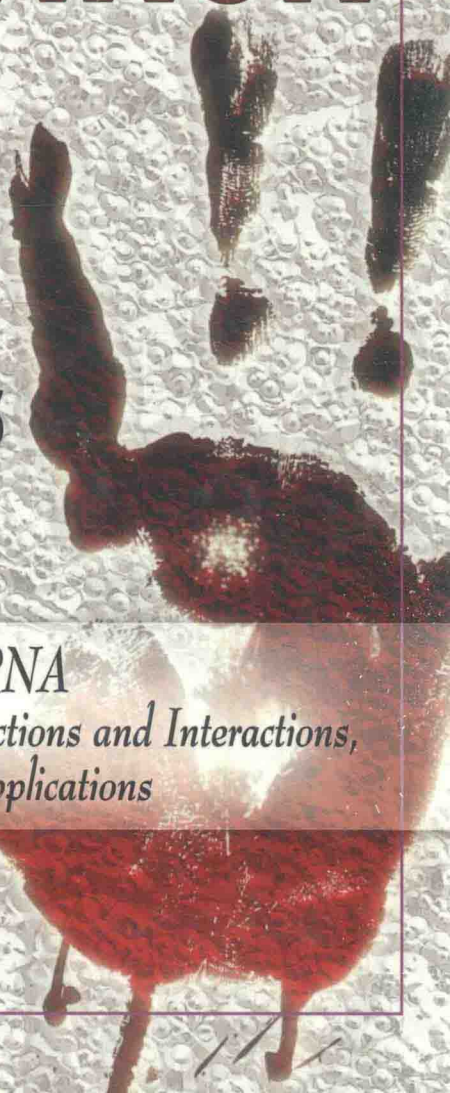
LATENT FINGERPRINT EXAMINATION

ELEMENTS, HUMAN FACTORS AND RECOMMENDATIONS



DNA and RNA
Properties and Modifications, Functions and Interactions, Recombination and Applications

EVA ACCURSIO
EDITOR

NOVA

DNA AND RNA: PROPERTIES AND MODIFICATIONS, FUNCTIONS AND INTERACTIONS, RECOMBINATION AND APPLICATIONS

LATENT FINGERPRINT EXAMINATION

ELEMENTS, HUMAN FACTORS AND RECOMMENDATIONS

EVA ACCURSIO
EDITOR

nova publishers
New York

Library of Congress Cataloging-in-Publication Data

ISBN: 978-1-63117-892-4

Published by Nova Science Publishers, Inc. † New York

PREFACE

Fingerprints have provided a valuable method of personal identification in forensic science and criminal investigations for more than 100 years. Fingerprints left at crime scenes generally are latent prints—unintentional reproductions of the arrangement of ridges on the skin made by the transfer of materials (such as amino acids, proteins, polypeptides, and salts) to a surface. Palms and the soles of feet also have friction ridge skin that can leave latent prints. The examination of a latent print consists of a series of steps involving a comparison of the latent print to a known (or exemplar) print. Courts have accepted latent print evidence for the past century. However, several high-profile cases in the United States and abroad have highlighted the fact that human errors can occur, and litigation and expressions of concern over the evidentiary reliability of latent print examinations and other forensic identification procedures has increased in the last decade. This book discusses latent print examinations in detail, and provides methods to improving the practice through a systems approach.

Chapter 1 – Fingerprints have provided a valuable method of personal identification in forensic science and criminal investigations for more than 100 years. Fingerprints left at crime scenes generally are latent prints—unintentional reproductions of the arrangement of ridges on the skin made by the transfer of materials (such as amino acids, proteins, polypeptides, and salts) to a surface. Palms and the soles of feet also have friction ridge skin that can leave latent prints. The examination of a latent print consists of a series of steps involving a comparison of the latent print to a known (or exemplar) print. Courts have accepted latent print evidence for the past century. However, several high-profile cases in the United States and abroad have highlighted the fact that human errors can occur, and litigation and expressions of concern over the evidentiary reliability of latent print examinations and other forensic identification procedures has increased in the last decade.

"Human factors" issues can arise in any experience- and judgment-based analytical process such as latent print examination. Inadequate training, extraneous knowledge about the suspects in the case or other matters, poor judgment, health problems, limitations of vision, complex technology, and stress are but a few factors that can contribute to errors. A lack of standards or quality control, poor management, insufficient resources, and substandard working conditions constitute other potentially contributing factors.

In addition to reaching correct conclusions in the matching process, latent print examiners are expected to produce records of the examination and, in some cases, to present their conclusions and the reasoning behind them in the courtroom. Human factors issues related to the documentation and communication of an examiner's work and findings therefore merit attention as well.

The study of human factors focuses on the interaction between humans and products, decisions, procedures, workspaces, and the overall environment encountered at work and in daily living. Human factors analysis can advance our understanding of the nature of errors in complex work settings. Most preventable, adverse events are not just the result of isolated or idiosyncratic behavior but are in part caused by systemic factors. The forensic science community can benefit from the application of human factors research to enhance quality and productivity in friction ridge examinations and to reduce the likelihood and consequences of human error at various stages in the interpretation of evidence.

To further this effort, the National Institute of Justice (NIJ) Office of Investigative and Forensic Sciences (OFIS) within the U.S. Department of Justice and the National Institute of Standards and Technology's (NIST's) Law Enforcement Standards Office (OLES) sponsored the work of this expert panel to examine human factors in latent print analysis and to develop recommendations to reduce the risk of error and improve the practice of latent print analysis.

Chapter 2 – Latent fingerprint development may be achieved with a wide array of optical, physical, and chemical processes, most having evolved during the past century. Because some techniques are often intricately related and continuously changing, it is imperative that those involved in laboratory and crime scene processing are well trained and well practiced.

For those involved in crime scene and laboratory work, safety is paramount. It is important to follow safe work practices when using the processes described in this chapter. This can be accomplished by observing manufacturer warnings, reading material safety data sheets, and observing one's own institutional policies regarding evidence handling and fingerprint development. It is also important for those working with potentially hazardous materials or equipment to wear the appropriate personal protective equipment, such as gloves, lab coats, eye protection, and respirators; to use engineering controls such as fume hoods; and to practice proper laboratory procedures to reduce exposure to pathogens or harmful chemicals.

CONTENTS

Preface		**vii**
Chapter 1	Latent Print Examination and Human Factors: Improving the Practice through a Systems Approach *Expert Working Group on Human Factors in Latent Print Analysis*	**1**
Chapter 2	Latent Print Development *Brian Yamashita, Mike French, Stephen Bleay, Antonio Cantu, Vici Inlow, Robert Ramotowski, Vaughn Sears and Melissa Wakefield*	**225**
Index		**321**

In: Latent Fingerprint Examination
Editor: Eva Accursio
ISBN: 978-1-63117-892-4

Chapter 1

LATENT PRINT EXAMINATION AND HUMAN FACTORS: IMPROVING THE PRACTICE THROUGH A SYSTEMS APPROACH*

Expert Working Group on Human Factors in Latent Print Analysis

INTRODUCTION

Fingerprints have provided a valuable method of personal identification in forensic science and criminal investigations for more than 100 years.[1] Fingerprints left at crime scenes generally are latent prints—unintentional reproductions of the arrangement of ridges on the skin made by the transfer of materials (such as amino acids, proteins, polypeptides, and salts) to a surface. Palms and the soles of feet also have friction ridge skin that can leave latent prints. The examination of a latent print consists of a series of steps involving a comparison of the latent print to a known (or exemplar) print. Courts have accepted latent print evidence for the past century.[2] However, several high-profile cases in the United States and abroad have highlighted the fact that human errors can occur,[3] and litigation and expressions of concern over the evidentiary reliability of latent print examinations and other forensic identification procedures has increased in the last decade.[4]

"Human factors" issues can arise in any experience- and judgment-based analytical process such as latent print examination. Inadequate training, extraneous knowledge about the suspects in the case or other matters, poor judgment, health problems, limitations of vision, complex technology, and stress are but a few factors that can contribute to errors. A lack of standards or quality control, poor management, insufficient resources, and substandard working conditions constitute other potentially contributing factors.

In addition to reaching correct conclusions in the matching process, latent print examiners are expected to produce records of the examination and, in some cases, to present their conclusions and the reasoning behind them in the courtroom. Human factors issues

* This is an edited, reformatted and augmented version of a report released by the U.S. Department of Commerce, National Institute of Standards and Technology, dated February 2012.

related to the documentation and communication of an examiner's work and findings therefore merit attention as well.

The study of human factors focuses on the interaction between humans and products, decisions, procedures, workspaces, and the overall environment encountered at work and in daily living.[5] Human factors analysis can advance our understanding of the nature of errors in complex work settings. Most preventable, adverse events are not just the result of isolated or idiosyncratic behavior but are in part caused by systemic factors.[6] The forensic science community can benefit from the application of human factors research to enhance quality and productivity in friction ridge examinations and to reduce the likelihood and consequences of human error at various stages in the interpretation of evidence.

To further this effort, the National Institute of Justice (NIJ) Office of Investigative and Forensic Sciences (OFIS) within the U.S. Department of Justice and the National Institute of Standards and Technology's (NIST's) Law Enforcement Standards Office (OLES) sponsored the work of this expert panel to examine human factors in latent print analysis and to develop recommendations to reduce the risk of error and improve the practice of latent print analysis.

1. The Expert Working Group on Human Factors in Latent Print Analysis

The Expert Working Group on Human Factors in Latent Print Analysis was convened in December 2008 and charged with conducting a scientific assessment of the effects of human factors on forensic latent print analysis. A *scientific assessment,* as defined by the Office of Management and Budget, "is an evaluation of a body of scientific or technical knowledge which typically synthesizes multiple factual inputs, data, models, and assumptions, and/or applies best professional judgment to bridge uncertainties in the available information."[7]

The Working Group was charged with:

- Developing an understanding of the role of human factors and their contributions to errors in latent print analysis through an evidence-based review of literature, case studies, and previous analyses;
- Evaluating approaches to reducing errors in terms of their efficacy, appropriateness in different settings and circumstances, cost, scientific basis, feasibility, institutional barriers to implementation, associated risks, and the quality of evidence supporting the approach;
- Providing guidance to the latent print analysis community on the practical, scientific, and policy outcomes of its work through peer-reviewed publications, presentations at conferences and meetings, and government-sponsored publications;
- Providing guidance to policy-makers and government agencies in promoting a national agenda for error reduction in latent print analysis;
- Attempting to develop credible estimates of the incidence, severity, and costs of errors; and
- Making recommendations for future research.

Working Group members were selected because of their expertise in the forensic sciences or another relevant field and the ability to balance scientific rigor with practical and

regulatory constraints. The Working Group consisted of experts from forensic disciplines, statisticians, psychologists, engineers, other scientific experts, legal scholars, and representatives of professional organizations.

The Working Group met 9 times over the course of 2 1/2 years and heard presentations from experts in human factors, vision science, laboratory design, latent print identification, and interpretation in forensic science. Each section in this report was developed by a subgroup of the Working Group, reviewed by the entire Working Group, edited by a committee within the group, and reviewed again by a set of independent experts. The report was developed through a consensus process in which each Working Group member had an opportunity to influence the recommendations and writing. Despite the diversity of backgrounds and views, the Working Group was able to reach substantial agreement on many important issues, not limited to the formal recommendations. On some matters, however, an irreducible range of opinions remained, and particular sections indicate those issues.

2. About the Sponsors

NIJ is the research, development, and evaluation agency of the U.S. Department of Justice and is dedicated to researching crime control and justice issues. NIJ provides objective, independent, evidence-based knowledge and tools to meet the challenges of crime and justice. The Office of Investigative and Forensic Sciences (OIFS) is the federal government's lead agency for forensic science research and development as well as for the administration of programs that provide direct support to crime laboratories and law enforcement agencies to increase their capacity to process high-volume cases, to provide needed training in new technologies, and to provide support to reduce backlogs. Forensic science program areas include Research and Development in Basic and Applied Forensic Sciences, Coverdell Forensic Science Improvement Grants, DNA Backlog Reduction, Solving Cold Cases with DNA, Postconviction DNA Testing Assistance, National Missing and Unidentified Persons System (NamUs), and Forensic Science Training Development and Delivery.

NIST's mission is to advance measurement science, standards, and technology. It accomplishes these actions for the forensic science community through the OLES Forensic Science Program. The OLES Forensic Science Program directs research efforts to develop performance standards, measurement tools, operating procedures, guidelines, and reports that will advance the field of forensic science. OLES also serves the broader public safety community through the promulgation of standards in the areas of protective systems; detection, enforcement, and inspection technologies; public safety communication; and counterterrorism and response technologies.

3. Organization of This Report

Section 1 provides an overview of the Analysis, Comparison, Evaluation, and Verification (ACE-V) process for the examination of latent prints. The section also explains certain terminology used throughout the report.

Section 2 outlines the general ideas behind human factors and organizational theory. It also addresses the nature of errors in latent print analysis, the reasons for identifying them or measuring their prevalence, and possible ways to estimate accuracy and error rates.

Section 3 describes, defines, and clarifies the interpretative stages of latent print comparisons. In addition, it describes the current state of knowledge, based upon published research, and discusses what this research suggests about potential concerns and pitfalls in the interpretive process.

Section 4 surveys new and forthcoming methods, technologies, and techniques. It examines research needs and ways to improve existing technologies for recording and storing exemplars, for utilizing automated searches to locate exemplars for further comparison, and for conducting latent print examinations.

Section 5 addresses written reports that summarize and document the results of friction skin impression examinations. Best practices in report writing and documentation increase the likelihood that the evidence is scientifically accurate and will be used appropriately in the administration of criminal justice. The section describes the purposes and value of reporting and documenting examinations and makes suggestions regarding the content of these materials. Appendices provide examples of sample reports.

Section 6 discusses trial and pretrial communications from the expert to lawyers, judges, and juries. It reviews the more important legal rules and principles that apply to these activities and surveys the types of testimony that might be provided at trial.

Section 7 focuses on the conditions under which latent print work is performed that can affect quality in the latent print examination process. It considers issues such as scheduling, lighting, workstations, interruptions, and workplace design.

Section 8 reviews the current status of education and training for latent print examiners, requirements and evaluation criteria, and curricula. It makes recommendations for training and educational programs to improve quality and accuracy in latent print analysis and reporting.

Section 9 focuses on the role of management in developing and maintaining the system for producing high-quality results. It reviews the components of a quality organization focused on latent print analysis. These include management, personnel, accreditation, certification, proficiency testing, and a systems approach to error identification and mitigation. It recommends actions that managers and the latent print community should take to create or maintain quality latent print units.

Section 10 summarizes the most important parts of the preceding sections. It draws the recommendations from Sections 3 through 9 into categories that may be helpful for latent print examiners, managers, research funding agencies, researchers, policymakers, and jurists. An appendix lists all formal recommendations in order of their appearance in this report.

Although this report explicitly addresses only the procedures for performing a latent fingerprint examination and communicating the results, much of the analysis and many of the recommendations are applicable to other forensic science disciplines. Issues of cognitive bias, standardization of procedures, documentation of examinations, working conditions, error detection and correction, and accuracy in testimony—among many others—cut across the forensic sciences. By identifying and managing the human factors issues relevant to latent print analysis, the latent print community not only can enhance the quality and accuracy of its contributions to the justice system but also can set an example for other forensic disciplines. The Working Group hopes that this report will assist in this effort.

4. Contributors to This Report

The Expert Working Group on Human Factors in Latent Print Analysis

The Working Group relied upon the contributions of many individuals. The opinions presented over the course of the Working Group's deliberation reflect personal experiences and research. The views in this report do not express the official positions of the institutions with which the members are affiliated.

David H. Kaye, JD, MS, (Editor in Chief) Distinguished Professor and Weiss Family Scholar, Dickinson School of Law and Graduate Faculty Member, Forensic Science Program, Eberly College of Science, Pennsylvania State University

Thomas Busey, PhD, (Editorial Committee) Professor, Department of Psychological and Brain Sciences, Indiana University

Melissa R. Gische, MFS, (Editorial Committee) Physical Scientist/Forensic Examiner, Latent Print Operations Unit, Federal Bureau of Investigation Laboratory

Gerry LaPorte, (Editorial Committee) Forensic Policy Program Manager, National Institute of Justice

Colin Aitken, PhD, Professor of Forensic Statistics, School of Mathematics, University of Edinburgh

Susan Ballou, MS, Law Enforcement Standards Office, National Institute of Standards and Technology

Leonard Butt, Chair, Scientific Working Group on Friction Ridge Analysis, Study and Technology

Christophe Champod, PhD, Professor, Institut de Police Scientifique, École des Sciences Criminelles, Université de Lausanne

David Charlton, PhD, Surrey and Sussex Police Forensic Services, UK

Itiel E. Dror, PhD, University College London and Cognitive Consultants International

Jules Epstein, JD, Associate Professor of Law, Widener University School of Law

Robert J. Garrett, Past President and Chairman of the Board, International Association for Identification

Max M. Houck, PhD, Co-Chair and Principal Analyst, Anser

Edward J. Imwinkelried, JD, Edward L. Barrett, Jr. Professor of Law, Director of Trial Advocacy, University of California, Davis

Ralph Keaton, Executive Director, American Society of Crime Laboratory Directors/Laboratory Accreditation Board

Glenn Langenburg, MS, Forensic Scientist, Minnesota Bureau of Criminal Apprehension

Deborah A. Leben, MS, Lead Fingerprint Specialist, United States Secret Service, Department of Homeland Security

Alice Maceo, Forensic Lab Manager, Las Vegas Metropolitan Police Department Forensic Laboratory

Kenneth F. Martin, Detective Lieutenant (Retired), Crime Scene Services Section, Massachusetts State Police

Jennifer L. Mnookin, JD, PhD, Professor of Law, University of California, Los Angeles

Cedric Neumann, PhD, Assistant Professor, Department of Statistics and Forensic Science Program, Eberly College of Science, Pennsylvania State University

Joe Polski, Forensics Committee Member, International Association of Chiefs of Police

Maria Antonia Roberts, MS, Research Program Manager, Latent Print Support Unit, Federal Bureau of Investigation Laboratory

Scott A. Shappell, PhD, Professor, Department of Industrial Engineering, Clemson University

Lyle Shaver, Forensic Scientist Supervisor, Virginia Department of Forensic Science

Sargur N. Srihari, PhD, SUNY Distinguished Professor, Department of Computer Science and Engineering, State University of New York at Buffalo

Hal S. Stern, PhD, Professor, Department of Statistics, University of California, Irvine

David Stoney, PhD, Chief Scientist, Stoney Forensic, Inc.

Anjali Swienton, MFS, JD, Director of Outreach, National Clearinghouse for Science, Technology and the Law (NCSTL), Stetson University College of Law

Mary Theofanos, MS, Computer Scientist, Information Access Division, Information Technology Laboratory, National Institute of Standards and Technology

Robert M. Thompson, Program Manager, Forensic Data Systems, Law Enforcement Standards Office, National Institute of Standards and Technology

John Vanderkolk, Laboratory Manager, Indiana State Police Laboratory

Maria Weir, MA, Supervising Forensic Identification Specialist, Los Angeles County Sheriff's Department

Kasey Wertheim, MBA, Co-Chair, President, and CEO, Complete Consultants Worldwide, LLC

Staff

Melissa Taylor, Study Director, Law Enforcement Standards Office, National Institute of Standards and Technology

Mark D. Stolorow, Director, Law Enforcement Standards Office, National Institute of Standards and Technology

Jennifer L. Smither, Lead Editor, Science Applications International Corporation

Kathi E. Hanna, PhD, Consultant Writer and Editor

Shannan Williams, MPP, Program Assistant, Booz Allen Hamilton

Acknowledgements

The Working Group gratefully acknowledges the following individuals for their contributions to the development of this document.

Bruce Budowle, PhD, Executive Director, Institute of Applied Genetics, Professor, Department of Forensic and Investigative Genetics, University of North Texas Health Science Center

Mike Campbell, Training Coordinator, Ron Smith and Associates, Inc.

Yee-Yin Choong, PhD, Industrial Engineer, Information Technology Laboratory, National Institute of Standards and Technology

Sarah Chu, Innocence Project

Gislin Dagnelie, PhD, Associate Professor of Ophthalmology, Johns Hopkins University School of Medicine

Susanne M. Furman, PhD, Cognitive Scientist, Information Technology Laboratory, National Institute of Standards and Technology

Danny Greathouse, Former Special Agent, Federal Bureau of Investigation

Marc Green, PhD, Visual Expert Human Factors, Marc Green, Phd and Associates

Austin Hicklin, Noblis

James Johnson, Forensic Consultant, Contracted to United States Secret Service

Philip J. Kellman, PhD, Professor, Department of Psychology, University of California, Los Angeles

Jonathan J. Koehler, PhD, Beatrice Kuhn Professor of Law, Northwestern University School of Law

Kevin Lothridge, Chief Executive Officer, National Forensic Science Technology Center

Tamas Makany, PhD, Cognitive Psychologist

Stephen B. Meagher, Federal Bureau of Investigation Laboratory (Retired)

Ross J. Michaels, PhD, Supervisory Computer Scientist, National Institute of Standards and Technology

Ken Mohr, Senior Forensic Programmer/Planner, Crime Lab Design

Keith Morris, PhD, Associate Professor/Director, Ming Hsieh Distinguished Professor, Forensic and Investigative Science, West Virginia University

Kamran Nouri, Senior Consultant, ABS Consulting

Ron Smith, President, Ron Smith and Associates, Inc.

Brian Stanton, MS, Cognitive Scientist, Information Technology Laboratory, National Institute of Standards and Technology

Lois Tully, Former Deputy Director, Office of Investigative and Forensic Sciences, National Institute of Justice

Lee N. Vanden Heuvel, Manager, Incident Investigation and Root Cause Analysis Services, ABS Consulting

Douglas A. Wiegmann, University of Wisconsin-Madison

David D. Woods, PhD, Professor, The Ohio State University

Reviewers

Individuals chosen for their diverse perspectives and technical expertise reviewed this report in draft form and provided constructive suggestions. These reviewers were not asked to approve or endorse any conclusions or recommendations in the draft report, nor did they review this final version before its release. Responsibility for the final content of this report rests with the members of the Working Group.

John P. Black, Senior Consultant, Ron Smith and Associates, Inc.

Deborah A. Boehm-Davis, George Mason University

David L. Grieve, Illinois State Police (Retired)

Austin Hicklin, Noblis

Kevin Lothridge, Chief Executive Officer, National Forensic Science Technology Center

Jennifer S. Mihalovich, F-ABC, Criminalist III, Oakland Police Department Criminalistics Division

Roger C. Park, James Edgar Hervey Distinguished Professor of Law, U.C. Hastings College of Law, San Francisco

Peter Peterson, PhD, Physical Scientist/Forensic Examiner, Federal Bureau of Investigation

Laura Tierney, Certified Latent Print Examiner

Mark L. Weiss, PhD, Division Director, Behavioral and Cognitive Sciences, National Science Foundation

Sandy Zabell, Professor of Mathematics and Statistics, Northwestern University

SECTION 1. THE LATENT PRINT EXAMINATION PROCESS AND TERMINOLOGY

Introduction

The conventional procedure for associating impressions of friction ridge skin by a latent print examiner involves four phases known as Analysis, Comparison, Evaluation, and Verification (ACE-V). This section describes the ACE-V process, notes some of its limitations, identifies areas where human factors should be considered, and defines certain terms used throughout this report.

BOX 1.1. TERMINOLOGY

ACE-V: An acronym for Analysis, Comparison, Evaluation, and Verification. The ACE-V process is described in section 1.1.

Bias and *error:* Defined and discussed in section 1.2.

Exemplar or *known prints:* Prints deliberately collected from an individual, usually fingerprints. Exemplar prints can be collected electronically or by using ink on paper cards. Exemplars may be called *ten-prints* when impressions of all ten fingers are taken. Exemplar prints collected during criminal arrests normally include one rolled (from one side of the nail to the other) print of each finger pad and a plain or slap impression of each finger.

Focal point: A small region containing distinguishing features within a print.

Forensic service provider: A laboratory or unit that examines physical evidence in criminal matters and provides testimony and reports about the examination findings. In this report, the term is used interchangeably with *agency*.

Latent print: Unintentional reproduction of the arrangement of ridges on the skin on the underside of the hands or feet made by the transfer of materials from the skin to a surface. This report uses the term *print* or *latent print* to denote impressions from all regions of friction ridge skin unless a more specific term such as "fingerprint" or "palm print" is used.

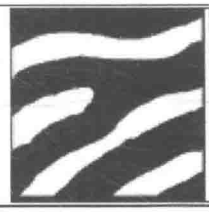
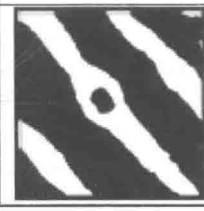
Latent print examination: The study of latent and exemplar prints to help determine the source of the latent print.

Because prints come from the friction ridge area of the skin on the hands or feet, latent print analysis is sometimes referred to as friction ridge analysis. As discussed below, "Analysis" and "Comparison" also have specialized meanings in "ACE-V;" therefore, this report generally uses the term "examination" rather than "analysis" or "comparison" when referring to the totality of work of latent print examiners.

Latent print examiner: The individual who conducts the latent print examination, also called latent print analyst.

Minutiae: Events along a ridge path, including bifurcations (points at which one friction ridge divides into two friction ridges), dots (isolated friction ridge units that have lengths similar their widths), and ridge endings (the abrupt end of ridges), as illustrated in Table 1.1.

Table 1.1. Illustrations of some friction ridge minutiae[8]

Bifurcation	Dot	Ridge Ending
		

1.1. The ACE-V Process

In broad strokes, a latent print examination using the ACE-V process proceeds as follows: *Analysis* refers to an initial information-gathering phase in which the examiner studies the unknown print to assess the quality and quantity of discriminating detail present. The examiner considers information such as substrate, development method, various levels of ridge detail, and pressure distortions. A separate analysis then occurs with the exemplar print. *Comparison* is the side-by-side observation of the friction ridge detail in the two prints to determine the agreement or disagreement in the details. In the *Evaluation* phase, the examiner assesses the agreement or disagreement of the information observed during Analysis and Comparison and forms a conclusion. *Verification* in some agencies is a review of an examiner's conclusions with knowledge of those conclusions; in other agencies, it is an independent re-examination by a second examiner who does not know the outcome of the first examination.

Figure 1.1, developed by members of the Working Group, describes the steps of the ACE-V process as currently practiced by the latent print examination community. The Latent Print Examination Process Map's purpose is to facilitate discussion about key decision points in the ACE-V process. This section briefly describes each step in ACE-V, although the sequence of some of the steps may vary in practice.

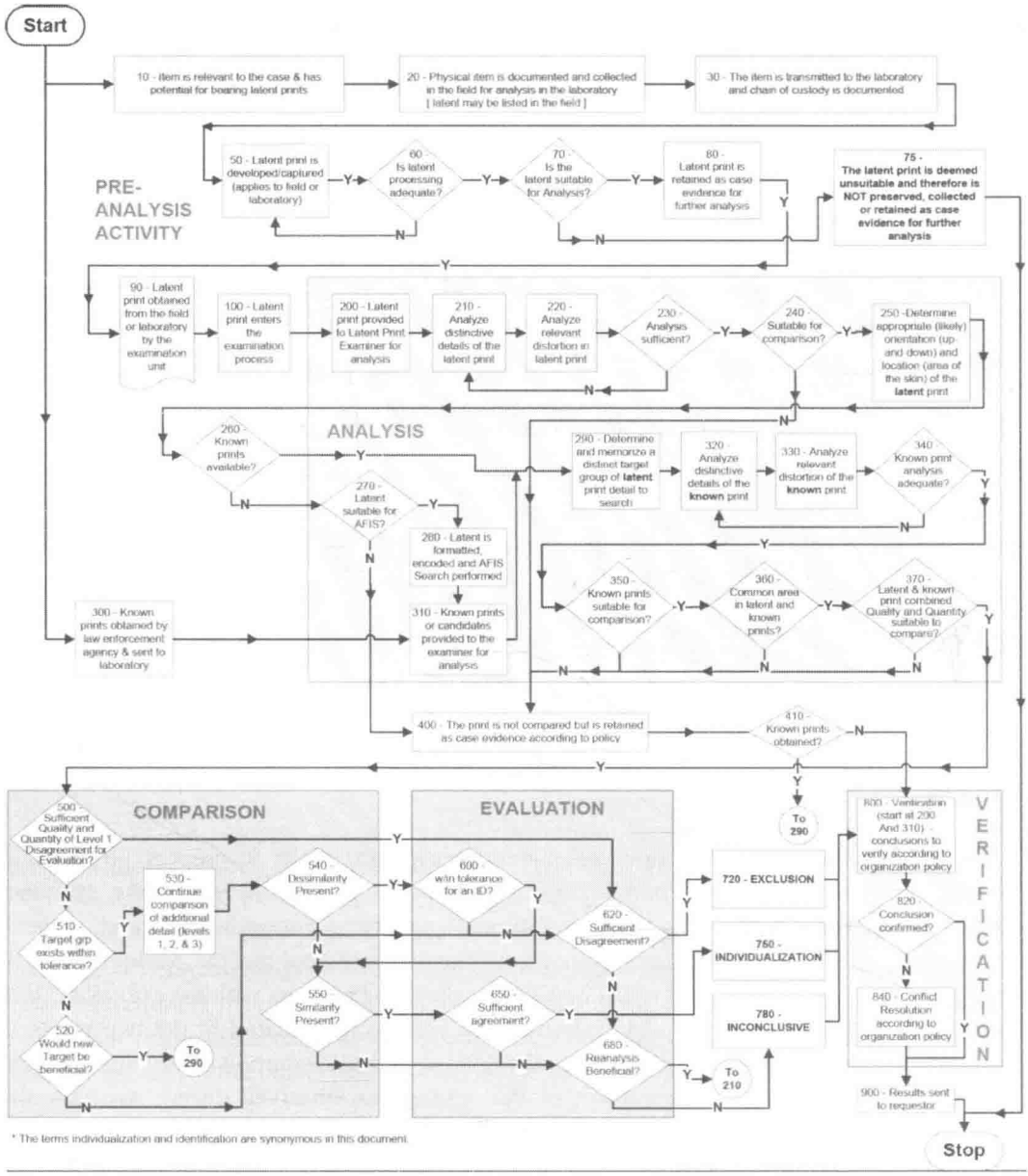


Figure 1.1. The Latent Print Examination Process Map.

1.1.1. Analysis

Analysis refers to the initial examination of a friction ridge impression. By inspecting the latent print, the examiner gathers information needed to decide whether it is useful for comparison.

To determine the print's value, the examiner considers three levels of detail in the impression. Level 1 Detail (L1D) is defined as "ridge flow."[9] Ridge flow often translates to a pattern type in a finger or palm, such as a loop, whorl, or arch formation (see Figure 3.1 in Section 3); ridge flow also includes other information such as relative curvature. Pattern types are class characteristics shared by many individuals. Level 2 Detail (L2D) is defined as "ridge

path."[10] L2D includes, but is not limited to, minutiae, such as ridge endings, bifurcations, or dots. Even the absence of minutiae in an area (called an "open field") can be significant and highly discriminating. Level 3 Detail (L3D) is defined as "ridge shapes." Ridge shapes include the edges of ridges (which may appear indented or protruded) and pores (the location of the center of the pore, not the size or shape, which can be highly variable within a source).[11] Section 3, which discusses interpreting information in latent prints, provides additional information on the three levels of detail and their use in the Analysis phase.

After considering the details and the distortion, the examiner judges whether the impression is suitable for a comparison. If the examiner concludes that the print lacks sufficient detail for a comparison, then the examination ends with the determination that the latent print is not suitable for a comparison. Otherwise, the examination moves into the Comparison phase.

1.1.2. Comparison

In the Comparison phase, the examiner compares the latent print to one or more exemplar prints. Information gathered in the earlier analysis of the latent print provides a starting point. A comparison of L1D might take only a split second, as when a whorl is present in the latent, but an arch is apparent in the exemplar. If there is no exclusion based upon L1D, then the examiner continues the comparison. If the examiner finds disagreement with respect to the target group that is too extensive to be the result of the distortion noted in the Analysis phase, the examiner will exclude the source of the exemplar as the source of the latent.

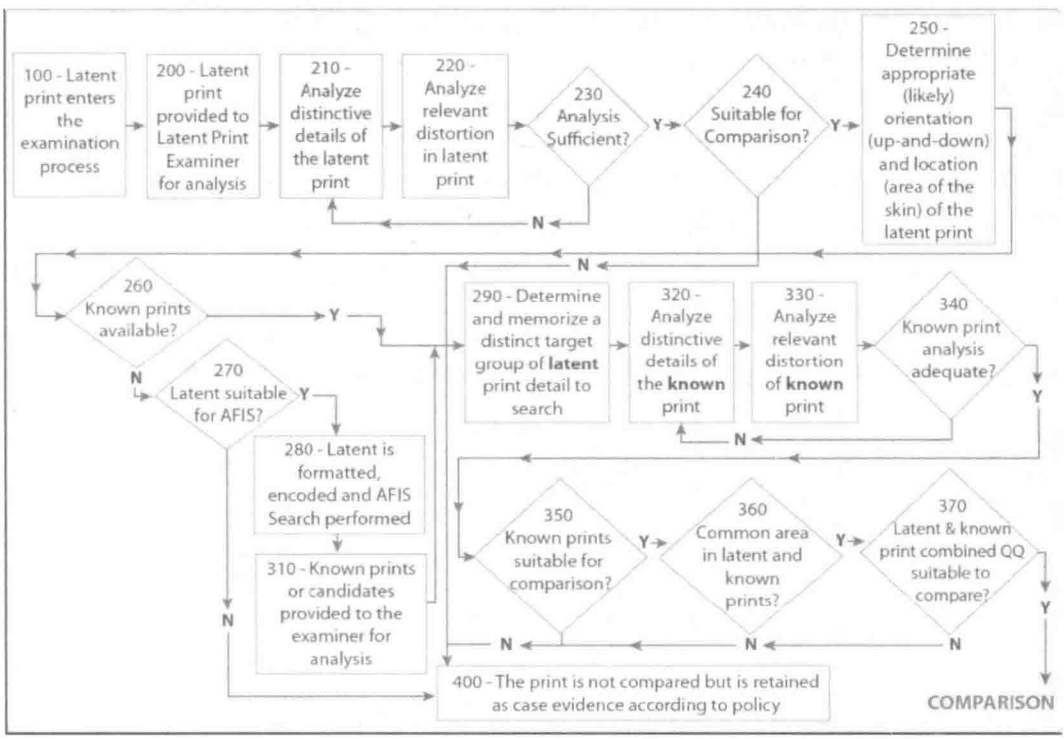


Figure 1.2. Analysis phase of ACE-V.