Recommendations for a Best Practices Model for Communication among Forensic Analysts and Crime Scene Processors in Multidisciplinary Criminal Investigations

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Recommendations for a Best Practices Model for Communication among Forensic Analysts and Crime Scene Processors in Multidisciplinary Criminal Investigations

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Abstract

Communications among crime laboratory analysts and on-scene processors of crime scenes are critical to the success of a criminal investigation that uses forensics. Communication can be problematic because of the different organizational goals of the multiple disciplines and/or organizations that may be involved in a criminal investigation that uses forensics. This paper explores the cause of these communication difficulties: and proposes a best practices model to facilitate communication among agencies. A communications network among all agencies participating in a criminal investigation that involves forensics will optimize the potential for positive organizational outcome goals for all agencies involved in such an investigation.

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CHAPTER I. INTRODUCTION

Forensic science is defined by the American Academy of Forensic Sciences as "the study and practice of the application of science to the purposes of law" (DeForest, Gaensslen & Lee, 1983). The all-encompassing term of forensic science embraces all scientific disciplines that are utilized in the investigation of crime. Forensic science includes, but is not limited to the disciplines of forensic medicine, toxicology, psychology, anthropology and practitioners of the examination of fingerprints, firearms, tool marks and questioned documents (Nickell & Fischer, 1998).

Forensic science did not burst upon the scene with the richness of the disciplines it now encompasses under the umbrella of its title: it evolved gradually. There was little advancement in the use of science in criminal investigations until the 1700s. In United States, scientific disciplines that applied the results of analysis of evidence in criminal investigations evolved independent of each other. The scientific disciplines that were used to assist in the investigation of criminal investigations were not formally organized in the form of crime labs in the United States, until the 1920s (Nickell & Fischer, 1998). Police use of the scientific disciplines to investigate crime became more organized with the formation police crime labs.

The use of science to assist in the investigation of criminal cases by police was advocated in earnest with the publishing of Hans Gross book *Manual for examining magistrates* in Germany in 1893. Gross advocated for using forensic medicine, toxicology, serology, ballistics, and anthropometry to assist in finding facts relevant to the criminal case being investigated. *Manual for examining magistrates* informs investigators in what cases, and in what manner scientific specialists may be useful (Gross, 1893). Gross is considered the father of criminal investigation.

Leland Kirk, who is considered to be the father of modern day crime labs, alluded to what is called crime scene processing today in his book *Crime Investigation* in 1953.

> " Perhaps the most important function of the police laboratory is to train the police investigators as to what constitutes physical evidence and how it is to be found, collected, preserved, and delivered to the proper laboratory investigator" (Kirk, 1953)

Crime scenes were examined and processed by police, the vast majority of whom had little training in science. Kirk recognized the need to train police in the usefulness of the results of scientific analysis of crime scene evidence in resolving crimes. Kirk also recognized an inherent tension between the scientific community and law enforcement regarding the utility of forensic. He wrote:

> " The laboratory investigator and the police officer must always keep in mind that they are not competitive but complementary in their functions. The laboratory cannot produce unless the officer makes it possible, and the officer can solve many more crimes if he utilizes the laboratory to the fullest extent" (Kirk, 1953)

The issue of the competitive relationship between police and laboratory analysts still exists today. This potentially competitive nature of this relationship can have a negative affect on communication between police and laboratory analysts. These communication issues may affect the outcome of a criminal investigation.

A quality crime scene process involves identification, documentation, collection and preservation of all physical evidence relevant to the crime: pattern, conditional, transient, transfer and associative. There is a higher probability that accurate interpretations of evidence will be

accomplished and the case will be resolved if crime scene process procedures are adhered to. Clearance rates for offenses with physical evidence analyzed were about three times greater than cases where physical evidence was not used (Peterson, Hickman, Strom & Johnson, 2013).

Practices and guidelines regarding the collection and analysis of forensic evidence are fragmented in the United States. Crime scene investigators have varying levels of training and experience. Some forensic analysis might be done by police officers with no scientific training or credentials. If evidence is mishandled or improperly analyzed, a jury can be mislead, which may lead to a wrongful conviction (National Research Council of the National Academies, 2009).

The National Institute of Justice recognizes crime scene investigation as a forensic science discipline (National Research Council of the National Academies, 2009). Crime scene investigators are expected to be a jack of all forensic trades, having a general understanding of all the different forensics fields in order to properly collect evidence that is usable for the forensic laboratory scientist (Gardner, 2012). Evidence recovery and interpretation at the crime scene is the first step in a forensic investigation (National Research Council of the National Academies, 2009). No two scenes are exactly the same, so issues unique to a specific scene may very possibly arise. A team approach of representatives from various disciplines and organizations, such as: police, crime scene investigators, forensic scientists, medical examiners, attorneys and specialists from the academic world (e.g., entomologists, geologists, engineers, etc.) is recommended (Lee, Palmbach & Miller, 2001).

A lack of standards and proper training affects the quality of crime lab analysis of evidence from investigations (National Research Council of the National Academies, 2009). The quality of evidence affects the outcomes of future legal proceedings. Forensic evidence plays a

robust role in how police and prosecutors decide whether or not to proceed with a case. The collection of crime scene evidence is predictive of arrest. (Peterson, et al, 2013).

Practitioners in forensic science determined there was a need for standardization of working practices, a need to provide educational opportunities, encourage research and provide a forum for collaborations with colleagues. These practitioners formed professional organizations to determine what these standard working practice would be. The International Association for Identification (IAI) was founded in 1915. The IAI offers certifications in the disciplines under its umbrella (International Association for Identification (International Association for Identification, n.d.). The American Academy of Forensic Sciences (AAFS) was formed in 1948. (American Academy of Forensic Science, n.d.). The American Association of Crime Lab Directors (ASCLD) was formed in 1974. The purpose of the accreditation to ensure professionalism, competency and proficiency, and ensure clear communications (American Society of Crime Lab Directors, n.d.).

A properly examined crime scene investigation requires the flow of information from the scene to investigative personnel (Lee, Palmbach & Miller, 2001). Improved communication and collaborative efforts among investigators, crime lab analysts, and others involved in a criminal investigation are needed to enhance the use and value of physical evidence (Horvath & Meesig, 1996). There are recurrent themes identified regarding how the use of forensic science affects an investigation. These include: the value of evidence and uncertainty on the part of police personnel of the capabilities of forensic science, limited forensic training of investigators, and poor communication among crime laboratory and police personnel. Two studies were done in 1980s England, which were both highly critical of the poor relationship and collaboration between police and crime labs (Ludwig & Fraser, 2013). Findings were: forensic labs and police

must be sure that each is aware of the problems and requirements of the other (Touche, 1987). Police had limited knowledge of the role and use of forensic science. Effective collaboration was necessary to make informed judgments about the value of forensic science (Ramsay, 1987).

To obtain the maximum utilization of forensic science, integration and collaboration must reflect the objectives and goals of all parties involved. Horvath & Meesig (1996) suggest collaborative training for police that focuses on the value, utility and limitations of forensic science, and the development of training programs, which cover the entire investigation. This training also includes articulating the different roles of all participants in a forensic investigation.

The exchange of information helps both parties perform their jobs and contributes to positive outcomes in the criminal justice system. Continued exchanges develop a sense of trust between organization participants. The exchange of information is facilitated by 'link pins' (i.e., networkers): individuals who have credibility in their own as well as other agencies organizations (Stojkovic, Kalinich & Klofas, 2015).

Exchange theory can serve as a theoretical foundation for this continued exchange of information, that if continued develops trust among organization participants. Forming exchange networks that circumvent the formal structure economizes on effort, time and resources, by cutting down on the number of transactions. This facilitates shared information (Stojkovic, Kalinich & Klofas, 2015).

The best practices model of crime scene processing and analysis of evidence presented in this paper would be four pronged. First, increased training for police focusing on the role and use of forensic evidence (Kirk, 1974; National Research Council of the National Academies, 2009; Gardner, 2012; Horvath & Meesig, 1996; Lee, Palmbach & Miller, 2001). Second, prior to scene processing or analysis, there would be training of all involved personnel to include: cross

training of individuals in the various organizations that are involved in crime scene processing and forensic evidence analysis that stressed the objectives and goals of the various participating organizations and explanations of the different roles of participants in the forensic investigation (Kirk, 1974; National Research Council of the National Academies, 2009; Lee, Palmbach & Miller, 2001; Touche, 1987; Horvath & Meesig, 1996; Gardner, 2012; Ramsay, 1987) Third, there would be an emphasis on certifications of forensic personnel (i.e., both crime lab and police) in their respective disciplines: using standards from existing professional organizations, which have scientific working groups, such as the IAI and the AAFS. Crime labs would be required to be ASCLD certified (National Research Council of the National Academies, 2009). Fourth, also included would be the development of communication channels among participating agencies in a forensic investigation that used rational choice theory, exchange theory, and social networking theory and analysis as its foundation. Exchange theory in practice would serve to facilitate communications among various agencies and cut through red tape (Kirk, 1953; Lee, Palmbach & Miller, 2001; Horvath & Meesig, 1996; Ludwig & Fraser, 2013; Touche, 1987; Ramsay, 1987; Stojkovic, Kalinich & Klofas, 2015).

This paper addresses issues that currently exist in the interface of police investigation practices and the crime lab practices. Failure to utilize science in criminal investigations affects clearance rates of crimes, decisions regarded whether police proceed with referral of charges or prosecutors file charges. The foundational issue is lack of effective communication between police and forensic analysts. These communication issues frequently result in from a lack of corroboration between police and the scientific community. Corollary and related issues that affect communication are police training in the role and use of forensic evidence, the structure

and organizational goals of involved agencies, and the lack of certification and accreditation standards required by agencies participating in forensic investigations.

Research Problem

This research will present a literature review that focuses on the historical development of police criminal investigation and the use of science in forensic investigations. The evolution of the sciences, police criminal investigation and the use of forensic science in criminal investigations intersected at several points in time. This intersection resulted in communication issues among what disciplines that were experiencing parallel albeit different evolutions. The research problem that is central to this paper is the communication issues among organizations in the criminal justice system whose mission is frontline processing of crime scenes and the subsequent analysis of this evidence in crime laboratories. A best practices model will be put forward that uses rational choice theory, social exchange theory and social networking theory and analysis as a theoretical framework for recommendations regarding the formation of communications networks among agencies that are involved in forensics investigations. These communication networks can facilitate successfully organizational outcome goals in the patchwork quilt world of diverse organizations. These organizations utilize diverse methodologies and together participate in forensic investigations. Successful communications will result in positive organizational outcomes for the multiple agencies that participate in a forensic investigation.

The FBI, ATF, Wisconsin State Crime Laboratory, New York State Police Crime Lab, Madison police department, Miami police department and Miami-Dade forensic services units will be compare and contrasted to illustrate the patchwork quilt nature of the organizational structures of agencies, accreditations and certifications that exist in the forensic community.

Finally, recommendations for an ideal communication network model will be suggested for use among agencies involved in forensic investigations that are multi-organizational in scope. The hope is that well designed, efficient communication networks among individuals employed in the great diversity of organizational structures that compromise the forensic investigation network can achieve positive outcome goals in context of the mission of their respective organizations.

CHAPTER II. LITERATURE REVIEW
DEVELOPMENT OF FORENSIC SCIENCE HISTORICALLY, IN CONTEXT OF LABORATORY ANALYSIS AND CRIME SCENE PROCESSING.

The development of a best practices model requires an exploration from a historical perspective of the origins and development of the use of science in criminal investigations. This exploration entails the evolution of both police and science practices and procedures. Understanding the evolution of the interface of police practices and scientific methodology puts a context on the interaction between police and scientists. This exploration highlights issues that hinder the most effective interaction of police and science. The suggested best practices model to improve these communication issues will be presented in a later section of this paper.

The Use of Science in Criminal Investigations

Forensic science is defined as the application of scientific practices to the recognition, collection, analysis, and interpretation of evidence for criminal or civil law or regulatory issues (Executive Office of the President's Council of Advisors on Science and Technology, 2016). Forensic science is a broad array of disciplines. These disciplines have a variety of techniques, methodologies, reliability, level of error, research, general acceptability, and published material. Some disciplines are laboratory based (e.g., DNA, toxicology, and drug analysis): others depend on interpretation of observed patterns (e.g., fingerprints, document examination, toolmarks, and bite marks) (National Criminal Justice Reference Service, 2009).

The development of forensic science has not been uniform throughout the world. Autopsies were being conducted in New England in the mid 1600s to support the conclusions of coroners regarding the manner and cause of death (Eckert, 1997). There was little advancement in the use of science in criminal investigations until the 1700s. Physicians investigating the cause of death of individuals used chemistry to determine if the person had been poisoned. Mathieu Joseph Bonaventure Orfila, who was French, is considered the father of forensic toxicology. Orfila was a physician and chemist who published on the subject of poisoning of deceased persons as early as 1813. He advocated routine testing of deceased persons for poisons (National Library of Medicine, n.d.). New York City changed from a coroners system to medicolegal death investigations in 1915. Prior to Dr. Norris being appointed Chief Medical Examiner, New York City did not have a system for accurately recording deaths. The coroners handled unnatural deaths. Individuals were appointed to the coroner positions, which were political in nature. These individuals were not required to have any minimal qualifications for the job. The system they worked in has been defined as corrupt (Blum, 2010). Dr. Charles Norris, the Chief Medical Examiner established a toxicology laboratory to assist in his investigations into cause and manner of death. This is considered the birthplace of toxicology in the United States (Eckert, 1997).

The beginning development of forensic sciences took place primarily in the late 1800s. Prior to this time little was done with the examination of physical evidence except for basic observations (Eckert, 1997). Dr. Edmond Locard of France was the first person to be identified as a criminalist. He worked in the areas of handwriting analysis and trace evidence. He assisted police with their investigations using his scientific analyses. Locard's "exchange principle" is foundational to crime scene processing. Locard's exchange principle posits that a criminal will

always bring some trace evidence to, and take some trace evidence from a crime scene (Eckert, 1997). Thus, the need to examine a crime scene to discover what has been brought to or taken from it. This evidence would need to be examined by a scientist to either include it or exclude the as being associated with the crime scene.

The disciplines of photography and fingerprint identification developed independently. Photography was in its infancy in the mid-1800s. It was used primarily to photographically document inmates. No training of practitioners was required. One of the earliest applied forensic sciences was photography. It was in use in 1859 to show juries photographs of signatures alleged to be forgeries (Eckert, 1997). Sir Francis Galton, who is considered the father of fingerprints, published his book *Fingerprints* in 1892 (Nickell & Fischer, 1998). Galton's book *Fingerprints* proposed a scientific classification system for fingerprints that is still in use in some form today (Tilstone, Savage & Clark, 2006).

Scientific Methodology

Scientific methodology has two components: general principles, which are applicable to all disciplines and specialized techniques, used only in a specific discipline (Grauch, 2003). Classical science is defined by hypothesis testing: the scientist proposes a hypothesis (e.g., the bullet was fired from this gun), performs experiments to test the hypothesis, and obtains results that confirm or refute the hypothesis. The scientific method is a framework to test the hypothesis. The scientist can never prove the hypothesis, but can perform experiments to disprove it, in which case he disproves the null hypothesis (i.e., he cannot prove the gun did not fire the bullet). These results lead to the conclusion that the hypothesis is true (i.e., the bullet was fired from this gun). Experimental results have no standing until they are peer reviewed, are reproduced, and the

results confirmed. The scientist can then interpret the data from the experiment and articulate a conclusion regarding the results (Inman & Rudin, 2001).

Scientists continually observe, test, and modify their respective bodies of knowledge. In the laboratory a scientist can control and vary conditions to better understand factors that influence certain outcomes. Studies are designed to reduce errors. The scientist attempts to be as free from bias as possible. The results of experiments are shared with peers. In sharing these results, the scientist must avoid conflicts of interest. New methods must be validated to determine their reliability. This validation process is beyond the scope of this paper (National Criminal Justice Reference Service, 2009).

Legitimacy Issues Regarding the Use of Forensic Science

Many forensic analyses, such as toolmark and bitemark examinations, have not received the same rigorous review as other sciences. These less rigorous examinations were developed in crime laboratories to assist in the investigation of crimes. The more procedurally rigorous disciplines such as DNA were not subject to reliability testing before being used in forensic applications, beginning in 1986. Fingerprint analysis is being questioned as an infallible application. The reliability question regarding fingerprints is not a matter of uniqueness, but a matter of records management of recorded fingerprint files. Forensic sciences that examine the individualization of the comparison of known and unknown evidence (e.g., footwear and tire impressions, tool and firearms, and handwriting) have been criticized for not submitting their work product for peer review (National Criminal Justice Reference Service, 2009).

The integrity of the crime labs in which analyses take place has been criticized. Areas of criticisms of crime labs are lack of or lax standards, lack of quality control measures, lack of proper education and training, the potential for bias when arriving at conclusions regarding

examinations, error rates, insistency that forensic methodologies are perfect and produce no errors (National Criminal Justice Reference Service, 2009).

In "Report to the President, forensic science in criminal courts: ensuring scientific validity of feature-comparison methods" (2016), the President's Council of Advisors on Science and Technology (PCAST) reported that there are two gaps in forensic science that need to be addressed: (1) the need for clarity about the scientific standards for the validity and reliability of forensic methods and (2) the need to evaluate specific forensic methods to determine whether they have been scientifically established to be valid and reliable. The gaps that need to be addressed are "feature-comparison" methods: specifically methods for comparing DNA samples, bitemarks, latent fingerprints, firearm marks, footwear and hair (Executive Office of the President's Council of Advisors on Science and Technology, 2016)

The nature of forensic science might tend towards an artistic or intuitive approach. Facts in cases are often few. The results of analyses are rarely textbook. Analysts might tend to fill these gaps. Recognizing that this may happen has resulted and continues to result in rigorous review of procedures by the scientific community to counter these tendencies (Inman & Rudin, 2001). Professional associations such as the American Academy of Forensic Science (AAFS), International Association for Identification (IAI), Law Enforcement and Emergency Services Video Association International (LEVA) and the American Association of Crime Lab Directors (ASCLD) form scientific working groups (SWGs) that address what they perceive to be actual or potential procedural, methodological or legitimacy issues in their respective forensic disciplines and crime laboratories in general. These working groups develop best practices suggestions and develop training opportunities for those engaged in those disciplines.

The quality of evidence affects the outcomes of future legal proceedings. Albeit DNA evidence is powerful linkage as well as exclusionary evidence, DNA evidence that is not properly recognized, documented, collected and preserved will be of no value to a criminal investigation (Lee & Ladd, 2001). Poor crime laboratory analyses in high profile cases such as O.J. Simpson and Jon Benet Ramsey can be traced back to poor forensic evidence collection procedures (Huff, 2004).

Accreditation and Certification Standards

Practitioners in forensic sciences determined there was a need for standardization of working practices, a need to provide educational opportunities, encourage research and provide a forum for collaborations with colleagues and formed professional organizations to determine what these standard working practice would be. Prior to the meeting of practitioners in the discipline of forensic identification in 1915, and the meeting of crime lab directors initiated by the FBI in 1973, there were no national best practices standards for forensic identification specialists and crime laboratories. Forensic practitioners worked within the accepted practices and methodologies of the disciplines they were involved with.

The International Association for Identification (IAI) was founded in 1915, when an Inspector from the Oakland Police Department sent letters to identification workers around the country asking them to meet in Oakland to further the aims of the identification profession. Among the disciplines included under the umbrella of the IAI are latent prints, blood pattern interpretation and crime scene investigation. The IAI states as objectives: to encourage research in scientific crime detection, education of its members, and standardization of working practices. The IAI offers certifications in the disciplines under its umbrella (International Association for Identification (International Association for Identification, n.d.).

The American Academy of Forensic Sciences (AAFS) was formed in 1948. This organization includes the disciplines of anthropology, criminalistics, digital & multimedia sciences, engineering sciences, jurisprudence, odontology, pathology/biology, psychiatry & behavioral science, questioned documents, and toxicology (American Academy of Forensic Science, n.d.).

The American Association of Crime Lab Directors (ASCLD) was formed in 1974, with the FBI being the initiating organization for the formation of ASCLD. The purpose of the initial organizational meeting was to open channels of communication between crime labs around the nation, including the FBI. Results from these meetings included voluntary proficiency training, establishing standards or operation for crime labs, external peer review of work product, and a program of laboratory accreditation. The purpose of the accreditation was and is described is to ensure professionalism, competency and proficiency, and ensure clear communications (American Society of Crime Lab Directors, n.d.).

Crime laboratory directors held meetings for the nine years between 1973 and 1982, before requirements for ASCLD accreditation were finalized. In 1982, eight laboratories applied for ASCLD accreditation. By the end of 1982, 12 additional crime labs had applied for accreditation. Crime laboratories from other countries also made requests for ASCLD accreditation thus making the organization international in scope. As of September 7, 2016, 395 crime laboratories are accredited by ASCLD. The list of accredited laboratories includes 187 state laboratories, 131 local agency laboratories, 32 federal laboratories, 18 international (outside of the United States) laboratories, and 27 private laboratories (American Society of Crime Lab Directors, n.d.).

The Law Enforcement & Emergency Services Video Association International, Inc. (LEVA) was established in 1989. It is a non-profit corporation that deals with the disciplines of video production and forensic imaging. The organization is international in scope. The mission statement of LEVA addresses professional development through quality training and informational exchange. The areas of expertise under the umbrella of LEVA include video analysis, image analysis, in-car video systems, surveillance video equipment, crime scene and documentation equipment, training, and multimedia and production equipment (Law Enforcement & Emergency Services Video Association International, Inc. n.d.).

Crime Laboratories Use of Forensics to Investigate Crime

The years of 1920 through 1970 are regarded as years when practitioners in the forensic sciences were forming partnerships with law enforcement investigators (Tilstone, Savage & Clark, 2006). Criminalistics developed as a science in the 1920s, paralleling the recognition by larger police departments that they should have units specializing in highly technical examinations of evidence by skilled specialists (Eckert, 1997). The scientific disciplines that were used to assist in the investigation of criminal investigations were not formally organized in the form or crime labs, in the United States, until the 1920s (Nickell & Fischer, 1998). Prior to this time period, any scientific activity was used in a police investigation was based on the initiative of the officer in charge of the case (Eckert, 1997). The individual detective would seek out a scientist to assist in the analysis of evidence associated with a crime.

Technological and instrumentation advances increased the usefulness of forensic examinations in a crime lab setting. In the 1920's Calvin Goddard refined the process for comparing bullets markings. Prior to this time, firearms examinations were primarily nonscientific. Analyses moved to the level of science with the development of the comparison

microscope to examine fired bullets and casings. Prior to that time comparisons were done with the naked eye (Eckert, 1997). Albert Osborn developed the fundamental principles for questioned document examination in his book *Questioned Documents,* which was published in 1910. Alec Jefferies was the first to use DNA in a forensic application in 1985 (Nickell & Fischer, 1998).

The need for crime laboratories to exist was articulated at a federal level. The "President's Commission of Law Enforcement and Administration of Justice" in 1968 recommended that: "In every metropolitan area, the central city or the State should provide laboratory facilities for the routine needs of all the communities in the area. State or multistate laboratories and the FBI laboratory should continue to provide the necessary research to make available to all laboratories more sophisticated means of analysis" (National Criminal Justice Reference Service, 1968, pg. 122)

The Utility of Forensically Analyzed Evidence

A quality crime scene process involves identification, documentation, collection and preservation of all physical evidence relevant to the crime: pattern, conditional, transient, transfer and associative. There is a higher probability that accurate interpretations of evidence will be accomplished and the case will be resolved if proper evidence procedures are adhered to. The procedures that are the outline of most crime scene processing/investigation books and articles have their origins in the FBI documentation guidelines that were developed by Supervisory Special Agent (SSA) Dale M. Moreau at the FBI National Academy in Quantico, VA. The publication is entitled "Practical Suggestions Regarding Crime Scene Administration and Management" (Moreau, n.d.). The approach has 12 steps, which will not be elaborated on in this paper. Clearance rates for offenses with physical evidence analyzed were about three times

greater than cases where physical evidence was not used (Peterson, Hickman, Strom & Johnson, 2013). A study of crime scenes processed by investigators trained in identifying physical evidence and crime scenes processed by investigators not trained to identify physical evidence showed crime scenes processed by trained investigators yielded more DNA and trace evidence. (Lingwood, Smith & Bond, 2015). The President's Commission of Law Enforcement and Administration of Justice (1968) reported that it should be an important goal of the police to develop the capacity to make a thorough search of the scene of every serious crime and to analyze the evidence so discovered" (National Criminal Justice Reference Service, 1968, pg. 118)

Utilization of analyzed evidence affects how a case is treated in the court system. Forensic evidence plays a robust role in how police and prosecutors decision regarding whether or not to proceed with a case. The collection of crime scene evidence is predictive of arrest. The analyzing of evidence is predictive of both referral for charges, charges being filed, conviction at trial, and sentence length (Peterson, et al, 2013);

Relationship between Crime Labs and Police regarding the Crime Scene Process

Leland Kirk, who is considered to be the father of modern day crime laboratories, alluded to what is called crime scene processing today in his book *Crime Investigation* in 1953.

> " Perhaps the most important function of the police laboratory
> is to train the police investigators as to what constitutes
> physical evidence and how it is to be found, collected, preserved,
> and delivered to the proper laboratory investigator" (Kirk, 1953)

Crime scenes were examined and processed by police, the vast majority of whom had little training in science. Kirk recognized the need to train police in the usefulness of the results of

scientific analysis of crime scene evidence in resolving crimes. Kirk also recognized an inherent tension between the scientific community and law enforcement regarding the usefulness of forensic evidence. He went on to write:

> " The laboratory investigator and the police officer must always keep in mind that they are not competitive but complementary in their functions. The laboratory cannot produce unless the officer makes it possible, and the officer can solve many more crimes if he utilizes the laboratory to the fullest extent" (Kirk, 1953)

Competitiveness

The multiple disciplines that constitute what is collectively called forensic science places an emphasis on laboratory procedures that are rigorous: including methodologies, reliability, level of error, research, general acceptability, and published material. In the overall outcomes picture, laboratory procedures will be affected by the quality of the evidence analysts have to analyze: evidence that was collected by law enforcement personnel. Police investigation methodology does not have a similar rigor. The current model for police investigation is to collect and examine evidence to the point where investigators decide upon a prime suspect (National Criminal Justice Reference Service, 2007).

An item of evidence cannot be analyzed if it has not been collected at the crime scene. The evidence item can only be analyzed in the condition in which the laboratory received it. Some evaluation and analyzing of evidence must be done in the field, because the analysis is time sensitive. Therefore, more positive outcomes may result if the crime laboratory educated police regarding what is evidence, and how personnel working in the field identify and conduct a field analysis if the analysis is time sensitive (Almog, 2006).

Training

Education in various forensic sciences varies from on-the-job training in small law enforcement department's crime laboratory to years of specialized training, such as in the field of forensic pathology (Eckert, 1997). A lack of standards and proper training affects the quality of crime lab analysis of evidence from investigations (National Research Council of the National Academies, 2009). The quality of evidence affects the outcomes of future legal proceedings.

Forensics laboratory processes have become increasingly more specialized and complex over the years. As a result, labs have become increasingly isolated from the crime scene and the investigation (Ribaux, Baylon, Lock, Delemont, Roux, Zingg & Margot, 2015). Crime laboratory analysts must analyze and examine evidence in context of accepted practices, procedures and methodologies of their respective disciplines. Police are not trained in these crime laboratory accepted practices, procedures and methodologies that analyst must adhere to.

The investigative process of police

The development of criminal investigation coincided with the industrial revolution and the resultant shift of population from rural to urban environments. In 1750 England, Henry Fielding established a non-uniformed volunteer group, the Bow Street Runners, to catch thieves. In 1829, the English Parliament passed the Metropolitan Police Act that created a police force in London. Some of these Metropolitan police officers were relieved from patrolling in uniform to investigating crime. In 1842, a detective branch was formed in Scotland Yard (Newburn, Williamson & Wright, 2007).

In the United States, in 1833, America's first paid police force was created in Philadelphia. Before 1850, few American cities had police forces. By 1880 most major American city had a police force (Newburn, Williamson & Wright, 2007).

Reliable detectives were needed for several reasons: (1) corruption was common in big city police departments: (2) the jurisdiction of sheriffs' offices and municipal officers was limited: (3) there was little information sharing by law-enforcement agencies. Detective bureaus in municipal agencies were organized in 1845 in the New York City Police Department. The beginnings of a Federal Police Agency can be trace to 1908, with what would eventually become the FBI (Newburn, Williamson & Wright, 2007).

Until the latter part of the 20th century, police relied on such tools as catching the perpetrator in the act, eyewitness accounts, suspects being found with fruits of the crime and confessions to investigate crimes (Lambert, Hogan, Nerbonne, Barton, Watson, Buss & Lambert, 2007). Prior to this time period, any scientific activity that was used in a police investigation was based on the initiative of the officer in charge of the case (Eckert, 1997).

A study presented in 1975 for the U.S. Department of Justice reported that an investigators time is largely spent in reviewing reports, documenting files, and attempting to locate and interview victims on cases that experience show will not be resolved. The single most important determinant of whether or not a case was solved was the information the victim gives to the initial responding officer. If the information that identifies the perpetrator is not obtained at the time the crime is reported, the perpetrator will probably not be identified. Most cases are solved as a result of routine police procedures (Greenwood & Petersilia, 1975).

Horvath, Meesig & Lee did a follow-up study to the Rand study of Greenwood & Petersilia (1975), in 2001. They found that the proportion of investigators remained constant at about 16% of sworn agency personnel. Most investigators did not receive any pre-appointment formal, classroom training. It was typical for police agencies to rely on on-the-job training with some attendance at post-appointment seminars. Much of the investigation management process

was still manually driven rather than computerized. Patrol officers, in spite of the recognized role they play in investigations, remained limited in their role in the investigative process. They were provided little or no training beyond what they receive in basic academy training. Two issues remained unchanged as foundational to criminal investigation: first, the role of the pubic as primary provider of crime information to the police; second, the role of the patrol officer in solving crimes.

The police investigative function seems to be isolated from the two major trends of community policing and the patrol officers' role in investigations. Those who give investigators guidance appeared to be preoccupied with internal organization and management issues. Investigators used case screening and case solvability factors to weed out hard-to-solve or less serious cases that may never be investigated. Not dealing directly with the public, as in community policing, or directly with patrol officers as part of the investigative process could be making the investigative process more difficult (Horvath, Meesig & Lee, 2001).

The current model for police investigation is to collect and examine evidence to the point where investigators decide upon a prime suspect. The investigation then focuses on evidence that confirms the investigators decision on who committed the crime. The priorities of this model efficiency oriented. There are several critiques of this model: it inhibits thorough collection of evidence, may promote focus on one suspect to the exclusion of all others, and it may increase the risk of a wrongful conviction (National Criminal Justice Reference Service, 2007)

Early Police use of Forensics to Investigate Crime

Law enforcement use of science by police began in Europe. In Germany, Hans Gross advocated for using forensic medicine, toxicology, serology, ballistics, and anthropometry to assist in finding facts relevant to the criminal case being investigated. Gross' book *Handbook on*

Criminalistics for the Examining Magistrate, was written in 1893 to describe for investigators what could be expected from forensic science (Tilstone, Savage & Clark, 2006). A disciple of Gross, Edmond Locard, posited a concept that was to become foundational to crime scene processing: Locard's Exchange Principle. This principle posits that when a criminal enters a crime scene, he both brings something to the crime scene and takes something away from the crime scene. This "something" is trace evidence: a hair, fiber, footwear impression (Nickell & Fischer, 1998). Locard's Exchange principle is foundational in both crime scene processing and scientific analysis of evidence related to criminal investigations.

Police Crime Laboratories

Police use of the scientific disciplines to investigate crime became more organized with the formation of police crime labs. The Los Angeles Police Department forensic laboratory was established by August Vollmer in 1923. The Los Angeles County Sheriff's Department Crime Lab was established in 1930. The California State Crime Lab was established in 1931. The first national lab was established in 1929 in Chicago: the Scientific Crime Detections Laboratory. The Chicago lab was a private laboratory set up at Northwestern University Law School. Calvin Goddard, who did the firearms examinations for the St. Valentine's Day massacre, was the Director (Eckert, 1997). The FBI established a fingerprint file in 1924. The FBI crime lab was established in 1930 (Nickell & Fischer, 1998). Thus, autonomous crime lab agencies were established across the geographical United States, at local, state and national levels. Up until that time, individual scientists did most scientific investigations. These individuals were the only source of scientific expertise in the community (Eckert, 1997).

Twentieth Century Police use of Forensics

Until the 1960s, the use of scientific activity in a police investigation was based on the initiative of the officer in charge of the case (Eckert, 1997). During the 1960s and 1970s, very little physical evidence was used to solve crime: eyewitnesses and suspect interrogations were relied on (Horvath & Meesig, 1996). Brian Parker (1963), found in a survey that physical evidence was used in about 1% of criminal cases. Police found physical evidence in about 88% of crime scenes. Most of this evidence was neither collected nor submitted to a crime laboratory for examination.

Greenwood & Petersilia (1975), in a report for the U.S. Department of Justice, Law Enforcement Assistance Administration, reported that: most police departments collect more physical evidence than can be productively processed. The report recommends that allocating more resources to increasing the processing capabilities of departments can lead to more identifications than some other investigative actions. A recommendation of the 1975 report was that fingerprint-processing capabilities should be strengthened. The report also recommended that communication links should be devised between investigator and fingerprint specialist to help motivate and facilitate the reciprocal exchange of information between these two parties. The fact that scientific activity was used in a police investigation was based on the initiative of the officer in charge of the case (Eckert, 1997).

Evidence was not collected or submitted for several reasons. A patrol officer or detective might decide not to request a trained crime scene technician to respond to the scene to identify, document, collect and preserve evidence. Evidence technicians responded to crime scenes but did not collect evidence that was present. These decisions were not only based on the presence of evidence, but included an assessment on the part of technicians and investigators that the

evidence present did not merit collection or examination. Most assessments of the merits of collecting evidence were made based on: perceived legitimacy of victims, the seriousness of the crime, and the condition and potential utility of the evidence. Evidence submitted to a crime laboratory would not be examined unless requested by the investigator in charge of the investigation (Peterson, 1974).

The President's Commission of Law Enforcement and Administration of Justice (1968), was critical of the lack of use of forensic evidence by police. In the final report, the commission reported:

> "Scientific crime detection is at present a limited tool. There is a shortage of policemen who are skilled the collection, analysis and preservation of evidence. Only the biggest and best-run departments have personnel with sufficient technical training to search a crime scene effectively and have laboratory facilities to make use of the fruits of such searches" (National Criminal Justice Reference Service, 1968, pg. 97).

The Commission found that police are not making the most of their opportunities to obtain and analyze physical evidence.

> "There is a lack of skilled evidence technicians in every sized department. Evidence might greatly help to establish a case for or against a suspect. Many patrolmen and detectives have no more than a rudimentary idea of how to search a crime scene.
>
> The Commission recommended that it should be an important goal of the police to develop the capacity to make a thorough

> search of the scene of every serious crime and to analyze the evidence so discovered" (National Criminal Justice Reference Service, 1968, pg. 118)

There are recurrent themes identified regarding how the use of forensic science affects an investigation. These include: the value of evidence and uncertainty on the part of police personnel of the capabilities of forensic science (Ludwig & Fraser, 2013). Even when physical evidence is available, police detectives seldom see it as having any fundamental value (Horvath & Meesig, 1996). Detectives use physical evidence primarily as leverage to in an interrogation of a person of interest, in order to clear the case by confession.

Horvath, Meesig & Lee (2001), in a follow-up study to Greenwood & Petersilia (1975), found that two areas that most directly influenced agency policy/practice were computerized databases and forensic science applications. Access to and timeliness of services supported by crime laboratories continued to be a problem for many agencies. New forensic techniques and technologies had been developed, without increases in personnel and training. Even with advances in forensic sciences since 1975, clearance rates of crimes remained stable.

Current Practices and Guidelines

There is no single standard across the U.S regarding who will collect and preserve evidence found at crime scenes: civilians trained in forensics, first responding officers, or sworn officers trained in forensics all perform these tasks (Pazarena, 2015). Practices and guidelines regarding the collection and analysis of forensic evidence are fragmented in the United States. Crime scene investigators have varying levels of training and experience. Some forensic analysis might be done by police officers with no scientific training or credentials (National Research Council of the National Academies, 2009).

The National Institute of Justice recognizes crime scene investigation as a forensic science discipline. Crime scene evidence collectors can be lab personnel, uniformed officers, detectives, criminalists, coroners and hospital personnel (National Research Council of the National Academies, 2009).

Crime scene investigators are expected to be a jack of all forensic trades, having a general understanding of all the different forensics fields in order to properly collect evidence that is usable for the forensic laboratory scientist (Gardner, 2012). It is imperative that the investigator must understand enough about scientific analytical procedures to not compromise those analyses by their actions at the scene (Inman & Rudin, 2001)

Police Training Issues in the Use of Science in Investigations

Evidence recovery and interpretation at the crime scene is the first step in a forensic investigation (National Research Council of the National Academies, 2009). The results of a study of crime scenes processed by investigators trained in identifying physical evidence and crime scenes processed by investigators not trained to identify physical evidence showed crime scenes processed by trained investigators yielded more DNA and trace evidence. Fingerprints were more likely to be recovered at scenes that were processed by individuals not trained in crime scene processing. (Lingwood, Smith & Bond, 2015).

A properly examined crime scene investigation requires adequate training, both current and ongoing, experience on the part of crime scene investigators, and managed coordinated team effort (Lee, Palmbach & Miller, 2001). Police had limited knowledge of the role and use of forensic science. Effective collaboration was necessary to make informed judgments about the value of forensic science (Ramsay, 1987).

There are recurrent themes identified regarding how the use of forensic science affects an investigation. These include: the value of evidence and uncertainty on the part of police personnel of the capabilities of forensic science, limited forensic training of investigators (Ludwig & Fraser, 2013). Strom & Hickman (2010), found in a survey of 2,000 law enforcement agencies over 2002-2007 found agencies had not submitted evidence to be examined in 14% of unsolved homicides, 18% of unsolved rapes, and 23% of unsolved property crimes. There were good reasons why evidence was not submitted, such as charges dropped or guilty pleas. There were situations where untrained personnel did not appreciate the potential of unexamined evidence in cases without suspects, where prosecutors had requested analysis, or crime lab backlogs had discouraged police from submitting evidence.

Legitimacy Issues that arise from flawed Crime Scene Processing

Inappropriate evidence collection and analysis can affect a criminal case outcome. If evidence is mishandled or improperly analyzed, a jury can be mislead, which may lead to a wrongful conviction (National Research Council of the National Academies, 2009). Exonerations of 340 individual: 144 cleared by DNA evidence and 196 by other means occurred between 1989 and 2003 (Gross, Jacoby, Matheon, Montgomery, & Patil, 2005).

The NIJ *Crime Scene Investigation: Guideline for Law Enforcement,* (2000, 2013) refers to an officer in charge of scene investigation, but does not clarify if that officer is a detective, or forensic investigator nor does it articulate the training that person should have. Ambiguity regarding who is the officer in charge of an investigation can affect investigation outcomes.

Public Expectations of Forensics

Current public opinion is that law enforcement uses forensic science to solve cases (Lambert et al, 2007). The CSI effect has affected public perceptions regarding the

presence or use of physical evidence by police. The television show CSI exaggerates and glamorizes forensic science. Schweitzer & Saks (2007) found that people who watch television programs regularly expect better science than what they are presented with in court. CSI viewers expect high-tech science and find low-tech science presented less convincing. This CSI effect increases the prosecutions burden. Maeder & Corbett (2015) reported jurors who perceived CSI as more realistic had more positive attitudes towards DNA evidence and were more influenced by presentation of DNA evidence at trial. Those who watched more television were less certain of the defendant's guilt.

Summary

In summary, the review of the evolution of science and police regarding criminal investigation shows the parallel development of two different occupational fields. The methodologies used in the two fields are different, but overlap in the area of forensic investigation. Science is the more rigorous field: Concerned with methodologies, reliability, level of error, research, general acceptability, and published material. Police criminal investigation is focused on collecting and examining evidence to the point where investigators decide upon a prime suspect (National Criminal Justice Reference Service, 2007). Forensically analyzed evidence is useful to criminal investigations.

The public expects there will be forensically analyzed evidence in court proceedings (Lambert et al, 2007). There is a higher probability that accurate interpretations of evidence will be accomplished and the case will be resolved if procedures are adhered to (Peterson, Hickman, Strom & Johnson, 2013). Moreau (n.d.) described the police crime scene process standard. Forensic science procedures are defined by standards related to each of the disciplines included under the umbrella of forensic science. The working relationship between police and crime

laboratories involves two-way communication. The full impact of scientific analysis cannot be achieved without communication. How to facilitate this communication is the focus of this paper.

CHAPTER III. THEORETICAL FRAMEWORK

Forensic scientists and police often collaborate during criminal investigations. The investigation of a crime can include participants who are employed by different agencies, both law enforcement and scientific laboratories. Because of this investigation dynamic, turf or territoriality issues will frequently arise. No one person: police officer, forensic scientist, detective, medical examiner or prosecutor can do their job without the cooperation of other participants in the investigation. A person in any of the cooperating agency positions can make either a disastrous mistake, or make and an outstanding contribution to the case at any step of the process (Fischer, 2004). Communication among participants can minimize mistakes and increase the probability of optimal work outcomes for all participating organizations.

Three theoretical frameworks will be put forward as a foundation upon which the best practices model that prioritizes communication among forensic scientists and law enforcement officers to achieve optimal and ethically sound investigation outcomes will be articulated. These theoretical bases are: Rational choice theory, and social exchange theory, and social networking theory and analysis.

Rational Choice Theory

Rational choice theory is borrowed from economics. Rational choice theory assumes that all action is rational in character. People calculate cost benefits of any action before deciding how to proceed. Rational choice theories assume that individuals pursue their goals efficiently (Green & Fox, 2007). The development of a communications network among the various

agencies participating in a criminal investigation will result in more efficient organizational work product outcomes for all organizations and disciplines involved. The outcomes may vary among agencies. The decisions agencies make to optimize their respective organizational goals are rational decisions.

The application of rational choice theory to social interaction is social exchange theory. Social exchange theory can serve as a framework to suggest how and what communication models may be structured and put into practice among different agencies to facilitate the best outcomes of all agencies involved, and the investigation as a whole.

Social Exchange Theory

George Homans (1961) posited a basic framework of social exchange theory. The assumptions of this theoretical framework were taken from behavioral psychology (Browning, Halcli & Webster, 2000). Homan (1974) articulated five propositions of human behavior: first, "The more often a particular action of a person is rewarded, the more likely the person is to perform that action" (Homans, 1974, pg. 16). Second, given that a past stimulus has resulted in a behavior that was rewarded: if a similar stimulus occurs at present the person is more likely to perform the rewarded past behavior (Homans, 1974, pg. 22-23). Third, the more value a person assigns to the task to be performed: the more likely it is he will perform the action (Homans, 1974, pg. 25). The last two propositions of Homan's theory are not relevant to the model presented in this paper.

Social exchange theory posits that worker A assists worker B, and B pays for the assistance of helping A in some way: not necessarily monetary. This assistance is typically in the form of information or help in cutting bureaucratic red tape. Large bureaucratic systems tend to pass on information slowly. Forming exchange networks that circumvent the formal

organizational structures economizes on effort, time and resources, by cutting down on the number of communication transactions. This facilitates shared information (Stojkovic, Kalinich & Klofas, 2015).

The exchange of information helps both parties perform their jobs. Continued exchanges develop a sense of trust between organization participants. The exchange of information is facilitated by 'link pins' (i.e., networkers): individuals who have credibility in their own as well as other agencies organizations (Stojkovic, Kalinich & Klofas, 2015).

Blau's social exchange theory (1964), argued that each face-to-face interaction of people involved a reciprocal exchange of reward. The actors engage in activities as a means of obtaining desired goals. All social activity involves some cost to the actor. A person for whom one has done a favor is expecting to return a service when the occasion arises. Blau assumes that people act rationally. Among Blau's social rewards were instrumental services and respect/privilege. Reciprocal social exchanges create trust and social bonds. Unilateral services create power and status difference, which are not conducive to information exchange (Blau, 1964).

Forensic investigation is a team investigation. Persons from various disciplines are brought together to investigate crimes (Fischer, 2004). The organizational outcome goals of agencies or disciplines participating in a criminal investigation will vary. The outcome goal of police will be criminal case resolution, which may involve either including or excluding a suspect. This inclusion or exclusion is based on a totality of circumstances of interpretations attached to the results of evidence that is analyzed in a crime laboratory. Outcome goals of the scientific disciplines within a crime laboratory will be analysis of items submitted by police within the policy, procedural, and regulation parameters of their respective disciplines.

In the context of social exchange theory: face-to-face interactions of employees from various agencies can result in all employees experiencing positive outcomes in context of what their organizations expect as work product. Face-to-face interaction is between individuals or small groups. The more often individuals experience positive outcomes: the more likely it is they will do what lead to the positive outcome. The behavior that leads to the positive outcome will become a practice that is repeated: because it is successful. The individuals from different agencies that are part of the process develop trusting, respectful relationships because they continue to experience positive outcomes.

The individuals involved in the communication channel that has developed are called "link-pins" (Stojkovic, Kalinich & Klofas, 2015). These individuals are part of a communications network that develops among the diverse agencies that are involved a criminal investigation. The smaller the number of individuals involved in this communication network, the more efficient they will be in accomplishing what may be their diverse organizational outcome goals. The smaller number of individuals in this communication network facilitates information exchange among diverse agencies (Stojkovic, Kalinich & Klofas, 2015).

Information exchange takes place in the context of social networks. Social exchange theory is associated with social network analysis theory.

Social Network Theory and Analysis

A social network consists of a set of entities (i.e., individuals, groups or organizations) that form relationships. These entities are distinct from one another and can be uniquely identified. The relationships are defined in context of pairs of entities. The pairs can be defined in terms of what attributes they have that are similar and what attributes are not similar. These networks involve interpersonal communications, institutional affiliation, collaborative task

performance, information sharing, training and mentorship. Social network analysis is useful to understanding the social processes involved in the dynamics of the entities that are part of it (Butts, 2008)

Academicians researching social networks formed the International Network for Social Network Analysis (INSNA) to facilitate interpersonal connections among people working in social networking analysis. Professional journals such as *Social Networks* were published to share information (Freeman, 2004). Crime laboratory scientists form the AAFS initiated group meetings that led to the formation of the ASCLD accreditation process. Similarly, networks of fingerprint identification specialists formed a social network that led to the formation of IAI. The IAI organized into areas of specialization: blood pattern analysis, crime scene, footwear examination, forensic art, forensic photography, forensic video and fingerprint identification. These areas formed scientific working groups (SWGs) that standardize terminology and define what are accepted working practices in their respective disciplines. These organizations formed networks international in scope.

Thus, communication among individuals from diverse organizations takes the form of networks in which information exchange can take place. Rational decisions can be made by the participants in these networks, which can result in positive outcomes in context of the organizations they are employed by.

CHAPTER IV. COMPARE AND CONTRAST THE CRIME SCENE PROCESSING AND FORENSIC ANALYSIS PROCEDURES OF SEVERAL AGENCIES

A comparison of federal, state and local law enforcement and crime laboratories can illustrate how diverse the arrangement of criminal justice organizational structures can be: albeit they are labeled under the umbrella of crime scene units and crime laboratories. The diversity of these organizational structures is illustrative of the challenges that are encountered by the

forensic community as a whole. Part of the challenge is to standardize procedures and terminology within the respective disciplines. Standardizing procedures within the respective disciplines is conducive to the adoption of standardized techniques, methodologies, reliability, level of error, research, and general acceptability of the various disciplines involved in a forensic investigation. Communication among these diverse organizations is a necessary condition of standardization within disciplines. Communication networks established using the theoretical framework presented could facilitate communication among diverse organizations involved in a forensic investigation.

The agencies compared and contrasted will be the Federal Bureau of Investigation (FBI), the Bureau of Alcohol, Tobacco, Firearms and Explosives Laboratories (ATF), the State of Wisconsin Crime Laboratory (WSCL), the New York State Police Crime Lab, the City of Madison Police Department and the combination of the City of Miami Police Department and the Miami-Dade Forensics Services Bureau.

Federal Bureau of Investigation Crime Laboratory and Evidence Response Teams

The FBI has both evidence response teams and a crime laboratory. In the lab, FBI staff establishes the priority of the evidence that is analyzed. The laboratory has a Research and Development program, which focuses on new forensics techniques, instrumentation and protocols. Their Research Partnership Program shares the new techniques and protocols with case-working examiners at state and local crime labs ((National Research Council of the National Academies, 2009; Federal Bureau of Investigation, n.d.). The FBI publishes a Handbook of Forensic Services that specifies what the lab's threshold for acceptance of cases (e.g. the lab does not accept evidence in thefts under $100,000, burglary cases, explosive incidents of unoccupied buildings). The manual also specifies what examinations the lab does,

and how the evidence associated with that case should be collected and packaged. This is an ASCLD accredited laboratory.

The evidence response team members are field Special Agents and contract employees who are trained at the FBI National Academy and also receive specialized advanced training outside the FBI Academy. Field responses by the FBI may be advisory in nature, and not a complete crime scene processing (Federal Bureau of Investigation, n.d).

Bureau of Alcohol, Tobacco, Firearms and Explosives Laboratories

The ATF is organized into four groups: the Forensic Science Laboratories in Atlanta, San Francisco, Washington D.C., and the Fire Research Laboratory. The ATF encourages but does not require certification of its lab personnel, which include: chemists, biologists, engineers, fingerprint specialists, firearm and tool mark examiners, and document examiners. The ATF is an ASCLD accredited laboratory (Bureau of Alcohol, Tobacco, Firearms and Explosives Laboratory, 2016). The ATF laboratories support the investigations of ATF investigators.

The field response of ATF certified explosives specialists (CES) involve investigating violations of federal explosives and firearms laws. These investigations include: bombings, explosives thefts, explosives-related matters relevant to the unlawful use, storage, manufacture and distribution of explosives (Bureau of Alcohol, Tobacco, Firearms and Explosives Laboratory: ATF Certified Explosives Specialist (CES), 2016). Federal, state and local investigators can request the national and international response team to investigate significant fire and explosion incidents. This response team was formed in 1978. The ATFs response team concentrates on large-scale incidents and more complex investigations (Bureau of Alcohol, Tobacco, Firearms and Explosives Laboratory: National an International Response Team, 2016)

State of Wisconsin Crime Laboratory

The State of Wisconsin Crime Laboratory has both forensic laboratory and field response capabilities. The crime scene field response unit is composed of crime laboratory analysts who are trained in-house regarding crime scene evidence identification, collection and presentation. The analysts who respond to crime scene assist police in the processing of crime scenes. These analysts take custody of critical evidence and submit it to the Wisconsin State Crime Laboratory. This field response unit responds to death investigations, officer involved shootings and clandestine graves excavations requests. The field response of the Wisconsin State Crime Laboratory may not be a total processing of the scene, but a partial field response to assist the requesting local law enforcement agency. Discussions between the agency of original jurisdiction and state crime laboratory personnel determine what the extent of the involvement of the crime laboratory will be. This laboratory is an ASCLD accredited laboratory (Department of Justice, State of Wisconsin, n.d.).

Wisconsin State Crime Laboratory has chemistry, criminalistics and DNA sections. The scientists in these units are divided into controlled substances, toxicology, trace, firearms/tool marks, identification, forensic imaging, AFIS specialists, DNA databank and DNA analysis sub-units (Department of Justice, State of Wisconsin, n.d.).

These units analyze evidence submitted from local law enforcement agencies in the State of Wisconsin.

Communication with state of Wisconsin law enforcement agencies is a key element of the mission of the Wisconsin State Crime Laboratory. Requests for the services of the State Crime Laboratory have to originate from the agency requesting the services. Part of the mission

of the Wisconsin State Crime Lab is education of crime scene processing for the local law enforcement agencies in Wisconsin (Department of Justice, State of Wisconsin, n.d.).

New York State Police Crime Laboratory

The New York State Police Crime Laboratory provides statewide crime laboratory service to all police agencies in the state of New York. This system is made up of four regional labs. The Forensic Investigation Center in Albany is a full service crime laboratory, and includes the state's DNA databank. The Mid-Hudson Regional Laboratory in Newburgh, NY does controlled substance and toxicology analyses. The Southern Tier Regional Laboratory in Port Crane, NY does controlled substances examinations. The Western Regional Laboratory in Olean, NY does controlled substances and trace evidence examinations. These laboratories are ASCLD accredited (New York State Police Crime Laboratory System, 2013).

The services of this laboratory system are available to State of New York law enforcement and district attorneys offices. The crime laboratory system has biological sciences, drug chemistry, firearms, forensic identification, toxicology and trace evidence sections. No specific mention is made of a field response unit. This crime laboratory system offers the assistance of technical investigation specialists who will assist investigators in evidence evaluation (New York State Police Crime Laboratory System, 2013).

City of Madison, Wisconsin, Police Department

The City of Madison, Wisconsin Police Department has a Forensic Services Unit, which has both a crime scene processing unit and limited laboratory capabilities. The unit is composed of sworn officers. Their primary task is identification, retrieval, preservation, and documentation of physical evidence at crime scenes. The cases these investigators are expected to deal with are any cases that may involve criminal activity. There are some lab analyses done by personnel in

this unit. These tasks include, but are not limited to: photography, video analysis, and comparing/recording latent fingerprints. This is not an ASCLD accredited lab (City of Madison, n.d.).

The Wisconsin State Crime Laboratory has one of its three laboratories located in Madison. Submissions of evidence to the Wisconsin State Crime Laboratory involving analyses beyond the capabilities of the Madison police department forensic services unit are made routinely. Either Madison Police Department detectives or forensics services investigators can make these submissions. Communication between the police, city forensic laboratory and state crime laboratory are a necessary element of decisions regarding how to proceed with analysis of evidence.

City of Miami, Florida Police Department/ Miami-Dade Forensic Services Bureau

The City of Miami, Florida forensics structure consists of a crime scene unit and a technical services unit. The Crime Scene Unit is made up of civilian employees. They process crime scenes when requested by police officers or investigators. The Technical Services Unit includes processing of latent prints, a photo lab and an employee identification unit (Miami Police Department, n.d.). The Miami Police Department uses the Miami-Dade Forensic Services Bureau as a laboratory. This is a full service laboratory. This is an ASCLD accredited laboratory (Miami-Dade Forensics Services Bureau, n.d.).

Comparison of Agencies

Comparing these four agencies: all to some extent have evidence analyzed in-house. The majority of crime laboratories are administered by law enforcement agencies. This may cause concern about the independence of lab analysis. Ideally, crime labs should be independent of law enforcement (National Research Council of the National Academies, 2009; Robertson, J., 2009).

All agencies utilize ASCLD accredited laboratories, albeit the Madison and Miami Police Departments do some limited in-house evidence processing and are not ASCLD accredited. The WSCL, New York State police crime laboratory, FBI, ATF laboratories and the Miami-Dade Forensics Services Bureau are ASCLD accredited.

The type of personnel doing crime scene processing varies. The FBI and ATF use both sworn (special agents) and contract civilian employees. The City of Madison police department uses sworn police officers. The City of Miami police department and the Wisconsin State Crime Laboratory, and New York Police State crime laboratory use civilian employees. The sworn employees used by the FBI, Madison Police Department and the civilian employees of the City of Miami Police Department are not scientists. The civilians who process crime scenes for the Wisconsin State Crime Lab (WSCL), and ATF are all scientific laboratory analysts.

These compositions of agency personnel who process and analyze crime scene evidence illustrate that there is no single standard across the U.S regarding who will collect and preserve evidence found at crime scenes: civilians trained in forensics, first responding officers, or sworn officers trained in forensics (Pazarena, 2015). It also illustrates that albeit there may be a patchwork quilt of what defines field response and scientific analysis: communication among participating agencies results in work being accomplished. The FBI, ATF, New York Police Crime Laboratory, and WSCL all articulate that they offer technical assistance to law enforcement agencies within their respective jurisdictions. Effective communication must take place for this happen. The quality of that work done as a result of requested technical assistance is beyond the scope of this paper.

The FBI, ATF, New York State Police Crime Laboratory and the WSCL are multi-organizational in their practices when they function as technical assistance, or analyze evidence

for state and local agencies. The educational mission of the FBI, ATF, New York State Police Crime Laboratory and WSCL can serve to make practices more standardized in their respective jurisdictions. The Miami Police Department and Madison Police Department are multi-organizational in their practices when they utilize respectively, the Miami-Dade Forensics Services Bureau and the WSCL. Effective communication among these agencies is imperative for positive outcomes.

None of the six agencies articulates that they require the certification of crime scene investigators or crime lab analysts. There are no requirements for crime scene investigators or analyst to be certified except those that may be required by individual agencies. The National Research Council of the National Academies, (2009), recommends that all crime laboratories be accredited and all crime scene processors and laboratory analysts be certified in their respective disciplines. The rational for certification and accreditation is to ensure validity, reliability and timely analysis of forensic evidence, and sharing a standardized terminology of what is being articulated in a communication. Standardized terminology ensures that analysts and scene technicians know what the other is talking about when communicating.

The ATF practice of concentrating on large-scale incidents and more complex investigations involving cases of federal jurisdiction, and the FBI laboratory's high threshold for acceptance of cases (e.g. the lab does not accept evidence in thefts under $100,000, burglary cases, explosive incidents of unoccupied buildings) limits federal involvement in state or local criminal cases (Bureau of Alcohol, Tobacco, Firearms and Explosives Laboratory: National and International Response Team, 2016). These high thresholds for acceptance of evidence may in part account for the inherent tension between the scientific community and law enforcement

articulated by Leland Kirk:

> " The laboratory investigator and the police officer must always keep in mind that they are not competitive but complementary in their functions. The laboratory cannot produce unless the officer makes it possible, and the officer can solve many more crimes if he utilizes the laboratory to the fullest extent" (Kirk, 1953).

Without communication among agencies, training and the subsequent value attached to the use of physical evidence could be inadequate. An item of evidence cannot be analyzed if it has not been collected at the crime scene. The evidence item can only be analyzed in the condition in which it was received by the lab. Some evaluation and analyzing of evidence must be done in the field, because the analysis is time sensitive. Therefore, more positive outcomes may result if the crime laboratory personnel educate police regarding what is evidence, and how people working in the field identify and conduct a field analysis if the analysis is time sensitive (Almog, 2006). Effective communication networks may minimize this potential problem, even taking into account budget restrictions.

The above examples would illustrate that law enforcement and crime laboratories approaches to forensics investigations are fragmented, varied and multi-organizational. What is unknown, is to what extent these various components, using fragmented, diverse approaches, may compromise an investigation and bring into question the reliability and validity of the science applied. These would be questions to be addressed in future studies: perhaps correlating specific communication models to successful outcomes. Although communication is implied by the way these organizations are structured: there are no empirical studies found to evaluate the quality or outcome, positive or negative, of those communications and resultant outcomes.

Albeit, the National Research Council of the National Academies (2009) is reporting that a lack of standards and proper training affects the quality of crime lab analysis of evidence from investigations.

The best practices model will be presented that stresses establishing communication channels among agencies participating in forensic investigations utilizing science. These communications channels are necessary in large part because of the fragmented nature of the organizational structures and practices among agencies. A shared understanding of what the terminology being used means, facilitates communication and decreases misunderstanding what is communicated. SWG's of the respective disciplines can arrive at a standardized terminology in the various disciplines. The diverse organizations must educate the other participating agencies as to what the standard terminologies are, and what they mean. This implies an educational function as part of the mission of each of the participating agencies. This educational function can be most effectively accomplished within the smaller group of persons that forms the communications network among agencies. These smaller groups of people are the networks of agency personnel involved in forensic investigations.

CHAPTER V. Recommendations for a Best Practices Model for Communication among Forensic Analysts and Crime Scene Processors in Multi-disciplinary Criminal Investigations

The goal of this paper is to give recommendations for an effective communication model to be used among agencies involved in forensic investigations that are multi-organizational in scope. The use of these recommendations as a systems process (i.e., best practices) for processing crime scenes and analyzing forensic evidence should result in a work product that accomplishes diverse organizational goals and is ethically sound.

This best practices model of crime scene processing and analysis of evidence (National Audit Office, 2003: National Research Council of the National Academies, 2009) would be four pronged: each step to serve as a foundation for the next step. First, there would be increased training for police, focusing on the role and use of forensic evidence in the context of an investigation. Second, prior to scene processing or analysis, there would be training of all involved personnel to include: cross training of individuals in the various organizations that are involved in crime scene processing and forensic evidence analysis. This cross training would stress articulating what the objectives and goals of the various participating organizations are, and explanations of the different roles of participants in the forensic investigation. Third, there would be an emphasis on certifications of forensic personnel (i.e., both crime laboratory and police) in their respective disciplines, using standards from existing professional organizations. These would be professional organizations, which have scientific working groups: such as the International Association for Identification (IAI) and American Academy of Forensic Sciences (AAFS). Crime laboratories would be required to be American Society of Crime Laboratory Directors (ASCLD) accredited. This requirement would enhance the ethical outcomes component of this best practices model as well as facilitating communications by using agreed upon terminology. Fourth, a communications network among participating agencies in a forensic investigation would be developed. This communication network would use rational choice theory, social exchange theory and social network theory and analysis as its theoretical foundation. Exchange theory, and social networking theory in practice, would serve to facilitate communications among various agencies and cut through bureaucratic red tape associated with participating agencies.

Increased Training for Police Focusing on the Role and Use of Forensic Evidence in the Context of an Investigation

Police should receive training in the role and use of forensic evidence. There is a higher probability that accurate interpretations of evidence will be accomplished and the case will be resolved if the procedures police are trained in are adhered to (Lee, Palmbach & Miller, 2001). Police should appreciate that the scientific disciplines are different organizations than the police organization and have different organizational goals and procedures. Effective collaboration is necessary to make informed judgments about the value of forensic science at any scene (Ramsay, 1987). To collaborate; police must first appreciate the potential of use of forensic evidence in their investigation.

A classic example of police appreciation of the utility of the use of science in forensic investigations is seen in the development of the New York City Medical Examiner's Office. Dr. Charles Norris, the Chief Medical Examiner, changed what had been a very corrupt Coroner's system, into a well respected model for a medical examiner's office by introducing toxicology into his system as a routine practice. The introduction of science into the investigative field resulted in a more ethical system, and a system that resolved cases based on factual rather than speculative information (Eckert, 1997).

There are recurrent themes identified regarding how the use of forensic science affects an investigation. These include: the value of evidence and uncertainty on the part of police personnel regarding the capabilities of forensic science, and the limited forensic training investigators receive (Ludwig & Fraser, 2013). The President's Commission of Law Enforcement and Administration of Justice (1968) reported that it should be an important goal of the police to develop the capacity to make a thorough search of the scene of every serious crime and to analyze the evidence so discovered" (National Criminal Justice Reference Service, 1968,

pg. 118). The collection of crime scene evidence is predictive of arrest. The analyzing of evidence is predictive of both referral for charges and, charges being filed (Peterson, et al, 2013). Police had limited knowledge of the role and use of forensic science. Knowledge of the role and use of forensic evidence is a necessary precursor to training prior to crime scene processing and forensic analysis.

Federal agencies may not be the most useful in directly educating police in the potential of forensic evidence. There is social distance between FBI and ATF laboratory personnel and state and local law enforcement. Both ATF and FBI websites articulate that their field responses or lab inquiries are advisory in nature. The FBI Research and Development program shares the new techniques and protocols with case-working examiners at state and local crime labs (National Research Council of the National Academies, 2009; Federal Bureau of Investigation, n.d.). This implies that the federal laboratories are resources for state and local crime labs, but not actively engaged in evidence analysis at state and local levels. The FBI has evidence response teams. Field responses by the FBI may be advisory in nature, and not a complete crime scene processing (Federal Bureau of Investigation, n.d). There is no mention of a training function of FBI laboratory or forensics personnel training local law enforcement. Use of the FBI forensics personnel would have to be made through state and local crime laboratories.

The ATF laboratories support the investigations of ATF investigators. Field response of ATF certified explosives specialists (CES) involve investigating violations of federal explosives and firearms laws. Federal, state and local investigators can request the national and international response team to investigate significant fire and explosion incidents. The ATFs response team concentrates on large-scale incidents and more complex investigations (Bureau of Alcohol, Tobacco, Firearms and Explosives Laboratory: National an International Response Team, 2016).

The threshold for being of assistance to state and local law enforcement is restricted to high profile incidents. There is no mention of a training function of ATF laboratory or forensics personnel for local law enforcement. Thus, the training of state or local law enforcement personnel prior to crime scene processing by crime laboratory personnel is not taking place in context of the FBI or ATF.

The New York State Police Crime Laboratory and the Wisconsin State Crime Laboratory are training state and local law enforcement crime scene personnel in crime scene processing and explaining the expectations and limitations of what the laboratories offer as services. Part of the mission of the Wisconsin State Crime Lab is education of crime scene processing for the law enforcement agencies in Wisconsin (Department of Justice, State of Wisconsin, n.d.). The New York State Police Crime Laboratory system offers the assistance of technical investigation specialists who will assist investigators in evidence evaluation to local agencies (New York State Police Crime Laboratory System, 2013).

The City of Miami, Florida crime scene unit and Technical Services unit do not mention training functions that occur outside of their departments (Miami Police Department, n.d.; Miami-Dade Forensics Services Bureau, n.d.). The City of Madison, Wisconsin Police Department Forensic Services Unit does not mention a training function that occurs outside of their Department (City of Madison, n.d.).

Training of law enforcement personnel by crime laboratory personnel in the context of organizational goals that exist at present, would take the form of State Crime Laboratories taking a primary role in training prior to crime scene processing or scientific analysis. This training would take the form of training police in the role and use of forensic evidence.

Training Prior to Crime Scene Processing or Scientific Analysis

Training prior to an incident and on-going training as scientific knowledge and technologies evolve is foundational to this best practices model. Leland Kirk articulated that:

> " Perhaps the most important function of the police laboratory is to train the police investigators as to what constitutes physical evidence and how it is to be found, collected, preserved, and delivered to the proper laboratory investigator" (Kirk, 1953).

Practices and guidelines regarding the collection and analysis of forensic evidence are fragmented in the United States. Some forensic analysis might be done by police officers with no scientific training or credentials (National Research Council of the National Academies, 2009). There is no single standard across the U.S regarding who will collect and preserve evidence found at crime scenes: civilians trained in forensics, first responding officers, or sworn officers trained in forensics all perform these tasks (Pazarena, 2015). No two scenes are exactly the same, so issues unique to a specific scene may very possibly arise (Lee, Palmbach & Miller, 2001). There is a need for a consistent, yet flexible crime scene processing methodology. Individuals need to be trained in this methodology. State crime laboratories will be the primary source of this training because of the previously articulated distance between local and national law enforcement agencies and crime laboratories.

A lack of standards and proper training affects the quality of crime lab analysis of evidence from investigations (National Research Council of the National Academies, 2009). Laboratory procedures will be affected by the quality of the evidence that analysts have to analyze: evidence that was collected by law enforcement personnel (National Criminal Justice Reference Service, 2007). The quality of evidence affects the outcomes of future legal

proceedings. An item of evidence cannot be analyzed if it has not been collected at the crime scene. The evidence item can only be analyzed in the condition in which it was received by the lab (Almog, 2006).

Forensics laboratory processes have become increasingly more specialized and complex over the years. As a result, labs have become increasingly isolated from the crime scene and the investigation work (Ribaux, Baylon, Lock, Delemont, Roux, Zingg & Margot, 2015). Going back to Leland Kirk's (1953) writing: that maybe the most important function of police crime laboratories is to train police investigators in the identification and uses of physical evidence in criminal investigations; it is suggested that there should be cross training of the personnel in the organizations involved. The state crime laboratories should be tasked with this education.

To obtain the maximum utilization of forensic science, integration and collaboration must reflect the organizational objectives and goals of all parties involved (Horvath & Meesig, 1996). This training of individuals from various organizations that are involved in crime scene processing and forensic evidence analysis would stress the sharing of the objectives and goals of the various participating organizations and explanations of the different roles of participants in the forensic investigation. It is necessary that participants in an investigation have an understanding that others have organizational goals and roles that are different from theirs. This understanding, gained through education, would hopefully result in cooperation among agencies to allow for the accomplishing every organization's outcome goals.

The focus of police and crime laboratory organizational goals are similar but different. The current model for a police investigation is to collect and examine evidence to the point where investigators decide upon a prime suspect. The investigation then focuses on evidence that confirms the investigator's decision regarding who committed the crime. The priorities of this

model are efficiency oriented (National Criminal Justice Reference Service, 2007). Scientists continually observe, test, and modify their respective bodies of knowledge. Studies are designed to reduce errors. The scientist attempts to be as free from bias as possible. The results of experiments are shared with peers. New methods must be validated to determine their reliability (National Criminal Justice Reference Service, 2009).

An understanding by police of the usefulness of physical evidence analyses in context of the procedures an ASCLD accredited crime laboratory must be accompanied by an understanding on the part of crime laboratory analysts of the current model for police investigations. The mutual understanding of organizational models could create an understanding and respect of the organizational goals of each participating agency. Hopefully, this would mitigate to some extent the social distance between individuals from various organizations working on the same forensic investigation. Expectations and limitations of what each organization could contribute to the forensic process could be shared. Thus, lessen any unrealistic expectations one agency might have regarding the capabilities of the other.

A starting point for this training prior to crime scene processing or forensic analysis of evidence would involve increased training of the police, which focused on the role and use of forensic evidence in criminal investigations. Horvath & Meesig (1996) suggest collaborative training for police that focused on the value, utility and limitations of forensic science. State Crime laboratory personnel would conduct this training.

Best practices models for first responding officers to a crime scene were developed by the NIJ (NIJ, 2013). It was not articulated in this document who should train police in these best practices. There is no absolute number of how many forensic scientific disciplines may be involved in an investigation. Dealing with multiple scientific disciplines is challenging for local

law enforcement. When multiple scientific disciplines are involved, they must share common terminology and accepted practices within their respective disciplines to communicate effectively. These shared terminologies and practices are addressed by professional certifications and accreditations associated with the IAI, AAFS, LEVA and ASCLD.

Certifications and Accreditations

Historically, practitioners in forensic sciences determined there was a need for standardization of working practices, a need to provide educational opportunities, and encourage research and provide a forum for collaborations with colleagues. This recognition lead to the formation of professional organizations to determine what these standard working practice would be.

All participants involved in processing crime scenes and analyzing forensic evidence should have or be in the process of working towards certification in their respective disciplines. Crime labs should be accredited. These certifications and accreditations should be developed by scientific working groups within professional organizations (e.g., IAI, AAFS, ASCLD, etc.) related to the their respective disciplines or organizations. This results in consistent, predictable procedures. The legitimacy of the participants or organizations is thus enhanced.

Communications are standardized because agreed upon terminology that is associated with an affiliation with a professional organization of discipline. Crime laboratory procedures that are standardized because of ASCLD accreditation can result in the necessary environment for the creation of effective communications networks among participants in a forensic investigation.

Development of a Communications Network between Police and Crime Laboratory Analysts

Lastly, a communications system should be developed among the various police and forensic organizations to facilitate timely, clear, concise communications. Large bureaucratic systems tend to pass on information slowly. A properly examined crime scene investigation requires the flow of information from the scene to investigative personnel (Lee, Palmbach & Miller, 2001). Improved communication and collaborative efforts among investigators, crime lab analysts, and others involved in a criminal investigation are needed to enhance the use and value of physical evidence (Horvath & Meesig, 1996).

Forming exchange networks that circumvent the formal structure economizes on effort, time and resources, by cutting down on the number of communication transactions. This facilitates shared information. Continued exchanges develop a sense of trust between organization participants. The exchange of information is facilitated by 'link pins' (i.e., networkers): individuals who have credibility in their own as well as other agencies organizations (Stojkovic, Kalinich & Klofas, 2015).

Rational choice theory will posit that people calculate the cost and benefits of any action before deciding how to proceed. Rational choice theories assume that individuals pursue their goals efficiently (Green & Fox, 2007). Agencies make decisions that optimize their respective organizational goals. The application of rational choice theory to social interaction is social exchange theory.

Social exchange theory explains that: the more often a particular action of a person is rewarded, the more likely the person is to perform that action again (Homans, 1974, pg. 16). A positive experience in a social exchange is more likely to result in a repetition of that action. If a person values a successful organizational outcome, the more likely it is that the person will

perform what is necessary to achieve that success. Workers exchanging information, who successfully achieve organizational goals, form a trusting communication network that is economical in time, effort and resources by minimizing the number of communications that must occur to achieve an organizational goal. The individuals participating in this information exchange are referred to as "link-pins": also known as networkers within their respective agencies (Stojkovic, Kalinich & Klofas, 2015). Continued success in achieving organizational outcome goals increases the credibility of these individuals in their own agency, as well as within the agencies these individuals network with. These information exchanges takes place in the context of a social network.

Social networks facilitate relationships. These relationships are among individuals whose entities, or organizations are different from one another. The social network involves interpersonal communications, institutional affiliation, collaborative task performance, information sharing, training and mentorship (Butts, 2008). Thus, individuals who are "link-pins" from their respective agencies can achieve successful organizational outcome goals for their respective agencies by sharing information among each other, in a collaborative, trusting, task performance (i.e., meeting).

A best practices model is: state crime laboratories training police in the utility of forensic evidence as a foundation. Training prior to crime scene processing or scientific analysis follows this foundational education, which stress understanding that organizations involved in an investigation have varying organizational outcome goals. Standardization of terms and methodologies within specific disciplines is accomplished by certifications and accreditations. The combinations of training in the utility of forensic investigations, understanding the organizational outcome goals of the multiple agencies involved in a forensic investigation, and

standardized terminology and methodologies can result in the creation of a communications systems among agencies with diverse organizational outcome goals. These communication networks facilitate information sharing in a collaborative, trusting interpersonal communication that results in positive organizational outcome goals for all individuals involved.

CHAPTER VI. SUMMARY AND CONCLUSION

Historically, science and criminal investigation evolved as distinctly different disciplines (Nickell & Fischer, 1998). Classical science is defined by hypothesis testing, using the scientific method. The scientist can then interpret the data from the experiment and articulate a conclusion regarding the results (Inman & Rudin, 2001). Scientists continually observe, test, and modify their respective bodies of knowledge. In the laboratory a scientist can control and vary conditions to better understand factors that influence certain outcomes. Studies are designed to reduce errors. The scientist attempts to be as free from bias as possible. The results of experiments are shared with peers. In sharing these results, the scientist must avoid conflicts of interest. New methods must be validated to determine their reliability. The current model for police investigation is to collect and examine evidence to the point where investigators decide upon a prime suspect. The investigation then focuses on evidence that confirms the investigators decision on who committed the crime. The priorities of this model efficiency oriented (National Criminal Justice Reference Service, 2007).

Forensic science is a broad array of disciplines. These disciplines have a variety of techniques, methodologies, reliability, level of error, research, general acceptability, and published material. Some disciplines are laboratory based (e.g., DNA, toxicology, and drug analysis): others depend on interpretation of observed patterns (e.g., fingerprints, document examination, toolmarks, and bite marks). (National Criminal Justice Reference Service, 2009).

These parallel evolutions result in communication issues among participants in forensic investigations at the intersection of science and police criminal investigation. Communication is a necessary component of a successful criminal case resolution. Effective collaboration was necessary to make informed judgments about the value of forensic science (Ramsay, 1987). Communication is necessary for collaboration. Laboratory procedures will be affected by the quality of the evidence analysts have to analyze: evidence that was collected by law enforcement personnel.

Science and criminal investigation intersect in the field of forensic science. People investigating cause of death and crimes utilized science to assist in these investigations (Nickell & Fischer, 1998). The use of forensic science began in earnest in the late 1800s, in Europe. In the U.S. the use of forensics in criminal investigations evolved in a patchwork quilt manner. This evolution resulted in practices in analysis of evidence in crime laboratories and crime scene processing that were fragmented and not standardized. Crime scene investigators have varying levels of training and experience. Some forensic analysis might be done by police officers with no scientific training or credentials (National Research Council of the National Academies, 2009).

Practitioners in forensic science determined there was a need for standardization of working practices. The nature of forensic science might tend towards an artistic or intuitive approach. Facts in cases are often few. The results of analyses are rarely textbook. Analysts might tend to fill these gaps. Recognizing that this may happen has resulted and continues to result in rigorous review of procedures by the scientific community to counter these tendencies (Inman & Rudin, 2001).

Individuals in specific forensic disciplines formed professional organizations that were national in scope to determine what these standard working practice would be. Some of these organizations were the IAI, AAFS, LEVA, and ASCLD. ASCLD supports crime laboratory accreditation. Accreditation includes: voluntary proficiency training, establishing standards or operation for crime labs, and external peer review of work product. The purpose of the accreditation was and is described is to ensure professionalism, competency and proficiency, and ensure clear communications (American Society of Crime Lab Directors, n.d.). LEVA, IAI, and the AAFS have certification programs as part of their organizational missions.

In the every day work of forensic investigations investigators and analysts identified several conditions that were necessary for successful crime scene processing and evidence analysis. A lack of standards and proper training affects the quality of crime lab analysis of evidence from investigations (National Research Council of the National Academies, 2009). The integrity of the crime labs in which analyses take place has been criticized. Areas of criticisms of crime labs are lack of or lax standards, lack of quality control measures, lack of proper education and training, the potential for bias when arriving at conclusions regarding examinations, error rates, insistency that forensic methodologies are perfect and produce no errors (National Criminal Justice Reference Service, 2009).

Forensics laboratory processes have become increasingly more specialized and complex over the years. As a result, labs have become increasingly isolated from the crime scene and the investigation (Ribaux, Baylon, Lock, Delemont, Roux, Zingg & Margot, 2015). Leland Kirk, who is considered to be the father of the modern day crime laboratory, articulate in *Crime Investigation*, that training of police officers of what is physical evidence, how is collected, preserved and submitted to a crime laboratory may be the most important function of a crime lab

(Kirk, 1953). More positive outcomes may result if the crime laboratory educated police regarding what is evidence, and how personnel working in the field identify and conduct a field analysis if the analysis is time sensitive (Almog, 2006).

There is no single standard across the U.S regarding who will collect and preserve evidence found at crime scenes: civilians trained in forensics, first responding officers, or sworn officers trained in forensics all perform these tasks (Pazarena, 2015). An item of evidence cannot be analyzed if it has not been collected at the crime scene. The evidence item can only be analyzed in the condition in which the laboratory received it.

The President's Commission of Law Enforcement and Administration of Justice (1968), was critical of the lack of use of forensic evidence by police. There are recurrent themes identified regarding how the use of forensic science affects an investigation. These include: the value of evidence and uncertainty on the part of police personnel of the capabilities of forensic science (Ludwig & Fraser, 2013). A properly examined crime scene investigation requires adequate training, both current and ongoing, experience on the part of crime scene investigators, and managed coordinated team effort (Lee, Palmbach & Miller, 2001).

A properly examined crime scene investigation requires the flow of information from the scene to investigative personnel (Lee, Palmbach & Miller, 2001). This flow of information was not always occurring between of the social distance that exists among agencies with diverse organizational outcome goals (Ludwig & Fraser, 2013). To address these shortcomings of organizational work product and subsequent work product, several solutions were posited. Horvath & Meesig (1996) suggest collaborative training for police that focuses on the value, utility and limitations of forensic science, and the development of training programs, which cover the entire investigation.

The best practices model put forward here is four pronged. Each idea presented is a necessary condition for subsequent ideas to be successful. First, would be increased training for police focusing on the role and use of forensic evidence (Kirk, 1974; National Research Council of the National Academies, 2009; Gardner, 2012; Horvath & Meesig, 1996; Lee, Palmbach & Miller, 2001). Second, prior to scene processing or analysis, there would be training of all involved personnel to include: cross training of individuals in the various organizations that are involved in crime scene processing and forensic evidence analysis that stressed the objectives and goals of the various participating organizations and explanations of the different roles of participants in the forensic investigation (Kirk, 1974; National Research Council of the National Academies, 2009; Lee, Palmbach & Miller, 2001; Touche, 1987; Horvath & Meesig, 1996; Gardner, 2012; Ramsay, 1987) Third, there would be an emphasis on certifications of forensic personnel (i.e., both crime lab and police) in their respective disciplines: using standards from existing professional organizations, which have scientific working groups, such as the IAI and the AAFS. Crime labs would be required to be ASCLD certified (National Research Council of the National Academies, 2009). Fourth, also included would be the development of communication channels among participating agencies in a forensic investigation that used rational choice theory, exchange theory, and social networking theory and analysis as its foundation. Exchange theory in practice would serve to facilitate communications among various agencies and cut through red tape (Kirk, 1953; Lee, Palmbach & Miller, 2001; Horvath & Meesig, 1996; Ludwig & Fraser, 2013; Touche, 1987; Ramsay, 1987; Stojkovic, Kalinich & Klofas, 2015).

Police should receive training in the role and use of forensic evidence. Police should appreciate that the scientific disciplines are different organizations than the police organizations

and have different organizational goals and procedures (Ramsay, 1987). To collaborate; police must first appreciate the potential of use of forensic evidence in their investigation.

Federal agencies may not be the most useful in directly educating police in the potential of forensic evidence. There is social distance between FBI and ATF laboratory personnel and state and local law enforcement. Training of law enforcement personnel by crime laboratory personnel would take the form of State Crime Laboratories taking a primary role in training prior to crime scene processing or scientific analysis. This training would take the form of training police in the role and use of forensic evidence.

Training prior to an incident and on-going training as scientific knowledge and technologies evolve is foundational to this best practices model. State crime laboratories will be the primary source of this training because of the previously articulated distance between local and national law enforcement agencies and crime laboratories.

When multiple scientific disciplines are involved, they must share common terminology and accepted practices within their respective disciplines to communicate effectively. These shared terminologies and practices are addressed by professional certifications and accreditations associated with the IAI, AAFS, LEVA and ASCLD. All participants involved in processing crime scenes and analyzing forensic evidence should have or be in the process of working towards certification in their respective disciplines. Crime labs should be accredited. These certifications and accreditations should be developed by scientific working groups within professional organizations (e.g., IAI, AAFS, ASCLD, etc.) related to the their respective disciplines or organizations.

A communications system should be developed among the various police and forensic organizations to facilitate timely, clear, concise communications. A properly examined crime

scene investigation requires the flow of information from the scene to investigative personnel (Lee, Palmbach & Miller, 2001). Forming exchange networks that circumvent the formal structure economizes on effort, time and resources, by cutting down on the number of communication transactions. The exchange of information is facilitated by ‘link pins’ (i.e., networkers): individuals who have credibility in their own as well as other agencies organizations (Stojkovic, Kalinich & Klofas, 2015).

Agencies make decisions that optimize their respective organizational goals. The application of rational choice theory to social interaction is social exchange theory. The individuals participating in this information exchange are referred to as “link-pins”: also know as networkers within their respective agencies (Stojkovic, Kalinich & Klofas, 2015). These information exchanges takes place in the context of a social network.

Individuals who are “link-pins” from their respective agencies can achieve successful organizational outcome goals for their respective agencies by sharing information among each other, in a collaborative, trusting, task performance.

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