with respect to the appearance of the print.

Observations

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_____

_____

_____

Part IV: Further Enhancement with RAM

RAM is a mixture of Rhodamine 6G, Ardrox, and MBD 10. RAM has been found to be effective on various colors of nonporous surfaces. RAM should be used in a fume hood and contact with skin should be avoided if possible (irritant). Application is as follows:

1. Apply the solution to the item to be processed by immersion or squirt bottle.

2. Allow the item to dry completely.

3. Examine the object under ALS between 415–500 nm. Photograph results using an orange barrier filter.

Using this method, enhance the fingerprints from the *aluminum foil* and *plastic bag* with the provided working RAM solution. It may be necessary to respray or rinse the object depending on the first application of the solution. Photograph this developed fingerprint and submit with the lab. Make observations in the space provided with respect to the appearance of the print.

Observations

_____
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Lab 6: Blood, Tapes, and Porous Substrates

Objective of Lab Exercise

Become familiar with the chemical development of fingerprints on challenging substrates.

Lab Instructions

Part I: Development of Fingerprints in Blood

Enhancement of impressions believed to be deposited in blood can be done through the application of a solution that results in a color change when in contact with alpha amino acids or proteins present in the blood. The suspected blood on the surface of the object should be dry prior to the processing with the selected solution. Application of a blood protein solution may prevent a serological exam of the evidence after staining. Several dye stains can be used for the development of blood impressions:

- Ninhydrin
- Amido Black
- Coomassie Brilliant Blue R250
- Leuco Crystal Violet

For this exercise, we will be using Leuco Crystal Violet for development of the blood impressions. Aqueous Leuco Crystal Violet can be applied to porous or nonporous surfaces, such as paper, metal, plastics or glass. Aqueous Leuco Crystal Violet is best applied by either submersion or by washing the solution over the surface in question. It is NOT recommended to spray Aqueous Leuco Crystal Violet except in the case of carpeting to observe shoeprints or other marks in blood. The development will begin to occur within 30 seconds. Then, blot with paper towels to remove the excess reagent.

Using the method outlined, develop the provided fingerprint impressions in blood. It may be necessary to re-develop the object depending on the first application of the solution. Make observations in the space provided with respect to the appearance of the prints.

Observations

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Part II: Development of Fingerprints on Adhesive Tapes

For this section of the lab exercise, both Gentian Violet and sticky side powder will be used for development on adhesive surfaces. Enhancement of impressions deposited on an adhesive surface can be done through the application of a solution that results in a color change when in contact with skin cells or other residues left in the adhesive material as a result of handling. The surface should be visually examined prior to the application of any solution.

Gentian violet stain has been used for many years to develop latent fingerprints on nonporous surfaces, particularly the adhesive side of sticky tapes. The specimen to be treated is simply immersed in or floated on a 0.1% w/v aqueous solution of gentian violet for one to two minutes and then rinsed with water. Repeated stain/rinse cycles may be used to intensify the color of the stains. When the print is fully developed, it can be viewed and photographed under ordinary light. Gentian violet is non-destructive, so it is often used first on sticky tape specimens. If gentian violet fails to develop the print, other powder-based methods can be attempted. Obviously, the aqueous solution of gentian violet should not be used on tapes that use water-soluble adhesives. Application is as follows:

1. Immerse item to be processed in the working solution in a large tray.

2. Allow the item to remain completely immersed for approximately 30 seconds while agitating.

3. Remove the item from the working solution and rinse excess stain from the item by washing with a gentle flow of cold tap water.

4. This process may be repeated until optimum contrast is reached between the impressions developed and the background.

Using this method, enhance the fingerprints on the *packaging* and *duct tapes* with the provided working Gentian Violet solution. Photograph this developed fingerprint and submit with the lab. Make observations in the space provided with respect to the appearance of the print.

Observations

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Sticky side powder is a pre-mixed liquid that is applied to the adhesive side of tape with a camelhair brush. It can be used to develop prints on any adhesive surface. Sticky side powder produces excellent friction ridge detail results and has an indefinite shelf-life. No mixing is required when using sticky side powder.

1. Paint the mixture on the sticky side of the tape using a soft bristled brush.

2. Allow the suspension to remain on the item for approximately 10 seconds.

3. Rinse excess suspension from the item by washing with a gentle flow of cold tap water.

4. This process may be repeated until optimum contrast is reached between the impressions developed and the background.

Using this method, enhance the fingerprints on the *electrical* and *duct tapes* with sticky side powder. Photograph this developed fingerprint and submit with the lab. Make observations in the space provided with respect to the appearance of the print.

Observations

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Part III: Development of Latent Fingerprints on Porous Substrates

Porous items such as paper, cardboard, and unfinished wood allow latent impression residues to be absorbed into the material allowing for the application of chemical reagent that react with specific compounds found in latent impression residue rendering visible ridge detail. The following preparations react with specific compounds in the residue and should be utilized at the discretion of the examiner taking into consideration the type of evidence being processed.

Ninhydrin, or triketo-hydrindene hydrate, is an extremely sensitive indicator of alpha-amino acids, proteins, peptides and polypeptides. The reaction produces a violet to blue-violet coloring of these substances and is effective even with older deposits and/or minute amounts of amino acids. While ninhydrin can be used on any surface, processing normally is confined to porous items which are not water-soaked and do not contain inherent animal proteins. Ninhydrin is readily soluble in most organic solvents. Working solutions of ninhydrin are governed by the nature of the solvent and the strength of the solution. Concentrations of the ninhydrin solution may vary according to application, but generally a 0.5% to 1.0% weight to volume mixture produces the best results in either a Acetone, Heptane, or Petroleum Ether preparation.

All applications should be done in a fume hood. The item of evidence should be saturated with solution, which can be accomplished by immersing the evidence in a tray of solution or by applying the solution with a brush or spray bottle. Follow the procedure below:

1. Completely saturate each item to be processed.

2. Remove from the immersion (if applicable) and allow the item to dry completely in the fume hood.

3. Once dry, place the item of evidence between two clean sheets of paper and develop using a clothing iron since heat accelerates the development process. Check the item periodically to monitor the impression development. Care should be taken not to saturate the item with water vapor.

Place multiple fingerprints on a localized area of the porous substrate provided. Circle the impression area using pencil; ink will run when exposed to the ninhydrin preparations. Using the method outlined, develop the fingerprints. It may be necessary to re-develop the object depending on the first application of the solution. Photograph any developed fingerprints and submit with the lab. Make observations in the space provided with respect to the appearance of the print.

Observations

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