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An Integrative Approach to the Elimination of the “Perfect Crime”

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Introduction

Does modern day criminal investigation eliminate the possibility of the perfect crime? The mere notion that this question could be answered affirmatively could quiet the anxiety felt by the general population. The community at large feels that they dwell in an unsafe and unprotected environment. Parents experience silent fear each time their children wander beyond their reach. While “...men are afraid women will laugh at them,...women are afraid men will kill them” (De Becker, 1997, p. 77). Deviant minds should not be allowed to entertain the thought that they can commit crime without grave consequences.

A perfect crime is one which will go unnoticed and/or one for which the criminal will never be caught (Fantom, Tilhet, & Achache, 1998). To achieve the level of expertise necessary to solve more crimes, perfect or otherwise, the criminal justice system would have to be in a constant state of innovation. This renewal would have to involve the complex integration of a wide range of skills emanating from multiple disciplines. The issue of crime is broad, and unraveling more crimes is a high social need. The synthesis of perspectives to produce new knowledge could result in safer communities, stronger deterrents to crime, and increased societal awareness of the importance of the advancement of criminalistics.

Solving criminal cases is easier attained with the cooperation of the social and physical sciences and the humanities. Criminal justice includes the whole legal process of the investigation. The social science of psychology provides understanding of the criminal mind and his or her subsequent behavior. The physical sciences of biology, chemistry, physics and mathematics are necessary in the laboratory testing of evidence to narrow down the list of suspects and provide credible items of testimony for court. Mathematics also provides statistics

showing a correlation between the improvement in scientific technology and an increase in the apprehension of criminals. “Forensics...is the application of science to law” (Saferstein, 2004, p. 1) and includes all the physical sciences plus disciplines such as osteology (study of bones), entomology (insects), odontology (teeth) and more. In the humanities, religion is able to provide some insight into a crime that was committed and based on a suspect’s belief system. The criminal history of a felon would provide hints to his or her future illegal plans or patterns.

The three disciplines most relevant to the issue at hand are *criminal justice*, *forensics*, and *psychology*. The Criminal justice system is responsible for the efficient processes used in building the case. Investigators must optimize the acquisition of various kinds of evidence (physical and testimonial). Forensic science (or criminalistics) involves the application of science to criminal investigations. Criminalists examine and perform scientific tests in the laboratory on obscure evidence found at a crime scene. Forensic psychology involves criminal profiling wherein profilers attempt to create a tentative personality composite of the potential suspect. The foremost method for preparing for this research was a thorough literature review. The other research methods used were critical thinking and interpretations of studies, procedures, computer simulations and experiments.

The investigation of major crimes frequently involves the cooperation of crime scene investigators, forensic scientists and pathologists, and forensic psychologists. These professionals integrate the information they gather so they can identify, apprehend and prepare to prosecute suspects. This paper will propose that there is the possibility of eliminating the notion of the perfect crime as investigative procedures improve, science advances, and psychological profiling digs deeper into the recesses of the criminal psyche.

Historical Background

The perfect crime is different from the unpunished crime. The latter exists when there are few or no witnesses, inaccurate testimonies, few pieces of evidence, poor investigative techniques or other problems (Fantom et al., 1998). Average criminals dream of committing a crime that will go unpunished. Sometimes they get their wish because of imperfect investigative practices. However, other criminals attempt to use their cleverness very deliberately to execute a crime that will be never even be suspected—the perfect crime (Fantom et al., 1998). Although it is important to address the roots of the problem of crime in order to reduce the overall crime rate, this paper focuses on how the three disciplines of criminal justice, forensic science and forensic psychology have evolved to meet the challenge of eradicating the perfect crime.

Criminal Justice

Criminal Justice embraces phenomena such as government regulations, court rulings and legal relationships. Specifically, this discipline encompasses the system of law enforcement directly involved in the apprehension, prosecution, defense, sentencing, imprisonment and supervision of a suspect or charged criminal. The focus here will be on the sub-discipline of criminal investigation. Scholars Ostrom, Parks and Whitaker defined criminal investigation as “the collection of information and evidence for identifying, apprehending and convicting suspected offenders” (as cited in Osterburg & Ward, 2000, p. 5). Professor Ralph Turner of Michigan State University prefers, “a criminal investigation is the reconstruction of a past event” (as cited in Osterburg & Ward, 2000, p. 5). Together, these two definitions comprise an elaborate array of procedures that must be executed efficiently and effectively in order to apprehend a criminal suspect. To appreciate the present investigative process it will help to understand its history.

Criminal investigations have always existed in some form or another, but to a large extent, these were conducted by private citizens. The earliest governments that did get involved did so by instituting police states, as in Tsarist Russia and France. In ancient and medieval England, law enforcement was generally the responsibility of the citizens (Morn, 2000). Crime and disorder increased, partly due to public servants turning into mercenaries and the flagrant use of informants. London responded with the creation of the London Metropolitan Police in 1892, which became nicknamed Scotland Yard (Weston & Wells, 1970). In colonial America, police and detective work were done by American citizens just as in medieval England. Watchmen patrolled at night and elected daytime constables did actual police and detective work; but, they often were very incompetent (Morn, 2000).

The murder of Mary Rogers in 1864 ushered in the media as a key player in investigations. The New York Herald kept the case visible to the public and did its own detective work. One of the reporters for the New York Herald, Edgar Allen Poe, wrote a book on the case with a fictional solution. The case and the book led to the formation of a modern police system in New York City (Morn, 2000). As in London, the police focused on preventing crime, thus the first U.S police force was mainly comprised of “peace officers” (Stephens, 2005).

Until the present, true detectives were absent in investigation in England and the United States—Russia and France had given them a bad reputation (Morn, 2000). In America, the earliest developments in criminal investigation began in 1850 with the creation of the Pinkerton Detectives who operated as railroad police to provide protection from train robbers. These detectives were able to thwart the first assassination attempt on Abraham Lincoln that was to occur as the President transferred trains on his trip from Illinois to Washington (Weston & Wells, 1970).

Many modern day investigative procedures—surveillance, identification, management and accountability—originated with the Pinkerton Detectives. The aftermath of the Civil War brought a crime wave which produced a need for even more detectives (Morn, 2000). Keeping the peace was replaced by an emphasis on catching and punishing criminal, and this law enforcement model is predominant today in America and other countries as well (Stephens, 2005).

In 1892, in an effort to improve policing in America, several police chiefs formed the International Association of Chiefs of Police. Their goal was primarily to “professionalize” law enforcement. August Vollmer started the first training academy for his police department in California. Vollmer’s concept of the academy spread across the nation. The Bureau of Investigation (later the FBI) was created by President Theodore Roosevelt in 1908. Professionalism continued from 1920 to 1960 and made crime fighting and detective work a higher priority than it was before (Morn, 2000). As crimes became more elaborate and criminals worked to avoid discovery, criminal investigation depended less on informants and more on searching for clues and evidence that would tie a suspect to a crime (Weston & Wells, 1970). Scientific methods began aiding law enforcement and the discovery of fingerprints as a means to identification provided even more momentum for change (Morn, 2000).

The 1960’s saw a dramatic increase in crime which brought necessary changes to the criminal justice system. The Supreme Court made decisions on cases that made detectives more accountable and their jobs more difficult. Criminal justice became an academic discipline in the 1970’s and ensured growth in research and education pertaining to the problems of crime in America. Colleges received more money to set up criminal justice programs. Funding for police agencies was increased so they could become more efficient. In this era, the most progress seen

in investigations came from the discovery of DNA and the rapid advancement of computer technology (Morn, 2000).

Academic research continues to help police improve their techniques allowing for more arrests. “Research across the spectrum of the behavioral and information sciences holds great promise for the improvement in the investigative function —if criminal justice is able to digest and adopt it for practical use” (Osterburg & Ward, 2000, p. 26). The improvement of principles and practices that govern the gathering of all types of evidence must be of prime importance in order to increase the number of convictions (Osterburg & Ward, 2000). As time moves on and innovation continues in the processes of criminal investigation, citizens may be able to anticipate living in a safer environment.

Forensic Science

Paul Kirk, one of the most revered criminalists of the twentieth century, said “criminalistics [forensic science] is an occupation that has all the responsibilities of medicine, the intricacy of law and the universality of the sciences” (Ballou, Goodpaster, MacCrehan & Needer, 2003, p. 1149). Forensic science is an interdisciplinary collection of physical and biological sciences and progressive technologies that are applied to issues of law (Gaensslen, 2003). This area of expertise is presently experiencing great exposure, but it has in fact been in existence for quite a long time.

As early as 650 A.D., the Chinese used finger and palm prints for identification (Lambert et al., 2003). Sir Arthur Conan Doyle was credited by many for stirring up the imagination of real-life criminalists with the forensic exploits of his fictional character, Sherlock Holmes. Holmes introduced the world to crime-detection procedures like firearm identification and fingerprinting before they were perceived as valuable to the existing forensic community

(Saferstein, 2004. Beginning in the nineteenth century, a number of notable forensic science pioneers introduced science to criminal investigation.

In the 1800's, Matthew Orfila, the father of toxicology, discovered that chemical tests could be done on the human body to detect poisons. Alexandre Lacassagne introduced the field of ballistics by being able to show the link between bullets found in a murder victim to the gun used in the crime (Almirall & Furton, 2003). In 1893, Frances Galton wrote *Fingerprints* which provided proof of the uniqueness of fingerprints which became the foundation of the present fingerprint system of identification. In the same year, Hans Gross wrote the first report emphasizing the necessity of using scientific methods for criminal investigation (Weston & Wells, 1970). Later, Edmond Locard believed that a criminal could be connected to a crime by examining the dust particles on his or her clothing. This concept of the cross-transfer of evidence became known as Locard's Exchange Principle (Saferstein, 2004).

In 1923 the first crime lab was created, and in 1932 the FBI created the first national crime laboratory to aid law enforcement across the United States (Saferstein, 2004). As of 2004, Saferstein (2004) notes that there were 320 public crime labs—a threefold increase since 1966, responding to an increase in drug-related crimes and the development of DNA profiling (1985) which matches DNA found at crime scenes to a specific individual.

Forensic science continues to captivate and fascinate. Famous criminal trials, novels, television and new discoveries have given the field of criminalistics much publicity. This field continues to pursue excellence in its training, education and scientific methods (Ballou et al., 2003). Forensic science as a whole is an innovative tool for the whole criminal justice system and can be a formidable force in the fight against crime.

Forensic Psychology

“Crime is, at its most basic level, an expression of one’s motivations and desires, and it is this tenet that is at the core of profiling” (Palmero, 2005, p. 246). Gerberth states that, fundamentally, a profiler analyzes acquired facts from the crime scene(s), victim(s), and witnesses to create a personality composite of a potential perpetrator (as cited in Woodworth & Porter, 1999). Homant and Kennedy point out that this discipline is not depended upon to solve a crime, but to aid in reducing the number of suspects (as cited in Woodworth & Porter, 1999). The development of profiling techniques has been documented factually and fictionally and continues to be studied and improved.

One of the earliest recorded abuses of criminal profiling occurred in 1486 with the publishing of *The Malleus Malificarum* —the Witch’s Hammer. It provided profiles of witches during the Spanish Inquisition (Turvey, 2002). Cesare Lombroso (1876), in *The Criminal Man*, theorized that there were eighteen physical characteristics indicative of a person’s predisposition to crime (Woodworth & Porter, 1999). The fictional character, Sherlock Holmes, used intuition and elementary principles of deduction that were quite impressive and served as a model approach to criminal profiling (Palmero, 2005). In 1888, forensic pathologist (police surgeon) Dr. George Phillips was involved in the Jack the Ripper murders in Great Britain and attempted to link his profession to profiling. He believed that examination of the wounds on the victims could provide some insight into the criminal’s personality—the beginning of wound pattern analysis (Turvey, 2002). In 1893, Hans Gross—justifiably the father of modern criminal profiling—wrote *Criminal Investigation* and later, *Criminal Psychology*. He believed in the necessity of criminal profiling and made it his life’s work to professionalize the investigation of crimes (Turvey, 2002).

In the twentieth century, criminal profiling continued with World War II. Dr. W.C. Langer, a psychiatrist, was commissioned to profile Adolf Hitler and even successfully predicted Hitler's suicidal death (Egger, 1999). Psychiatrist Dr. James Brussel, advanced the course of profiling by describing an offender's characteristics based on his or her behavior evident at the crime scene. In 1957, he profiled the "Mad Bomber"—responsible for thirty bombings in a fifteen year span in New York City—almost perfectly, leading police to apprehend George Metesky. He used the same techniques to aid in the arrest of the Boston Strangler in 1964 (Egger, 1999). In 1972, the FBI offered profiling services to law enforcement across the United States with the creation of the Behavioral Science Unit (BSU) after a surge of serial and mass homicides in the 1960's (Woodworth & Porter, 1999). Presently, many state law enforcement agencies across the world, have their own profiling units and expansion continues (Turvey, 2002). Turvey suggests that criminal profiling, at the very least, involves the collaboration of criminalistics, death investigation and psychology, yet has not reached the status of a "profession" (2002). Saferstein, a noted forensic scientist, states that over time, profiling has achieved some semblance of discipline and order (Turvey, 2002).

Profiling will reach a higher level of dependability and authenticity if the FBI's use of intuition and experience can be integrated with the investigative psychologist's use of psychological theory and experimental research (Woodworth & Porter, 1999). "An improved relationship between psychology and law enforcement could lead to the apprehension of many dangerous criminals who would otherwise remain free and continue to perpetrate violent crimes" (Woodworth & Porter, 1999, p. 260).

Summary

There can be a symphonic relationship among the three disciplines of criminal investigation, forensic science and forensic psychology. Criminal investigation could use profiling information to reduce the number of suspects. Psychological profilers can use information gathered at the crime scene to help understand the behavior and personality of a possible offender. The forensic science laboratory needs evidence to be collected correctly by investigators in order to deliver scientifically accurate results. Those results could focus the investigation in the right direction for criminal investigators. Criminal profiling could use forensic fingerprint and DNA information to help create a more specific psychological profile of a suspect. Profiling, as a forensic sub-discipline, could work with the laboratory to develop the psychological evidence for a criminal investigation. Forensic documentation examiners and criminal profilers could work together and analyze handwriting to formulate a tentative personality profile.

Advancements in technology and knowledge in all three disciplines may one day eliminate the possibility of the perfect crime. However, new methods for crime solving could create new kinds of criminal activity. Investigators, scientists and profilers would also have to invest more time, money and education to remain current on new information. If all three specialties continue to search for new ways to refine their skills and work as a team, perhaps law-abiding citizens could look forward to living in a safer place and enjoying greater peace of mind.

*Theories and Methods**Criminal Investigation*

A successful investigation depends upon the proper and orderly collection of evidence and information from a crime scene. Investigators—including police, crime scene technicians and death investigators—must protect, search and document a crime scene with extreme caution in order not to compromise an investigation. As science (behavioral and physical) and law increasingly build upon and learn from each other, the responsibility of law enforcement to implement new techniques to improve the prospect of obtaining a criminal conviction becomes much greater (Lambert, et al., 2003). Keeping up with technological advances can be quite overwhelming for law enforcement, but departments that rise to the challenge will be more capable of keeping communities safe by becoming more effective at preventing and fighting crime (Schmallenger, 2004).

False memories and the cognitive interview. Collecting evidence includes the gathering of eyewitness testimony. Studies pertaining to eyewitness memory have played a key role in teaching investigators how to acquire accurate testimonial evidence. Elizabeth Loftus, in her 1979 and 1996 papers, concluded that a witness' memory could be altered if he or she were fed leading questions by an investigator i.e. "did you see the *broken* headlight?" (as cited in Loftus, 2003a). Their memories become contaminated. Loftus and Hoffman (1989) explained that the "misinformation effect" occurs when witnesses are questioned in a suggestive manner or they discuss the experience of a crime with others before being interviewed. These embellished details become part of their memory (Loftus, 2003a). To counteract this effect, Highhouse and Bottrill (1995) discovered that informing people of their susceptibility to misinformation can

actually enable them to resist forming inaccurate information in their minds (as cited in Loftus, 2003a).

Although victims and witnesses develop false memories, they believe these memories to be totally accurate (Loftus, 2003b). The *Technical Working Group for Eyewitness Evidence* (1999) discovered that false memories are the major cause of the growing number of wrongful convictions (as cited in Loftus, 2003a) and points out that criminal convictions based mostly on victim or witness testimony (see Figure 1; Saks & Koehler, 2005) can be highly unreliable (Loftus, 2003a). Yarmey (2003) notes that this analysis has led to various recommendations and guidelines for interviewing procedures (as cited in Loftus, 2003a).

In 1984, Edward Geiselman and colleagues developed the *cognitive interview* (Davis, McMahon & Greenwood, 2004). The original researchers found that the cognitive interview produced more accurate testimonial information than the standard police interview (Osterburg & Ward, 2000). The standard police interview typically limits eyewitness accounts to necessary information using tactics such as frequent interruptions and the use of a rigid question/answer style (Kebbell & Wagstaff, 1996).

Fisher and Geiselman's (1992) research was directed at the recovery of more reliable eyewitness memories (as cited in Davis et al., 2004). "The cognitive interview has been accepted as one of the most successful interview techniques used in real-life investigations" (Aldridge, 1999). The first step in memory retrieval is to ask the eyewitness to recreate the conditions of the event—the description of the crime scene, the weather, the people, their personal feelings and reactions. Second, they are asked to write down every detail they remember, whether or not they think it is significant. Third, they are asked to recall the events in reverse order. Last, they are asked to recollect the incident from the perspective of someone else who was there—perhaps the

victim (Osterburg & Ward, 2000). In 1987, the cognitive interview was enhanced to include a longer and more relaxed interview, fewer interruptions, questions always phrased positively (Aldridge, 1999), rapport building with the interviewer, empathy, and preventing the eyewitness from feeling overpowered (Davis et al., 2004). The entire process is designed to ensure flexibility and questions are tailored to extract an individual's own unique interpretation of an event (Aldridge, 1999).

Collection of physical evidence. Fleming, Homand & Kennedy (1984) point out that as crime labs have learned how to analyze more types of evidence, it has become more important for officers responsible for evidence collection to be aware of all the possible kinds of forensic evidence (see Table 1; Lambert, et al., 2003) that can be present at a crime scene (as cited in Lambert et al., 2003). At a crime scene, knowing how to collect, store and label this evidence using the tools designed to help with this retrieval can be critical (see Appendix A; US National Institute of Justice, 2000).

A familiar investigative process concerns the recovery of fingerprints at a crime scene. Fingerprints left behind by a perpetrator are usually invisible and considered "latent." They can be made visible by being dusted with various types of powders or treated with chemicals. Some surfaces are not conducive to clearly revealing a fingerprint, i.e. human skin or paper toweling, so the print is processed with a chemical and then illuminated with a laser. The fingerprint is photographed and "lifted" with a special cellophane tape and then placed on a card (Osterburg & Ward, 2000).

Automated Fingerprint Identification Systems (AFISs) store police fingerprint files in computers and compare these files to prints lifted at a crime scene. This system narrows down the number of matches so a latent print examiner can make a final decision as to whether a crime

scene print matches a specific criminal's print in the database (Morn, 2000). In the case of the "Night Stalker" serial killer, police were able to search AFIS and pinpoint the perpetrator, Richard Ramirez, in twenty minutes. If a single technician had had to find a match manually using Los Angeles' 1.7 million fingerprint cards on file, it would have taken 67 years to find a match (Morn, 2000).

Science and law enforcement are working together to solve more crimes. *Teleforensics* is an attempt to use the non-destructive analyzing techniques used in space exploration, on physical evidence at a crime scene (Trombka et al., 2002). A working group consisting of NASA scientists and law enforcement professionals developed a prototype of a portable XRF (X-ray fluorescence) system that identifies gunpowder and primer residue, blood and semen without destroying the substances at a crime scene (Trombka et al., 2002). This development is of great significance. Gunshot residue, blood splatter and semen are easy to see on white filter paper, but undetectable on printed clothing. At a crime scene, substances that appear black, red and yellow are not necessarily gunpowder, blood and semen (Trombka et al., 2002), so a device such as this can be indispensable.

Identification of suspects. As research uncovers more about how the human mind works, more effective alternatives to tedious, inefficient suspect identification practices can be implemented. Typically, a witness is shown a random set of photos from a mug shot album to try and identify a criminal suspect. As a witness views more photos, the probability of making a correct identification decreases. Computerized feature-based systems have been developed to increase the likelihood of positively identifying a suspect. A minimum of two police officers are asked to describe physical characteristics on mug shot photos using a 107 feature questionnaire (see Table 2; Lee, Whalen, Terris & McCarthy, 2004). They rate each suspect's features using a

5-point Likert scale (i.e. nose size: small 1 2 3 4 5 large). Witnesses use the same questionnaire to rate a potential suspect's features and their results are compared to the database of descriptions provided by police. Witnesses then get to view photos in order of similarity to the facial ratings they completed of the offender rather than in the customary random fashion. Normally a witness would have to view approximately 500 photos out of 1,000 from a mug shot album before identifying a suspect. Studies have shown that the number of photos necessary to view for a positive identification was reduced to 25 with the new system (Lee, et al., 2004). Laughery & Wogalter (1989) note that the new process increases the chances of identifying the right suspect and reduces the probability of mistakenly implicating an innocent person (as cited in Lee et al., 2004).

A study has shown that the primary reason for innocent people are sent to prison is faulty suspect identification (Hansen, 2001a). Witnesses are inaccurate at spotting a suspect when shown a group of possible offenders simultaneously (in a lineup) because they tend to compare each person to the other, choosing the one they think is "best." If the lineup is conducted by someone who already knows who the suspect is, that person inadvertently does or says things (i.e. nodding approval or saying "take another look") that influence a witness' decisions. After twenty years of psychological research, the lineup process is starting to change. Witnesses shown one possible suspect at a time must make a yes or no decision based on memory and not on comparison between suspects. Having a lineup guided by someone who has no knowledge of the suspects prevents unintentional hints from influencing an eyewitness' decision. In New Jersey, the first state to employ these new procedures, police departments are getting fewer identifications, but a higher percentage of correct ones (Hansen, 2001b).

“Would not life be simpler and safer if we could accurately discover a person’s dangerous intentions simply by asking each individual if he or she meant to harm others?” (Dery, 2004). New *thermal imaging lie detection* technology, tested by the Mayo Clinic and Honeywell Laboratories, measures increased warming around a person’s eyes that occurs when blood flow increases to the face when someone is lying. In experiments done at the Department of Defense Polygraph Institute (DoDPI), the new system accurately detected 83% of the lies (compared to 70% using a polygraph) and 90% of truthful statements (compared to 66% with the polygraph). Since this method of lie detection can be used on someone without their knowledge, this has implications concerning Fourth Amendment rights (unreasonable search and seizure) and raises questions regarding protection from self-incrimination under the Fifth Amendment. These constitutional concerns are being considered as the appropriate use of this new lie-detection technology in law enforcement and terrorism is discussed (Dery, 2004).

Forensic Science

“Criminalistics (or in the broadest sense, forensic science) is generally defined as the application of science to law” (Ballou et al., 2003, p. 1149). Forensics continues to be an invaluable tool in law enforcement for analyzing the evidence collected at a crime scene. The majority of forensic laboratory work involves toxicology (detection of chemicals, drugs and gun powder residues), analysis of biological evidence (blood, semen, saliva), and identification and comparison of trace evidence (glass, hair, soil, plants and fibers). Exciting new developments have emerged in forensic science methods, allowing for the presentation of scientific evidence for criminal trials (Ballou et al., 2003).

DNA profiling. DNA is polymorphic—its characteristics differ only very slightly from one person to another. This quality makes it a nearly foolproof method of identification (Hansen,

2001b). Using United States standards for the collection of DNA samples, the probability of a match with a randomly chosen person is less than one in a trillion (Gill, 2005). DNA is present in blood, skin, hair, hair, teeth, bones (even charred) and bodily fluids. First introduced to the United States in 1986, DNA testing has improved and been accepted faster than any other scientific forensic technique (Hansen, 2001a).

In the 1990's, DNA analysis made incredible strides. The retrieval of a DNA profile from a small evidentiary sample—called low-copy DNA profiling—made it possible to recover DNA evidence from the smallest of samples like skin cells on a fingerprint (Gill, 2005). Initially, forensic techniques measured the total amount of DNA in a sample, but several newer procedures using polymer chain reaction (PCR) can separate and quantify human DNA from non-human DNA (food, animal or bacterial contamination) (Nicklas & Buel, 2003).

Additionally, DNA can be recovered from anything that has been worn or handled because of the transfer of DNA from skin cells. A shoe impression taken from the crime scene that matches a suspect's shoe can be analyzed for DNA evidence. Skin cells can be "tape lifted" (best method) from the insoles of the shoes from the toe and heel regions. Connecting the wearer of a shoe to a shoe impression found at the scene significantly increases the value of the forensic evidence (Bright & Petricevic, 2004).

Forensic toxicology. Toxicology is the identification of drugs or poisons in human tissues (DiMaio & DiMaio, 2001). The increase in drug-facilitated sexual assaults has precipitated the development of detection methods for drugs like Rohypnol. These new scientific techniques are being employed to help in the successful prosecution of rapists (Negrusz & Gaensslen, 2003).

A sexual predator slips a drug into their victim's drink and then sexually assaults them while they are unconscious. There is a loss of memory during and after the attack. It is this

amnesia-inducing quality that makes various “date-rape” drugs so appealing to a perpetrator (Negrusz & Gaensslen, 2003).

Many such victims do not immediately report a rape for emotional reasons, but more likely because of the amnesia brought on by the drug slipped into their drink. If a perpetrator is identified through DNA typing, he can claim the sex was consensual. With the detection of one of the many date-rape drugs found either in the victim’s blood, urine or hair, the claim of the crime being a rape would be supported by evidence (Negrusz & Gaensslen, 2003).

Very sophisticated and sensitive testing procedures have been developed that can positively test urine for even a single dose of a drug fourteen days after an assault. A longer delay in the reporting of a rape—because of amnesia, doubts concerning what actually happened and other emotional reasons—can decrease the reliability of urine detection. Recent advances in analytical instrumentation have improved the sensitivity of drug detection in a victim’s hair (Negrusz & Gaensslen, 2003). Yegles et al. (1997) reported positive findings of drugs in the hair of twenty- one corpses. Le Beau et al. recommended that the testing of hair could be invaluable in cases where the report of the crime was delayed (as cited in Negrusz & Gaensslen, 2003). Continued improvements in drug detection methods will help victims and aid law enforcement in the conviction of rapists who commit drug-assisted assaults (Negrusz & Gaensslen, 2003).

Forensic entomology. Forensic entomology is the study of insects with reference to a criminal investigation. Haskell et al. (1997) mentions that in the past, maggots crawling within dead bodies were simply washed off on the autopsy table (Campobasso & Introna, 2001). Not until the last few decades has entomology’s contribution to the solving of criminal investigations been realized (Benecke, 1998). Entomologists know which insects are drawn to particular stages of body decomposition this. Combining this knowledge with the rate of insect development, they

can approximate the time of death. Determination of time of death can help estimate the time of a murder, which can help implicate or eliminate suspects (DiMaio & DiMaio, 2001).

Medico-criminal entomology can also supply information that helps investigators determine the cause, manner and place of death—especially concerning decomposed, charred or skeletonized remains. When there are no soft tissues left on a body (skeletonized or charred) to examine postmortem changes (i.e. rigor mortis or body temperature), insect activity is the only way to determine postmortem interval (PMI)—how long a body has been deceased. Within seventy two hours after death, the entomological method of determining PMI is superior to soft tissue examination (Campobasso & Introna, 2001).

Other advantages to entomological investigation include the linking of a suspect to a crime scene when he or she was bitten by an insect indigenous to that specific area. If a corpse is discovered with insects not normally found in the particular area, there would be reason to believe that the body had been moved, which would lead investigators to search for the original crime scene (Benecke, 1998). Seemingly nonexistent blood stains on a murder weapon can attract flies, thereby identifying a murder weapon and leading to a suspect (Hall & Donovan, 2001). Scientific testing has successfully extracted human DNA from blood-feeding insects. This forensic analysis could aid investigators in identifying an offender if lice has been transferred from he or she to a victim or to a crime scene (Lord et al., 1998). Knowledge of insects provides surprisingly useful information to the discipline of forensic science and the process of criminal investigation (Campobasso & Introna, 2001).

Forensic odontology. Forensic odontologists specialize in identifying the body of a decomposed victim by comparing the structure of their mouth to dental records. Bite mark analysis can specifically tie a victim to a criminal suspect (Saferstein, 2004). A criminal trying to

commit the perfect crime would not necessarily leave his “mark” —a bite mark—on his victim; but, a victim might defensively leave his or her mark on an attacker, linking the two people together. In life and death struggles, Furness (1981) notes that teeth are sometimes the only weapon available to the victim (as cited in Sweet & Pretty, 2001). Dentists can help identify and prosecute assailants if they are apprised of the newest methods of collection and preservation of dental evidence from victims and suspects (Sweet & Pretty, 2001).

It is the distinct traits of human teeth that lend the evidentiary value to a case. Teeth, like incisors and wisdom, can be identified by their class characteristics (properties that tie them to a group but not a single source), but it is necessary to exhibit unique traits caused by the abuse of teeth to render distinct individual characteristics that connect the impressions to a specific individual (Sweet & Pretty, 2001).

A forensic dentist must document bite marks by taking notes, photographs and impressions of the actual bite marks (and the actual teeth of the victim or suspect) using various compounds available to a dentist. Bite marks on victims or suspects can also be swabbed for saliva DNA testing (Sweet & Pretty, 2001). Bite marks are usually measured and their pattern, shape and size analyzed and compared to someone’s actual teeth. Bite mark analysis is presumed to be reliable because of the uniqueness of teeth patterns, however the moving of the jaw, the movement of the person being bitten and the location of the bite can influence the accuracy of the impression in the skin. A new software package called Dental Print (2004) produces three dimensional images of bite marks. Dental Print creates multiple bite mark simulations that reflect different biting pressures or distortions of a bite using the suspect’s or victim’s dental casts (Heras et al., 2005).

Forensic Psychology

Not all crimes are easy to solve. There are crimes that are complex and serial in nature and seem to evade a solution. For these more complicated felonies, police turn to criminal profilers for help in identifying suspects and detecting their motives (Palmero, 2002).

The goal of a profiler is to gather enough information concerning the behavior, personality and physical attributes of an offender to help with his¹ capture (Muller, 2000). Criminal profiling is most often used in cases involving serial offenders (homicide, arson and sexually motivated crimes) as an investigative tool for law enforcement (Woodworth & Porter, 1999). Pinizotto (1984) remarks that profiling is usually reserved for crimes where a serial offender has exhibited extreme psychopathy such as sadistic torture, ritualistic or bizarre behavior, staging (purposeful alteration of a crime scene in order to mislead an investigation) or acting out a fantasy (as cited in Woodworth & Porter, 1999). O'Reilly-Fleming (1996) pointed out that although there are usually only a few active serial murderers in any given period of time, their crimes cause communities to feel extremely fearful and highly threatened (as cited in Woodworth & Porter, 1999). Profilers aid investigators in meeting the need for the public to feel and perhaps be free from danger.

Generally, the information needed is extrapolated from data collected from the crime scene, from victims and from the geographic patterns of other crimes possibly connected in a serial crime spree (Muller, 2000). There are two main methods used in profiling. The first one discussed is termed *crime scene analysis* and was developed by the FBI in the 1970's (Woodworth & Porter, 1999). The second, commonly referred to as *investigative psychology*, originated in Britain from work done by David Canter in 1985 (Muller, 2000).

Crime scene analysis. Holmes and Holmes (1998) define serial homicide as a string of three or more murders with a “cooling off” time between them (as cited in Woodworth & Porter, 1999). Serial homicide² is one of the most complex crimes to solve and compels law enforcement to employ techniques such as criminal profiling. There are various reasons why serial crimes are so perplexing. Victims are chosen at random and offer no connective evidence to a perpetrator as in typical homicides. Also, there is either no obvious motive or it is very hard to detect one (Woodworth & Porter, 1999).

The FBI addressed this challenge by developing crime scene analysis which involves the basic studying of crime scenes. The FBI also developed offender categories by interviewing incarcerated serial offenders (Egger, 1999). FBI profilers came up with two major categories of serial murders—organized and disorganized. An organized murder is repetitive and well planned. The murderer is self-centered, well prepared, takes pride in his actions, uses torture, commits sexual acts with the live victim and exhibits control over his victim with threats and restraints (Woodworth & Porter, 1999). He is fairly intelligent and often married, but has an antisocial tendency. A disorganized murderer has low intelligence, displays a severe form of psychosis, and has a history of contacts with the mental health system. He is sexually inexperienced and socially removed with only a few relationships outside of his immediate family. His crime will show little or no planning and he does not come prepared with his own murder weapons. The crime scene will reflect a frenzied and impulsive personality. The sexual acts are postmortem (necrophilia) and the victim’s body is brutalized—a “blitz” attack (Muller, 2000).

In order to provide some consistency in the methods of profiling, Ressler et al. (1998) states that the FBI designed a six stage process for profiling (as cited in Muller, 2000). The first

stage is *Profiling Inputs* and involves the compilation of all crime scene documentation collected from police and forensic investigators (Muller, 2000). In the second stage—the *Decision Process Model*—all the information is organized, the specifics of the crime scene(s) and victim(s) are evaluated and a preliminary analysis is formed. *Crime Assessment* is the third stage, when the profiler tries to get inside the mind of the killer in an attempt to reconstruct the crime. The formation of the *Criminal Profile* is the fourth stage and includes descriptions of a potential offender such as age, race, gender, appearance, history of relationships, occupations and education and whether he is organized or disorganized. In the fifth stage, the *Investigation*, the profiler submits his report. It is at this point when a profile is judged successful or not—based on whether or not there is a positive identification of a suspect. If new data becomes available, the profile is re-evaluated. *Apprehension* is the sixth and final stage and involves the use of profiling data to secure an arrest (Muller, 2000).

According to the FBI, a successful criminal profiler must have investigative experience which cannot be replaced by any amount of education. There must be a basic understanding of human psychology and the criminal mind, and some natural gifts of insight and intuition (Woodworth & Porter, 1999). It has been suggested that clinical psychology could improve the effectiveness of criminal profiling. Investigative psychology (an integration of investigation techniques with psychological concepts) can complement the FBI approach or be used as an alternative method (Woodworth & Porter, 1999).

Investigative psychology. This method, developed by David Canter and Rupert Heritage, differs from the FBI's approach which uses intuition and police experience. Investigative psychology (IP) uses the methods of social psychology, criminology and forensic psychiatry and relies heavily on information retrieved from the victim/body (Egger, 1999). Canter (2000)

stresses that profiling should formulate offender characteristics from the behavior they have exhibited during the execution of their crime (as cited in Woodworth & Porter, 1999). Canter (1995) notes that the IP approach differs from the FBI methods in that the conclusions about the offender are based on practical research and not investigative knowledge (as cited in Woodworth & Porter, 1999).

Investigative psychologists use facts acquired about a crime to form their research methods. Information is *retrieved* from the victim, suspect and witness statements, *captured* in documentation (photographs, pathologist reports and crime scene notes) and then *found* in letters from the offender, suicide notes, the suspect's computer files and pertinent facts about a victim. The goal is to use this data to form a profile and to maintain strong scientific standards for profiling (Canter, 2004).

Canter (1989) proposed five ways that psychology could be used to form criminal profiles. *Interpersonal coherence* refers to knowledge of the offender that can be obtained by noting how the offender engaged with the victim. The *significance of time and place* deals with the notion that an offender commits crimes near places of significance to him, such as his place of residence or his workplace. *Criminal characteristics* compare crimes and perpetrators to determine whether offenders can be placed into categories. *Criminal career* takes advantage of the observation that criminals generally are consistent in their manner of executing their crimes. Their past patterns can provide valuable information. The fifth approach is *forensic awareness*. If a criminal goes to extreme lengths to cover his tracks (i.e. having a rape victim take a bath), this is a sign that he has had experience dealing with the police. This knowledge could narrow down the list of suspects to those with criminal records (Muller, 2000).

Profiling advancements. Godwin and Canter (1997) conducted a study that concluded that IP does offer the help needed for difficult investigations (Muller, 2000). Although there is still a need for more research and scientific study, recent advances in the field of profiling show the promise of refinement and continued improvement of profiling methods (Woodworth & Porter, 1999). As of 1999, Canada had led the way in the advancement of profiling techniques. The Royal Canadian Mounted Police have turned to computer technology and other profiling innovations (Woodworth & Porter, 1999). Other countries can benefit from their innovative ideas.

The computer-based *Violent Crime Linkage Analysis System (VICLAS)* is a criminal profiling system that holds detailed information from all the solved and unsolved homicides, sexual assaults, missing persons and unidentified bodies resulting from homicides. A network of servers connects all the provinces to the main server in Ottawa. Investigators working on a case answer standardized questions regarding a victim's characteristics, modus operandi, forensic data and any apparent behavioral qualities of the suspect. The computer attempts to form linkages between crimes committed locally and in other provinces. Although there needs to be more research to determine the true effectiveness of VICLAS, reports suggest that it should greatly advance the cause of profiling. Other countries are very interested in adopting this system (Woodworth & Porter, 1999).

Another computer-based system called *Geographic Profiling* was developed by Canadian police officer Dr. Kim Rossmo. After a psychological profile has been developed, linked crime scene locations are used to approximate an offender's possible residence. The computer system *Rigel* creates a three dimensional map limiting the potential areas of residence of an unknown suspect. The application draws upon research from the disciplines of geography, mathematical

modeling, criminal investigation and environmental psychology. Data from these two systems allow police to limit the area they must search and thereby increases the likelihood of a criminal apprehension (Woodworth & Porter, 1999). Rossmo (1996) states that “a greater understanding of an offender’s spatial patterns and ‘crime space’ should be considered an important research objective” (as cited in Woodworth & Porter, 1999).

In addition to using the computer to improve profiling processes, Holmes and Holmes (1996) suggest that victims can provide valuable information (as cited in Woodworth & Porter). There is also a much to be learned from unsolved cases. Shared characteristics between cold cases could provide valuable insights as to why they remain unsolved (Woodworth & Porter, 1999). With *profile decoding*, researchers are attempting to use the forensic analysis of written documents (i.e. ransom or kidnapping notes) to discover the identity and nature of the person who wrote it (Egger, 1999).

Summary

The elimination of the perfect crime is an ambitious, complex, and worthy endeavor. The disciplines of criminal justice, forensic science and forensic psychology are in a constant state of innovation and their respective theories and methods are being integrated in an attempt to meet this objective. While new techniques provide criminal investigators, forensic scientists and criminal profilers the means to work more efficiently and solve more crimes—even perfect crimes, these new methods are not always easy to incorporate and can produce unforeseen challenges.

New procedures in criminal investigation can increase the probability of correctly identifying suspects and therefore re-energize the morale of police officers and the community

(Hansen, 2001a). “Police agencies throughout the world are entering an era in which technology is not only desirable, but necessary in order to combat crime effectively” (Schmallegger, 2004, p. 5). However, implementing new techniques requires education, money and time. The police are comfortable with their methods (Hansen, 2001a) and find it difficult to adjust to new technology and processes (Schmallegger, 2004).

Forensic science continues to achieve greater accuracy in connecting a perpetrator to a crime scene through the refinement of scientific techniques that analyze evidence. DNA is used to convict the guilty and exonerate the innocent (Hansen, 2001b). Unfortunately, as criminals become more aware of new forensic methods, they learn how to reduce their chances of getting caught— i.e. planting someone else’s DNA at a crime scene (Hansen, 2001b).

Forensic psychology, as a relatively new investigative tool, needs to continue refining its research techniques and further develop its theories (Egger, 1999). Criminal profiling may not solve crimes, but it holds great potential for helping investigators. It can be used to narrow down a list of suspects and point police in a more promising direction when there are no leads in an investigation (Muller, 2000). Criminal profiling can provide a fresh perspective and help predict future behavior of a serial offender (Woodworth & Porter, 1999). Decidedly, FBI profilers and investigative psychologists lack some appreciation for each other’s profiling methodologies. The FBI maintains that there is no substitute for experience and intuition, while investigative psychologists hold that more than insightful knowledge is required to understand complex psychopaths (Woodworth & Porter, 1999). Yet most of the current assumptions in either area of profiling have not been scientifically tested (Woodworth & Porter, 1999).

Investigators sometimes lack basic knowledge of scientific principles and have unknowingly tainted evidence, making it useless for scientific analysis and therefore

inadmissible in court (Lambert, et al., 2003). Failure to provide uncontaminated evidence can tarnish the image of a law enforcement agency (Lambert, et al., 2003) and create tension and frustration between police and forensic scientists. Criminal investigators can improve their methods of evidence collection and therefore provide a forensic laboratory with uncontaminated samples to be analyzed. Any relevant scientific data obtained from this evidence would help solve a case for law enforcement.

Although most homicide investigators are convinced of the value of criminal profiling for providing focus in their investigations, some in law enforcement remain skeptical of profiling because it is a poorly developed field (Muller, 2000). An inaccurate profile can lead an investigation in the wrong direction (Woodworth & Porter, 1999). For the collaboration of forensic psychology and criminal investigation to be more effective, each discipline must become more aware of each other's informational needs.

While forensic scientists do not have a distinct need for profiling in their scientific analysis of evidence, profilers can identify predictive characteristics of a possible suspect when forensic evidence is lacking (Canter, 2004). There are no apparent conflicts between these two disciplines—one deals with the physical sciences while the other deals with the behavioral. It is conceivable, however, that scientists would prefer the scientific assumptions of investigative profiling to the intuition and insights of crime scene analysis.

The prospect of solving many more crimes could be realized if the three disciplines of criminal justice, forensic science and forensic psychology worked together more consistently, better understood each other's needs and integrated their theories and methods. Innovations in investigative procedures, analytical techniques and the behavioral sciences will further the integration of these disciplines and their collective ability to solve more crimes. As they work as

a cohesive unit, society will benefit from living in safer communities and the criminal justice system will move closer to the goal of eliminating the perfect crime.

Integration

“Integration or synthesis...is a creative and complex process of combining disciplinary perspectives...for the purpose of forming a more comprehensive understanding of the question, problem, or issue” (Repko, 2005, p. 160). Each of the disciplines of criminal justice/investigation, forensic science and forensic psychology offers great insights and methods throughout the course of a criminal investigation. However, by knitting together the unique knowledge possessed by each of these areas of expertise, experts can create more comprehensive solutions for the elimination of the perfect crime.

A criminal investigator must recreate a past event—a crime. The “past” is formed using the collected and documented information from the crime scene. This data is very valuable to the investigator; but, if not shared with the other two disciplines, it’s usefulness is limited. Eyewitness testimony, documented facts of a crime scene and physical evidence have greater potential for helping solve a crime when processed through the perspectives of forensic science and forensic psychology.

Sharing evidence with a forensic laboratory places an increased responsibility on law enforcement to locate, secure, and collect evidence without contamination. Failure to do this correctly would lessen the likelihood of a conviction (Lambert, et al., 2003). A study conducted with law enforcement agencies revealed that 78% of participants considered knowledge of forensic science to be an important asset in carrying out their investigative duties (Lambert, et al., 2003). Police officers who receive forensic training are aware of the forensic laboratory’s needs regarding the thorough analyses of evidence. Although law enforcement must invest time

and money to stay current on updated standards concerning evidence recovery, they will benefit by becoming more professional, improving their image in their communities, and solving more crimes (Lambert, et al., 2003). Untainted forensic evidence also plays a large role in exonerating the innocent.

Criminal investigators depend on the forensic laboratory to scientifically analyze physical evidence, but behavioral evidence is examined through the discipline of forensic psychology. Whether this is done through crime scene analysis or investigative psychology, a profile of a criminal helps investigators limit their list of suspects, and provides focus for the investigation process (Woodworth & Porter, 1999). Jackson and Bekerian (1997) mention that investigators can supply profilers with the most pertinent and accurate information if they have some understanding of the theories and research behind offender profiling techniques (as cited in Egger, 1999). Studies have been conducted that reveal that profiling has validity, yet many police officers are skeptical of profiling partly because they view the solving of crimes as primarily dependent on their own expertise (Muller, 2000). “An improved relationship between psychology and law enforcement could lead to the apprehension of many dangerous criminals who would otherwise remain free and continue to perpetrate violent crimes” (Woodworth & Porter, 1999).

Forensic science is an invaluable tool to the criminal investigation process. Innovation in scientific techniques has significantly advanced the cause of fighting crime by connecting perpetrators to crime scenes with the thorough analysis of evidence originally collected by criminal investigators. Unfortunately, as forensic methods improve, criminals attempt to outsmart scientists and investigators by leaving less detectable evidence. Science must continue to deliver breakthroughs in evidence detection and analyzing techniques. As these procedures are

refined, evidence collection kits and protocols will have to be updated so that investigators can best serve the forensic laboratory (Negrusz & Gaensslen, 2003).

As a physical science, forensics can offer detailed scientific facts to support the discipline of forensic psychology in the development of criminal profiles. Information from the forensic laboratory can dramatically change the direction of an emerging profile. Forensic document examiners can combine their knowledge with that of a criminal profiler to form a composite of a suspect personality.

Forensic psychology offers the tools of crime scene analysis and investigative psychology to criminal investigators. Criminal profilers use information about the crime scene, victims, and apparent behavioral characteristics of a suspect exhibited at a crime scene to form a criminal profile. Crime scene analysis interprets the information using intuition and experience. By contrast, investigative psychologists make conclusions based on practical research. The synthesis of these two profiling methods may provide the most effective approach to criminal profiling (Woodworth & Porter, 1999).

Profiling attains its highest potential when profilers understand the needs and requirements of police (Egger, 1999). A profiler can be an asset to an investigation by providing a criminal profile that could result in the reduction of the field of suspects, predicting the future behavior of a suspect (Woodworth & Porter, 1999) and suggesting investigative avenues that may have been overlooked (Muller, 2000). However, an inaccurate profile can lead an investigation in the wrong direction (Woodworth & Porter, 1999). If the profiling community can share their data and theories, law enforcement agencies would have access to profiling techniques they could use themselves (Muller, 2000). In turn, forensic profilers can use practical police data to develop more scientific methods in profiling (Canter 2004).

There is no mention in the literature of how the discipline of forensic psychology can directly help the discipline of forensic science. However, in the absence of sufficient forensic evidence, an offender profile can still be formed based on how the crime was committed (Canter, 2004). Forensic psychology and forensic science can help each other build a criminal profile by combining their expertise in the behavioral and physical sciences. It is conceivable that attributes of a suspect in a criminal profile could cause forensic scientists to conduct further testing that would otherwise have been overlooked.

Conclusion

Can the integration of the theories and methods of criminal justice/investigation, forensic science and forensic psychology eliminate the possibility of the perfect crime? Each discipline contributes great insight and perspective into the problem. This integrated relationship creates a formidable force against the criminal element.

Every criminal dreams that his crime will go unsolved. Sometimes an offender deliberately plans a crime so that it will remain a mystery. The response of the criminal justice system has been to continuously create and refine techniques and procedures. Throughout the research process, it was discovered that advancements in these three disciplines were seemingly infinite and that police, forensic scientists, and criminal profilers are working tirelessly to fight an uphill battle. This discussion has demonstrated some of the developments that have occurred in criminal investigation, forensic science and forensic psychology and how these three disciplines can work more efficiently as an integrated team.

It may be difficult to find a correlation between innovation among the three disciplines and a decreased crime rate. Few crimes, approximately one in three, are even reported to police.³ Furthermore, crime data is sometimes changed to make a city's statistics appear favorable

(Stephens, 2003). Nevertheless, innovation within and among the three disciplines must continue. The importance of integrating their expertise and knowledge cannot be understated. This would bring them closer to achieving the worthy goals of making communities safer, providing stronger deterrents to crime, increasing societal awareness of the importance of criminalistics and eliminating the perfect crime.

*References***General**

- Faunton M.D., L., Miras M.D., A., Tilhet-Coartet M.D., S., Achache M.D., P., & Malicier M.D., D. (1998). The perfect crime: Myth or reality [Electronic version]. *The American Journal of Forensic Medicine and Pathology*, 19(3), 290-293.
- Repko, A., (2005). *Interdisciplinary practice: A student guide to research and writing*. Boston: Pearson Custom Publishing.
- Stephens, G. (2003). Global trends in crime [Electronic version]. *The Futurist*, 37(3), 40-46.

Criminal Justice

- Aldridge L.C.S.W., Ph.D., N. (1999). Enhancing children's memory through cognitive interviewing: An assessment technique for social work practice [Electronic version]. *Child and Adolescent Social Work Journal*, 16(2), 101-126.
- Davis, M. R., McMahon, M., & Greenwood, K. M. (2004). The role of visual imagery in the enhanced cognitive interview: Guided questioning techniques and individual differences [Electronic version]. *Journal of Investigative Psychology and Offender Profiling*, 1, 33-51.
- De Becker, G. (1997). *The gift of fear*. New York: Dell Publishing Co., Inc.
- Dery, G.M. (2004). Lying eyes: constitutional implications of new thermal imaging lie detection technology [Electronic version]. *American Journal of Criminal Law*, 31(2), 217-250.
- Hansen, M. (2001a, December). Second look at the lineup: New Jersey hopes to net fewer false identifications [Electronic version]. *American Bar Association Journal*, 87(12), 20-21.

- Kebbell, M. R., & Wagstaff, G. M. (1996) Enhancing the practicality of the cognitive interview in forensic situations. *Psychology*. 7(16). Retrieved October 11, 2005, from <http://psycprints.ecs.soton.ac.uk/archive/00000508/>
- Lambert, E., Nerbonne, T., Watson, P. L., Buss, J., Clarke, A., Hogan, N., et al. (2003). The forensic needs of law enforcement applicants and recruits: a survey of Michigan law enforcement agencies [Electronic version]. *Journal of Criminal Justice Education*, 14(1), 67-81.
- Lee, E., Whalen, T., Terris, M., & McCarthy, A. (2004). Computerized feature systems for identifying suspects: Empirical tests using crime scenarios [Electronic version]. *Behavior and Information Technology*, 23(2), 83-96.
- Loftus, E. (2003a, November). Make-believe memories [Electronic version]. *American Psychologist*, 58(11), 864-873.
- Loftus, E. (2003b, March). Our changeable memories: Legal and practical implications [Electronic version]. *Nature Reviews: Neuroscience*, 4, 231-234.
- Morn, F. (2000). *Foundations of criminal investigation*. Durham, NC: Carolina Academic Press.
- Osterburg, J.W., & Ward, R.H. (2000). *Criminal investigation*. (3rd ed.). Cincinnati, OH: Anderson Publishing Co.
- Saks, M.J., & Koehler, J.J. (2005). The coming paradigm shift in forensic identification science [Figure]. *Science*, 309(5736), 892-895.
- Schmallegger, F. (2004). On the horizon: Emerging investigative and security technologies [Electronic version]. *Crime and Justice International*, 20(78), 4-9.
- Stephens, G. (2005). Policing the future: Law enforcement's new challenges [Electronic version]. *The Futurist*, 14(1), 51-57.

- Trombka, J.I., Schweitzer, J., Selvka, C., Dale, M., Gahn, N., Floyd, S., et al. (2002). Crime scene investigations using portable, non-destructive space exploration technology [Electronic version]. *Forensic Science International*, 129(1), 1-9.
- US National Institute of Justice. (2000). *Crime scene investigation: A guide for law enforcement* [Appendix] [Electronic version]. Washington, DC: Government Printing Office.
- Weston, P.B., & Wells, K.M. (1970). *Criminal investigation: Basic perspectives*. Englewood Cliffs, NJ: Prentice-Hall, Inc.

Forensic Science

- Almirall, J.R., & Furton, K.G. (2003). Trends in forensic science education: expansion and increased accountability [Electronic version]. *Analytical and Bioanalytical Chemistry*, 376, 1156-1159.
- Ballou, S., Goodpaster, J., MacCrehan, W., & Reeder, D. (2003). Forensic analysis [Electronic version]. *Analytical and Bioanalytical Chemistry*, 376, 1149-1150.
- Benecke B.Sc., M.Sc., Ph.D., M. (1998). Six forensic entomology cases [Electronic version]. *Journal of Forensic Sciences*, 43, 797-805.
- Bright, J., & Petricevic, S.F. (2004). Recovery of trace DNA and its application to DNA profiling of shoe insoles. *Forensic Science International*, 145(1), 7-12.
- Campobasso, C. P., & Introna, F. (2001). The forensic entomologist in the context of the forensic pathologist's role [Electronic version]. *Forensic Science International*, 120(1-2), 132-139.
- DiMaio, V. J., & DiMaio, D. (2001). *Forensic Pathology*. (2nd ed.). Boca Raton, FL: CRC Press.
- Gaensslen, R. E. (2003). How do I become a forensic scientist?: Educational pathways to forensic science careers [Electronic version]. *Analytical and Bioanalytical Chemistry*, 376, 1151-1155.

Gill Ph.D., P. (2005). DNA as evidence: The technology of identification [Electronic version].

The New England Journal of Medicine, 352(26), 2669-2671.

Hall, M., & Donovan, S. (2001). Forensic entomology: What can maggots tell us about murders?

[Electronic version]. *Biologist*, 48(6), 249-253.

Hansen, M. (2001b, April). The great detective [Electronic version]. *American Bar Association*

Journal, 87(4), 36-42, 44, 77.

Heras M.D., Ph.D., B.D.S., S. M., Valenzuela M.D., Ph.D., B.D.S., A., Ogayar, C., Valverde

B.D.S., A. J., & Torres Phys.D., Ph.D., J. C. (2005). Computer based production of comparison overlays from 3D-scanned dental casts for bite mark analysis [Electronic version]. *Journal of Forensic Sciences*, 50(1), 1-7.

Lambert, E., Nerbonne, T., Watson, P. L., Buss, J., Clarke, A., Hogan, N., et al. (2003). The

forensic needs of law enforcement applicants and recruits: a survey of Michigan law enforcement agencies [Electronic version]. *Journal of Criminal Justice Education*, 14(1), 67-81.

Lord, W. D., DiZinno, J. A., Wilson, M. R., Budowle, B., Taplin, D., & Meinking, T. L. (1998).

Isolation, amplification, and sequencing of human mitochondrial DNA obtained from human crab louse, *Pthirus pubis* (L.), blood meals [Abstract] [Electronic version]. *Journal of Forensic Sciences*, 43(5), 1097-1100.

Negrusz, A. & Gaensslen, R. E. (2003). Analytical developments in toxicological investigation of

drug-facilitated sexual assault [Electronic version]. *Analytical and Bioanalytical Chemistry*, 376(8), 1192-1197.

Nicklas, J. A. & Buel, E. (2003). Quantification of DNA in forensic samples [Electronic

version]. *Analytical and Bioanalytical Chemistry*, 376(8), 1160-1167.

Saferstein, R. (2004). *Criminalistics: An introduction to forensic science*. (8th ed.). Upper Saddle River, NJ: Pearson Prentice Hall.

Sweet, D. & Pretty, I. A. (2001). A look at forensic dentistry— part 2: Teeth as weapons of violence—identification of bite mark perpetrators [Electronic version]. *British Dental Journal*, 190(8), 415-418.

Weston, P.B., & Wells, K.M. (1970). *Criminal investigation: Basic perspectives*. Englewood Cliffs, NJ: Prentice- Hall, Inc.

Forensic Psychology

Canter, D. (2004). Offender profiling and investigative psychology [Electronic version]. *Journal of Investigative Psychology and Offender Profiling*, 1, 1-15.

Egger, S. A. (1999). Psychological profiling: Past, present and future [Electronic version]. *Journal of Contemporary Criminal Justice*, 15(3), 242-261.

Muller, M. A. (2000). Criminal profiling: Real science or just wishful thinking? [Electronic version]. *Homicide Studies*, 4(3), 234-264.

Palmero, G. B. (2002). Criminal profiling: The uniqueness of the killer [Electronic version]. *International Journal of Offender Therapy and Comparative Criminology*, 46(4), 383-385.

Turvey, B. E. (2002). *Criminal profiling: An introduction to behavioral evidence analysis* (2nd ed.). San Diego, CA: Academic Press.

Woodworth, M. & Porter, S. (1999). Historical foundations and current applications of criminal profiling in violent crime investigations [Electronic version]. *Expert Evidence*, 7, 241-264.

Figure Caption

Figure 1. Factors associated with wrongful convictions.

Figure 1

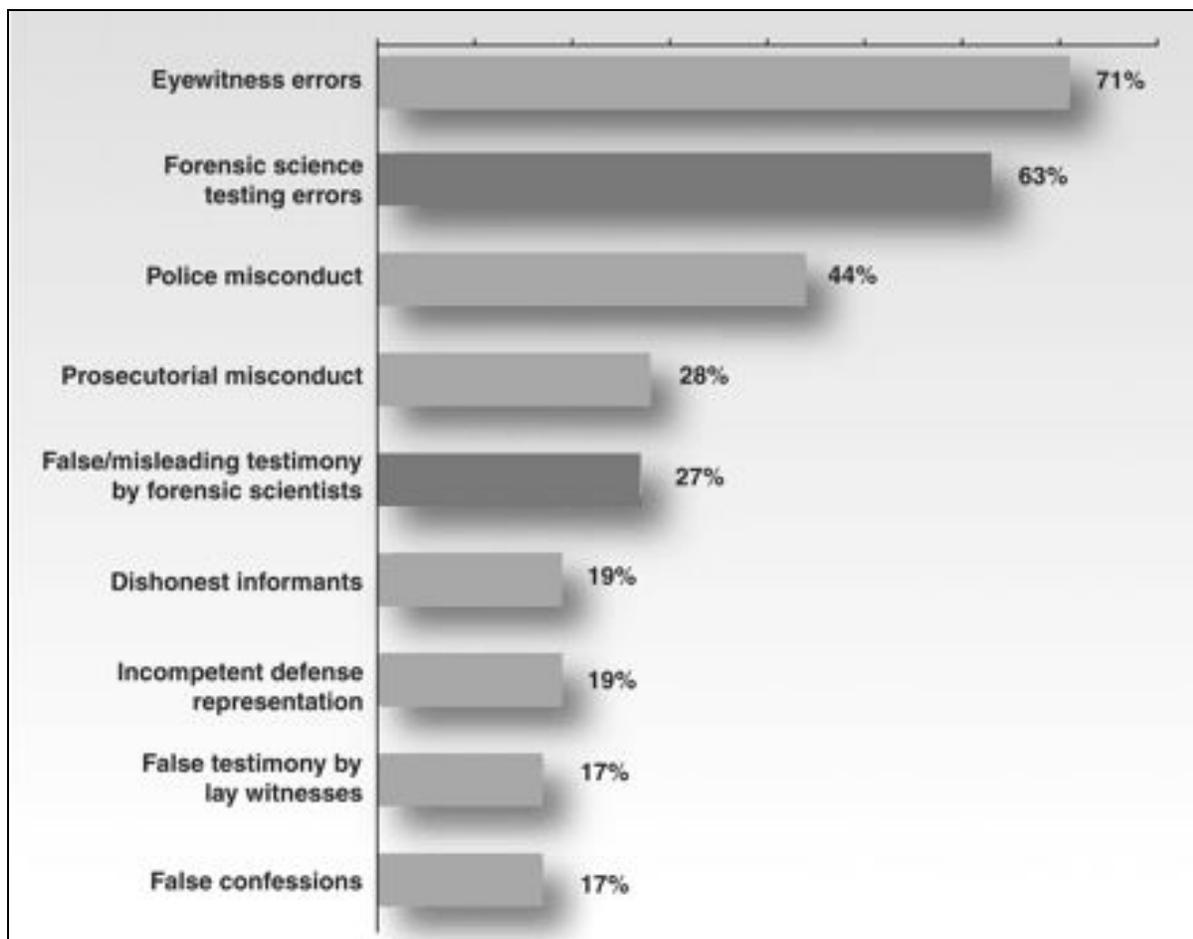


Fig. 1. Factors associated with wrongful convictions in 86 DNA exoneration cases.

Table 1

Various Types of Forensic Evidence

- **Blood Evidence** - any evidence that involves blood, including blood typing, presence of blood, spatter patterns, etc.
 - **DNA Evidence** - any evidence involving DNA testing, including typing, isolation and electrophoresis (movement and separation of DNA fragments through a gel by electrical current), RFLP (Restriction Fragment Length Polymorphism, a type of DNA analysis), PCR (Polymerase Chain Reaction, a method of replicating very small pieces of DNA to gain enough DNA for analysis), population genetics (DNA profiles of various ethnic populations), etc.
 - **Latent and Fingerprint Evidence** - evidence involving a print made by fingers, hands, and/or feet that is either readily or not readily visible.
 - **Firearm Evidence** - evidence involving firearms. Including ballistics, ammunition analysis, projectile analysis, etc.
 - **Trace Evidence** - hair, textile fibers, other fibers, paint chips, gunshot residue particles, and/or glass fragments.
 - **Document Evidence** - analysis of paper documents, such as forgery, handwriting analysis, etc.
 - **Biological Fluid Evidence** - fluid evidence that have human or animal origin, such as mucus, perspiration, saliva, semen, vaginal secretions, urine, etc.
 - **Plant Evidence** - botanical traces, such as wood, pollen. spores, plant cells, starch grains, etc .
 - **Impression Evidence** - objects or materials that have retained the characteristics of other objects that have been physically pressed against them, such as bite marks, tool marks, tire impressions, shoe impressions, etc.
 - **Electronic Recorded Evidence** - evidence that was recorded via an electronic device, such as phone tapes, answering machine tapes, video surveillance tapes, other surveillance recordings, etc.
-

Table 2

*Suspect Feature Questionnaire**Overall shape of face*

1. Short vs. long
2. Narrow vs. broad
3. Bony vs. fleshy
4. Not round vs. round
5. Not well vs. well proportioned
6. Weak vs. strong facial structure
7. Flat vs. protruding face

Complexion

8. Fair vs. dark
9. Pale vs. florid (ruddy)
10. Unlined vs. lined
11. Clear vs. blemished
12. Untanned vs. tanned
13. Not olive vs. olive
14. Not brown vs. brown
15. Not sallow vs. sallow
16. Not black vs. black

Hair

17. Short vs. long
18. Untidy vs. tidy
19. Straight vs. curly
20. Bald vs. full head of hair
21. Light vs. dark
22. No grey vs. white
23. No black vs. black
24. No brown vs. brown
25. No red vs. red
26. Not blond vs. blond
27. Not receding vs. receding
28. Unkempt vs. kempt
29. No height vs. lot of height
30. No part vs. part
31. Not clean cut vs. clean cut
32. No style vs. style

Forehead

33. Low vs. high
34. Narrow vs. broad
35. Not protruding vs. protruding

Eyebrows

36. Thin vs. bush
37. Straight vs. rounded
38. Do not vs. do meet in middle
39. Low vs. high
40. Short vs. long

Eyes

41. Small vs. large
42. Narrow vs. wide opening
43. Close set vs. wide separation
44. Deep set vs. bulging
45. Not blue vs. blue
46. Not grey vs. grey
47. Not green vs. green
48. Not hazel vs. hazel
49. Not brown vs. brown
50. None vs. abnormalities

Ears

51. Small vs. large
52. Close to head vs. stick out
53. Normal vs. unusual shaped
54. Little vs. large earlobes

Nose

55. Small vs. large
56. Short vs. long
57. Narrow vs. broad
58. Concave vs. hooked
59. Small vs. large nostrils
60. Narrow vs. broad tip
61. Not flat vs. flat
62. Not crooked vs. crooked

Cheeks

63. Low vs. high cheek bones
64. Sunken vs. full cheeks

Mouth

65. Small vs. large
66. Thin vs. thick upper lip

Table 2

Suspect Feature Questionnaire, continued

67. Thin vs. thick lower lip

68. Lower lip overlaps upper vs. ...

Teeth

69. Malformed vs. regular

70. Not ivory vs. ivory white

71. None vs. braces, caps, spacers

72. Not clean vs. clean

Chin

73. Small vs. large

74. Pointed vs. square

75. Receding vs. jutting out

76. Not fat vs. fat

77. No cleft vs. cleft

78. Weak vs. strong

Neck

79. Thin vs. thick

80. Short vs. long

81. Small vs. large adams apple

Facial hair

82. None vs. lots (beard, etc)

83. No sideburns vs. sideburns

84. No beard vs. long beard

85. None vs. long moustache

86. Light vs. dark

Body

87. Narrow vs. broad shoulders

Physical peculiarities

88. Normal vs. unusual eyes

89. None vs. scars/tattoos/etc.

90. None vs. physical deformities

Attire

91. Casual vs. formal

92. Sloppy vs. neat

93. Flamboyant vs. conservative

94. Inexpensive vs. expensive

Accessories

95. No glasses vs. glasses

96. No earrings vs. earrings

97. No chain vs. chain

Appearance

98. Young (teen) vs. older (50+)

99. Unattractive vs. handsome

100. Unkempt vs. well-groomed

101. Undignified vs. dignified

102. Unhealthy vs. healthy looking

103. Not vs. foreign looking

Personality

104. Looks uneducated vs. educated

105. Effeminate vs. masculine

106. Not tough vs. tough looking

107. Looks unintelligent vs. intelligent

Appendix A: Crime Scene Equipment

Crime Scene Equipment

Initial Responding Officer(s)

Essential*

Consent/search forms.
 Crime scene barricade tape.
 First-aid kit.
 Flares.
 Flashlight and extra batteries.
 Paper bags.
 Personal protective equipment (PPE).

* These items should be in police vehicles or readily available to initial responding officer(s).

Optional

Audiotape recorder.
 Camera with flash and extra film.
 Chalk.
 Directional marker/compass.
 Disinfectant.
 Maps.
 Plastic bags.
 Pocket knife.
 Reflective vest.
 Tape measure.
 Tarps to protect evidence from the weather.
 Traffic cones.
 Waterless hand wash (towelette with germicide).
 Wireless phone.

Crime Scene Investigator/Evidence Technician

Essential*

Bindle paper.
 Biohazard bags.
 Body fluid collection kit.
 Camera (35 mm) with flash/film/tripod.
 Casting materials.
 Consent/search forms.
 Crime scene barricade tape.
 Cutting instruments (knives, box cutter, scalpel, scissors).
 Directional marker/compass.
 Disinfectant.
 Evidence collection containers.
 Evidence identifiers.
 Evidence seals/tape.
 First-aid kit.
 Flashlight and extra batteries.
 High-intensity lights.
 Latent print kit.
 Magnifying glass.
 Measuring devices.
 Permanent markers.

Personal protective equipment (PPE).
 Photographic scale (ruler).
 Presumptive blood test supplies.
 Sketch paper.
 Tool kit.
 Tweezers/forceps.

* These items should be in police vehicles or readily available to initial responding officer(s).

Optional

Audiotape recorder.
 Bloodstain pattern examination kit.
 Business cards.
 Chalk.
 Chemical enhancement supplies.
 Entomology (insect) collection kit.
 Extension cords.
 Flares.
 Forensic light source (alternate light source, UV lamp/laser, goggles).

Crime Scene Equipment, continued

Generator.
 Gunshot residue kit.
 Laser trajectory kit.
 Maps.
 Marking paint/snow wax.
 Metal detector.
 Mirror.
 Phone listing (important numbers).
 Privacy screens.
 Protrusion rod set.
 Reflective vest.
 Refrigeration or cooling unit.
 Respirators with filters.
 Roll of string.
 Rubber bands.
 Sexual assault evidence collection kit (victim and suspect).
 Shoe print lifting equipment.
 Templates (scene and human).
 Thermometer.
 Traffic cones.
 Trajectory rods.
 Video recorder.
 Wireless phone.

Evidence Collection Kits (Examples)

Blood Collection

Bindle.
 Coin envelopes.
 Disposable scalpels.
 Distilled water.
 Ethanol.
 Evidence identifiers.
 Latex gloves.
 Photographic ruler (ABFO scales).
 Presumptive chemicals.
 Sterile gauze.
 Sterile swabs.
 Test tubes/test tube rack.

Bloodstain Pattern Documentation

ABFO scales.
 Calculator.
 Laser pointer.
 Permanent markers.
 Protractor.
 String.
 Tape.

Excavation

Cones/markers.
 Evidence identifiers.
 Metal detectors.
 Paintbrushes.
 Shovels/trowels.
 Sifting screens.
 String.
 Weights.
 Wooden/metal stakes.

Fingerprint

Black and white film.
 Brushes.
 Chemical enhancement supplies.
 Cyanoacrylate (super glue) wand/packets.
 Flashlight.
 Forensic light source.
 Lift cards.
 Lift tape.
 Measurement scales.
 One-to-one camera.
 Powders.

Crime Scene Equipment, continued

Impression

Bowls/mixing containers.
Boxes.
Dental stone (die stone).
Evidence identifiers.
Measurement scales.
Permanent markers.
Snow print wax.
Water.

Pattern Print Lifter

Chemical enhancement supplies.
Electrostatic dust lifter.
Gel lifter.
Wide format lift tape.

Toolmarks

Casting materials.

Trace Evidence Collection

Acetate sheet protectors.
Bindle paper.
Clear tape/adhesive lift.
Flashlight (oblique lighting).
Forceps/tweezers.
Glass vials.
Slides and slide mailers.
Trace evidence vacuum with disposable collection filters.

Trajectory

Calculator.
Canned smoke.
Dummy.
Laser.
Mirror.
Protractor.
String.
Trajectory rods.

Notes

¹This paper assumes that the serial offender is male. Almost all identified serial killers are male (Muller, 2000).

²Egger (1997) uses the term serial homicide to include serial rape. A violent rape often turns into a murder. Both serial crimes are more about the exercise of power than sexual gratification (as cited in Muller, 2000).

³ Unreported crime is termed by criminologists as “the dark figure of crime” (Stephens, 2003).