Commentary

Levels of Quality and Quantity in Detail

The forensic examiner conducts most examinations by visual observation and mental evaluation of detail that can be seen in two images. The examiner will attempt to determine whether the two images were made by the same source. Usually, one image is from an unknown source and the other image is from a known source. This is typical of analyzing a latent print from a crime scene and analyzing inked finger prints from a suspect, comparing them to each other, and then evaluating the significance of the comparison. A verification of the examination can then take place.

Often a crime scene investigator will develop latent prints at a scene and wonder if there is sufficient detail in an image to warrant a forensic examination. The crime scene investigator might seek a verbal description of how much detail is needed while ignoring the need for a description of clarity, or quality, of the detail. Quantitative statements of a required minimum number of "points" that ignore quality are ignoring the total consideration of information found in images. Information from detail is more than just a quantity. Information also has quality, or levels of detail that have power or significance.

David Ashbaugh introduced the concept of levels of detail in friction ridge examination. Throughout his book and in his glossary he refers to first level detail as general overall pattern shape, i.e., circular, looping, arching or straight. Second level detail is ridge path, major ridge path deviations and paths caused by damage such as scars. Third level detail is ridge shape, relative pore location and some accidental details [1]. He also explains that the use of the descriptive terms first, second and third level detail identify the clarity of the print and indicates to others its potential for individualization. For friction ridge images, first level detail by itself does not have individualizing value, second level detail does have individualizing power, and the finer third level detail also has individualizing power [2].

Levels of detail are not necessarily consistent throughout an image. Contact and transfer of information take place as features in the friction ridge skin are recorded as detail in an image. This detail can have various levels of clarity throughout the image and information can be obtained from many areas of the image. This information might be levels of first level, second level and/or third level detail. The total image needs to be considered when the examination takes place.

The following is an attempt to present visual and written information to explain a part of the mental process that considers visible detail in images when conducting a forensic examination. Various levels of quality of detail are present in most images. The significance of a quantity of detail is affected by the levels of clarity, or quality, of detail throughout the image. For source determination, quality affects the needed quantity and quantity affects the needed quality [3, 4]. A predetermined fixed quantity of detail cannot be justified as the standard for source determination. There are too many variations in quality and significance of levels of detail throughout images to set a minimum required quantity standard.



Journal of Forensic Identification 462 / 51 (5), 2001

The diagram in figure 1 represents the levels of detail for images (friction ridge prints) from source items (friction ridge skin) that only have unique features. The diagram in figure 1 depicts the significance of quality and levels of detail. There are no numerical values assigned to the quality axis. The diagram is only a visual depiction of explaining the levels. The finer and clearer the detail, the more significance it has. As the quality of the image increases, the level of detail increases as well as the significance of that detail [5]. As the quality of the image decreases, the significance of the detail decreases.

The bottom of the diagram starts at 0. There is no image, no detail, no information and no significance. The diagram is then separated into levels 1, 2 and 3 (first, second and third levels). An undefined width of each level exists. Each level does not have only one single increment of power or significance. Widths within each level depict the undefined increments that detail will have as the quality of the image increases. All first level detail is not equally clear. Therefore, all first level detail does not have the same significance. All second level detail is not equally clear. Therefore, all second level detail does not have the same significance. All third level detail is not equally clear. Therefore, all third level detail does not have the same significance. Detail at the top of each level has more significance than detail at the bottom of that same level. Notice there is no top to third level detail. The quality of the detail in third level can be extremely clear, but complete and exact recording of the features of the source item will never occur. The image can approach, yet will never reach, complete and exact recording of the source item.

An undefined width of gray area in figure 1 separates each level. These gray areas represent doubt. When the examiner's decision is in a gray area between levels, the examiner needs to drop to and accept the information as being in a lower level of detail. When in doubt, the examiner should not give too much significance to the detail. The widths of the gray areas represent the understanding and ability of the examiner. As examiner understanding and ability increase, the widths of the gray areas will decrease. Just as significant as being in the gray area, the examiner must not give too much significance to detail within a white level area. Widths of a specific level area represent various levels within a level of detail. Too much significance should never be given to any detail [6, 7].



Figure 2

The curves in figure 2 depict the significance of quality and quantity of information in images during an evaluation of a comparison. "Qualitative and quantitative analyses may shift in relative importance according to the latent evaluated, but must serve the examiner in harmony" [8]. This relationship of quality and quantity of detail is expressed in the mathematical curve X=1/Y, or XxY=1. The X and Y axes of the curve represent the quality and quantity of detail that are considered in conjunction with each other when evaluating the significance of the totality of the images under examination [7]. Quality of information represents the combination of quality of first, second and third level detail. Quality does not represent just one static level of detail while ignoring the remainder of the total image. Quantity of information represents the combination of quantity of first, second and third level detail. Quantity does not represent just an amount of one static level of detail while ignoring the remainder of the total image. The quality and quantity curves represent the consideration of all levels of all the information in both the unknown and the known images.

In reality, the unknown friction ridge image is or is not from the same source as the known image. In reality, information found in two images agrees or disagrees. That is why there are two curves. Informa-

Journal of Forensic Identification 464 / 51 (5), 2001

tion found in each of the two images is sufficient or insufficient to determine agreement or disagreement. That is why there are only two options, sufficient or insufficient, that make up each curve. Quality and quantity of information are equally important and influence the need of the other. That is why the quality and quantity curves are based on X=1/Y. The curves never intersect either axis. If the curves would intersect either axis, there would be no quality or no quantity; therefore, there would be no image. The detail can approach, yet will never reach, exact and complete quality and quantity recording of all levels of all the features of the source item. Therefore, the curves continue indefinitely.

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The white areas above the curves represent sufficient combination of quality and quantity of information to determine agreement or disagreement of information between images. The gray areas in the curves represent doubt. As understanding and the ability of the examiner increases, the width of the gray area will decrease. When the examiner has doubt about sufficient agreement or disagreement of information between images, the examiner needs to admit that doubt and conclude that the information is insufficient. The black areas under the curves represent insufficient information to determine agreement or disagreement of information between the images. Since there is no such thing as a perfect match of detail between two separately deposited images, source determination must consider the quality and quantity of levels of information in the images.

Refer to the right curve in figure 2. When agreement of information between two images is sufficient, the examiner is able to determine the images were produced by the same source. When in doubt about sufficiency of agreement, the gray area, the examiner is unable to definitely determine whether the agreement is sufficient; therefore, the information becomes insufficient. When agreement of information between two images is insufficient, the examiner is unable to determine that the information actually agrees. Therefore, the examiner is unable to determine the images were produced by the same source.

Refer to the left curve in figure 2. When disagreement of information between two images is sufficient, the examiner is able to determine the images were produced by different sources. When in doubt about sufficiency of disagreement, the gray area, the examiner is unable to definitely determine whether the disagreement is sufficient; therefore, the information becomes insufficient. When disagreement of information between two images is insufficient, the examiner is unable to determine that the information actually disagrees. Therefore, the examiner is unable to determine the images were produced by different sources.

Gray doubt connects the insufficient black areas below the two curves in figure 2. In reality, the insufficient information agrees or disagrees. If the examiner is unable to determine whether the information agrees, the examiner is also unable to determine whether the information disagrees. If the examiner is unable to determine whether the information disagrees, the examiner is also unable to determine whether the information agrees. That is why gray doubt connects the two separate and distinct insufficient areas under the curves to each other. The examiner has doubt about whether the information agrees or disagrees because the information is insufficient.

Discussion

An understanding of the friction ridge skin is the foundation for determining the source of a friction ridge image. No matter the numerous generic labels attached to friction ridge skin, the actual formations throughout the friction ridge skin are unique. Durable unique features in source items such as friction ridge skin and sufficiently recorded unique detail in images provide the basis for the examiner to determine or exclude a source as the origin of the unknown image under examination.

Various conclusions can be reached after an examination. The conclusion of same source of origin based on agreement of sufficient information in friction ridge images is acceptable. The conclusion of different sources of origin based on disagreement of sufficient information in friction ridge images is acceptable. The conclusion that the information in an image is insufficient is acceptable. The conclusion that the information in friction ridge images is insufficient to determine or exclude a unique friction ridge source is acceptable. The inability to determine or exclude the image as having been made by a known friction ridge source is not the same as definitely including this friction ridge source with other friction ridge image under examination. Insufficient recording of unique features as detail in an image does not grant the image commonality with images from a variety of unique sources. I disagree with any conclusion concerning images from inherently unique sources that includes a variety of other unique sources as being capable of producing an image. I disagree with possible, probable, likely or most likely conclusions when considering unique images from sufficiently durable unique sources such as friction ridge skin.

The Levels of Detail Diagram and Quality x Quantity Curves are presented as visual explanations or models of the significance of information in images. These explanations are useful for determining or excluding a source as origin of an image based on sufficient agreement or sufficient disagreement of information in images. When using these models, the examiner needs to understand many factors for understanding information in images. These factors are:

- 1. The examiner must have knowledge and understanding about the source of the image.
- 2. The examiner must understand the difference between repeatable features and unique features on the source item. No matter the numerous generic labels attached to friction ridge skin, friction ridge skin only has unique features.
- 3. The examiner must understand the durability of the features on the source item.
- 4. The examiner must understand that the image of the source item will have less quality and quantity of detail than found in the features of the actual source item.
- 5. The examiner must understand that as quality of detail increases, the power or significance of the detail increases. As quality of detail decreases, the power or significance of the detail decreases.
- 6. The examiner must understand the relationship between quality and quantity of all the information from the detail in the images. As quality of information increases, the requirement for quantity of information decreases. As quality of information decreases, the requirement for quantity of information increases.

7. The examiner must understand that insufficient information does not give the examiner the latitude to definitely include an item as being a possible source of an image. The inability to determine actual agreement or disagreement is not the same as definite inclusion.

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Journal of Forensic Identification 468 / 51 (5), 2001