ADDENDA OF CITED MATERIALS NOT READILY AVAILABLE

MOTION TO VACATE JUDGMENT OF CONVICTION

PEOPLE V. CHRISTOPHER PORCO

Albany County Indictment Number DA848-05

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Article

*53 DATABASE LIMITATIONS ON THE EVIDENTIARY VALUE OF FORENSIC MITOCHONDRIAL DNA EVIDENCE

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ABSTRACT: Mitochondrial DNA (mtDNA) typing is increasingly being offered in criminal jury trials as proof that the defendant is a possible contributor of DNA found at a crime scene. As a prerequisite to introducing such evidence, the prosecution typically must estimate the frequency in the general population of the mtDNA sequence found in the defendant and the crime scene so that jurors can evaluate the probative value of the defendant's inclusion as a potential contributor. The government estimates sequence frequencies by comparing the observed sequence to sequences listed in a racially categorized mtDNA database developed and maintained by the Federal Bureau of Investigation and the Scientific Working Group on DNA Evidence. While mtDNA evidence has significant potential as a law enforcement tool, the SWGDAM database is currently too small and insufficiently representative to provide meaningful estimates of sequence frequencies. Most importantly, the database fails to account for historic and recent human migration patterns that, because mtDNA is maternally inherited and not recombinant, have resulted in significant regional differences in sequence frequencies. With further sampling and study, large regional databases may prove to be an effective and feasible improvement upon the current forensic database for the calculation of meaningful frequency estimates. However, until such databases and meaningful frequency estimates exist, mtDNA evidence is not yet ready for admission in criminal cases to permit inferences that suspects left mtDNA at crime scenes.

INTRODUCTION

Although the public and the legal community are now familiar with nuclear ***54** DNA, first admitted as evidence in United States courts almost twenty years ago, [FN1] nuclear DNA has a less famous counterpart found in the mitochondria of human cells, known as mitochondrial DNA ("mtDNA"). In recent years, law enforcement has increasingly used mtDNA evidence as a tool of both exclusion and inclusion of individuals as suspects in criminal cases. Specifically, because mtDNA exists in greater copy numbers per cell than nuclear DNA, mtDNA is becoming the primary type of forensic evidence extracted and reported from hair shaft samples and degraded DNA. A person may be excluded as a suspect if his mtDNA "profile," i.e., his mtDNA sequence in particular regions of his full mtDNA strand or "genome," differs from the profile of the crime scene sample. Such

exclusion evidence may be relevant both at the pretrial investigation stage — to prevent wrongful accusation and conviction of innocent persons — and in post-conviction proceedings, such as Innocence Project DNA exonerations, to correct wrongful convictions. Use of mtDNA typing for exclusion purposes has been widely embraced in the scientific and legal communities because it preserves law enforcement resources by removing red herrings from investigations and focusing attention on the true perpetrator(s). [FN2]

As a tool of inclusion, however, mtDNA typing is more controversial. In criminal cases involving mtDNA, the prosecution typically reports that a defendant is included as a suspect if his mtDNA profile is consistent with, or "matches," [FN3] the profile in a crime scene sample. [FN4] Most courts also require the prosecution to present an estimate of this shared mtDNA profile's frequency in the relevant population, [FN5] on grounds that, without such an estimate, jurors cannot meaningfully assess the probative value, if any, of the defendant's inclusion as a potential *55 contributor. To estimate such frequencies, an analyst typically compares the suspect's mtDNA profile to a forensic reference database compiled and maintained by the Scientific Working Group on DNA Evidence ("SWGDAM"), a group sponsored by the Federal Bureau of Investigation ("FBI"). [FN6] In comparing a suspect's sequence to the SWGDAM database, the analyst counts the number of times the sequence appears in various sub-databases organized by the self-reported "race" [FN7] of the sample contributors, then uses this number to estimate the true frequency of the sequence in each race-based population. [FN8] Because of the small size of these databases and the diversity of mtDNA profiles, [FN9] this approach usually yields zero "hits" in the database. Thus, the estimated frequency of the sequence reported out is often less than 0.1%. [FN10] Such a low estimate is potent evidence in a criminal jury trial because it suggests that a randomly selected individual has only a 1 in 1000 chance of sharing the profile observed in the crime scene sample.

Of course, a frequency estimate is only as good as the statistical method used to calculate it. If the method is invalid, such as if the database is not representative of the relevant population, the resulting frequency estimates may be inaccurate and, if so, will not give the jury a meaningful way to evaluate the probative value of the reported inclusion. In turn, if the probative value is unknown or inaccurately reported, most courts would rule that the evidence of inclusion is inadmissible based on rules of relevance and novel scientific evidence. Thus, whether the SWGDAM database is a valid tool to estimate mtDNA sequence frequencies is a critical question courts should ask in determining whether to admit evidence of mtDNA inclusions. Neither forensic scientists nor attorneys frequently present these questions to courts in a considered way. This Article is an attempt to *56 encourage the legal and scientific communities to view these questions with a more critical eye.

Part I of this Article briefly discusses the fundamentals of mtDNA biology and forensic typing methods and how they differ significantly from nuclear DNA biology and typing methods. Part II explains mtDNA's forensic applications and the particular methods used by the FBI to type mtDNA sequences and estimate sequence frequencies using population databases.

Part III contends that reported mtDNA frequency estimates are currently misleading because the SWGDAM database from which the estimates are calculated is neither representative of the general population nor of the various sub-populations it professes to characterize. First, the SWGDAM database is an incomplete, non-random, non-representative collection of mtDNA profiles compiled without regard to geographic patterns of genetic clustering that have resulted from cultural, political,

historical, and economic forces. Second, current reliance in criminal cases on estimates derived from comparisons to the SWGDAM database is misplaced given the poor quality control measures of the database and the manner in which the assessment method is skewed toward reporting an inclusion.

Part IV examines both the general principles governing the admissibility of scientific evidence in most jurisdictions and courts' treatment of mtDNA inclusion evidence. Part IV argues that, because the estimation of profile frequencies using the SWGDAM database is currently controversial and of questionable validity, evidence of mtDNA inclusions does not yet meet most jurisdictions' legal standards for admissibility.

The Article concludes by prescribing various measures to improve the quality and integrity of forensic mtDNA typing. It is the expectation of the authors that, once mtDNA evidence is properly understood in its full scientific context, and once statistically valid databases can place a true probative value on mtDNA evidence, it will be reliable, highly relevant, and properly used in criminal investigations and prosecutions. Today, however, the state of mtDNA evidence presents an unacceptable risk of accusing or convicting the innocent based on inaccurate and misleading scientific evidence.

I. THE BASICS OF MTDNA TYPING AND HOW IT DIFFERS FROM NUCLEAR DNA TYPING

A. Differences in the Biology of MtDNA and Nuclear DNA

Deoxyribonucleic acid ("DNA") exists in every human cell and contains genetic codes inherited from previous generations. Humans have two types of DNA: nuclear DNA ("nDNA") and mtDNA. The mtDNA genome is distinct from the nDNA genome, and the two types of DNA differ in terms of their location within the body, genome size, and genetic makeup. While nDNA is bundled within chromosomes in the nucleus of most human cells, mtDNA exists outside the *57 nucleus in energy-producing organelles called mitochondria. The mtDNA genome is also much smaller than that of nuclear DNA; while the nuclear genome consists of approximately three billion base pairs, [FN11] the mtDNA genome contains approximately 16,569 base pairs. [FN12] The mtDNA genome consists of two primary regions: a *coding region*, which regulates the production of various biological molecules, and a *control region*, which regulates replication of the mtDNA molecule itself. [FN13] The control region, approximately 1125 base pairs long, [FN14] is the only significant portion of the mtDNA strand that does not code for genes. [FN15] In contrast, the nDNA genome contains coding regions spread throughout the twenty-three chromosomes that are known to have a genetic purpose, surrounded by regions of so-called "junk" nDNA, for which scientists have yet to find a genetic purpose.

B. Differences in Forensic Typing of MtDNA and Nuclear DNA

To distinguish one individual's DNA from that of another, forensic scientists look to particular locations within non-coding regions of the nuclear and mtDNA genomes that are highly variable among humans and therefore have discriminating power. In nuclear DNA typing, scientists typically look to thirteen locations along an individual's nDNA strand identified by the FBI as particularly suit-

able for forensic testing and used by the FBI to generate the profiles contained in its Combined DNA Index System (CODIS). A person's forensic nDNA "profile" consists of the twenty-six alleles he exhibits at these thirteen "CODIS loci." [FN16]

To compare individuals' mtDNA strands, most forensic scientists focus on two regions within the mtDNA control region — "Hypervariable Region I" ("HVI") and "Hypervariable Region II" ("HVII") — that together encompass approximately 610 base pairs and that exhibit high mutation rates and high amounts of variation from person to person. [FN17] A person's mtDNA "profile" consists of a list of the differences in HVI and HVII between that person's sequence and a reference sequence called the Cambridge Reference Sequence ("CRS") or "Anderson sequence," so named ***58** because the mtDNA genome of a particular individual, Stephen Anderson, was completely sequenced in 1981 by biochemist Fredrick Sanger in Cambridge, England. [FN18]

Scientists have begun to sequence nucleotides other than those in HVI and HVII in an effort to provide additional means of distinguishing different individuals' mtDNA. [FN19] They have focused, for instance, on a region referred to as "Hypervariable Region III" ("HVIII"), [FN20] also in the control region. In addition, even greater discrimination may be possible by typing certain nucleotides in the coding region called Single Nucleotide Polymorphisms ("SNPs"), single locations along the mtDNA genome exhibiting hypervariability. [FN21] Most forensic analysts do not currently type these additional locations along the mtDNA genome both because they know little about the variation outside HVI and HVII and because of convenience and cost concerns. [FN22] Exceptions exist, however; the Armed Forces DNA Identification Laboratory ("AFDIL") is currently attempting to detect levels of variation throughout the entire mtDNA genome for forensic purposes. [FN23]

MtDNA typing also differs significantly from nDNA typing because of the manner in which mtDNA is inherited. A child inherits twenty-three chromosomes from both of his parents; each set of chromosomes contains a full complement of nDNA strands with 3.2 billion base pairs. Thus, at each location along the nDNA ***59** strand, each individual has two genetic forms or "alleles" — one from each parent. [FN24] Of course, the parents each have two alleles at each location as well; which one of these two alleles each parent passes on is random. At each of the thirteen locations along the human nDNA genome used in forensic testing, only a limited number of possible alleles have been observed. As recombination occurs with each successive generation, different combinations of alleles are created over time. In contrast, scientists generally believe that the human mtDNA genome is only passed on from mother to child. [FN25] Consequently, all biological children of one woman will, absent mutations, have identical mtDNA profiles, and, going back generations, *all* relatives within the maternal lineage, absent mutations, will share the same mtDNA sequence.

While mtDNA's lack of recombination makes mtDNA sequences relatively static compared to nDNA, mtDNA exhibits a high rate of mutation between generations. Some regions of mtDNA evolve at rates five to ten times faster than single-copy nuclear genes. [FN26] Consequently, while each member of a maternal line should theoretically exhibit identical mtDNA profiles, the high mutation rate of mtDNA means that the profiles of members of the same maternal line, particularly over generations, may be slightly different.

Individuals are "homoplasmic" with respect to their nuclear DNA profile, meaning that all nuclear DNA strands found in a person's body contain the identical genetic material and do not differ from

cell to cell. As recently as ten years ago, most scientists considered the vast majority of individuals to be "homoplasmic" with respect to mtDNA as well. [FN27] Scientists now understand, however, that most, if not all, individuals are actually "heteroplasmic" with respect to mtDNA, meaning that an individual's mtDNA sequence can differ among ***60** locations in the body, or even within the same cell. [FN28] Although heteroplasmy is routinely observed, its causes are not fully known. [FN29] The chance of detecting heteroplasmy depends on the sequencing chemistry and techniques used. [FN30] Some body tissues, such as hairs, tend to show more variability in mtDNA sequence than others. [FN31]

Heteroplasmy and high mutation rates complicate forensic mtDNA analysis in two respects. On the one hand, samples from a suspect and a crime scene may, because of heteroplasmy, exhibit mtDNA sequence differences even when the two are, in fact, from the same individual or lineage, thus leading to potentially false exclusions. On the other hand, the suspect and crime scene samples may exhibit sequence commonalities even when the two are, in fact, from different individuals.

One other important difference in the state of current nDNA and mtDNA typing is the existence of population databases from which accurate frequency estimates can be generated. Scientists have conducted many population studies to generate population frequency estimates for nDNA and have reached some agreement that, using modifications to account for population inter-relatedness, reliable frequency estimates are possible. [FN32] In stark contrast, the frequency and distribution of mtDNA sequences in the population are not yet known. These population substructure issues with respect to mtDNA are the focus of nascent, but already quite active, scholarship among genetic anthropologists and forensic scientists. [FN33]

What *is* known about the frequency of mtDNA profiles in the population suggests that, unlike nuclear DNA, mtDNA profiles are far from randomly distributed. Groups of people with similar mtDNA within a circumscribed range of variation are called "haplogroups"; variation within a haplogroup divides people into "haplotypes," or particular mtDNA sequences. Researchers have named haplogroups observed in certain populations, based on the presence of certain ***61** combinations of variations. [FN34] For example, ten mtDNA haplogroups have been identified at significant frequencies in the European and U.S. European-American sub-populations. [FN35]

II. THE USE OF FORENSIC MTDNA TESTING AS A TOOL OF INCLUSION IN CRIMINAL TRIALS

To be clear, mtDNA typing is used as a tool of identification in many fields unrelated to inculpation of suspects in criminal trials. Because mtDNA is maternally inherited and found in higher copy number than nDNA, mtDNA analysis is particularly helpful in conducting population studies for medical, [FN36] genealogical, [FN37] and anthropological purposes, [FN38] and has been used by the military to identify casualties of war and terrorism. [FN39] For example, through mtDNA analysis, scientists have been able to identify victim remains from the World Trade Center tragedy, the Oklahoma City bombing, the Bosnian War, natural disasters, and plane crashes. [FN40] The demonstrated utility of mtDNA testing in these contexts stems ***62** largely from its ability to identify maternal lines and to exclude individuals whose profiles differ from questioned samples. For similar reasons, mtDNA is appropriately used in criminal cases to exonerate persons whose mtDNA profiles are

revealed inconsistent with crime scene samples. [FN41]

The FBI has led the field in the use of mtDNA evidence to *inculpate* criminal suspects. The FBI began studying mtDNA technology in 1992 and conducting mtDNA casework in 1996, [FN42] and is now one of a handful of public and private laboratories in the United States that conduct forensic mtDNA testing. [FN43] Because the FBI is the federal government's forensic laboratory, and because SWGDAM, under the auspices of the FBI, maintains the sole database used in the United States in forensic mtDNA analysis, this Article discusses its procedures as illustrative of all forensic mtDNA laboratories. What follows is a description of the FBI's methods for developing a suspect's mtDNA profile, determining whether the suspect should be "included" as a potential contributor because his profile is consistent with the evidence sample profile, and calculating the statistical significance of an inclusion through estimation of sequence frequencies in the population using the SWGDAM database. [FN44]

An analyst first sequences the HVI and HVII regions of a sample found at the crime scene. Next, assuming a suspect has been identified and has submitted a DNA sample, the analyst sequences the HVI and HVII regions of the suspect's sample and compares the two profiles against each other. The FBI, according to its protocols, does not automatically exclude a suspect if his profile differs from that of the evidence sample. Indeed, the FBI will only definitively exclude a suspect if there are two or more base pair differences between the samples with no evidence of heteroplasmy, on the theory that one difference may be the result of heteroplasmy. [FN45]

While the FBI declares an automatic exclusion only in cases involving two or more differences, the FBI will declare an *inclusion* (called a "failure to exclude") ***63** under several different scenarios. [FN46] Thus, if the examiner determines that the profiles of the suspect and evidentiary samples are identical at each of the bases in HVI and HVII, the suspect is included as a possible contributor. [FN47] The examiner also will not exclude the suspect if the profiles have a one base-pair difference and either sample displays heteroplasmy. [FN48] If the profiles have a one-base pair difference in HVI and HVII and no evidence exists that the suspect or evidence sample is heteroplasmic, the result is "inconclusive," and the suspect will again not be excluded. [FN49] As explained in Part I, the FBI does not sequence outside HVI and HVII to determine whether other differences exist besides those already observed that could exclude the suspect as a potential contributor to the evidence sample.

If the suspect's profile is consistent with the evidence profile, the analyst then compares this shared profile to the SWGDAM database. [FN50] The entire database contains 5071 profiles. [FN51] The database is subdivided into fourteen so-called "racial" sub-populations. [FN52] The database profiles come from samples collected by ***64** paternity testing laboratories, blood banks, FBI agents, and scientific research groups. [FN53] The classifications of the sequences are based on the self-reporting of the individuals who agreed to give the samples. The FBI does not claim that these samples are geographically diverse, randomly selected, or representative. Rather, the samples were obtained in an *ad hoc*, non-random manner from a few locations. [FN54]

To generate frequency estimates from the SWGDAM database, forensic scientists count the number of times that the shared profile "matches" a profile in each of the sub-population databases (the "counting method"). [FN55] The analysts count only the number of appearances of the profile in the database and not the appearances of the profile in the suspect and in the evidence sample. Because

the SWGDAM database omits the vast majority of mtDNA profiles and because more than 50% of the profiles in the SWGDAM database appear only once in the database, [FN56] this approach most often results in a count of zero observations or "hits."

The analyst next estimates the rarity of the profile in various "racial" populations based on the number of observations in each of several sub-databases categorized by self-reported ancestry. If the analyst sees at least one observation, ***65** this process involves dividing the number of observations by the size of the database. [FN57] For example, if the profile were observed once in the African-American database (n = 1148), the frequency would be 1/1148 or 0.0008711. The analyst would then place a 95% confidence interval around that number as a margin of error in estimating the frequency in the larger population, [FN58] and the laboratory would report the upper-bound frequency. For an observed frequency of 0.0008711, the upper confidence limit is 0.002577, or 0.2577%, and the laboratory would report that about 99.74% of African Americans are excluded as potential contributors of the sample.

Because all people sharing a common maternal lineage are expected to have the same mtDNA sequence (excluding considerations of intergenerational mutation), the FBI acknowledges that examiners cannot declare identity based on mtDNA analysis alone. Yet such small reported probabilities of inclusion calculated from the SWGDAM database can suggest to juries that the consistency between the mtDNA profiles is a "match" amounting to a statement of identity. [FN59] Based on such small frequency estimates, mtDNA evidence has thus become a powerful tool of prosecution. A closer examination suggests, however, that such frequency estimates are based on faulty scientific assumptions that do not meet prevailing legal standards for admissibility of scientific evidence, and should not, in their current state of development, be admitted against criminal defendants at trial.

III. THE DUBIOUS RELIABILITY OF FREQUENCY ESTIMATES ASSOCIATED WITH FORENSIC MTDNA

The current SWGDAM database suffers from several structural problems that make it incapable of producing reliable estimates of mtDNA profile frequencies in particular geographical and ancestral populations. *First*, the database is a statistically unsound sample set from which to estimate mtDNA sequence frequencies ***66** because it does not account for geographic and ancestral clustering of identical or related mtDNA profiles. Specifically, the manner in which the samples are collected — samples taken from a handful of arbitrarily selected regions of the United States — assumes, incorrectly, that mtDNA profiles are randomly distributed in the population. But unlike nuclear DNA, which always reflects inheritance of certain of the mother's and father's unique influences and thus varies even between siblings (except identical twins), mtDNA is maternally inherited, does not recombine, and is far from randomly distributed in the population. Moreover, the "racial" categories in the databases, do not sufficiently take into account the intra- and inter-ethnic diversity resulting from well-documented ancestral migration patterns and clustering of profiles into identifiable haplogroups. *Second*, the SWGDAM database is too small in relation to the general populations it purports to represent to estimate such frequencies adequately. *Third*, even if the database were representative and large enough, significant previously unaddressed quality control problems undermine its reliability. *Fourth*, as applied, the "counting method" potentially understates frequency estimates systematically through assumptions biased against suspects. While each of these problems can be remedied, their

existence suggests that reliance upon the current SWGDAM database is currently unfounded and that such issues should, in any event, be addressed by attorneys and the courts.

A. MtDNA Is Not Randomly Distributed in the Population

1. The Statistical Validity of the SWGDAM Database Is Premised on False Assumptions about the Distribution of MtDNA Profiles in the Population

Many of SWGDAM's sequences came from the same samples that existed in the FBI's STR databases used to generate match statistics in forensic nDNA typing. [FN60] In nuclear DNA testing, forensic scientists typically obtain miniscule random match probability statistics generated by comparison of alleles at each of the thirteen standard STR locations. [FN61] The nDNA STR databases, and the validation studies thereof, were based on the premise that, particularly given the miniscule associated statistics, only statistically insignificant genetic linkage exists within the populations sampled. Accordingly, for nDNA, it was concluded that sampling from a small number of locations was acceptable. [FN62]

This assumption of randomness is not valid with respect to mtDNA sequences. As explained below, because mtDNA is maternally inherited and not recombinant, ***67** mtDNA profiles are not randomly distributed. The distribution of a particular mtDNA sequence is primarily a function of the migration of women. A child and his maternal great-great-great-great-grandmother, or a child and all of his mother's sisters' children, are expected, absent mutations, to have identical mtDNA profiles. Over generations, profiles stay intact or mutate to a very similar sequence. In addition, the high mutation rates characteristic of the HVI and HVII regions create unique variants, including more recently created ones that have not had time to spread from their location of origin. This creates geographical areas where certain haplogroups or haplotypes are prevalent, and other areas where those same haplogroups and constituent haplotypes are wholly or largely nonexistent.

2. Phylogeographic Studies Confirm That MtDNA Haplogroups Exist and Are Geographically Stratified

Dozens of phylogeographic [FN63] studies have been performed to identify the geographic distribution of mtDNA haplotypes in countries all over the world, although such studies are extremely limited in the United States. These studies demonstrate that mtDNA is not randomly distributed and that different haplogroups and haplotypes are concentrated within certain populations that vary geographically. [FN64] Scientists rarely come across new nDNA gene types when studying new population subgroups; however, the same is not true for mtDNA sequences. While certain haplogroups of mtDNA sequences are widely distributed throughout the population, [FN65] many exist only within certain geographic clusters. [FN66] ***68** Non-random mtDNA haplotype distributions also exists *within* geographic locations, because of often subtle linguistic, religious, or economic/caste distinctions. [FN67]

Distinctive mtDNA haplotype distributions are not limited to rare or ancient populations; today, different geographic regions demonstrate strikingly different mtDNA patterns. [FN68] For example, a

particular cluster of mtDNA sequences called haplogroup J is widely distributed in western and central Europe, but is rare in the Iberian Peninsula. [FN69] A sub-haplogroup of that cluster has been observed primarily in Britain, with one other occurrence from an ancestor in Italy. [FN70] A mutation that has an 8% frequency within the Canary Islands has never been found outside the Islands. [FN71] One study related to the natives of Mozambique as compared to those in the Americas identified a considerable number of matches between Mozambique and American sequences from African haplogroups, including some sequences ***69** that had never been observed outside Mozambique, as well as others observed only in the American populations. [FN72] From 2000 to the present, the AFDIL has been documenting such regional differences through a DOJ-funded effort to create databases of mtDNA control region sequences for African-origin, Hispanic, and Central Asian individuals. As of July 2005, AFDIL had databased "249 African-American, 646 U.S. Hispanic, and nearly 2500 Central Asia samples." [FN73] The five-year project "is intended to ... investigate the potential for forensically significant regional variation within U.S. racial/ethnic groups" and has success-fully unearthed such significant results, particularly with respect to U.S. Hispanics. [FN74] Based on these observed differences, AFDIL reported to the National Institute of Justice that its "work establishes that there is highly significant geographic variation of mtDNA types among individuals classified as 'Hispanics' in the United States" and that "[t]his has serious implications for the appropriate structuring of forensic mtDNA population databases." [FN75] To the AFDIL researchers, "[i]t seems very unlikely that reference to a single Hispanic database can be justified in evaluating the significance of mtDNA matching in the Hispanic population." [FN76]

Similarly, a study of the Han Chinese revealed dramatic regional differences in haplogroup frequencies among a population that constitutes 93% of the Chinese population and nearly 20% of the world's population. [FN77] Researchers examined 263 unrelated Han Chinese samples taken from six different provinces. They observed that, while certain haplogroups made up almost 20% of the population in a certain province, the haplogroup was nonexistent in a different province. Ultimately, the clustering in particular provinces was so pronounced that the authors concluded that an East Asian database, or even "Northern Han" and "Southern Han" databases, would grossly underestimate the frequency of certain groups of sequences***70** that themselves are highly common in surrounding regions. [FN78]

MtDNA population genetic linkage in North America — discussed in detail in the next two sections — is also well documented in scientific research. [FN79] Whether the heterogeneous geographic distribution of mtDNA lineages reflects genetic clustering, inadequate sampling, or some combination of the two, it appears clear that the sampling of mtDNA profiles must take into account geographic heterogeneity and stratification in order to create representative databases for use in forensic typing.

3. Significant Ancestry-Related Population Substructure Exists in the Distribution of MtDNA Sequences in the African-American Population

The SWGDAM database also fails to account for ancestry-related clustering of haplogroups in the United States, particularly with respect to the collective experience of African Americans, whose post-slavery era migration patterns are well documented. [FN80] The oldest mtDNA profiles stem from Africa, whose population***71** displays great regional diversity and heterogeneity in mtDNA pro-

files. [FN81] In some regions, specific mtDNA profiles are common; in others, the same mtDNA profiles are rare or nonexistent. [FN82] Scientific studies in Africa repeatedly uncover more unknown and previously unexamined mtDNA sequences, and far more is left to learn about regional differences that exist both now and hundreds of years ago.

During the period of slavery in the United States, the forced migration of Africans to the New World brought these regional differences to the United States and led to significant regional differences in the ethnic and geographic ancestry of African Americans. [FN83] Various political, economic, and cultural factors associated with the implementation of slavery contributed to these regional differences. For instance, during the period of slavery in the South, plantation owners in South Carolina primarily grew rice. These owners sought West Africans who already knew how to grow rice and therefore imported enslaved Africans from the "Grain Coast" of Africa. [FN84] In contrast, in Virginia, plantation owners primarily sought to grow tobacco. [FN85] The area surrounding the tobacco farms was swampy, and with the swamps, mosquitoes and malaria were common. [FN86] Neither Native American nor European American workers had genetic resistance to malaria and were dying in large numbers. Plantation owners sought enslaved Africans resistant to malaria and turned to the "Gold Coast" — modern day Ghana and Benin. [FN87] Similarly, because *72 Portuguese and French slave traders were the primary slave traffickers in New Orleans, many of the enslaved Africans brought to Louisiana were from Angola. [FN88] Thus, the forced migration of enslaved Africans to the United States led to geographic variation in this country similar to that of regional African variation.

Once in the United States, the clusters of African Americans either remained in their geographical origins or migrated in distinct groups, as family members joined family members, friends followed friends, and neighbors encouraged neighbors to emigrate. [FN89] This patterned migration resulted in further geographic variation throughout the United States. For the most part, this took place during the "Great Migration" — roughly 1910 to 1930 — when African Americans in the rural south traveled north for better jobs in light of World War I and a boll weevil crop infestation in the South. [FN90] These migrations took predictable routes: African Americans from Mississippi, Alabama, and Louisiana largely followed the Mississippi River and migrated to the great cities of the Midwest, such as Detroit, Chicago, Cleveland, and Kansas City; and African Americans from the Carolinas and Virginia tended to travel up the coastline to Washington, D.C., Philadelphia, and New York. [FN91] Notwithstanding the effects of this large-scale migration, most African Americans have remained in the southern part of the United States, in the crescent-shaped region ranging from Washington, D.C. to Louisiana. [FN92] Today, scientists observe genetic variation among African Americans in different regions of the country based upon the routes of those African Americans who migrated there and based on the variable levels of mixing with European Americans in different parts of the United States.

Heterogeneity also exists in African-American mtDNA profiles as one moves westward across the country. African Americans living in the western United States tend to exhibit larger percentages of European and Native American ancestry than those living in the South, Mid-Atlantic, and Midwest. [FN93] These phenomena may be the result of history, in that western territories and states had less restrictive social mores with respect to interracial relationships at the time of greatest migration. Additionally, the number of Native Americans surviving European settlement living in western states was significantly higher than in the *73 east, which helps to explain the Native-American

"admixture" in African-American mtDNA profiles. [FN94]

A further critical dimension of regional variation in mtDNA profiles is a result of the variation in the level of "admixture" between African Americans and other groups around the country. For example, while African Americans living in Charleston, South Carolina, possess about 6.5% of European maternal ancestry, this figure is much higher in Baltimore (14.94%), New York (9.11%), and Pittsburgh (9.9%). [FN95] To determine the frequency of an mtDNA sequence at a Charleston crime scene, for example, a forensic scientist should use a database that takes into account the types of mtDNA profiles that exist in Charleston. As further illustration, Jamaican Americans, whose mtDNA is on average 12.93% derived from European ancestry, have quite different mtDNA profiles from African Americans in most American cities — information that should be known to the forensic scientist in electing to which mtDNA database to compare the questioned profile. [FN96] The SWGDAM database does not account for, or reflect, these regional differences.

4. Population Substructure with Respect to MtDNA Sequences in the United States and Other, Non-African-American Ancestral Populations

The SWGDAM database also fails to account for regional variation in other U.S. ethnic groups. For example, while the database has a Hispanic category, most geneticists agree that the term "Hispanic" is primarily a language-based categorization, not a genetic one. [FN97] Not surprisingly, then, individuals in the linguistic category "Hispanic" display tremendous amounts of genetic variation. [FN98] One cannot reasonably claim, for example, that Hispanics living in South Florida (largely of Cuban and Puerto Rican ancestry) are genetically representative of Hispanics living in California (largely Mexican in ancestry). Yet the design of the SWGDAM mtDNA database assumes that mtDNA profiles of Hispanic-*74 Americans are randomly distributed. This failure to account for genetic diversity is particularly troubling given that the FBI *does* distinguish between Southeast and Southwest Hispanics in its *nuclear* DNA database, presumably to account for population substructure within the "Hispanic" population. [FN99] The FBI's attempt to subcategorize its (more recombinant) nDNA database to account for substructure is laudable, but the lack of recombination in mtDNA inheritance makes geographic clustering all the more critical in designing a representative mtDNA population database.

A simple contrast between the SWGDAM database and various compilations of mtDNA sequences observed in the published literature highlights the database's lack of geographic representation. For example, the SWGDAM database contains only two categories of Native-American mtDNA profiles, Apache and Navajo, which contain 180 and 146 mtDNA sequences, respectively. These SWGDAM sub-databases are incomplete and unrepresentative. Haplogroup D exists in Apache anthropological databases but is completely missing from the SWGDAM Apache database. [FN100]

The frequency of Haplogroup X in studies in the academic literature is four-to-five times greater than in the corresponding SWGDAM database. [FN101] More generally, the collections of mtDNA sequences in the research literature — which are approximately one-third the size of the SWGDAM database — report entire haplogroups not present in the SWGDAM database and significantly different percentages of the kinds of haplotypes represented in the SWGDAM database. [FN102]

The same issue of disproportionate representation of sub-populations is also reflected in SWG-

DAM's East Asian databases. The database fails to account for the proportional ancestry of East Asian Americans. The 753 individuals in the SWGDAM East Asian database are from China, Korea, Japan and Thailand, with almost half from China. [FN103] Significant disconnect exists between the SWGDAM *75 database and the 2000 U.S. Census figures. [FN104] For example, based on the 2000 Census, 18.3% of the U.S. Asian population is Filipino, while there are no Filipinos in the SWGDAM database. [FN105] Similarly, the percentage of Chinese and Korean individuals in the SWGDAM database is double that reflected in the Census, while the database's percentage of Asian-Indians is one-seventh of their true percentage of the population in 2000. Simply put, the SWGDAM database is not representative of the distribution of Asian-American source populations. [FN106]

The Caucasian database is also problematic in its apparent failure to account for non-random distribution of ancestral haplogroups. Those who argue that SWGDAM's Caucasian database is representative point to the fact that its samples include 44.2% of the H Haplogroup, which appears in approximately the same proportion in certain Western European countries. [FN107] But the percentage of "H" varies widely outside a handful of countries in Western Europe, such as countries in Scandinavia, Eastern Europe, and parts of West Europe such as France, Northern Germany, and Scotland — areas where, of course, many American *76 families originated. [FN108]

In sum, the SWGDAM database appears to misrepresent the regional genetic diversity of mtDNA profiles to ignore studies showing tremendous intra-group diversity in the various macro-ethnic categories represented in the database. The database combines internally heterogeneous groups under broad rubrics without a demonstration that the deviation from homogeneity would have negligible consequences in reporting mtDNA match significance. If the database is not representative, it does not serve its intended purpose of providing a random selection of the relevant population from which reliable sequence frequency estimates may be calculated. In turn, if the database does not produce reliable frequency estimates, its admissibility under the prevailing rules for admission of scientific evidence would, as discussed below in Part IV, seem to be questionable at best. [FN109]

B. The Size of the SWGDAM Database

Given the degree of known mtDNA genetic variation, the SWGDAM database, whether the surveyed category contains 8 profiles (the Pakistani category of the database), 1148 profiles (the African-American category of the database), or 5071 profiles (the total number of profiles in the database), is too small to provide meaningful estimates of sequence frequencies. Extrapolation from small sample sizes inhibits the ability to make meaningful mtDNA profile frequency estimates, and statistical claims about frequency estimates based on databases smaller than one hundred profiles are particularly questionable. [FN110] While the larger categories such as the Caucasian, African-American, and Hispanic databases may appear to contain a considerable number of profiles, such appearances are misleading. Even the relatively larger databases are insufficient, both because the validation work *77 underlying those databases is incomplete [FN111] and because individuals in those categories come from a much wider geographic range than the smaller, more narrowly targeted databases.

Take the African-American database, containing 1148 profiles, as an example. Assume, for the sake of illustration, that the database contains 1200 profiles and is representative of the relevant population. Given that many mtDNA profiles occur with a frequency of at least 1 per 1000, or 0.1%, one

can state that there is a 99.9% chance that any particular person in the relevant population will *not* exhibit this profile. In a 1200-sequence database presumed to be representative, the probability of completely missing a profile that is as common as 1 in 1000 is 30.1%. [FN112] In an *unrepresentative* database, where the distribution of sequence frequencies is unknown, such a probability cannot even be calculated. To predict the frequency of a given mtDNA frequency, the database needs to be both representative *and* sufficiently large.

Any determination of how large the database must be to provide accurate frequency estimates must take into account what scientists presently know about mtDNA haplotype frequencies. For example, over 50% of known mtDNA sequences have been observed just one time. [FN113] Therefore, in a database of one thousand samples, one would expect that five hundred of the samples occur only once in the database. If an additional 1000 individuals were sampled, the likelihood that those same five hundred samples would each be observed only once decreases significantly. In addition, given that mtDNA sequence frequencies in the population are yet unknown, ancestral categories not yet accounted for in the SWGDAM database may have significantly higher or lower frequencies of unique sequences. So as not to underestimate the frequency of a suspect's profile in determining the probative value of a "match," databases should be constructed to ***78** minimize the probability of missing a rare profile and to maximize the probability that the database represents all possible profiles in the relevant population.

To the authors' knowledge, no published article on mtDNA typing has suggested how large a database would have to be to generate accurate mtDNA sequence frequency statistics for forensic use, and the authors do not speculate in this article as to how large such a forensic database would have to be. Scientists are still in the process of collecting mtDNA samples and determining the extent of geographic and ancestry-related substructure in the distribution of mtDNA profiles. The scientific community must arrive at an accurate estimate of the level of mtDNA variation, and the distribution of profiles, in the population before determining how many, and what type of, samples would be necessary to create a statistically sound forensic mtDNA database.

C. Quality Control Issues

There is reason to believe that the SWGDAM database contains errors that potentially affect the quality of the data and therefore potentially undercut the ability of the database to generate accurate statistical estimates. Not surprisingly, mtDNA sequencing — which involves typing the 600-base HVI/II region and hand-transcribing the positions at which the sequence differs from the CRS — results in many more transcription errors than does nDNA testing. [FN114] Human errors also stem from incorrect recording or exchanging of laboratory samples or misreading of machine outputs. [FN115] Outside scientists have found several transcription errors in the SWGDAM database. [FN116] Upon the publishing of such errors, the FBI has conducted its own studies and found even more errors. [FN117]

The lack of quality control has subjected the SWGDAM database to international***79** criticism. For example, several European scholars, after inspecting the database for errors, have written about its "poor quality," saying that reliance on its utility "inhibit[s] the generation of a new reliable mtDNA database in the United States." [FN118]

For the African-American database, the researchers conducted a phylogenetic analysis — the use of computer algorithms to detect inconsistencies in the evolutionary position of individual sequences resulting from miscoding or recombining of computer records during data entry — and observed "a number of major deficiencies," suggesting a confusion of specimens in the laboratory or faulty data entry. [FN119] Because the FBI's raw data is not publicly available for reexamination and correction by independent scientists, the European scientists were unable to manually look for errors; instead, the FBI was notified of their findings with the hope that the FBI would conduct a comprehensive investigation into the accuracy of the database profiles. [FN120]

Instead, the FBI's response to these reports of errors was to conduct only a partial inquiry for error correction. [FN121] Specifically, when notified of the findings of error by the European scholars, the FBI conducted a phylogenetic analysis and partial manual verification of its database, uncovering additional errors. Despite finding a number of errors in the manual verification process, the FBI only checked a small percentage of the SWGDAM profiles manually. For example, only 196 of the 1148 sequences in the African-American database were so checked, [FN122] leaving unknown how many other errors exist in the African-American database or in the other subpopulation databases. Given that only the FBI has the ability to conduct a complete inquiry into errors in its database, and that the FBI currently refuses to grant non-employees uncontrolled access to its raw data, [FN123] no apparent means exist for independent reviewers to ensure that the SWGDAM database is now free of such errors. [FN124]

*80 *D. Problems with the Counting Method*

The present method of estimating the frequency of a sequence in the population — counting the number of hits in the SWGDAM forensic database and calculating an upper-bound confidence interval around that number — does not take into account the observations of the profile in the suspect sample and in the evidence sample. In cases in which the suspect sample and the evidence sample are consistent for reasons other than the suspect being the source, this approach systematically underestimates the frequency of questioned mtDNA profile in the relevant population. This issue should be addressed and resolved by attorneys and courts, given the effect such underestimations can have on the presumption of innocence.

Again, consider the hypothetical in which a suspect's mtDNA sequence is consistent with that found at the crime scene, and the shared profile is compared to the SWGDAM African-American database, where the number of profiles is 1148 ($n = 1148$) and where the database is assumed to be representative and random. If an examiner searches the database and does not find the shared profile, she reports the number of hits as zero, reporting that the suspect's profile has never been seen before in the database. But the suspect's profile has arguably been seen twice: once in the suspect himself and once in the evidence sample. Failing to count the observation of the profile in the suspect as a hit in the database seems to ignore useful and relevant information. The suspect is, after all, part of the relevant population, and there appears to be no reason to consider him outside the scope of the database of profiles. Thus, rather than conduct a frequency estimate based upon zero hits in a database of 1148 samples, the examiner should, at the very least, conduct a frequency estimate based upon one hit in a database of 1149 ($n+1$) samples.

Moreover, the election to disregard the observation of the profile in the suspect's sample and in the evidence sample may implicate the presumption of innocence. Most jurisdictions have a jury instruction providing that, unless and until the suspect is proven guilty by the prosecution and the jury renders a verdict of guilty, the suspect in a criminal trial is presumed innocent in the eyes of the jury. [FN125] If that ***81** presumption is taken seriously, the evidence sample and the suspect's sample should not be presumed to confirm the same person. After all, the question of whether or not the suspect actually contributed the sample is the very question to which the mtDNA frequency estimate is relevant. Thus, the most appropriate assumption is that the suspect's profile has been seen twice: once in the evidence sample and once in the suspect's sample. Therefore, in the hypothetical, the FBI should conduct a frequency estimate based upon two hits in a sample of 1150 (n+2) sequences. [FN126] Such modifications to the "counting method" affect — in some cases, dramatically so [FN127] — the reported frequency estimates and therefore should be provided to the jury.

IV. COMMUNICATION OF SWGDAM DATABASE ISSUES TO COURTS AND JURIES THROUGH ADMISSIBILITY CHALLENGES

Notwithstanding these inherent problems with using the SWGDAM database to calculate the statistical significance of a mtDNA "inclusion," the burgeoning use of mtDNA evidence in criminal trials throughout the country has continued unabated. The reason, as discussed below, is not that large numbers of courts have rejected challenges based on these problems; rather, courts and defense counsel are generally not *aware* of the existence or scope of the scientific dispute over the reliability of the FBI's methods. It is critical that courts be apprised of these issues through admissibility challenges so that they may have the opportunity to examine the issues and ensure that only reliable scientific evidence is used against criminal ***82** defendants.

A. Legal Standards Governing Admission of Scientific Evidence

Most U.S. courts employ one of two tests to determine admissibility of novel scientific evidence. A number of jurisdictions follow *Frye v. United States*, [FN128] admitting novel scientific evidence only when the methodology used is "generally accepted" in the relevant scientific community. [FN129] Still others, including the federal courts, follow the test set forth by the Supreme Court in *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, [FN130] in which the Court construed the Federal Rule of Evidence governing admission of expert testimony to require that trial judges make an independent judicial determination whether the scientific evidence is sufficiently reliable. [FN131] Still other courts follow some combination of the two dominant approaches or another, more idiosyncratic approach. [FN132] Because the vast majority of jurisdictions subscribe to either *Frye*, *Daubert*, or a hybrid standard, this section focuses on the two dominant standards.

The *Frye* standard requires that the scientific community approve of a technique before it may be used in courts. If scientists, significant either in number or expertise, publicly oppose a new technique as unreliable, the trial judge must exclude the evidence. [FN133] The *Frye* standard is inherently conservative in that it requires those experts who are in a position best to understand and review a procedure to pass on its reliability. While the waiting period that scientific evidence and techniques must endure before gaining legal acceptance under *Frye* ***83** has generated criticism, [FN134] the *Frye* standard remains the standard for admission of scientific evidence in a number of jurisdictions.

In *Daubert*, the Supreme Court rejected the *Frye* standard for use in federal court and concluded that that the Federal Rules of Evidence require judges to act as gatekeepers, making a "preliminary assessment of whether the reasoning or methodology underlying the testimony is scientifically valid and of whether that reasoning or methodology properly can be applied to the facts at issue." [FN135] The Supreme Court set out a flexible and nonexclusive list of factors for courts to consider, including (1) whether the science underlying the questioned evidence can be, and has been, empirically tested; (2) whether the science has been subjected to peer review and publication; (3) whether there is a known or potential rate of error; (4) whether standards exist and are maintained to control the technique's operation; and (5) whether the scientific proposition at issue has been generally accepted. [FN136] If, after considering these and any other relevant factors, the trial judge determines that the scientific methodology is both "reliable" and "fit[s]" the circumstances of the case, [FN137] the evidence is admissible. [FN138] While *Daubert* involved interpretation of a Federal Rule, many states have adopted the *Daubert* standard. [FN139]

As numerous commentators have observed and courts have held, evidence of a DNA inclusion or match has little meaning without a sense of the frequency of the profile in the population. [FN140] If the frequency of a profile from evidence at the crime scene were found in 99% of the general population, for example, the fact that the defendant is a potential contributor would have only nominal probative value. And while expert testimony as to frequency statistics may not be necessary where the issue is the frequency of people with blond hair or other information easily accessible through common human experience, most jurors have little if any ***84** intuition as to the relative frequencies of mtDNA sequences in the population. [FN141] Thus, as a legal matter, the statistical methodology used to estimate the significance of an inclusion or match must independently pass muster under either the *Frye* or *Daubert* standard of admissibility for scientific evidence.

Neither *Daubert* nor *Frye* sets a more "lenient" threshold for admissibility than the other; both require a pretrial showing of scientific validity. The principal distinction between the two lies in the question, "who decides the issue of scientific validity?" Under *Frye*, the trial court defers to the opinions of scientists as to whether a particular scientific advancement is valid. Under *Daubert*, the court considers the views of scientists but, ultimately, the court itself determines the scientific validity of the evidence. Under either standard, evidence with a strong scientific foundation will likely be admitted; evidence lacking such a foundation will likely be excluded. [FN142] For the reasons given in Part III, this Article submits that forensic mtDNA does not yet have a strong enough scientific underpinning to satisfy either the *Frye* or *Daubert* standards for admissibility, and courts should take great care prior to admitting such evidence — whether by the prosecution seeking to inculpate a defendant or by the defense seeking to convince the jury that an uncharged third party is the true perpetrator.

B. The Importance of Well-Litigated Admissibility Challenges to the Reliability of MtDNA Evidence Used Against Criminal Defendants

The stakes in admitting mtDNA evidence without a proper scientific foundation are high; because reliance on the SWGDAM database potentially underestimates the frequency statistic, jurors typically hear that the defendant belongs to the less than 1% of the population who could have contributed the mtDNA, and, therefore, are given the sense that the defendant likely committed the offense. [FN143] An additional concern is that jurors will confuse mtDNA with nDNA, which has an ***85** aura of infal-

libility from its coverage in the popular press and is viewed as having an almost mysterious quality as a tool of identification. In fact, recent jury studies suggest that jurors may confuse different types of DNA, and may see all DNA evidence as infallible. [FN144]

If litigants do not timely apprise trial judges of these scientific issues, courts will not have the opportunity to determine whether, in light of such issues, the proffered mtDNA inclusion statistics that will be reported to the jury are scientifically unsound or are not generally accepted in the scientific community. Due in large part to the fact that mtDNA evidence is often admitted against a defendant without any challenge to its admissibility, most courts are simply unaware of the unique aspects of mtDNA typing as compared to nDNA typing, and have not been exposed to the scientific literature discussing the problems with the SWGDAM database. While the majority of the few courts that *have* ruled on the admissibility of mtDNA evidence have approved of its use against a defendant, judicial consideration of this form of evidence is in its infancy. To date, only two published opinions from federal courts address the admissibility of mtDNA evidence, along with a handful of published state trial and appellate decisions. Significantly, no state court of last resort has yet ruled mtDNA evidence admissible under a *Frye*-type standard. [FN145] Only one federal appellate court and two state supreme ***86** courts have ruled mtDNA admissible under a *Daubert*-like standard. [FN146] In many of these cases, the evidence was admitted without the trial court ever hearing a witness contrary to the government's forensic scientist vouching for admission of the evidence. [FN147] None of the published decisions discusses in a meaningful way problems with the content of the databases used to generate frequency statistics. [FN148] In addition, scholars in legal academia, while recognizing general issues with respect to admission of mtDNA evidence in criminal trials, have not yet begun to discuss the database problems at length. [FN149]

The lack of awareness on the part of courts and other participants in the legal system with respect to the problems with the SWGDAM database and other important scientific issues is compounded by the fact that most practicing forensic scientists are not part of, and perhaps not even aware of, the conversation taking place among medical geneticists, evolutionary biologists, and molecular anthropologists concerning the extent of genetic individuality and diversity of mtDNA. [FN150] Additionally, because most criminal defendants do not have the resources to mount complicated, expensive admissibility challenges to forensic mtDNA evidence, the ***87** emerging and accumulated knowledge of scientists who regularly work outside the legal system appears not to be making its way into courtrooms before judges and juries. Professors Mildred Cho and Pamela Sankler express the need to bridge the gap between science inside, and outside, the courtroom:

> [The] series of arguments and counterarguments about the association between 'race' and patterns of DNA markers [that] has been unfolding in the medical genetics literature over the last four years ... are relevant to, and should include, forensic geneticists.... These conversations are directly relevant to the forensics genetics community[, but they] have not been widely extended into this group. There is an urgent need to expand this debate into the field of forensics. [FN151]

While hiring experts to testify at admissibility hearings may be beyond a particular defendant's means, individual attorneys and defender institutions should at the very least bring to courts' attention the scientific studies discussed in articles such as this one, so that courts will begin to take notice of evidence of both a lack of general acceptance in the scientific community of using the SWGDAM database to generate mtDNA frequency estimates, which may render the mtDNA evidence inadmiss-

ible under *Frye*, and a lack of scientific validity in using the database, evidence that, if accepted, would potentially render the mtDNA evidence inadmissible under a *Daubert*-like standard.

CONCLUSION

What can be done to ensure that mtDNA evidence is used fairly and effectively as "inclusion" evidence? In the first instance, both forensic scientists and the broader scientific community should work to improve the science of mtDNA frequency statistics to provide a sufficient scientific underpinning for mtDNA to support its admission in criminal cases. Scientists should also follow the lead of laboratories such as AFDIL by increasing the discriminatory power of mtDNA typing and decrease the chance of a false inclusion, by typing additional locations in both the control region and coding region of the mtDNA genome, and by taking advantage of SNP technology.

Additionally, the SWGDAM forensic mtDNA database should be corrected and expanded. Specifically, before mtDNA evidence is used as inclusion evidence in the courtroom, the scientific community should collect more data on human migration patterns, including migration patterns within the United States, to identify possible locations of mtDNA clusters based on historical developments. Upon generating that data, the scientists should conduct phylogeographic as well as phylogenetic studies to determine not only the full diversity of mtDNA ***88** sequences in the population, but the geographic distribution of such sequences as well. Upon understanding the geographic distribution of such sequences, the criminal justice community should develop *regional* databases that reflect uneven geographic distribution of mtDNA sequences. In doing so, efforts should be made to vastly increase the number of sequences in those databases over the current size, by additional sampling and by accessing the raw data from the published academic studies and adding that data to the regional forensic databases.

Furthermore, because databases are only useful if their data are accurate, forensic scientists should develop and implement an additional quality assurance procedure to create a systematic means of identifying, minimizing, and correcting database errors, including the implementation of quality control measures urged by AFDIL and other reputable laboratories. Forensic scientists should also open up the raw data of the sequences in the SWGDAM database to independent researchers to permit outside review of the database, and immediately implement a complete manual verification of every sequence in the database, double-checked visually and by hand, base-pair by base-pair. Errors should not be accepted.

Moreover, we suggest modification in the counting method, by accounting for the observation of the profile in the suspect and the evidence sample when determining the number of "hits" in the database, and using a 99% confidence interval to reflect the grave need to avoid error in criminal trials. Such a process accords more with a constitutional presumption of innocence.

Finally, prosecutors, defense attorneys, and judges must be vigilant in ensuring the reliability of mtDNA evidence admitted in criminal trials. As Professor Michael Saks notes, the true "'revolution' of *Daubert* lies" in the fact that "[j]udges and lawyers, long insulated from the scientific revolution, are now obligated to become familiar with the methods and culture of science." [FN152] As scientists and legal professionals work to foster an understanding of the "methods and culture of science" in the courtroom, genuinely reliable evidence will appear before juries, promoting greater confidence in the

outcome of criminal trials.

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[FN1]. The first use of nuclear DNA in a criminal trial was in a Florida sexual assault trial in 1987. *See* NORAH RUDIN & KEITH INMAN, AN INTRODUCTION TO FORENSIC DNA EVIDENCE 186, 187 (2d ed. 2001) (discussing *Florida v. Andrews*).

[FN2]. *See, e.g.*, Max M. Houck & Bruce Budowle, *Correlation of Microscopic and Mitochondrial DNA Hair Comparisons*, 47 J. FORENSIC SCI. 1, 4 (2002) (noting that mtDNA has been used to exclude suspects who were originally included falsely based on microscopic hair analysis).

[FN3]. The term "match" in the context of forensic mtDNA typing is misleading because mtDNA is maternally inherited and nonrecombinant and therefore is not a unique identifier. *See* discussion *infra* at 58-99.

[FN4]. *See, e.g.*, DAVID L. FAIGMAN ET AL., 3 MODERN SCIENTIFIC EVIDENCE § 25-1.2.1 (2d ed. 2002) (listing criminal cases admitting mtDNA evidence against defendant). The federal government is in the process of greatly expanding its use of mtDNA typing in criminal cases. *See The FBI Selects 4 Regional MtDNA Laboratories*, 6 FORENSIC SCI. COMM. (Jan. 2004), *available at* http:// www.fbi.gov/hq/lab/fsc/backissu/jan2004/shortcomm/2004_01_short02.htm ("As laboratories become operational during the next two years, the effect will be to double the FBI's capacity to deliver no-cost mtDNA analysis to the criminal justice system.").

[FN5]. *See, e.g.*, United States v. Porter, 618 A.2d 629, 640 (D.C. 1992) ("[I]t is the probability feature which is at the very core of the DNA evidence."); United States v. Cuff, 37 F. Supp. 2d 279, 282 (S.D.N.Y. 1999) (same). *See generally* David H. Kaye & George F. Sensabaugh Jr., *Reference Guide on DNA Evidence, in* REFERENCE MANUAL ON SCIENTIFIC EVIDENCE 545 (2d ed. 2000) (citing cases for proposition that "many courts have held that a DNA match is inadmissible unless the expert attaches a scientifically valid number to the figure"); NATIONAL RESEARCH COUNCIL, THE EVALUATION OF FORENSIC DNA EVIDENCE 192 (1996) (discussing the statistical basis for interpretation) [hereinafter NRC II (1996)]; NATIONAL RESEARCH COUNCIL, DNA TECH-

NOLOGY IN FORENSIC SCIENCE 74-75 (1992) (discussing the meaning of "match") [hereinafter NRC I (1992)].

[FN6]. *See Bylaws of the Scientific Working Group on DNA Analysis Methods*, 5 FORENSIC SCI. COMM. (Apr. 2003), *available at* http:// www.fbi.gov/hq/lab/fsc/backissu/april2003/swgdambylaws.htm (noting that FBI Director charged SWGDAM with reviewing DNA laboratory protocols, sets terms of SWGDAM members, receives SWGDAM recommendations, and provides SWGDAM with resources, including staff, travel and lodging budget). The version of the SWGDAM database currently used in forensic testing was made public in 1999. *See* Mark R. Wilson et al., *Further Discussion of the Consistent Treatment of Length Variants in the Human Mitochondrial DNA Control Region*, 4 FORENSIC SCI. COMM. (Oct. 2002), *available at* http:// www.fbi.gov/hq/lab/fsc/backissu/oct2002/wilson.htm.

[FN7]. While the SWGDAM database classifies individuals by "race," we believe that the more accurate classification for mtDNA profiles is by ancestry and use that terminology in discussing classifications in genetic lineages.

[FN8]. *See* Keith L. Monson et al., *The MtDNA Population Database: An Integrated Software and Database Resource for Forensic Comparison*, 4 FORENSIC SCI. COMM. (Apr. 2002), *available at* http:// www.fbi.gov/hq/lab/fsc/backissu/april2002/miller1.htm (explaining database comparison method); FBI Laboratory DNA Unit II, Mitochondrial DNA Sequencing Protocol § 11.4.1 (2004) [hereinafter FBI MtDNA Protocols (2004)] (explaining counting method used by FBI when comparing profile to database).

[FN9]. *See* discussion *infra* at 76-78.

[FN10]. Because the prosecution bases its frequency estimate solely on the number of "hits" in the database, the number reported to the jury in *any* case involving a mtDNA sequence not observed in the SWGDAM database, regardless of the geographical origin, ancestry, or other characteristic of the suspect, will be identical. *See* FBI MtDNA Protocols, *supra* note 8, at § 11.4.4 (stating FBI reports 95% confidence interval around number of "hits" in every case, without consideration of other variables, such as ancestry or geographical origin).

[FN11]. Base pairs consist of pairs of nucleotides that are bound to each other across the double helix of DNA (Adenine pairing with Thymine, Guanine pairing with Cytosine). The order of the base pairs encodes the genetic instructions.

[FN12]. *See* JOHN M. BUTLER, FORENSIC DNA TYPING, 242 (2d ed. 2005).

[FN13]. *Human Mitochondrial DNA — Amplification and Sequencing Standard Reference Materials* 1-2, NAT'L INST. OF STANDARDS AND TECH SPEC. PUB. NO. 260-155 (Sept. 2003).

[FN14]. *See* Stephen Anderson et al., *Sequence and Organization of the Human Mitochondrial Genome*, 290 NATURE 457, 457-65 (1981); Mitchell M. Holland & Thomas J. Parsons, *Mitochondrial DNA Sequence Analysis: Validation and Use for Forensic Casework*, 11 FORENSIC SCI. REV. 21, 24 (Feb. 1999).

[FN15]. Anderson et al., *supra* note 14, at 457; Thomas Parsons & Michael Coble, *Increasing the Forensic Discrimination of Mitochondrial DNA Testing Through Analysis of the Entire Mitochondrial DNA Genome*, 42 CROATIAN MED. J. 304, 304 (2001).

[FN16]. *See, e.g.*, Bruce Budowle et al., *Genotype Profiles for Six Population Groups at the 13 CODIS Short Tandem Repeat Core Loci and Other PCR-Based Loci*, 1 FORENSIC SCI. COMM. (July 1999), *available at* http:// www.fbi.gov/hq/lab/fsc/backissu/july1999/budowle.htm.

[FN17]. Holland & Parsons, *supra* note 14, at 24.

[FN18]. Anderson et al., *supra* note 14, at 457; Richard M. Andrews et al., *Reanalysis and Revision of the Cambridge Reference Sequence for Human Mitochondrial DNA*, 23 NATURE GENETICS 147 (Oct. 1999).

[FN19]. *See, e.g.*, Carla Bini & Stefania Ceccardi et al., *Different Informativeness of Three Hypervariable Mitochondrial DNA Regions in the Population of Bologna (Italy)*, 135 FORENSIC SCI. INT'L 48 (2003); Sabine Lutz & Holger Wittig et al., *Is It Possible to Differentiate MtDNA By Means of HVIII In Samples That Cannot Be Distinguished By Sequencing the HVI and HVII Regions?*, 113 FORENSIC SCI. INT'L 97 (2000).

[FN20]. Lutz & Wittig, *supra* note 19, at 97.

[FN21]. *See* Michael D. Coble et al., *Single Nucleotide Polymorphisms Over the Entire MtDNA Genome that Increase the Power of Forensic Testing in Caucasians*, 118 INT'L J. LEGAL MED. 137, 143-44 (2004) (discussing typing of SNPs, including position 16519, which is outside of HVI and HVII and has greatest variability in entire mtDNA genome); Luisa Pereira et al., *Evaluating the Forensic Informativeness of MtDNA Haplogroup H Sub-Typing on a Eurasian Scale*, FORENSIC SCI. INT'L, *available at* http://www.sciencedirect.com (2005) (discriminating otherwise identical haplotypes by sequencing eight coding region SNPs); Yong-Gang Yao et al., *Phylogeographic Differentiation of Mitochondrial DNA in Han Chinese*, 70 AM. J. HUM. GENETICS 635, 648 (2002) (noting that "[c]oding region information is indispensable for phylogenetic analysis of mtDNA").

[FN22]. *See* Coble et al., *supra* note 21, at 143-44 (discussing how further typing of regions outside HVI and HVII would require development of new databases and other costly and laborious efforts).

[FN23]. Parsons & Coble, *supra* note 15, at 305. *See also* Coble et al., *supra* note 21, at 137 (discussing the study about sequencing entire mtDNA genome to increase forensic discrimination); Rebecca S. Just et al., *Toward Increased Utility of MtDNA in Forensic Identifications*, 146S FORENSIC SCI. INT'L S147 (2004) (discussing preliminary results of large-scale databasing project targeting populations underrepresented in current forensic mtDNA databases); Thomas J. Parsons et al., Report for U.S. Dep't of Justice, Office of Justice Programs, Progress of Project 2000-IJ-CX-K010, Homogeneous Fluorescent PCR Assays over the MtDNA Genome, up to June 30, 2005, provided in response to OJP FOIA No. 05-00258 (on file with authors) (explaining that, from 2000 to 2005, AFDIL has sequenced hundreds of full mtDNA genomes in the African-American, Hispanic, and Central Asian populations in an effort to better account for documented regional variation in mtDNA sequence frequencies).

[FN24]. BUTLER, *supra* note 12, at 20.

[FN25]. *See* D. Andrew Merriweather & Frederika A. Kaestle, *Mitochondrial Recombination? (Continued)*, 285 SCI. 835 (1999) (concluding mtDNA is maternally inherited and finding no evidence for mtDNA recombination in humans). Other scientists have reported observations of "recombination" — mixing between maternal and paternal mtDNA in offspring. *See* Adam Eyre-Walker, Noel Smith & John Maynard Smith, *How Clonal Are Human Mitochondria?*, 266 PROC. BIOLOGICAL SCI. 477 (1999). These observations are disputed. *See, e.g.*, Joanna L. Elson et al., *Analysis of European MtDNAs for Recombination*, 68 AM. J. HUM. GENETICS 145, 145 (2001) (disagreeing with Eyre-Walker results and concluding "that there is no compelling reason to overturn the standard paradigm of clonal mtDNA transmission in humans"); Peter Forster, *To Err Is Human*, 67 ANNALS OF HUM. GENETICS 2 (2003) (same). There have been some observations of paternal inheritance, *see* Marianne Schwartz & John Vissing, *Paternal Inheritance of Mitochondrial DNA*, 347 NEW ENGLAND J. OF MED. 576, 579 (Aug. 22, 2002) (observing paternal inheritance of pathogenic mtDNA), but the phenomenon of paternal inheritance is an exception, if not a well understood one, to the general rule of maternal inheritance.

[FN26]. Bruce Budowle et al., *Forensics and Mitochondrial DNA: Applications, Debates, and Foundations*, 4 ANN. REV. GENOMICS & HUM. GENETICS 119, 121 (2003).

[FN27]. *See id.* at 128 ("A decade ago, most individuals were thought to be homoplasmic."); Terry Melton, *Mitochondrial DNA Heteroplasmy*, 16 FORENSIC SCI. REV. 1, 3 (Jan. 2004).

[FN28]. Walter Bär et al., *Guidelines for Mitochondrial DNA Typing*, 79 VOX SANGUINIS 121, 122 (2000) ("[I]t is now thought that all individuals are heteroplasmic at some level."); Melton, *supra* note 27, at 2 ("[I]t is also certain that some degree of heteroplasmy exists in all individuals.").

[FN29]. *See* John Buckleton, Simon Walsh, & Sallyann Harbison, *Nonautosomal Forensic Markers, in* JOHN BUCKLETON, CHRISTOPHER M. TRIGGS & SIMON J. WALSH, EDS., FORENSIC DNA EVIDENCE INTERPRETATION 303 (2005) (discussing various theories); Peter D'Eustachio, *High Levels of Mitochondrial DNA Heteroplasmy in Human Hairs by Budowle et al.*, 130 FORENSIC SCI. INT'L 63, 63 (2002) ("Major unresolved issues include the molecular mechanisms responsible for the occurrence of heteroplasmy to different extents in different tissues, and the possibility that heteroplasmy levels in an individual might vary with age.").

[FN30]. Buckleton et al., *supra* note 29, at 304 (stating routine-sequencing methods cannot detect heteroplasmy above sequencing background noise unless it approaches 20%).

[FN31]. Mark R. Wilson et al., *A Family Exhibiting Heteroplasmy in the Human Mitochondrial DNA Control Region Reveals Both Somatic Mosaicism and Pronounced Segregation of Mitotypes*, 100 HUM. GENETICS 167, 167 (1997).

[FN32]. The NRC's 1992 and 1996 reports on forensic DNA typing both contain lengthy discussions of population substructure in the database used by the FBI to generate nDNA frequency tables and, using the product rule, a "random match probability" over the thirteen locations used in forensic nDNA testing. NRC II (1996), *supra* note 5, at 122-23; NRC I (1992), *supra* note 5, at 74-77.

[FN33]. *See* discussion *infra* at III.

[FN34]. Marc W. Allard et al., *Characterization of the Caucasian Haplogroups Present in the SWGDAM Forensic MtDNA Dataset for 1771 Human Control Region Sequence*, 47 J. FORENSIC SCI. 1215, 1219 (2002).

[FN35]. *Id. See also* Sarah A. Tishkoff et al., *Genetic Analysis of African Populations: Human Evolution and Complex Disease*, 3 NATURE REVIEWS - GENETICS 611 (2002).

[FN36]. *See, e.g.*, Douglas C. Wallace, *Mitochondrial Disease in Man and Mouse*, 283 SCI. 1482, 1482 (1999).

[FN37]. *See, e.g.*, Mark Shriver & Rick Kittles, *Genetic Ancestry and the Search for Personalized Genetic Histories*, 5 NATURE REVIEWS - GENETICS 611, 611 (2004); Anne C. Stone, James E. Starrs, & Mark Stoneking, *Mitochondrial DNA Analysis of the Presumptive Remains of Jesse James*, 46 J. FORENSIC SCI. 173, 173 (2001) (using mtDNA to determine if particular remains could be those of Jesse James); Lev A. Zhivotovsky, *Recognition of the Remains of Tsar Nicolas II and His Family: A Case of Premature Identification?*, 26 ANNALS HUM. BIOLOGY 569, 569 (1999).

[FN38]. *See, e.g.*, Rebecca L. Cann et al., *Mitochondrial DNA and Human Evolution*, 325 NATURE 31, 31 (1987); Frederika A. Kaestle & K. Ann Horsburgh, *Ancient DNA in Anthropology: Methods, Applications, and Ethics*, 45 YEARBOOK OF PHYS. ANTHROP. 92 (2002); Frederika A. Kaestle & David Glen Smith, *Ancient Mitochondrial DNA Evidence for Prehistoric Population Movement: The Numic Expansion*, 115 AM. J. PHYS. ANTHROP. 1-12 (2001) (using ancient and modern mtDNA to test hypothesis that modern Native American inhabitants of Nevada are recent arrivals who replaced previous inhabitants); Ripan S. Malhi et al., *Patterns of MtDNA Diversity in Northwestern North America*, 76 HUM. BIOLOGY 33, 33-34 (2004) (using ancient and modern mtDNA to show significant migration from sub arctic and Pacific coast into Columbian Plateau region); Stéphanie Plaza et al., *Insights into the Western Bantu Dispersal: MtDNA Lineage Analysis in Angola*, 115 HUM. GENETICS 439 (2004) (using mtDNA to clarify spread of Bantu populations throughout Africa and to trace movement of slaves into Brazil from Angola).

[FN39]. The Armed Forces DNA Identification Laboratory engages in such identification procedures using mtDNA testing for casualties from wartime and disasters. *See AFDIL Mitochondrial DNA (MtDNA) Section*, http:// www.afip.org/Departments/oafme/dna/afdil/mito.html (last visited Jan. 20, 2006).

[FN40]. *See, e.g.*, Sarah Koenig, *DNA Identification Is a Daunting Task* (Sept. 20, 2001), http://www.baltimoresun.com/news/custom/attack/bal-te.dna20sep20,1,242800.story?coll=bal-attack-utility (discussing use of mtDNA typing to identify remains from September 11 bombings, the Oklahoma City bombings, and plane crashes); Yasser Daoudi et al., *Identification of Missing Individuals from Bosnia and Herzegovina Using Mitochondrial DNA Analysis*, presented at 11th International Symposium on Human Identification (2000), http://www.promega.com/geneticidproc/ussymp11proc/abstracts/daoudi.pdf. *See generally* http://www.dna.gov/uses/m_person (discussing the President's DNA Initiative, including use of mtDNA in identifying missing persons from natural disasters and crimes).

[FN41]. *See* Peter Neufeld, *Preventing the Execution of the Innocent: Testimony Before the House Judiciary Committee*, 29 HOFSTRA L. REV. 1155, 1161-62 (2001).

[FN42]. Alice A. Isenberg, *Forensic Mitochondrial DNA Analysis*, FBI LAW ENFORCEMENT BULLETIN 16 (August 2002), *available at* http:// www.fbi.gov/publications/leb/2002/august021eb.pdf.

[FN43]. Forensic mtDNA testing is far more specialized, expensive, and time-consuming than nDNA testing. Over one hundred laboratories in the United States are authorized to conduct forensic nuclear DNA analysis. Government forensic mtDNA laboratories include the FBI and AFDIL. Commercial forensic mtDNA laboratories include Bode Technology Group, Inc., in Springfield, Virginia; Laboratory Corporation of America, in Research Triangle Park, North Carolina; Mitotyping Technologies, LLC, in State College, Pennsylvania; Orchid Cellmark Dallas, in Dallas, Texas; Reliagene Technologies, Inc., in New Orleans, Louisiana; and Serological Research Institute, in Richmond, California.

[FN44]. Drs. Kaestle and Kittles have become familiar with forensic laboratories' procedures for analyzing and typing mtDNA sequences through their anthropological and genetic research involving mtDNA sequencing. Ms. Roth and Mr. Ungvarsky have become familiar with such procedures through trial and appellate litigation involving the United States' use of mtDNA typing conducted by the FBI and other laboratories as evidence in criminal trials.

[FN45]. FBI MtDNA Protocols (2004), *supra* note 8, at § 11.3.3.

[FN46]. While this Article focuses on the sequence comparison protocols followed by the FBI, it is worth noting that other mtDNA typing laboratories differ in their treatment of heteroplasmy when comparing the suspect's profile to the evidence sample profile. *See* Statement of Dr. M. Thomas P. Gilbert, submitted in *United States v. Chase*, D.C. Super. Ct. Crim. No. F-7330-99 (July 9, 2004) (on file with authors) (reviewing protocols for all major mtDNA testing laboratories and observing that "forensic laboratories come to no consensus as to how to interpret heteroplasmic sequences.... [T]he interpretation guidelines vary when determining what would be labeled as 'inconclusive' and what would be labeled as an 'exclusion.'").

[FN47]. FBI MtDNA Protocols (2004), *supra* note 8, at § 11.3.3.

[FN48]. *Id.*

[FN49]. *Id.*

[FN50]. For convenience purposes, forensic laboratories do not search all 610 bases of the HVI and HVII regions. Rather, the sample is first compared to the revised CRS. Differences between the two are then searched against the profiles in the SWGDAM database. Alice R. Isenberg & Jodi M. Moore, *Mitochondrial DNA Analysis at the FBI Laboratory*, 1 FORENSIC SCI. COMM. 1 (1999), *available at* http:// www.fbi.gov/hq/lab/fsc/backissu/july1999/dnalist.htm.

[FN51]. *See* FBI MtDNA Protocols (2004), *supra* note 8, at § 12.1. The SWGDAM database has grown from 1393 sequences in 1998 to its current size of 5071. *See* Bruce Budowle et al., *Mitochondrial DNA Regions HVI and HVII Population Data*, 103 FORENSIC SCI. INT'L 23, 25 (1999)

[hereinafter Budowle et al. (1999)] (1393 sequences in 1998); Isenberg & Moore, *supra* note 50, at 1 (2426 sequences in 1999); Constance Fisher & Bruce Budowle, Presentation, *Mitochondrial DNA: Today & Tomorrow*, 11th Annual Int'l Symposium on Human Identification (2000), *available at* http:// www.promega.com/geneticidproc/ussymp11proc/content/fisher.pdf (4142 sequences in 2000). The database has not grown at all since at least April 2003. *See* FBI MtDNA Protocols (2004), *supra* note 8, at § 12.1 (stating that the database as of April 14, 2003, "contain[s] 5071 individuals").

[FN52]. None of the sub-databases has more than 1814 profiles; ten have fewer than two hundred profiles; and five have fewer than one hundred profiles. The populations and the number of profiles within each are as follows:

Race	Number of Profiles
African-Americans	1148
Apaches	180
Caucasians	1814
Chinese/Taiwanese	356
Egyptians	48
Guam	87
Hispanics	759
India	19
Japanese	163
Koreans	182
Navajos	146
Pakistan	8
Sierra Leone	109
Thai	52
TOTAL	**5071**

Monson et al., *supra* note 8, at "Release Notes," *available at* http://www.fbi.gov/hq/lab/fsc/backissu/april2002/mtDNA_popDB1.2ReleaseNotes.pdf.

[FN53]. *See* Budowle et al. (1999), *supra* note 51, at 25 (explaining origins of SWGDAM database profiles).

[FN54]. *See id.* (listing geographical origins of SWGDAM profiles).

[FN55]. FBI MtDNA Protocols (2004), *supra* note 8, at § 11.1 (stating the FBI reports the number of "hits" in each racial database regardless of the suspect's putative race).

[FN56]. *See* Allard et al., *supra* note 34, at 2 (stating 72% of profiles in SWGDAM Caucasian database as of 2000 appear only once); Parsons & Coble, *supra* note 15, at 305:

> [C]omparing the 2000 database with the 1998 database shows that the number of sequences occurring once is decreasing, going from 63% in 1998 to 54% in 2000. The percentage of single occurrences will continue to decrease as more mtDNA samples are typed. However, the number of individuals who must be sequenced to reach the limit of mtDNA diversity is unknown [as] the overall distribution of mtDNA types is highly skewed toward rare types.

[FN57]. Laboratories use a slightly different statistical calculation when the sequence is not observed in the database. *See* Holland & Parsons, *supra* note 14, at 31-32.

[FN58]. A 95% confidence interval means that, if a series of such margins of error were constructed in estimating the frequency of the sequence in the population, approximately 95% of them should include the true frequency of the sequence in the population. Alternatively stated, there is approximately a 5% chance that the margin of error does not contain the true frequency of the sequence in the population. *See* ROBERT S. WITTE, STATISTICS 215 (2d ed. 1985). As the sample size grows, the confidence interval will become narrower, indicating 95% confidence in a smaller range of possible values for the frequency. *Id.* at 216. Ninety-nine percent confidence intervals are also "prevalent" in statistical calculations. *Id.* at 221. None of the forensic literature or forensic laboratory protocols reviewed by the authors discusses why a 95% confidence interval, as opposed to a more conservative interval like 99%, is used in forensic casework. Indeed, the FBI uses a 99% confidence interval when determining whether to label a nuclear DNA profile as "unique" in the population. *See* FBI Laboratory Unit I, Short Tandem Repeat Analysis Protocols § 10.6 at 10-10, 10-11 (Apr. 1, 2002).

[FN59]. *See, e.g.*, United States v. Coleman, 202 F. Supp. 2d 962, 964, 967 (E.D. Mo. 2002) (stating 99.93% of all persons excluded from contributing mtDNA sample); Lewis v. State, 889 So. 2d 623, 673 (Ala. Crim. App. 2003) (stating 99.8% of Caucasians excluded); State v. Pappas, 776 A.2d 1091, 1104 (Conn. 2001) (stating 99.75% of Caucasians excluded); Magaletti v. State, 847 So.2d 523, 587 (Fla. Dist. Ct. App. 2003) (stating 99.93% of all persons excluded).

[FN60]. *See* Budowle et al. (1999), *supra* note 51, at 25.

[FN61]. *See* BUTLER, *supra* note 12, at 502 ("Often the rarity of a calculated [nuclear] DNA profile

goes beyond one in billions (10^9) or trillions (10^{12}) to numbers that are not frequently used because they are so large."); *id.* at 504, tbl.21.3 (listing values such as quadrillion (10^{15}), quintillion (10^{16}), and google (10^{100})).

[FN62]. *See* NRC II (1996), *supra* note 5, at 30 (stating STR database consists of convenience samples from "blood banks, paternity-testing laboratories, laboratory personnel, clients in genetic-counseling centers, law-enforcement officer, and people charged with crimes"); United States v. Bridgett, 120 Daily Wash. L. Rptr. 1697, 1700 n.12 (D.C. Super. Ct Aug. 11, 1992) (same).

[FN63]. Phylogeography "is a field of study concerned with the principles and processes governing the geographic distributions of genealogical lineages, especially those within and among closely related species [and] deals with historical, phylogenetic components of the spatial distributions of gene lineages. In other words, time and space are the jointly considered axes of phylogeography onto which (ideally) are mapped particular gene geneaologies of interest." JOHN C. AVISE, PHYLOGEOGRAPHY: THE HISTORY AND FORMATION OF SPECIES 3 (2000).

[FN64]. *See, e.g.*, Ripan S. Malhi et al., *The Structure of Diversity Within New World Mitochondrial DNA Haplogroups: Implications for the Prehistory of North America*, 70 AM. J. HUM. GENET. 905, 906 (2002) [hereinafter Malhi et al. (2002)] ("significant geographic variation in frequency distributions across North America" existed for nearly five hundred Native American haplotypes and "haplogroup frequency distribution was correlated with geography"); Dan Mishmar et al., *Natural Selection Shaped Regional MtDNA Variation in Humans*, 100 PROC. NATL. ACAD. SCI. 171 (Jan. 7, 2003) ("extensive global population studies have shown that there are striking differences in the nature of the mtDNAs found in different geographic regions").

[FN65]. In North America, the C and D haplogroups, present in Native American populations, are widely distributed across the continent. *See* Malhi et al. (2002), *supra* note 64, at 909-11 & figs. 2, 3, 4. The H haplogroup occurs in 20% to 25% of the population in the Near East, 50% in Europe, and nearly 60% in the Basque country of Spain. *See* Martin Richards et al., *In Search of Geographical Patterns in European Mitochondrial DNA*, 71 AM. J. HUM. GENETICS 1168, 1170 (2002).

[FN66]. While *phylogenetic* analysis — reconstructing genetic relationships within a population — has been conducted on many of the SWGDAM racial sub-databases, such studies only show, at most, that a particular database accurately reflects most of the haplogroups that exist in the relevant population, e.g., that the Caucasian database contains all major haplogroups in the Caucasian population. *See* Allard et al., *supra* note 34, at 8. Such studies do not, however, take into account the *geographical distribution* of the sequences within the population, and thus cannot be cited as evidence that a database accurately reflects the frequency of a profile in a particular geographic area. Only *phylogeographic* studies — those that focus on the spectrum and area-specificity of major haplogroups and the haplotypes within them — can accurately determine true frequencies. *See* Juan C. Rando et al., *Phylogeographic Patterns of MtDNA Reflecting the Colonization of the Canary Islands*, 63 ANNALS HUM. GENETICS 413, 424 (1999).

[FN67]. *See, e.g.*, Michael Bamshad et al., *Genetic Evidence on the Origins of Indian Caste Populations*, 11 GENOME RESEARCH 994 (2001) (discussing economic and caste distinction); Ranjan Dutta et al., *Patterns of Genetic Diversity at the Nine Forensically Approved STR Loci in the Indian*

Populations, 74 HUM. BIOL. 33 (2002) (same); D. Andrew Merriwether et al., *Mitochondrial DNA Is an Indicator of Austronesian Influence in Island Melanesia*, 110 AM. J. PHYS. ANTHROPOL. 243 (1999) (linguistic distinctions); Pavao Rudan et al., *Anthropological Research of Hvar Islanders, Croatia — From Parish Registries to DNA Studies in 33 Years*, 28 COLLEGIUM ANTHROPOLOGICUM 321 (2004) (religious); Lev A. Zhivotvsky et al., *The Forensic DNA Implications of Genetic Differentiation Between Endogamous Communities*, 119 FORENSIC SCI. INT'L 269 (2001) (no obvious subdivision).

[FN68]. *See, e.g.*, DAVID BALDING, WEIGHT-OF-EVIDENCE FOR FORENSIC DNA PROFILES 105-06 (2005):

> [M]aternally-related individuals might be expected to be tightly clustered, possibly on a fine geographical scale. Reports of F_{ST} estimates for mtDNA drawn from cosmopolitan European populations typically cite low values, reflecting the fact that this population is reasonably well-mixed, as well as the effects of high mtDNA mutation rates. However, researchers rarely are able to focus on the fine geographic scale that may be relevant in forensic work, and there are some large F_{ST} estimates at this scale.

see also Anita Brandstätter et al., *Mitochondrial DNA Control Region Sequences from Nairobi (Kenya): Inferring Phylogenetic Parameters for the Establishment of a Forensic Database*, 118 INT'L J. LEGAL MED. 294 (2004) (describing new forensic database containing sequences from Nairobi and finding that there were significant differences in mtDNA compositions of this new database and the African-American SWGDAM database, as well as of published sequences from Sierra Leone, Mozambique, and United States); Peter Forster et al., *Continental and Subcontinental Distributions of MtDNA Control Region Types*, 116 INT'L J. LEGAL MED. 99, 99 (2002); Kaestle & Horsburgh, *supra* note 38, at 95 ("[M]itochondrial markers are also often geographically specific, and in some cases are limited in distribution to a single tribe (private polymorphisms)."); Rick A. Kittles & Shomarka O. Keita, *Interpreting African Genetic Diversity*, 16 AFRICAN ARCHEOL. REV. 87, 87 (1999); Luisa Pereira et al., *Prehistoric and Historic Traces in the MtDNA of Mozambique: Insights into the Bantu Expansions and the Slave* Trade, 65 AM. J. HUM. GENETICS 439 (2001); Rando et al., *supra* note 66, at 424; Antonio Salas et al., *The African Diaspora: Mitochondrial DNA and the Atlantic Slave Trade*, 74 AM. J. HUM. GENETICS 454 (2004); Yao et al., *supra* note 21, at 649.

[FN69]. Richards et al., *supra* note 65, at 255 (discussing J Haplogroup).

[FN70]. *Id.* at 254 (discussing J1b1 Haplogroup).

[FN71]. Rando, *supra* note 66, at 420, 424.

[FN72]. Pereira et al., *supra* note 68, at 452:

> There remain a large number of sequences from African haplogroups sampled in the Americas and Europe for which no match can be found in the current African database. This may be due in part to the fact that the main regions from where slaves were taken, such as Angola and the Slave Coast remain uncharacterized.

See also Joseph Lorenz et al., *African-American Lineage Markers: Determining the Geographic Source of MtDNA and Y Chromosomes* (Apr. 15, 2004), http://

www.physanth.org/annmeet/aapa2004/ajpa2004.pdf (discussing study suggesting that there is large proportion of unexamined, undocumented mtDNA variability among individuals indigenous to sub-Saharan Africa).

[FN73]. Parsons, *supra* note 23, at 1.

[FN74]. Parsons et al., *supra* note 23, at 4-5 ("U.S. Hispanics are a complex admixture of Native American, European, and African lineages, making the regional variation of U.S. Hispanics important in a forensic context."); *id.* (listing dramatic differences in frequency of various haplotypes among Hispanics in different regions of the United States).

[FN75]. *Id.* at 5.

[FN76]. *Id.*

[FN77]. Yao et al., *supra* note 21, at 635.

[FN78]. *See id.* at 649:

> The comparison of the regional Han mtDNA samples revealed an obvious geographic differentiation in the Han Chinese, as shown by the haplogroups-frequency profiles.... Hence, the grouping of different Han populations into just "Southern Han" and "Northern Han" or the use of one or two Han regional populations to stand for all Han Chinese ... does not appropriately reflect the genetic structure of the Han.

[FN79]. *See, e.g.*, David Biello, *Skulls Suggest Differing Stocks for First Americans* (Dec. 13, 2005), http://www.sciam.com/print_version.cfm?articleID=000E8538-F33D-139D-B33D83414B7F0000 ("Today, no South American native group presents the X [mitochondrial DNA] lineage, which is universal among North American native groups.") (alteration in original); Jason Eshleman et. al., *Mitochondrial DNA Studies of Native Americans: Conceptions and Misconceptions of the Population Prehistoric of the Americas*, 12 EVOL. ANTHROPOL. 7-18 (2003) (noting that while Haplogroup X is found in low frequency in Europe and Western Asia, Native American variant is significantly different, possessing mutation that distinguishes it from Old World versions); Lynn B. Jorde & Stephen P. Wooding, *Genetic Variation, Classification, and "Race,"* 36 NATURE GENETICS S28, S29 (Nov. 2004) ("[I]ndividuals tend to cluster according to their ancestry or geographic origin."); Malhi et al. (2002), *supra* note 64, at 3-5 (stating native Americans have haplogroups whose frequencies varies greatly among Canada, United States, and Mexico); Esteban J. Parra, Rick A. Kittles et al., *Ancestral Proportions and Admixture Dynamics in Geographically Defined African Americans Living in South Carolina*, 114 AM. J. PHYS. ANTHROPOL. 118 (2001) [hereinafter Parra & Kittles (2001)]; Estaban J. Parra, Amy Marcini et al., *Estimating African-American Admixture Proportions by Use of Populations-Specific Alleles*, 63 AM. J. HUM. GENETICS 1839 (1998); Sarah A. Tishkoff & Kenneth K. Kidd, *Implications of Biogeography of Human Populations for "Race" and "Medicine,"* 36 NATURE GENETICS S21, S26 (Nov. 2004) (stating that frequency of mtDNA haplogroups are unevenly distributed within and among geographic regions and "knowledge of ethnicity (not just broad geographic ancestry) and statistical tests of substructure are important proper design of case control association studies"). *Cf.* Terry Melton et al., *Diversity and Heterogeneity in Mitochondrial DNA of North American Populations*, 46 J. FORENSIC SCI. 46 (2001) (arguing that North American population is homogeneous, and identifying, without exploring, population of Hispanics in Pennsylvania

who differed significantly from any other population in study).

[FN80]. The authors' focus on the migration patterns of African Americans should not be taken as a statement that ancestry-related substructure in mtDNA profile distribution does not exist with respect to other groups in the United States. Rather, the focus reflects the fact that the African-American population exhibits high genetic heterogeneity, and the most infrequently occurring haplotypes, compared to other ethnic groups in the United States. As descendants of enslaved Africans, African Americans possess a diverse gene pool that is mainly of west and central African origin but also of substantial European and Native American admixture. As a result, it is of significant scientific importance, both in forensic science and biomedicine, to understand the genetic consequences of this unique population history. The authors' emphasis also reflects the significant number of studies on African-American migration in particular and the relative familiarity of the lay public with the historical post-slavery era migration of African Americans.

[FN81]. Rebecca L. Cann, Mark Stoneking, & Allan C. Wilson, *Mitochondrial DNA and Human Evolution*, 325 NATURE 31 (1987). *See also* Philip D. Curtin, *From Guesses to Calculations, in* THE ATLANTIC SLAVE TRADE: A CENSUS (David Northrup ed., 1994). Curtin's calculations were later refined by David Northrup. Paul E. Lovejoy, *Curtin's Calculations Refined but Not Refuted, in* THE ATLANTIC SLAVE TRADE 50-59 (David Northrup ed., 1994). *See also* Elizabeth E. Watson et al., *MtDNA Sequence Diversity in Africa*, 59 AM. J. HUM. GENETICS 437 (1996).

[FN82]. *See, e.g.*, Terry Melton et al., *Extent of Heterogeneity in Mitochondrial DNA of sub-Saharan African Populations*, 42 JOURNAL OF FORENSIC SCI 582, 588-89 (1997) (finding numerous haplotypes with occurrences of sequence-specific oligonucleotides (SSO) — particular base pair variations in certain parts of the mtDNA control region — of more than 10% in a particular African population and "substantial subpopulation heterogeneity" in "continental African populations"). The authors conclude that "control region sequencing would be a good alternative for forensic identifications in African or African-derived populations where there is uncertainty about whether subpopulations are present, at least until further populations are studied." *Id.* at 589.

[FN83]. *See generally* Salas et al., *supra* note 68, at 455-56.

[FN84]. Parra & Kittles (2001), *supra* note 79, at 19.

[FN85]. PHILLIP D. MORGAN, SLAVE COUNTERPOINT: BLACK CULTURE IN THE EIGHTEENTH CENTURY CHESAPEAKE AND LOWCOUNTRY 33-44 (1998).

[FN86]. *Id.* at 34-36.

[FN87]. Fatimah Jackson, *Concerns and Priorities in Genetic Studies: Insights from Recent African-American Biohistory*, 27 SETON HALL L. REV. 951, 961-62 (1997); Parra, Marcini et al., *supra* note 79, at 1839 (listing countries of Africa by economic region). This very same resistance makes African Americans whose ancestors come from the Gold Coast more likely to carry the sickle cell trait and sickle cell disease. A. Muniz et al., *Sickle-Cell-Anemia and Beta-Gene Cluster Haplotypes in Cuba*, 49 AM. J. OF HEMATOLOGY 163 (1995); Gabriella Pante-De Sousa et al., *Betaglobin Hapolytpes Analysis in Afro-Brazilians from the Amazon Region: Evidence for a Significant Gene Flow from Atlantic West Africa*, 26 ANNALS OF HUM. BIO. 365 (1999).

[FN88]. Curtin, *supra* note 81, at 83.

[FN89]. *See generally* JAMES R. GROSSMAN, LAND OF HOPE: CHICAGO, BLACK SOUTHERNERS, AND THE GREAT MIGRATION (1991).

[FN90]. *Id.* at 28-30.

[FN91]. *Id.* at 112-13 (describing migration from Mississippi delta to Chicago); NICHOLAS LEMANN, THE PROMISED LAND: THE GREAT BLACK MIGRATION AND HOW IT CHANGED AMERICA 119-20 (1991) (alluding to migration from Carolinas and Virginia up East Coast).

[FN92]. *See* http://www.censusgov/prod/cen2000/dp1/2khus.pdf (displaying a pictorial depiction of geographical distribution of African Americans in United States).

[FN93]. *See* Parra, Mancini et al., *supra* note 79, at 1845-47; Ranajit Chakraborty, *Gene Admixture in Human Populations: Models and Predictions*, 29 YEARBOOK OF PHYS. ANTHROP. 1-43 (1986); David C. McLean, Jr. et al., *Three Novel MtDNA Restriction Site Polymorphisms Allow Exploration of Population Affinities of African Americans*, 75 HUM. BIOLOGY 147-61 (2003).

[FN94]. *See American, Indian, Eskimo, and Aleut Persons* (last visited Feb. 17, 2006) http://www.census.gov/geo/www/mapGallery/images/americanindian.jpg (displaying visual depiction of heavy Native-American clustering in western part of United States); STELLA U. OGUNWOLE, THE AMERICAN INDIAN AND ALASKA NATIVE POPULATION: 2000 4-6 (U.S. Census Bureau Feb. 2002) (noting that 43% of American Indians lived in West, 31% lived in South, 17% lived in Midwest, and 9% lived in Northeast United States).

[FN95]. Parra, Marcini et al., *supra* note 79, at 1845. The admixture study reports *two* results from Philadelphia, based on two independent sample sets taken from patients in two separate hypertension studies. These sample sets exhibited significant differences in their percentage of admixture. *Id.* Thus, even within a single city, different groups of African Americans display significantly different mtDNA profiles.

[FN96]. *Id.* at 1845-47.

[FN97]. *See* Carolina Bonilla et al., *Admixture in the Hispanics of the San Luis Valley, Colorado and Its Implications for Complex Trait Gene Mapping*, 68 ANNALS HUM. GENETICS 139, 140 (2004) (stating that the term "Hispanic" applies to individuals from several continents with "diverse cultural features and genetic back-grounds").

[FN98]. *See id.* (reporting differences in admixture among Puerto Rican, Cuban, and Mexican groups, as well as within smaller region of San Luis Valley).

[FN99]. *See* Bruce Budowle et al., *Population Data on the STR Loci D2S1338 and D19S433*, FORENSIC SCI. COMM. (July 2001), *available at* http://www.fbi.gov/hq/lab/fsc/backissu/july2001/budowle2.htm.

[FN100]. Ripan S. Malhi et al., *Native American MtDNA Prehistory in the American Southwest*, 120

AM. J. PHYS. ANTHROP. 108, 113 (2003).

[FN101]. *Id.* Additionally, the Navajo and Apache are not representative of the variation present in haplotypes/haplogroups among all North American Native Americans. Tribal groups in the United States share few haplotypes. *See* Malhi et al. (2002), *supra* note 64, at 914, tbl.2 (estimating sharing at about 29%).

[FN102]. Malhi et al., *supra* note 100, at 121-22.

[FN103]. The primary published analysis of this database concerns only the Chinese samples and while the analysis suggests that the frequencies of the haplogroups in the dataset are similar to those in another Han Chinese dataset of 263 individuals, the authors' data reveal significant differences in almost all cases. Marc W. Allard, Mark R. Wilson et al., *Control Region Sequences for East Asian Individuals in the Scientific Working Groups on DNA Analysis Methods Forensic MtDNA Data Set*, 6 LEGAL MED. 11, 18, fig.2 (2004). Other studies also show significant genetic variation among and within Asian populations. *See, e.g.*, Toomas Kivisild et al., *The Emerging Limbs and Twigs of the East Asian MtDNA Tree*, 19 MOL. BIOL. EVOL. 1737 (2002) (noting other Asian populations not represented in the SWGDAM East Asian database have significantly different frequencies of mtDNA haplogroups than those in the database); Terry Melton & Mark Stoneking, *Extent of Heterogeneity in Mitochondrial DNA of Ethnic Asian Populations*, 41 J. FORENSIC SCI. 591-602 (1996) (same); Yao et al., *supra* note 21, at 636 (combining all Han Chinese would be inappropriate).

[FN104]. *See* Terrance J. Reeves & Claudette E. Bennett, WE THE PEOPLE: ASIANS IN THE UNITED STATES, Pub. No. CENSR-17, U.S. Census Bureau, Dep't of Commerce 1, tbl.1 (2004) (listing major Asian groups in U.S., many of which are not included in SWGDAM Asian databases), *available at* http:// www.census.gov/prod/2004pubs/censr-17.pdf.

[FN105]. *Id.* at 4, fig. 1.

[FN106]. A chi-square analysis conducted by the authors comparing the SWGDAM and 2000 Census frequencies of Asian subpopulations (converted to sample sizes in both cases) rejects the hypothesis that the SWGDAM database is a random sample of the Census Asian Populations, with an extremely significant p value of less than 10^{-20}:

Asian Population	2000 Census	SWGDAM Database
Asian Indian	16.1%	2.4%
Cambodian	1.7%	0
Chinese	23.8%	45.7%
Filipino	18.3%	0
Hmong	1.7%	0

Japanese	7.8%	20.9%
Korean	10.6%	23.3%
Laotian	1.7%	0
Pakistani	1.6%	1%
Thai	1.1%	6.7%
Vietnamese	10.9%	0
Other Asian	4.7%	0

[FN107]. *See* Allard et al., *supra* note 34, at 1219-20.

[FN108]. *See* Wojciech Branicki, Ksenia Kalista et al., *Distribution of MtDNA Haplogroups in a Population Sample from Poland*, 50 J. FORENSIC SCI. 732, 733 (2005) (noting H Haplogroup was observed in 37.8% of samples in population from Southern Poland); Vincent Dubut et al., *MtDNA Polymorphisms in Five French Groups: Importance of Regional Sampling*, 12 EUR. J. HUM. GENETICS 293, 296 (2004) (showing that within France alone, frequency of H varies between 35% and 50% in two separate communities in Brittany); Ana M. Gonzalez et al., *Mitochondrial DNA Affinities at the Atlantic Fringe of Europe*, 120 AM. J. PHYS. ANTHROPOL. 391, 394 (recording 26.3% in Norway, 34% in England, 36.4% in Northern Germany, 38.5% in France and 42.2% in Galicia); Boris A. Malyarchuk et al., *Mitochondrial DNA Variability in Bosnians and Slovenians*, 67 ANNALS HUM. GENETICS 412-25 (2003) (illustrating frequency of H haplogroup is 24% in Finland, 26.8% in Scotland, and 45% in Poland). *See also* Pereira et al., *supra* note 21, at 7 (noting the use of SNPs to more closely examine haplogroups demonstrates significant inter-relatedness below the haplogroup level and suggests that "phylogenetic dissection of mtDNA haplogroups is revealing gradients previously hidden on the Eurasian scale").

[FN109]. That the SWGDAM database is not representative also arguably invalidates the FBI's use of a confidence interval to extrapolate from the database to a sub-population. Use of such margins of error presupposes random distribution in the population. WITTE, *supra* note 58, at 214.

[FN110]. *See* NRC II (1996), *supra* note 5, at 34 (noting that database of "a few hundred persons" is necessary even to have "some statistical accuracy" in estimating nDNA frequencies); RUDIN & INMAN, *supra* note 1, at 147 ("[T]he mtDNA databases are not yet large enough to be confident that an occurrence of a particular type divided by the number of people in the database gives a reasonable estimate of the frequency.").

[FN111]. Melton, *supra* note 79, at 46 and Budowle et al., *supra* note 51, at 31-32, argue that the SWGDAM database is valid based on the "lack" of significant population structure in the sequence-specific oligonucleotide ("SSO") types and the similarity of the haplogroup frequencies in the database to various non-U.S. populations. This argument has two fundamental flaws. First, these studies look only to haplo*group* or SSO diversity, not to haplo*type* diversity, even though it is at the haplo*type* level that many population differences are detected and that the FBI generates its inclusion statistics. *See, e.g.*, Malhi et al. (2002), *supra* note 64, at 906. Second, their use of the F_{ST} — an ostensible measure of genetic population differentiation — is controversial. Melton (2001) relies on the F_{ST} to tout the homogeneity of North American populations. But the assumptions of F_{ST} make the statistic inherently biased against the detection of diversity among populations. Jeffrey C. Long & Rick A. Kittles, *Human Genetic Diversity and the Nonexistence of Biological Races*, 75 HUM. BIOLOGY 449, 450 (2003). Even if the use of F_{ST} indicates no significant subdivision in a haplogroup or SSO, such evidence is irrelevant to whether significant differences exist in frequencies of haplo*types* in various populations.

[FN112]. To calculate the cumulative probability that a database containing 1200 samples should miss a particular such profile, one must use the product rule to determine the probability that an event with probability .999 will not occur in 1200 trials. As it turns out, $(0.999)^{1200} = 0.301$.

[FN113]. *See* Tishkoff & Kidd, *supra* note 79, at S25. Of the 1771 individuals in the SWGDAM Caucasian database as of 2000, 72% of the profiles appeared only once in the database. Allard et al., *supra* note 34, at 1216; Parsons & Coble, *supra* note 15, at 305 (noting rare profiles exceed 50% of observed sequences in SWGDAM database). *See generally* Kittles & Keita, *supra* note 68, at 88-89.

[FN114]. *See, e.g.*, Carina Dennis, *Error Reports Threaten To Unravel Databases of Mitochondrial DNA*, 421 NATURE 773, 773-74 (2003) (reporting observation by Dr. Neil Howell that Dr. Forster's error-detection method may underestimate number of errors in databases); Forster, *supra* note 25, at 2:

> In forensics, accurate comparative mtDNA database are needed to assess the probability that an mtDNA profile from a crime stain is likely to derive from a suspect rather than from any other member of the population, so the number of errors in forensic journals listed in Table 1 does not engender confidence.

Corinna Herrnstadt et al., *Errors, Phantom and Otherwise, in Human MtDNA Sequences*, 72 AM. J. HUM. GENETICS 1585, 1585 (2003).

[FN115]. Hans-Jurgen Bandelt et al., *Detecting Errors in MtDNA Data by Phylogenetic Analysis*, 115 INT'L J. LEGAL MED. 64, 64 (2001).

[FN116]. *See, e.g.*, Hans-Jurgen Bandelt, Antonio Salas, & Lutz-Bonengal, *Artificial Recombination in Forensic MtDNA Population Database*, 118 INT'L J. LEGAL MED. 267 (July 2004).

[FN117]. Kevin Miller & Bruce Budowle, *A Compendium of Human Mitochondrial DNA Control Region: Development of an International Standard Forensic Database*, 42 CROATIAN MED. J. 315, 316 (2002). Miller and Budowle found that "a few substitutions in some published and SWGDAM sequences were clearly reviewed to be anomalous." *Id.* Sources for confusion in the data, according to the authors, include failure to conform to a standardized numbering system, non-recordation of in-

sertions and deletions in the polycystine stretch of HVI, and differences between the number of sequences in the literature and the number of sequences in GenBank/EMBL. *Id.* While the authors subsequently recommended that the public data containing the errors be used for "investigative or research purposes only and not for the assignment of weight regarding forensic matches," the authors did not address how, if at all, the FBI addressed the SWGDAM sequencing errors. *Id.*

[FN118]. Hans-Jurgen Bandelt, Antonio Salas, & Antonio Bravi, *Problems in FBI MtDNA Database*, 305 SCIENCE 1402, 1403-04 (Sept. 2004).

[FN119]. *Id.*

[FN120]. *Id.*

[FN121]. *Id.*; Bruce Budowle et al., *Addressing the Use of Phylogenetics for Identification of Sequences in Error at the SWGDAM Mitochondrial DNA Database*, 49 J. FORENSIC SCI. 1, 1256 (Nov. 2004).

[FN122]. Budowle et al., *supra* note 121, at 1259 tbl.2, 1260 tbl.3.

[FN123]. *See* D. Michael Risinger & Michael J. Saks, *Rationality, Research and Leviathan: Law Enforcement-Sponsored Research and the Criminal Process*, 2003 MICH. ST. L. REV. 1023, 1047 & n.107 (2003) (noting that current FBI rules require an FBI employee to be a co-author on any article as a condition for gaining access to agency data).

[FN124]. AFDIL researchers have already suggested possible improvements to quality control in mtDNA testing. *See* Coble et al., *supra* note 21, at 139 Table (minimizing human intervention in process and reviewing all results by two individuals who conducted independent evaluations); Just, et al., *supra* note 23, at S148-49 (noting that implementation of a high-throughput robotic system for population databasing backed up by multiple scientists checking key laboratory steps increases the size and range of current mtDNA databases and decreases potential sources of error in creating databases).

[FN125]. *See, e.g.*, Pattern Jury Instr. (criminal cases) First Circuit § 3.02 (1998) ("It is a cardinal principle of our system of justice that every person accused of a crime is presumed to be innocent unless and until his/her guilt is established beyond a reasonable doubt. The presumption is not a mere formality. It is a matter of the most important substance."); Manual of Model Crim. Jury Instr. Eighth Circuit § 3.05 (2005) ("The presumption of innocence alone is sufficient to find the defendant not guilty and can be overcome only if the Government proves, beyond a reasonable doubt, each essential element of the crime charged."); Conn. Prac., Crim. Jury Instr. § 2.8 (3d ed. 2005) ("[T]he accused is presumed to be innocent until he is proved guilty. That means that at the moment when he was presented before you for trial, he stood before you free of any bias, prejudice or burden arising from his position as the accused."); Criminal Jury Instr. for the District of Columbia § 2.08 (2004) ("This presumption of innocence remains with the defendant throughout the trial unless and until s/he is proven guilty beyond a reasonable doubt."); Haw. Crim. Jury Instr. § 3.02 (2005) ("You must presume the defendant is innocent of the charge against him/her. This presumption remains with the defendant throughout the trial of the case, unless and until the prosecution proves the defendant guilty beyond a reasonable doubt."); Tenn. Pattern Jury Instr. Criminal § 2.01 (2005) ("This presumption

[of innocence] remains with the defendant throughout every stage of the trial, and it is not overcome unless from all the evidence in the case you are convinced beyond a reasonable doubt that the defendant is guilty."); Va. Model Jury Instr. Crim. § 2.100 (2005) ("This presumption of innocence remains with the defendant throughout the trial and is enough to require you to find the defendant not guilty unless and until the Commonwealth proves each and every element of the offense beyond a reasonable doubt.").

[FN126]. Other commentators have advocated such modification to the counting method. *See* BALDING, *supra* note 68, at 99 ("to make some allowance for sampling variability, it is advantageous to include both the crime scene and the defendant profiles with those of the population database."); Marlan D. Walker, Note, *Mitochondrial DNA Evidence in* State v. Pappas, 43 JURIMETRICS J. 427, 437 (2003) ("[T]he fact that T has been observed once in a sample of 1220 individuals (the 1219 in the database plus the defendant) suggests that the sample frequency of 0/1219 used to form the confidence interval may be understated.").

[FN127]. Using the FBI's formula for calculating confidence intervals, *see* FBI MtDNA Protocols (2004), *supra* note 8, at § 11 at 10, the upper bound 95% confidence limit for 0/1148 is 0.26%. The upper bound 95% confidence limit for 2/1150 is still small, but almost twice as great, 0.42%. Using a more conservative 99% confidence interval increases the frequency estimates a bit more. The upper bound 99% confidence limit for 0/1148 is 0.4%. The upper bound 99% confidence limit for 2/1150 is 0.49%. The smaller the database, the more pronounced the effects of such modifications. The SWGDAM Chinese/Taiwanese population database has 356 profiles. The upper bound 95% confidence limit for 0/356 is 0.84%. The upper bound 95% confidence limit for 2/358 is 1.33%. Changing the confidence limits to 99% causes the upper bound confidence limits increase to 1.3% and 1.6%, respectively. While the practical effects of these modifications may be marginal in most cases, the difference may be material in a particular case, and accuracy is a worthy goal in itself.

[FN128]. Frye v. United States, 293 F. 1013 (D.C. Cir. 1923).

[FN129]. *Id.* at 1014:

> Just when a scientific principle or discovery crosses the line between the experimental and demonstrable stages is difficult to define. Somewhere in this twilight zone the evidential force of the principle must be recognized, and while courts will go a long way in admitting expert testimony deduced from a well-recognized scientific principle or discovery, the thing from which the deduction is made must be sufficiently established to have gained general acceptance in the particular field in which it belongs.

[FN130]. Daubert v. Merrell Dow Pharmaceuticals, Inc., 509 U.S. 579 (1993).

[FN131]. *Id.* at 589. The *Daubert* test was subsequently refined by the Court and incorporated into the relevant Federal Rule of Evidence. *See* Kumho Tire v. Carmichael, 526 U.S. 137, 138 (1999) (extending *Daubert* more generally to non-scientific expert testimony); General Electric Co. v. Joiner, 522 U.S. 136, 136-37 (1997) (applying abuse-of-discretion standard of review to trial court's determination of admissibility under *Daubert*); Comment to Fed. R. Evid. 702 (discussing 2000 amendments to Federal Rules of Evidence in response to *Daubert* that codify the requirement that "the testimony is the product of reliable principles and methods" and that "the witness has applied the prin-

ciples and methods reliably to the facts of the case").

[FN132]. *See generally* Andrew R. Stolfi, Note, *Why Illinois Should Abandon Frye's General Acceptance Standard for the Admission of Novel Scientific Evidence*, 78 CHI.-KENT L. REV. 861 (2003) (discussing standards for admission of scientific evidence in all U.S. jurisdictions).

[FN133]. People v. Pizarro, 3 Cal. Rptr. 3d 21, 44 (Cal. Ct. App. 2003); United States v. Porter, 618 A.2d 629, 633-34 (D.C. 1992).

[FN134]. *See* MICHAEL J. SAKS ET AL., ANNOTATED REFERENCE MANUAL ON SCIENTIFIC EVIDENCE, SECOND 73 (2004) (stating that "*Frye* is often criticized as overly conservative, for it imposes a protracted waiting period that valid scientific evidence and techniques must endure before gaining legal acceptance.").

[FN135]. *Daubert*, 509 U.S. at 592-93.

[FN136]. *Id.* at 593-94.

[FN137]. *Id.* at 597-98.

[FN138]. *See id.* (stating that "[p]ertinent evidence based on scientifically valid principles" satisfies the Federal Rules of Evidence).

[FN139]. *See* SAKS ET AL., *supra* note 134, at 78 & n.9 (listing jurisdictions that have adopted or declined to reject *Daubert*).

[FN140]. *See* BUTLER, *supra* note 12, at 270 ("When 'failure to exclude' is the interpretation for reference and evidence samples, then a statistical estimate of the significance of a [mtDNA] match is needed."); *Porter*, 618 A.2d at 640 (indicating that a statistical assessment of significance of DNA is at the core of its admission and "underlying method of arriving at that calculation must pass muster under [*Frye*]"). *See generally* Kaye & Sensabaugh, *supra* note 5, at 545 & n.269 (noting a number of courts that have concluded that reliable statistical methodology must accompany science to be admissible). *But see id.* at 546 & n.275 (advocating that jurors need not be presented with a particular number if the profile is shown to be exceedingly rare by admissible scientific methodology).

[FN141]. This point should not obscure forensic mtDNA testing's effectiveness in the exoneration of suspects. The issue when *excluding* an individual is simply whether the sequencing was done properly at each stage. But when mtDNA typing is used to *include* an individual as a suspect, the information has no meaning without determining the statistical significance of the inclusion.

[FN142]. *See* SAKS ET AL., *supra* note 134, at 96-97 (comparing *Daubert* and *Frye* tests).

[FN143]. One dilemma facing courts is whether to consider the defendant's apparent ancestry in determining which database to use to determine a frequency estimate. At least one court has suggested that the presumption of innocence requires that no assumptions be made as to the perpetrator's ancestry and, thus, the statistics reported to the jury should not assume that the perpetrator is of a particular ancestry. *See, e.g.*, People v. Prince, 36 Cal. Rptr. 3d 300, 305-07 (Cal. App. 5th Dist. 2005) (reaffirming and following *Pizarro*'s disapproval of how the prosecution, when it presented the His-

panic profile frequency, impermissibly assumed the *perpetrator*, like the defendant, was Hispanic). On the other hand, where a perpetrator is likely from a particular ethnic community, it may be to the defendant's advantage to consider the perpetrator's ancestry, because the observed haplotype may be quite common in a particular ancestral sub-population, even though very uncommon in the general U.S. population. *See* Julian Adams, *Nuclear and Mitochondrial DNA in the Courtroom*, 13 J. L. & POL'Y 69, 88 (2005) (giving example of *Passino* case in which perpetrator of crime in remote trailer camp was likely of Abnaki ancestry).

[FN144]. In December 2003, the Public Defender Service for the District of Columbia commissioned a jury poll through Lake Snell Perry and Associates, an independent polling firm, of 1000 potential D.C. jurors. *See* http://www.pdsdc.org/SpecialLitigation/SLDSystemResources/Brady%20Poll%CCC20Results,%CCC20December%CC0 C 03.pdf. The poll showed that, on a scale of 0 to 10, 10 being most persuasive, the mean response for DNA evidence was 9, as compared to 6.6 for the testimony of the accuser. *Id.* at 2. Thirty-one percent of those polled stated that DNA evidence can never "be wrong." *Id.* at 4. Thirty percent stated that mistakes are made "almost never" with respect to DNA evidence. *Id.* When asked which was more reliable, nuclear or mtDNA, 32% answered that the two forms of DNA are "equally" reliable, while 11% answered that mtDNA was *more* reliable. *Id.* A study commissioned by the National Institute of Justice showed that, after sitting through a mock trial involving mtDNA, a large percentage of jurors fell victim to fallacies and misperceptions about DNA in general, and mtDNA in particular. *See generally* B. MICHAEL DANN ET AL., TESTING THE EFFECTS OF SELECTED JURY TRIAL INNOVATIONS ON JUROR COMPREHENSION OF CONTESTED MTDNA EVIDENCE, FINAL TECHNICAL REPORT 41-54 (Dec. 30, 2004), *available at* http://www.ncjrs.gov/pdffiles1/nij/grants/211000.pdf. *Cf.* Michael J. Saks & Jonathan J. Koehler, *The Coming Paradigm Shift in Forensic Identification Science*, 309 SCIENCE 892, 893 (2005) ("[E]rroneous forensic science expert testimony is the second most common contributing factor to wrongful convictions, found in 63% of those cases.").

[FN145]. For state courts that have admitted mtDNA evidence under *Frye*, see Magaletti v. State, 847 So. 2d 523, 526-29 (Fla. Dist. Ct. App. 2003); Wagner v. Maryland, 864 A.2d 1037, 1044-50 (Md. Ct. Spec. App. 2005); People v. Holtzer, 660 N.W.2d 405, 409-11 (Mich. Ct. App. 2003); People v. Ko, 757 N.Y.S.2d 561, 563 (N.Y. App. Div. 2003); People v. Klinger, 713 N.Y.S.2d 823, 831 (N.Y. Sup. Ct. 2000). *See also* Adams v. State, 794 So. 2d 1049, 1057 (Miss. Ct. App. 2001) (stating in one sentence that mtDNA expert was qualified and that, because expert claimed evidence was "generally accepted," defense challenge to testimony was denied). *Contrast* RUDIN & INMAN, *supra* note 1, at 195 (reporting on *State v. Crow*, No. 96-1156 (Fla. 18th Cir. Ct. May 14, 1998), in which the trial judge "ruled that the results of an mtDNA test did not meet the *Frye* standard and were inadmissible as evidence. He based his opinion on his understanding that the FBI database was too small and was insufficient to provide reliable statistical conclusions. [The judge] further found that the 'counting method' failed to provide meaningful comparison that would assist, rather than confuse, the jury.")

[FN146]. For federal courts that have admitted mtDNA under a *Daubert* standard, see United States v. Beverly, 369 F.3d 516, 527-31 (6th Cir. 2004); United States v. Coleman, 202 F. Supp.2d 962 (E.D. Mo. 2002). For state courts that have admitted mtDNA under a *Daubert* standard, see Lewis v. State, 889 So. 2d 623, 668-74 (Ala. Crim. App. 2003); State v. Pappas, 776 A.2d 1091, 1100-13 (Conn. 2001); State v. Underwood, 518 S.E.2d 231 (N.C. App. 1999); State v. Council, 515 S.E.2d

508 (S.C. 1999). *Cf.* State v. Scott, 33 S.W.3d 746, 759-60 (Tenn. 2000) (admitting mtDNA evidence by statute that looks at reliability of proposed evidence).

[FN147]. *See Beverly*, 369 F.3d at 530-31 (stating court heard only from prosecution's expert); *Lewis*, 889 So. 2d at 673-74 (same); *Magaletti*, 847 So. 2d at 526-27 (same); *Klinger*, 713 N.Y.S.2d at 824 (same); *Scott*, 33 S.W.3d at 752 (upholding denial of hearing as not abuse of discretion and deeming harmless trial court's failure to give defendant funds to hire DNA expert).

[FN148]. The Public Defender Service for the District of Columbia raised many of the issues discussed in this Article through testimony, affidavits, and articles from statisticians, genetic anthropologists, molecular biologists, and population geneticists at a *Frye* hearing in D.C. Superior Court in July 2004. While the trial judge admitted the mtDNA evidence, the jury rendered a verdict of not guilty on all counts — perhaps reflecting the exculpatory nature of some of the mtDNA evidence and/or the challenges to the prosecution's frequency statistics brought out at trial. *Compare* Memorandum & Order, United States v. Chase, No. F-7730-99, 2005 WL 757259 (D.C. Super. Jan. 10, 2005) (denying defendant's motion to exclude mitochondrial DNA test results in the Ida Chase case), *with* Henri E. Cauvin, *Woman Acquitted in 1996 Slaying of Md. Salesman*, WASH. POST, Feb. 10, 2005, at B01 (reporting Mrs. Chase's acquittal).

[FN149]. *See, e.g.*, Adams, *supra* note 143, at 87-89 (focusing on heteroplasmy issues; touching upon potential relevance of perpetrator's ancestry in determining mtDNA frequency estimate); Kiran Bisla, *It All Came Down to a Single Hair: The Probability of Exclusion vs. the Probability of Guilt Through the Use of Mitochondrial DNA Evidence in* State v. Pappas, 26 WHITTIER L. REV. 263, 296-98 (2004) (analyzing *Pappas* decision and briefly noting that court dismissed arguments relating to convenience samples and fact that "FBI was in complete control of the contents of the database"); Edward K. Cheng, *Mitochondrial DNA: Emerging Legal Issues*, 13 J. L. & POL'Y 99, 107-18 (2005) (focusing on advantages of mtDNA testing over microscopic hair analysis and on privacy issues in mtDNA databanks); Paul C. Giannelli, *Mitochondrial DNA*, 19 CRIM. JUST. 54, 54-56 (Winter 2005) (primarily discussing problems with contamination and chain of custody); FAIGMAN ET AL., *supra* note 4, at § 25 (discussing legal and scientific issues with DNA typing).

[FN150]. *See, e.g.*, Pereira et al., *supra* note 21, at *2 (study is "an attempt to extend the use of phylogeographic approaches to mtDNA forensics"); RUDIN & INMAN, *supra* note 1, at 196 ("Forensic scientists tend to be insular and self-reliant to a fault.").

[FN151]. Mildred K. Cho & Pamela Sankar, *Forensics Genetics and Ethical, Legal, and Social Implications Beyond the Clinic*, Vol. 36 No. 11 NATURE GENETICS SUPP. S-8, S-9 (Nov. 2004).

[FN152]. SAKS ET AL., *supra* note 134, at 78.
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THE SOCIAL PSYCHOLOGY OF POLICE INTERROGATION:

THE THEORY AND CLASSIFICATION OF TRUE AND FALSE CONFESSIONS

Richard J. Ofshe and Richard A. Leo

INTRODUCTION

Through the first third of the twentieth century, American police used the *third degree* to obtain confessions. Because they routinely threatened, beat, and tortured suspects, it is readily understandable that police wrung confessions from the guilty and the innocent alike (Bedau and Radelet 1987; Wickersham Commission Report 1931). Since the 1930s, the supreme court has obliged police to abandon the third degree, (*Brown v. Mississippi* 1936) and they now depend almost exclusively on psychologically based procedures to obtain confessions (Leo 1992; Hart 1981). Contemporary American interrogation methods rely on suggestion, deception and, too often, superficially disguised threats of punishment and promises of leniency to move suspects to confession.

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Now that third degree methods have largely disappeared, it is no longer immediately obvious why the innocent confess.[1] While the phenomenon of psychologically induced false confession may seem irrational and counter-intuitive, the literature documents that some illicit and some routinely used interrogation techniques lead the innocent to falsely confess (Gudjonsson and MacKeith 1994; Wrightsman and Kassin 1993; Gudjonsson 1992; Gudjonsson and MacKeith 1990; Ofshe 1989).[2]

With the shift to psychological methods, accusatory interrogation has become more subtle, sophisticated and differentiated. Consequently, the analysis of the interrogation process has become more complicated. While some scholars analyze false confessions separately from true confessions (see e.g., Wrightsman and Kassin 1993), the similarities between true and false confessions are more impressive than their differences.

Modern interrogation methods were, after all, developed to manipulate the decision-making of a person who committed a crime, and are meant to be directed only against the guilty. Even the most popular police training manual acknowledges that accusatory interrogation should only be undertaken when there is sufficient evidence against a person that the interrogator is sure that this individual is the perpetrator (Inbau et al. 1986, p. 77). False confessions are caused by inappropriate, improper and inept use of the methods of psychological interrogation.

This paper develops a model of interrogation influence that starts with the assumption that because they are elicited by variants of similar methods, both true and false confessions can be explained by a single formulation. The model describes both the tactics of influence employed during interrogation and the decision-making principles that guide a suspect's choices and behavior. It accounts for the similarities common to interrogations that yield true and false confessions and identifies the particular tactical differences that produce one or the other outcome.

The topics that follow are: (1) Presentation of a social psychological decision-making model that describes, in brief, the methods of influence through which interrogation proceeds and identifies the factors leading the guilty and the innocent to decide to confess; (2) Specification of the sequence and effects of the tactical moves through which interrogators influence suspects' decisions; (3) Description of the variety of types of confessions and their differentiating characteristics; and (4) Development and illustration through case materials of a classification system for categorizing types of statements made in response to interrogation. Together, the decision-making model and the expanded classification system provide a framework for explaining the process of police interrogation as it is practiced in the United States.

THE FREQUENCY AND IMPORTANCE OF FALSE CONFESSIONS

Police-induced false confessions have long been recognized as one of the leading causes of miscarriages of justice in America (Huff et al. 1996; Radelet et al. 1992; Yant 1991; Bedau and Radelet 1987; Frank and Frank 1957; Borchard 1932). Nevertheless, the incidence[3] and prevalence[4] of false confessions is not presently known.

There are at least three reasons why these statistics have eluded investigators. First, for the most part custodial interrogation is conducted in secret: Police question suspects in private, and typically do not record the entire interrogation in stenographic, audio or video form. Second, police do not keep records or collect statistics on the number or frequency of accusatory interrogations they conduct. Therefore, we know neither how often suspects are interrogated nor how often they confess, whether truthfully or falsely. Third, many cases of false confession are likely to go entirely unreported. Even in reported cases it is frequently difficult to unequivocally establish the *ground truth* about the crime (i.e., what really happened), especially since in confession-driven prosecutions the suspect is likely to be convicted.[5] Because it is not possible to reliably estimate the "dark figure"[6] of false confessions, it is also impossible to estimate how often false confessions lead to wrongful convictions.[7]

Nevertheless, at least three sources of empirical evidence suggest that false confessions occur regularly: case studies, laboratory research, and these authors' study of interrogations that result in false confession. First, in recent years scholars and journalists have documented numerous cases of psychologically induced false confessions in America (see e.g., Connery 1996; Parloff 1996; Huff et al. 1996; Sauer 1996; Hourihan 1995; Mones 1995; McMahon 1995; Thomas 1995; Leo 1995; Gray and Edelhart 1995; Sigman 1995; Linscott 1994; Shapiro 1994; Wrightsman and Kassin 1993; Kimball and Greenberg 1993c, 1993b, 1993a; Rossmiller and Creno 1993; Davis and Friedberg 1993; Ofshe 1992a; Radelet et al. 1992; Underwager and Wakefield 1992; Perske 1991; Yant 1991; Pratkanis and Aronson 1991; Demoretcky 1991; Paxton 1990; Ofshe 1989; Weiss 1989; Coons 1988; Derian 1988; Lykken 1981; Hart 1981; Connery 1977; Foster 1969; Shapiro 1969).[8] Because a multitude of factors contribute to false confessions going unnoticed, unreported or unacknowledged (see pp. 189-190), it is reasonable to presume that the reported cases represent the tip of the iceberg. Only the most egregious and high profile cases involving demonstrably false confessions are likely to be written about in the academic or the popular literature.

Second, psychological research has demonstrated through controlled laboratory experimentation that a very *commonly used* interrogation technique has a coercive impact on suspects and is thus likely to be a source of false confession. Kassin and McNall (1991) examined how the sentencing

expectations of seventy-five subjects were affected by the two prongs of the accident strategy: "*maximization*" (i.e., exaggerating the strength of the evidence, magnitude of the charges, or seriousness of the offense) and "*minimization*" (i.e., playing down the strength of the evidence, magnitude of the charges or seriousness of the offense). Using the video-tape of a police interrogation and accompanying transcript but varying the information presented, Kassin and McNall (1991) found that through "*pragmatic implication*"[9] maximization effectively communicates a threat of harm, while minimization communicates a promise of leniency. The leading interrogation training manual advocates this technique (see Inbau et al. 1986, pp. 102-106), and it is commonly used in practice (Leo 1996a; Wald et al. 1967).

Reading "between the lines," suspects exposed to these tactics infer harsh or lenient sentencing outcomes just as if the differing consequences had been blatantly threatened or promised. Both direct and indirect techniques for communicating threats or promises rely on the same logic to precipitate a suspect's decision to confess. They change the result of the person's rational calculation about what to do through the introduction of a strong incentive to confess (leniency), and/or a strong disincentive to remain silent (threat of harsh punishment). As Kassin and McNall comment:

> Although the courts take promises and threats more seriously when they are made explicitly than when they are implicit in an interrogator's remarks, our data indicate that because people often process information "between the lines"... these means of communication are functionally equivalent in their impact (1991, p. 248; see also Hilton 1995; Nisbett and Ross 1980; and Nisbett and Wilson 1977).

It is well settled that because directly stated offers of leniency and threats are coercive, can overbear a suspect's will, and can result in false confession, they are an unconstitutional means for obtaining a confession. The modern interrogator's shift from a direct to an indirect method for communicating benefits or harms is little more than a method for eliciting confessions by circumventing well established legal protections.

Third, these authors have discovered numerous examples of probable or confirmed false confessions (several of which are discussed below). One line of research involves the analysis of well over 150 interrogation transcripts, case files, interviews of police and suspects, and the analysis of sworn testimony describing interrogations (see Ofshe 1996, 1992a, 1989). The second line involves studying nearly 200 interrogations, interviewing approximately 100 police interrogators, analyzing interrogation transcripts, and collecting data on well over 100 likely or proven post-Miranda era false confessions (Leo 1996a, 1995, 1994). Both lines of inquiry have led to repeated observations of the process whereby interrogators manipulate suspects and coerce or persuade them to confess to crimes that they did not commit. In some

interrogations, such as those directed against the mentally handicapped, false confessions can be elicited rapidly and with minimal inducements. Most often, however, eliciting a false confession takes strong incentives, intense pressure and prolonged questioning.

Although there is little evidence that American police intend to extract confessions from the innocent, they too frequently become so zealously committed to a preconceived belief in a suspect's guilt or so reliant on their interrogation methods that they mistakenly extract an uncorroborated, inconsistent, and manifestly untrue confession. Too often interrogators appear to give no thought to the possibility that the confession they have extracted could be false. Generally, police in America are not trained how to avoid causing false confessions, how to recognize different types of false confessions, or how to identify the telltale characteristics of false confessions.[10] Even when the sum of the evidence establishes the suspect's innocence beyond any reasonable doubt, police rarely admit that they have mistakenly elicited a false confession or that their errors have caused someone to be wrongfully convicted, imprisoned or executed.[11]

Police-induced false confession is likely to lead to the wrongful conviction of innocent individuals because confession evidence is likely to be treated as enormously damning and as persuasive as any evidence that can be brought against a defendant (Leo 1996a; Simon 1991; Kassin and Wrightsman 1985; Miller and Boster 1977; Wigmore 1970). Because of the weight given to confession evidence, false confession is at least as prejudicial to a defendant's right to a fair trial as any type of erroneous, incriminating evidence. Confession creates a virtually irrebuttable presumption of guilt among criminal justice functionaries, who, like most Americans, rarely question the veracity of self-incriminating statements. As a result, once a confession is introduced in court any attempt to refute it is likely to be futile (Wrightsman and Kassin 1993).

A suspect who confesses will not only be presumed guilty from the start, but will also be pressured to plead guilty and treated more harshly by every criminal justice official and at every stage of the trial process (Leo 1996a). Once police elicit a confession—even if it is obtained by coercion, is internally inconsistent, does not lead to corroboration, and is contradicted by the facts of the case—they too often "clear" the case and consider it solved. Retractions are not believed and are treated as evidence of the defendant's cunning. Defendants who have confessed experience greater difficulty making bail, a disadvantage that significantly reduces their likelihood of acquittal (Walker 1994). Confession almost always insures that prosecutors will file charges (Cassell and Hayman 1996), charge high and make the confession the centerpiece of the case. Defense attorneys may encourage clients to accept a plea bargain and concede guilt solely because of the enormous risk of a harsh sentence after being found guilty at trial (Nardulli et al. 1988; Wald et al. 1967). At trial, the jury will probably treat the confession as more probative of the

accused's guilt than any other type of evidence (Miller and Boster 1977),[12] and if convicted, an innocent, false confessor may be sentenced harshly for failing to show remorse.[13]

EXPLAINING TRUE AND FALSE CONFESSIONS: A DECISION MODEL[14]

Guilty or Innocent: Why Shift From Denial to Admission

All approaches to the analysis of human behavior that presume rationality would, if applied superficially, classify confession as an irrational act—whether the person is innocent or guilty of the crime. This conclusion holds when the act of confessing is considered outside of the context of the influence environment that is created by the process of modern police interrogation. Psychological methods of interrogation have evolved for the purpose of influencing a rational person who knows he is guilty to alter his[15] initial decision to deny culpability and decide instead to confess. Police accomplish this change in a person's behavior by strategically manipulating the suspect's analysis of his immediate situation, structuring the choices before him and dwelling on the likely consequences that attach to these choices. The tactics that the interrogator uses in response to a denial of guilt are intended to lead the suspect to perceive confession as the optimal choice among the alternatives that he is considering (Hilgendorf and Irving 1981; Irving and Hilgendorf 1980).

During the portion of an interrogation that centers on causing a suspect to shift from denial to admission (the *pre-admission phase*) police use two groups of tactics to achieve two major goals: One set of tactics is focused on changing the suspect's perception of his immediate situation while another set is used to communicate information about incentives for confessing and disincentives for holding to denial. The process of interrogation produces confession because it results in the suspect being convinced either that he has been caught (if he is guilty) or that his situation is hopeless (if he is innocent), that further denial is pointless and that it is in his self-interest to confess. For both innocent and guilty suspects, confessing is something neither would have chosen to do prior to the start of the interrogation and something each would have predicted he would have resisted to his last breath.

Although contemporary interrogation methods are intended to produce true confessions from the guilty, they can, unfortunately, also produce false confessions from the innocent. Interrogations are, by design, relentless in their focus on moving the suspect to confess and are insensitive to denials or protestations of innocence. Interrogators employ tactics that create a sequential influence process that can effectively succeed in overcoming the resistance of a person who has no reason to confess and is, at least initially, unwilling to

do so. To understand how and why false confessions occur, it is important to recognize that the techniques and tactics used to alter a suspect's initial choice to deny culpability *do not depend* for their efficacy on the suspect being guilty and knowing it. They depend on creating circumstances in which the suspect's analysis of his situation and of the consequences of the choices before him lead him to conclude that confession is both a rational choice and his best option.

The promoters of psychological interrogation methods give no significant thought to how they will affect the innocent, but instead merely assume that the methods they advocate will not cause an innocent person to confess (see Inbau et al. 1986; Jayne and Buckley 1992). The unanticipated and unappreciated fact about psychological methods of interrogation is that they are so influential that if allowed to go forward without restraint or if directed at the exceptionally vulnerable they will have devastating consequences. These methods produce false confessions because they convince innocent suspects that their situations are hopeless just as surely as they convince the guilty that they are caught.

In recent years, the continuous development of psychological tactics for overcoming resistance has given interrogators the tools necessary to actually persuade some persons that they committed murders about which they have no personal knowledge. The combination of tactics that undercut a suspect's confidence in the accuracy of his memory together with commonplace false evidence tactics and the use of incentives can combine to persuade a suspect that he is guilty of a crime about which he knows nothing and lead him to make the decision to confess.

Accusatory interrogation (as distinct from interviewing) is not useful for identifying a likely suspect; rather, it is a purposive and highly stylized attempt at influence that has only one goal: to obtain a confession from whomever is selected for processing. The interviewing and information-gathering activities of an investigation should precede interrogation and culminate in the selection of a suspect. Once an interrogation commences, information gathering—including checking on any alibi a suspect might offer in response to being confronted—is typically suspended pending the outcome of questioning.

The choice of whom to interrogate may be well founded (e.g., based on solid evidence), in error (e.g., based on information that latter turns out to be erroneous), or reckless (e.g., based on no evidence but solely on a hunch or an unjustified assumption about the statistical likelihood of a particular suspect's guilt). No matter why a suspect is selected, the interrogation process that follows will, at least superficially, be the same.

There are, however, major and non-obvious differences that distinguish interrogations directed at well chosen targets from those misdirected at the innocent. The differences can be detected by comparing the interaction paths taken by the interrogator and the suspect, the points of conflict that erupt between them and the fit between the contents of confession statements they

produce and the facts of the crime being investigated. Noting these differences and their causes is worthwhile because their identification contributes to understanding both why interrogation works well and why it goes wrong.

When the choice of whom to process is well founded, the interrogator has solid evidence with which to confront the suspect and thereby has a considerable advantage. He can, if necessary, produce the evidence he claims (i.e., witness' statements, co-perpetrators' confessions, laboratory reports, etc). In addition, since a well selected target is likely to be guilty, the suspect's awareness of his guilt works very much to the interrogator's advantage. The guilty suspect starts the interrogation concerned about the risk of detection and punishment. Knowledge of his guilt renders the suspect genuinely vulnerable to the interrogators' tactics and ploys and makes them more likely to succeed at convincing the suspect that he has been caught. Only under the rarest of circumstances do an interrogator's ploys persuade an innocent suspect that he is in fact guilty and has been caught. When this happens, the interrogation will be marked by certain characteristics that distinguish its history from the interaction paths that are the histories of interrogations that lead to other types of confession.

An interrogation is poorly founded when solid evidence is lacking. If an innocent suspect is selected or a guilty suspect is chosen based on a lucky hunch, the interrogator necessarily lacks a valid basis from which to confront the person. The interrogator is necessarily reduced to relying entirely on deception and interpersonal dominance to gain a confession. He runs the risk of fabricating evidence that a guilty suspect can either easily explain away or will recognize as a bluff. The innocent suspect necessarily recognizes that the interrogator's ploys are inaccurate. However, knowing that he is innocent, the suspect is not considering whether he has been caught. The innocent suspect is analyzing whether his situation is hopeless. Therefore, the obvious inaccuracies of the ploys are unimportant since the claimed evidence contributes to a growing certainty that his situation is hopeless.

Unlike the guilty suspect, who is genuinely vulnerable to the interrogator's accusations, the innocent suspect has a valid basis for denying involvement. The interrogator is forced to contend with the heartfelt resistance of someone who knows he is being falsely accused. Although motivated by righteous indignation, the innocent suspect is likely to experience far greater shock and disorientation at being accused than is the guilty suspect. The innocent suspect is not in the least prepared for the confrontation and accusations that signal the start of serious business during an accusatory interrogation. He will likely be unable to understand how the interrogator could possibly suspect him. As the process unfolds and the interrogator reveals a lengthening list of damning evidence, the innocent suspect is likely to become progressively more distressed, confused and desperate. In the end, the innocent suspect is likely to be more emotionally distressed than the guilty party, who has only to accept the fact that he has been found out.

Interrogators rightly expect that almost all suspects will deny involvement in the crime when first confronted and so treat denials as unimportant. Investigators are, however, often misled by their training to believe that there are simple signs and behavioral indicators readily observable in a suspect's demeanor that distinguish truth-tellers from liars. In fact, rarely will an interrogator be able to discern that a suspect is guilty or innocent based on his demeanor (Ekman and O'Sullivan 1991).[16] Because the guilty suspect who lies when denying his guilt and the innocent suspect who tells the truth when denying his involvement are indistinguishable to the interrogator, they are in exactly the same functional position throughout an interrogation.

Since the goal of accusatory interrogation is to obtain a confession rather than to evaluate whether the suspect is guilty, the interrogator will be insensitive to and ignore the evidence the suspect offers to support his protestations of innocence. As the questioning moves forward, the interrogator focuses his attention on how close the suspect is to admitting guilt, and his thinking is directed toward the question—"what can I do now to move the suspect closer to giving a confession?"

The important differences between guilty and innocent suspects are not reflected in their demeanor, but rather, are present in their internal perceptions, cognitions about their immediate situation, their memories (including the presence or absence of knowledge of having committed the crime) and their ongoing mental activities and decisions. Although indicators of a suspect's true state of innocence or guilt can be identified in the suspect's conduct in response to the interrogator's tactics, the differences between the guilty and the innocent *only become reliably and objectively observable* after each has made the decision to confess. The differences between the suspect's true state of guilt or innocence can only be detected with substantial confidence by analyzing the *contents* of their respective confession statements—the statement which follows the person's admission of involvement.

The Two Phases of an Interrogation

Modern interrogations can be divided usefully into two sub-parts. The first, the *pre-admission phase*, is organized to change the suspect's decision to deny responsibility and elicit the statement, "I did it." The goal of the second segment of the interrogation is to obtain from the suspect a *post-admission narrative* of the crime that proves his guilt. Although interrogators are not trained to recognize this fact, the suspect's post-admission narrative can also provide powerful evidence tending to prove the suspect's innocence.

By following a simple formula, interrogation progressively leads a suspect to see himself as caught and/or hopeless. Early on, police challenge his denial and accuse him of committing the crime. Their accusations are repeated frequently throughout this phase of questioning. They are more strongly made

with each repetition and as evidence for them is revealed. Eventually, the accusations are presented as facts. Throughout, the interrogator pretends absolute personal certainty of the suspect's guilt no matter how confident or doubtful he may be.

If police have evidence linking a suspect to the crime, they slowly reveal it to bolster their accusations and justify their apparently certain position. Even if the interrogator has no evidence linking a suspect to the crime, he will nevertheless claim to possess incontrovertible proof of the person's guilt. Interrogators commonly claim that they have witnesses, fingerprints, hair, blood, semen or other evidence when they have little or nothing. Whether revealing evidence or telling lies, the interrogator labors to convince the suspect that the case against him is so overwhelming that he has no choice but to face the fact that he has been caught, will shortly be arrested, successfully prosecuted and severely punished. This sets the stage for eliciting an admission of guilt in exchange for the smallest of benefits.

Once the suspect makes an "I did it" admission, the second part of the interrogation commences. The interrogator turns his efforts toward obtaining a post-admission narrative of the crime—a detailed description of the suspect's actions—including his motive, his planning, the circumstances leading up to the crime, how he executed it, facts about the crime scene and the location of evidence unknown to the police. The voluntariness of a confession is determined by the tactics and incentives police use to shift the suspect from denial to admission. The truth of the suspect's admission ("I did it") is established by the accuracy of the information elicited during the post-admission narrative phase of interrogation.

The *fit* between the suspect's post-admission narrative and the facts of the crime provides undeniable and strong evidence of whether the suspect possesses actual knowledge of the crime or is ignorant of information that would be known to the perpetrator. While confession evidence (the statements the suspect makes during the post-admission phase) is often both powerful and persuasive, the important question remains: does the confession statement yield evidence of guilt or innocence? Evaluating the fit answers this question.

The post-admission narrative gathering phase for a true confession has the potential to prove the suspect's guilt in a fashion that can never be repudiated. A thorough post-admission narrative can link a guilty suspect to the crime so strongly that virtually anyone willing to evenhandedly evaluate his statements will conclude that he is guilty. For example, a guilty suspect can supply information known only to the offender, he can lead police to missing evidence, provide them with missing information, and explain any seemingly anomalous facts about the crime.

Similarly, if a suspect is innocent, carrying out a thorough post-admission information gathering exercise can generate persuasive evidence showing that he has no actual knowledge of the crime. An analysis of the suspect's statement

must lead to the conclusion that he is ignorant of the crime if the post-admission narrative is riddled with errors, demonstrates the suspect's inability to correctly describe significant facts, inability to provide corroboration (e.g., correct information regarding the missing murder weapon, loot, etc.) and inability to contribute a host of specific details the perpetrator should know. Therefore, anyone willing to evenhandedly evaluate the suspect's statements should find that he is almost certainly innocent.[17] For example, in the Garrett case (see pp. 226-230), an innocent man who falsely admitted "I did it" did not know any of the key details of the crime other than what he had learned from his interrogators. His post-admission narrative provided police and the jury that acquitted him at trial with information that demonstrated gross inaccuracies and ignorance of even how his daughter was killed.

The Steps in Shifting from Denial

The Decision to Allow Questioning

Choosing to allow interrogation to commence is the first major event in the decision analysis. Even if the suspect is not in custody, the police may remind him of his constitutional rights to remain silent and to have counsel present. Both innocent and guilty suspects waive their rights because they perceive themselves as better off by permitting questioning to proceed than by terminating the process.

The reasons for allowing the interrogation to go forward are, however, quite different for guilty and innocent suspects. A suspect who knows that he is guilty is likely to be acutely aware of his jeopardy when a detective indicates a desire to question him, and is motivated to avoid detection, arrest and punishment. A guilty suspect may be thought of as engaging in a game with the interrogator in which each has as his goal manipulating and deceiving his opponent (Leo 1996c; Simon 1991). The decision to allow questioning to proceed by a guilty suspect who is aware that he can, in fact, refuse to be questioned only makes sense if the suspect is motivated to mislead the interrogator, convince him of his innocence and perhaps gain information about what evidence, if any, the police have against him.

The innocent suspect perceives his situation differently. Knowing that he is uninvolved in the crime, he is likely to believe that speaking to police carries no significant risk. Because he believes that he has nothing to hide, the innocent suspect is likely to perceive the Miranda warning as an unimportant formality. Unlike the guilty suspect, who is aware of his potential risk from the start, the innocent suspect only becomes aware of his growing jeopardy as the process unfolds. It takes a while before he realizes that the interrogator will not accept the idea that a mistake has been made. By then, his assessment of his situation has been altered by the interrogator's tactics. His Miranda rights are still likely to seem unimportant, but now because it is too late to invoke them. The suspect

has already been accused of a crime and threatened with arrest, but remains certain of his innocence. Therefore, he is likely to view continuing to interact with the interrogator as the most straightforward way to resolve the problem.

Neither the guilty nor the innocent suspect is likely to appreciate that the methods of accusatory interrogations are designed to initially encourage the belief that questioning is relatively risk free. The opening procedures are intended to allow the guilty suspect to entertain the idea that he can start the questioning, mislead the interrogator and emerge in a more secure position by having allowed police to question him. Refusal, he is likely to believe, would cause the investigator to single him out for more rigorous investigation.

The initial structure of an interrogation (both as to its physical characteristics and psychological aspects) is designed not only to encourage the belief that the questioning will be relatively risk free, but also to create the impression that the interrogator has the power to radically alter the suspect's life. On the one hand, he appears benign—perhaps easily fooled, or simply seeking to do good by solving the crime. His potential power is, however, awe-inspiring: the interrogator wields the power of the state to take the suspect into custody, detain him against his will, and subject him to a trial that can lead to severe punishment. The location at which the interrogation happens, the physical setting in which questioning takes place and the demeanor of the interrogator are chosen to produce the suspect's initial impression of the interrogator as benign and at the same time possessing enormous potential power.

Shifting The Suspect From Confident To Despairing

The decision model assumes that both innocent and guilty individuals consent to police interrogation because they expect to emerge unscathed from questioning. As the process unfolds, however, the interrogator works to drive down the suspect's initial subjective certainty that he will survive the interrogation and reduce to near zero his expectation that he will be able to leave when questioning ends. The interrogator works to convince the suspect that all his future holds is certain arrest, trial, conviction and punishment.

The interrogator typically begins by obtaining an account of the suspect's relations with the victim and his whereabouts at the time the crime occurred.[18] Under the non-threatening guise of information gathering, he may require the suspect to repeatedly describe his relations with the victim and activities. Once he obtains the suspect's baseline account, the interrogator changes his style, becomes accusatory and begins to press for an admission. He typically opens the accusatory phase by pointing out contradictions in the suspect's account and confronting him with evidence of one or more flaws in his story.

The interrogator's opening gambit and virtually every move he makes thereafter will affect innocent and guilty suspects differently. Even if the interrogator's choice of a suspect is well founded and he has solid information

that contradicts the suspect's account, he will carefully conserve his supply of real evidence, revealing only enough to make confrontation appear reasonable. The interrogator's strategy is to return to this storehouse of evidence to neutralize each objection in the long series of roadblocks he anticipates that the suspect will erect. The tactic of introducing something new in response to each objection helps create the impression that the interrogator's supply of information is endless.

If the interrogator lacks solid information, he will be forced to open his game either with a report of contradictory evidence that may be erroneous and easily countered or with an entirely fabricated claim. In some instances, interrogators attempt to capitalize on inconsistencies that arise simply from the suspect having to tell and re-tell his account. While a guilty suspect's repeated accounts may sometimes reveal one or more gross and material inconsistencies, an innocent suspect's accounts will contain nothing more than trivial omissions or additions that appear because of the normal variability attendant to repeating a complicated story or because he chooses to keep private something that he sees as unrelated to the crime. When aggressively confronted over a trivial inconsistency or irrelevant omission, an innocent suspect is likely to perceive the interrogator as unreasonable, hostile, suddenly suspicious and accusatory for no good reason.

As the interrogation progresses, the basic pattern of revealing evidence—whether valid or fabricated—that links the suspect to the crime is repeated often. When the investigation is well founded, the interrogator's presentation of actual evidence implicating the suspect, together with fabricated evidence, creates the impression of an airtight case. For a guilty suspect who recognizes that the evidence is true and that the interrogator probably has all he claims, the effect of revealing a grossly overstated case is likely to be sobering and effective.

For an innocent suspect exposed to the same interrogation ritual, the experience is radically different. Knowing that he is innocent, the suspect is likely to be shocked when confronted with erroneous or fabricated evidence. He is initially likely to react to the so-called evidence by saying that a mistake has been made and offering reasons why the interrogator's reported evidence is in error. The interrogator will reject the innocent suspects denial just as he would if it were made by a guilty suspect—by expressing great confidence in the reliability of the evidence, assuring the suspect that no mistake is possible and perhaps emphasizing that the suspect's reaction is itself further evidence of his guilt (e.g., "You know you did it, I can see it in the expression on your face").

The interrogator unveils for the innocent suspect the outline of an apparently airtight case. With the possible exception of mistaken evidence, everything the interrogator claims to have that points to the innocent suspect is fabricated. Because part of the interrogator's stylized role is to present a demeanor and attitude that communicates certainty, he will try to exude unwavering confidence in the suspect's guilt even while confronting him with completely false evidence.

For an innocent suspect, the steadily growing list of inculpatory facts makes it increasingly difficult to classify what is going on as a simple mistake. Wrongly accused suspects frequently come to see themselves as either being set up by someone or railroaded by the police.[19] Regardless of the theory that the innocent suspect entertains, the dominant fact before him is the interrogator's message that the case against him is airtight and his arrest is inevitable.

As the process unfolds and more evidence is revealed or invented, the interrogator repeatedly runs through the string of facts linking the suspect to the crime. This tactic functions both to emphasize the strength of the case and to make it effectively impossible for the suspect to coherently respond to the interrogator's massed presentation of evidence. Each time the suspect objects and claims to be innocent, the interrogator is handed the opportunity to repeat the list of facts that seem to irrefutably confirm the suspect's guilt.

An interrogator may sometimes invite the suspect to evaluate the evidence against him and to critique the reasoning and logic of the interrogator's position. This tactic forces a suspect (at least privately) to recognize that the evidence is overwhelming, and forces him to conclude that there is a more than sufficient basis for his being arrested.

False evidence ploys based on eyewitness reports are likely to exert a less powerful influence than false evidence ploys based on scientific procedures. When confronted with fabricated eyewitness evidence, suspects can always respond that the identification is mistaken or that the witness is lying. Anytime a suspect can counter an interrogator's evidence ploy with a plausible alternative explanation or is able to diminish the apparent strength of the evidence, he impedes the interrogator's progress toward confession. Whenever an issue is not resolved in the interrogator's favor, the suspect's ability to resist the interrogator's demands is strengthened.

False scientific evidence can be presented so as to leave little opportunity for counters. Interrogators represent positive results of fingerprint, hair or DNA tests as error free and therefore unimpeachable. Interrogators sometimes go through long dissertations about the infallibility of the test results they are about to report, whether the results are real or fabricated. Some even tell suspects of fabricated, new scientific technologies that prove involvement in the offense. For example, in one case an interrogator told a suspect that a "Neutron Proton Intelligence Test" showed that he had fired the gun (Smith Transcript 1991, p. 32).

The polygraph examination is one of the most frequently used pseudoscience influence devices relied on during interrogation. Although under optimal conditions the polygraph may allow an examiner to detect deception more accurately than by chance, in interrogations that produce false confessions polygraph examination usually functions as an influence tactic with about the same scientific significance as the "Neutron Proton Intelligence Test." While the nominal purpose of the polygraph test is to diagnose the subject as "truthful" or "deceptive," the primary function of lie detectors during an accusatory interrogation is to induce confessions. By playing on a suspect's fear of arrest and by creating the impression that the procedure is infallible, the polygraph examination becomes a powerful pseudoscientific tool of persuasion and manipulation.

In addition to providing the opportunity to claim new evidence against the suspect, polygraph examination allows for another interrogator to enter the process. This operative (whether a police officer or a hired technician) represents himself as an objective and disinterested party, emphasizes the supposed scientific validity of the test results and then behaves as an interrogator, seeking to obtain a confession in the post-polygraph confrontation with the suspect (typically called an interview and supposedly directed at clarifying the readings obtained from the machine).

The polygrapher is in an ideal position to add new, damning evidence to the string of facts with which the interrogator has confronted the suspect. In the course of setting up a basis for countering denials that the suspect may issue after being told that he has failed the examination, polygraph examiners often claim that their machine will detect the truth of the suspect's involvement, even if the suspect is ignorant of it. For an innocent suspect who has already been told of overwhelming evidence of his guilt, the bogus claim that the polygraph machine reads his "unconscious" knowledge and thereby proves his involvement can be devastating. It can contribute to the suspect's certainty that he will be convicted and start the process of shattering his confidence in his innocence.

Eliciting the Admission

Eventually the interrogator will shift the target of his influence attempts away from creating a sense of hopelessness to persuading the suspect to make the crucial admission. The ideal turning point occurs when the suspect's subjective estimate of successfully surviving the interrogation without being arrested is at or approaching zero. The closer the suspect is to certainty that his future is both determined and extremely undesirable, the easier it is for the interrogator to elicit a decision to confess.

The decision analysis assumes that at the beginning of interrogation the suspect expects to survive the experience without being arrested. A suspect who perceives his situation in this way is unlikely to respond to an initial or premature suggestion that he confess. However, as the suspect's perception of his situation changes and his subjective estimate of surviving sharply declines, the psychological cost of confessing diminishes. What, after all, is the harm of confessing if a person knows he is guilty and believes that he has been caught?

As the apparent cost of confessing diminishes, so too does the magnitude of the incentive necessary to precipitate a decision to confess. Even if a suspect believes that arrest is virtually certain, it is still irrational for him to volunteer a confession. However, once the suspect has accepted the fact that he cannot

convince the interrogator of his innocence and that he will be arrested, he may reason that confessing alters his situation very slightly. At this point when his struggle seems to have ended in defeat, he may be influenced by a minimal, or even a trivial, incentive if it is offered.

When an interrogator feels that he has succeeded in convincing the suspect that his fate is certain and has substantially reduced the strength of his resistance to the accusation that he is guilty, or has simply exhausted his resources, he redirects of his efforts. The shift to a principle focus on eliciting the admission "I did it" is sometimes signaled by an interrogator's announcement that he is no longer interested in wasting time debating whether or not the suspect committed the crime. He may summarize the evidence supporting his position yet again and say that, "all I'm really interested in is why you did it."

From this point forward the interrogator suggests reasons why an admission is to the suspect's advantage. The incentives used to induce a confession can be arrayed on a continuum ranging from legally permissible psychological benefits (e.g., the suspect will feel better) to the strongest coercive threats and promises (e.g., the suspect will be charged with capital murder if he does not confess or permitted to go home if he does).

At the low end of the continuum, suggestions emphasize the incentives that the suspect will continue to experience distress if he does not confess but that he will experience moral or self-image benefits if he does. Interrogators sometimes trade on the remorse that a suspect actually feels and urge him to demonstrate his feelings, perhaps emphasizing that he will experience relief by getting it off his chest. For example, interrogators may tell a suspect that taking responsibility is the manly or Christian thing to do. They sometimes tell suspects that the victim's family is suffering and that if the suspect is a decent person he will disclose the body's location so that the family can provide a proper burial.

If appeals based on the benefit of reducing feelings of guilt, doing the right thing or expressing empathy for the victim's family do not succeed in precipitating the decision to confess, an interrogator is likely to emphasize more tangible benefits for cooperation. Once the interrogator does this by suggesting that there are *systemic* benefits for confessing and *systemic* punishments for failing to confess, he moves dangerously close to introducing legally coercive threats of harm and offers of leniency.

Interrogators often manipulate suspects so as to lead them to conclude that confession versus continued denial will result in different sentencing outcomes. To communicate that there is a material benefit for confessing, an interrogator need not promise that he will obtain the particular benefit for the suspect. Nor need he explicitly threaten the suspect in order to communicate that the suspect can expect a harsh punishment if he does not confess. It can be sufficient to lead the suspect to believe that there are systemic benefits that follow from confession or silence. When leading a suspect to recognize a systemic benefit, the first step is to impress upon him that certain consequences follow "naturally" from what he does *now*—during the interrogation.

For example, an interrogator may emphasize that the suspect should think about how the prosecutor, the judge and the jury will react to the suspect's litany of denials, or how they are likely to be affected by a demonstration of remorse. An interrogator may tell the suspect that now is the time for him to choose how he will be viewed in court. The obvious implication is that the contrite, remorseful defendant asking for mercy will receive a lesser sentence. The interrogator's strategy is to bring into the room considerations and outcomes that favor confessing. If he succeeds, the interrogator effectively changes the mix of factors the suspect actually considers when making the decision to confess or to remain silent.[20]

This strategy permits the interrogator to avoid having to suggest or promise that he will act to procure the benefit for the suspect. He manipulates the suspect by persuading him to view the operations of the justice system as naturally conferring rewards for confessing his guilt and naturally meting out punishment for denial. The interrogator seeks to reduce the variability, uncertainty and unpredictability of prosecution and defense to a few simple principles—that, of course, support the line of action the interrogator favors. This approach is intended to motivate the suspect to confess by leading him to conclude that he will be more or less severely punished depending on whether he confesses at this moment in time.[21]

Once an interrogator attempts to influence a suspect's decision by offering an incentive, his likely reaction to continued resistance is to increase the value of the benefit that he is offering. If an interrogator moves up the incentive scale, he may emphasize that he wants to "help" the suspect (in some deliberately vague fashion), but that first the suspect must reveal his side of the story. For example, an interrogator told Cheval Wright that when the interrogation ended his best opportunity to save himself would be gone (Wright Transcript 1993). If he did not confess, he would be in worse shape because the interrogator would not be able to help him in the future. Wright's interrogator went further than suggesting some sort of unspecified help.

The judge suppressed Wright's confession because the interrogator told wright that his lawyer would never let him take the witness stand at trial. The investigator painted a picture in which he (the investigator) takes the stand at trial, and is regarded as the professional witness by the jury. The interrogator continued by telling Wright that the interrogator's account of what happened would be believed by the jury. If Wright would only confess to the accident scenario, the interrogator could save him.[22]

The uppermost end of the incentive scale is to threaten direct physical harm (a tactic that is sometimes still used), the death penalty, a lengthy prison sentence or to directly promise that confession will result in prosecutorial leniency. Although these kinds of incentives are generally recognized as

improper and coercive, they are often employed either directly or in a superficially disguised manner. Police use of these incentives is illustrated below in the excerpted exchanges from the interrogation transcripts of Dante Parker (see pp. 230-233) and Tom Sawyer (see pp. 80-86).

One of the most frequently used techniques through which confessions are coerced is known as the "accident" technique or scenario. After the interrogator shifts his focus, he may attempt to elicit an admission to a version of the crime that involves a lesser criminal act and lesser punishment. The interrogator seeks to obtain an admission that both he and the suspect know to be untrue (i.e., a confession not to the crime as it actually happened, but to a version of events different from what the interrogator believes to have occurred).

The interrogator is likely to introduce this technique shortly after he signals his shift in focus. For example, he might conclude his refusal to further discuss the suspect's guilt by declaring, "all I'm interested in knowing is whether you planned to do this or whether it was an accident."

As the technique is used, the interrogator suggests a version of the facts that drastically lowers the charge appropriate for the confessed crime in comparison with the charge appropriate for the actual crime. The interrogator puts forward a scenario that describes an event that might not even be a criminal act. For example, assume that the crime scene describes a homicide that was a rape and murder involving significant torture. The scenario, as put forward by the interrogator, instead describes an event that was not pre-meditated, but rather happened because of something beyond the suspect's control—the accident. Perhaps the gun went off accidentally or the suspect understandably lost his temper or was understandably driven temporarily mad by the temptress who was killed.[23]

As discussed previously (pp. 187-188), this technique elicits a decision to confess because it communicates the understanding that the suspect will receive a reduced level of punishment if he admits to the lesser crime. The accident technique lies at the heart of the Reid method of interrogation (see Inbau et al. 1986, pp. 102-106). Even Inbau, Reid and Buckley (1986) grant both that the accident technique elicits a confession that everyone (interrogator and suspect, whether guilty or innocent) knows is a false confession and that the false confession is to a lesser crime (Inbau et al. 1986, pp. 103-106).

Inbau, Reid and Buckley fail to explain to their readers that the technique works by means that are coercive. The suspect is motivated to act by a threat of harm (a more serious charge) or a desire for a benefit (a lesser or no criminal charge). The accident scenario theme functions to systematically persuade a suspect that the beneficial consequences of confessing outweigh the harmful consequences (Kassin and McNall 1991).

Remarkably, Inbau and associates rationalize this interrogation strategy and defend it as permissible so long as the interrogator alters only the suspect's perception, but not the reality, of what happens during an interrogation:

> During a legal interrogation, reality cannot be changed. A confession will be inadmissible as evidence if the interrogator takes away the consequences of the confession (promises), or physically adds anxiety (threats, abuse) during the interrogation. However, the interrogator can legally change the suspect's *perception* of the consequences of confessing or the suspect's *perception* of the anxiety associated with deception through influencing the suspect's beliefs (Inbau et al. 1986, p. 333).

Inbau, Reid and Buckley's distinction is nonsense. There is no meaningful difference between manipulating a suspect's perceptions about anticipated punishment outcomes and manipulating the reality of anticipated punishment outcomes—a person's perceptions are his reality.

The interrogator's reality may well be that he has no intention of going through with the implied "deal" to accept the accident scenario of the crime and use it as the basis for his decision about the appropriate charge for which to arrest the suspect. Inbau and associates fail to appreciate that what is at issue is the suspect's will to resist and whether it is overborne by the conduct of the interrogator, not whether in the interrogator's mind his threat or promise is sincere.

While the private thoughts, mental activity, and contemporaneous verbalizations made by innocent and guilty suspects are different, these differences are less impressive than the similarities that a modern accusatorial interrogation can produce in suspects' decision-making and conduct. The underlying structure of police interrogation consists of convincing a suspect that he has been caught and pointing out or offering incentives that suggest he will be better off by confessing. Whether the suspect is innocent or guilty, the variable that explains his decision to confess is his subjective estimate of the likelihood of surviving police questioning without being arrested and punished. While innocent and guilty suspects comprehend and react differently to an interrogator's accusations of guilt and claims about evidence linking them to the crime, they both experience growing certainty that they will soon be arrested and ultimately punished—which explains why and when they give confessions to police.

CLASSIFYING CONFESSIONS

Kassin and Wrightsman's Classification System

Kassin and Wrightsman's (1985) typology posits three conceptually distinct types of false confessions: voluntary, coerced-compliant, and coerced-internalized.[24] This typology is held together by two essential distinctions: whether the confession is initiated by the suspect or elicited by police (voluntary vs. coerced); and whether the suspect acquiesces to the interrogator's influence attempts (tactics) for instrumental reasons or because he comes to believe the

interrogator's suggestions of guilt (compliance vs. internalization). Accordingly, the distinguishing feature of a voluntary false confession is that it is spontaneous and thus does not arise in response to significant police questioning or pressure. The distinguishing feature of a coerced-compliant false confession is that the suspect knowingly confesses to a crime he did not commit in order to escape the pressures of an aversive interrogation process and/or gain a benefit such as leniency. For a coerced-internalized false confession the distinguishing feature is that the suspect confesses only after he comes to believe that he committed the offense.

Kassin and Wrightsman point out that this conceptual framework is consistent with several important insights into the causes and consequences of false confessions. First, while police will most effectively elicit compliant responses through powerful or extreme interrogation methods, they will most effectively elicit internalized responses through more subtle or persuasive methods of questioning (see also Ofshe 1989; Gudjonsson and MacKeith 1988). Second, while compliance and internalization may be closely related processes, compliant behaviors persist only to the extent that they have instrumental value whereas internalized behaviors "persist over time and across a variety of situations" (Kassin and Wrightsman 1985, p. 77). Kassin and Wrightsman expect that coerced-compliant false confessions will be retracted shortly after the suspect leaves the interrogation, whereas coerced-internalized false confessions can lead to enduring belief change by permanently altering a suspect's memory, "making its original contents potentially irretrievable" (1985, p. 78). Third, they argue that coerced-compliant false confessions can be explained by the individual's desire to escape the aversive pressures of interrogation and secure a favorable outcome.

Wrightsman and Kassin (1993) identify three factors that explain coerced-internalized false confessions: (1) The conditions of interrogation may induce a state of hypnotic trance that causes the suspect to confuse truth with confabulation; (2) As self-perception theory would predict, suspects induced to tell lies under conditions associated with telling the truth may come to believe those lies as the truth (see Bem 1972, 1966 1967; Lepper 1982); and (3) Individuals prone to high levels of "interrogative suggestibility" are more likely to actually accept a police interrogator's suggestions of guilt.[25]

Kassin and Wrightsman's threefold typology applies social psychological principles to the categorization and explanation of false confessions and offers a conceptual framework with which to classify, identify the variation in, and presumably explain false confessions to police. In the last decade their classification scheme has provided a useful framework for studying false confessions, has generated a series of research questions (see Gudjonsson 1992) and has been relied upon by confession scholars, including these authors (Ofshe 1992a, 1989; Leo 1992, 1995).

In light of further research, it has become clear that Kassin and Wrightsman's classification scheme is in some ways inadequate and is based, in part, on erroneous assumptions. There are three weaknesses in their scheme. First, it presents a different explanation for true and false confessions when both are driven by the same underlying logic and arise from interrogations that are to a considerable degree similar.

Second, their classification scheme fails to encompass the entire range of police-induced false confessions that are not coerced (Davison and Forshaw 1993). A satisfactory classification scheme should recognize and be consistent with an explanation for how and why individuals falsely confess in response to police pressures that do not include elements of classical coercion (e.g., threats and/or promises of benefit).

Third, their classification scheme misapplies the concept of internalization to the phenomenon of false confessions. Internalization refers to the social psychological process by which individuals come to learn and accept a set of enduring values and beliefs. Internalized values and beliefs, as Kassin and Wrightsman correctly note, therefore persist over time and across a variety of situations. No reported case nor any case known to these authors has produced this type of relatively stable belief.[26] Ordinary police interrogation is not sufficient to produce transformative or internalized belief change. Even in political thought reform programs that take months to execute, the internalization of belief change is so rare as to be regarded as anomalous and attributable to a personality characteristic of the target of influence (Schein 1961; Ofshe 1992b).

The case literature suggests that police-induced belief change during interrogation is temporary, inherently unstable, and situationally adaptive; it has never been observed to endure long after the influences and pressures of interrogation have been withdrawn. Individuals who falsely confess because they come to believe that they committed the crime do not demonstrate internalization of a belief in their guilt in any meaningful way. Rather, they confess falsely because they have been *temporarily persuaded* by the tactics of the interrogation to accept responsibility for a crime they have no actual knowledge of having committed. The person who has been persuaded to falsely confess is, at the moment of confession, only more certain than not that he committed the crime.

The persuaded but innocent suspect is neither certain of his innocence nor of his culpability. As a result of particular interrogation tactics, the suspect becomes convinced that he is probably guilty of the crime under investigation. While his subjective state is one of uncertainty, he is over the line—more certain than not that he committed the crime. His inability to retrieve actual memories of the crime explains his inability to achieve complete certainty of his guilt. The tactic of claiming overwhelming evidence of culpability prevents him from remaining certain of his innocence.

Table 1. Type of Confession and Its Legal Implications

	Whether Confession is True or False	
Type of Confession	*True*	*False*
Voluntary	Voluntary/Reliable	Voluntary/Unreliable
Stress-Compliant	Involuntary/Reliable	Involuntary/Unreliable
Coerced-Compliant	Involuntary/Reliable	Involuntary/Unreliable
Non-Coerced-Persuaded	Impossible	Voluntary/Unreliable
Coerced-Persuaded	Impossible	Involuntary/Unreliable

Accurately describing the persuaded false confessor's belief state is important because it leads to identification of the particular interrogation tactics that produce this type of false confession, explains why it happens, and explains why characteristics of the confessor's behavior are different from the behaviors of true confessors and those who give coerced-compliant false confessions (Gudjonsson 1992; Ofshe 1989). Like other false confessors, persuaded false confessors will typically recant their confession shortly after they escape the aversive pressures and reinforcers present in the interrogation environment.

A Category System for Classifying Confessions

The categorization scheme in Table 1 is useful for classifying and explaining the decision to make a true or false statement in response to interrogation.

Voluntary Confessions—Reliable and Unreliable. Voluntary confessions arise either in the absence of accusatory interrogation or in response to the use of legally permissible interrogation tactics. When elicited in response to interrogation, the confession results from the manipulation of a suspect's perceptions of his situation and his desire to obtain a legally insignificant benefit. Kassin and Wrightsman (1985) propose that individuals make voluntary unreliable (false) confessions for several reasons: to receive attention or fame, to expiate guilt, to receive a recommendation of leniency, to protect or aid the real offender,[27] or out of an inability to distinguish between fact and fantasy. Gudjonsson (1992) suggests that the motives for voluntary unreliable confessions range from a normal desire to protect loved ones to depression, pathological feelings of inadequacy and mental illness. High profile crimes such as the Lindbergh kidnapping in the 1930s and the Black Dahlia murder in the 1940s attracted hundreds of voluntary unreliable confessions (Corwin, 1996). Little is known about the frequency or risks of a miscarriage of justice attributable to voluntary unreliable confessions.

Stress-Compliant Confessions—Reliable and Unreliable. Distinguishing between stress-induced and classically coerced confessions is helpful for understanding the causes and variety of statements made to police in response to interrogation.[28] The former are elicited by the excessive use of psychological, and sometimes physical, stressors that, at a lower level of intensity, are ubiquitous in accusatorial interrogation. The latter are precipitated by classical forms of coercion (e.g., threats and promises).

The overuse of stressors necessarily in play during custodial interrogation can be sufficient (even absent classical coercion) to precipitate both reliable and unreliable confessions. Suspects make stress-compliant statements when the aversive interpersonal pressures of interrogation become so intolerable that they comply in order to terminate questioning. As the term is defined, a stress-compliant confession (1) is elicited in response to the exceptionally strong use of the aversive stressors typically present in interrogations; and (2) is given knowingly *in order to escape* the punishing experience of interrogation. If the suspect is guilty, he confesses because of the stress of the interrogation and is fully aware of his guilt; if the suspect is innocent, he confesses because of the stress of the interrogation despite full awareness of his innocence.

The causal structure of stress-compliant confessions can be readily understood. Interrogation is stressful by design. The multiple stressors built into the interrogation environment are present because they exert pressure on the suspect to comply with the interrogator's demand for confession.[29] The suspect is confined in an unfamiliar setting, isolated from any social support, and perceives himself to be under the physical control of the interrogator. He exercises little or no control over the timing, duration or the emotional intensity of the interrogation, the outcome of which remains uncertain. In extreme cases, fatigue, hunger and cold may function to additionally stress the suspect.

Since the purpose of interrogation is to elicit a legally voluntary admission of guilt by breaking down a suspect's resistance to self-incrimination, interrogators quite properly use whatever methods the law allows. To this end, they are permitted to employ techniques that are intended to induce distress and anxiety, attack the suspect's self-confidence, and reinforce the interrogator's position that the suspect's guilt is certain. Stress at any level of intensity advantages the interrogator because the suspect can only escape continuing discomfort through compliance.

An interrogator may create stress through the use of a variety of interpersonal styles and techniques. The routine tactics of an accusatory interrogation are inherently distressing even when an interrogator actively works to minimize the punishing aspects of interrogation. Often, however, interrogators choose to make statements that increase a suspect's anxiety or choose to adopt a hostile style to maximize distress and enhance the effect of certain influence tactics. An interrogator's choice to use a hostile, confrontational interpersonal style together with other factors (such as the

duration of the process) or the use of a stressor to which the suspect has a pathological sensitivity (e.g., confinement in a small space) can stress some suspects to the point that their desire for release from the painfully aversive interrogation results in a decision to comply and confess.[30]

An interrogator may use some or all of the following tactics as he presses for a confession: invading the suspect's personal space; falsely confronting the suspect with "incontrovertible" evidence of his guilt; accusing the suspect of fictitious crimes; plying the suspect with leading questions; asserting the futility of denying guilt; pointing out inconsistencies in the suspect's account; alternating displays of sympathy with displays of hostility; preventing the suspect from verbalizing his innocence; or offering to support or personally help the suspect only if he confesses. These and other influence techniques are likely to be used repeatedly and in combination. Any normal individual facing an accusatory interrogation will conclude that he is being accused of a serious crime, his future is uncertain and may well involve prison. No matter how "soft" the interrogator's style, the interrogation experience will inevitably be distressing and anxiety-provoking to a significant degree.

If, as interrogation progresses, the detective relies excessively on an interpersonally oppressive strategy, the suspect's stress will be enhanced, and he may become physically exhausted, emotionally distraught or mentally confused. Confronted by an aggressive, demanding, overbearing interrogator who refuses to take no for an answer, a suspect may reason that telling the interrogator what he wants to hear—confessing to the crime—is the only way to escape from the physical confinement, fatigue and distress of continuous questioning.

Gudjonsson (1984b, 1987) has constructed a measure of "interrogative suggestibility"—the extent to which a person is likely to comply with the pressures of interrogation.[31] A predisposing characteristic of an individual, interrogative suggestibility provides an important index of how inherently responsive and differentially vulnerable a particular suspect is to the demands and stresses of interrogation. Intellectually normal individuals are likely to vary in the degree to which they are vulnerable to interrogative pressure. Gudjonsson's research demonstrates that their personality characteristics explain some of the variance in who confesses and who does not.

While individuals in the general population vary widely in their capacities to resist the stresses of interrogation, the mentally handicapped are unusually responsive to pressure to submit to and comply with the demands of authorities (see Gudjonsson et al. 1993). As illustrated through excerpts from the interrogation of Johnny Lee Wilson (see pp. 218-222), the mentally handicapped are especially vulnerable to the pressures of accusatorial interrogation. For this reason, even the average level of stress built into an interrogation can be excessive and overbearing for them.

Two legal points follow from the analysis of stress-compliant confessions. First, since classical coercion is not necessarily an element used to induce a stress-compliant unreliable confession, the Fourteenth Amendment due process voluntariness test is not likely to provide an adequate safeguard against the admission of confession evidence when the statement is elicited through the induction of psychological stress that overbears a suspect's will to resist (see e.g., Gudjonsson 1992, pp. 247-251).

This is contrary to current legal understandings about both the psychological causes of false confessions and the legal safeguards that exist to prevent their admission in court. For example, the Department of Justice (1986, p. 99) has written that, "[s]o long as coercion is avoided a suspect's incriminating statements are highly probative evidence, since innocent people are not prone to make false confessions." Like the Department of Justice, many legal professionals wrongly assume that only physically or cognitively coercive police tactics will induce false confessions. However, stress-compliant unreliable confessions may mistakenly be admitted into evidence against the accused and therefore pose a significant risk of wrongful conviction. Current constitutional safeguards do not provide an adequate bar to the admission of involuntary and often unreliable confessions (see White, 1997).

Second, the special situation of the mentally handicapped perhaps most clearly illustrates the problem of stress-induced compliance. Whereas some intellectually normal individuals are especially responsive to stress, they are not easily identified as being vulnerable at the time they are selected for interrogation. The situation is quite different for individuals who are intellectually impaired. As is generally recognized, they are quite likely to be highly vulnerable to the stress inherent in a modern accusatory interrogation (Ellis and Luckasson 1985). The psychological pressures and demand characteristics of even routine accusatorial interrogation can lead mentally handicapped suspects to confess—whether truthfully or falsely—in order to placate a police officer and avoid what for a normal individual would be a tolerable level of psychological stress.

The mentally handicapped suffer not only from impaired intelligence, but are also likely to possess limited social skills, and lack the ability to appreciate the seriousness of a situation. Because of these characteristics, the submissive mentally handicapped learn to accommodate to a variety of situations in life by readily agreeing with the suggestions of others. They thus tend to give consistently affirmative responses to questions, and tend to be unusually responsive to authority. As the President's Panel on Mental Retardation noted in 1963 (Ellis and Luckasson 1985, p. 451):

> A retarded person may be hard put to distinguish between the fact and the appearance of friendliness. If his life has been molded into a pattern of submissiveness, he will be less able than the average person to withstand normal police pressures. Indeed they may impinge

on him with greater force because their lack of clarity to him, like all unknowns, renders them more frightening. Some of the retarded are characterized by a desire to please authority; if a confession will please, it may be gladly given. "Cheating to lose," allowing others to place blame on him so that they will not be angry with him, is a common pattern among the submissive retarded. It is unlikely that a retarded person will see the implications or consequences of his statements in the way a person of normal intelligence will.

Because of the hypersensitivity of the mentally handicapped, police may easily and altogether unwittingly elicit stress-compliant unreliable confessions from them—without resorting to any coercive tactics, but simply by applying the ordinary, baseline pressures of accusatory interrogation.

Coerced-Compliant Confessions—Reliable and Unreliable. A coerced-compliant confession is defined as a statement elicited by the use of classically coercive interrogation techniques, and is given knowingly in order to receive leniency or escape the harshest possible punishment. Coerced-compliant confessions thus differ from stress-compliant confessions in two fundamental ways. First, they are caused by the classically coercive influence techniques (e.g., threats and promises). Second, they are the result of the suspect's *conscious* decision to gain a benefit or to avoid an anticipated harsh punishment. Coerced-compliant confessions differ from stress-compliant confessions not only in terms of the interrogation techniques by which they are elicited, their motivational antecedents, and the logic of the decision-making leading to confession, but also by their potential legal consequences. Since they are elicited by tactics acknowledged to overbear a person's will, if detected they are more likely than stress-compliant confessions to be excluded from evidence in trial proceedings. Like stress-compliant confessions, however, coerced-compliant confessions may be either true or false.[32]

More than any other category of police-induced statements, coerced-compliant confessions have been recognized in the law as overbearing a suspect's will. For example, in *Lynumn v. Illinois* (1963), Chicago police officers threatened to arrest Mrs. Lynumn—which, they told her, would lead to a cut-off of her welfare payments, the loss of her children, and a prison term—if she did not confess to selling marijuana. Ms. Lynumn confessed and was subsequently sentenced to 10-11 years. The United States Supreme Court unanimously ruled that police coerced her confession and reversed her conviction. In *Leyra v. Denno* (1954), another well known Supreme Court case, a police psychiatrist elicited a confession from Mr. Leyra after explicitly promising him that he would be let off easily if he admitted murdering his parents. As in *Lynumn*, the U.S. Supreme Court ruled that Leyra's confession was coerced and reversed his conviction.

While the use of explicit threats and promises may no longer be as common in the 1950s and 1960s, interrogators currently employ more subtle and

camouflaged threats and promises to elicit confessions of guilt. The accident technique, for example, is nothing more than a device for delivering veiled threats and promises: it communicates the expectation that the suspect will receive a lower level of punishment if he confesses (leniency), but that he will receive a significantly higher level of punishment if he does not confess (threat) (see pp. 187-188 and 202-203).[33]

Non-Coerced-Persuaded Confessions. When a suspect confesses because he comes to believe that he is probably guilty of the offense, the necessary underlying social psychological process is persuasion. Persuaded belief change that is generated by interrogation does not necessarily persist over time or across situations; rather, it is temporary, unstable, situationally adaptive and endures only as long as the suspect accepts the interrogator's definition of the situation. As soon as the suspect successfully challenges the interrogator's framing of reality and critically analyzes the facts on which his new position rests, the persuasive effects of interrogation are likely to disappear. There are two types of persuaded confessions: those produced solely through manipulation and those in which classical coercion plays a significant role as well. As the term is defined, a non-coerced-persuaded confession is elicited in response to the influence tactics and techniques of modern, psychologically sophisticated accusatorial interrogation, and given by a suspect who has temporarily come to believe that it is more likely than not that he committed the offense despite no memory of having done so.

Some of the influence techniques that interrogators routinely employ can cause an innocent person to become confused, doubt his memory, be temporarily persuaded of his guilt and confess to a crime he did not commit. When the interrogation begins, an innocent suspect has no recollection of committing the crime; the only factual details he knows are those that are either public knowledge or that police have supplied. Believing or pretending to believe that the suspect is guilty, the interrogator repeatedly accuses him of having committed the crime, asserts the futility of denial, and presses for an admission of details to the offense. At this stage, the innocent suspect will likely steadfastly deny any involvement in the crime and remain firmly committed to the knowledge that he is innocent.

The factor distinguishing a persuaded confession is that, at some point, the accuracy of the suspect's memory becomes central. Persuaded confessions depend upon a successful attack on a suspect's confidence in his memory—specifically his lack of memory of having committed the crime. The suspect's knowledge that "I know I did not do this" completely depends on his confidence in the workings of his memory.[33]

Undermining a suspect's confidence happens after the interrogator has presented erroneous or fabricated evidence. If an innocent suspect does not know that police lie, he may become confused and upset because of the implications of the so-called evidence, and may desperately seek to convince

the interrogator of his innocence. Failing to understand the strategic nature of the interrogator's repeated accusations and failing to reject the false evidence ploys, the suspect will realize, at some point, that the foundation of his belief in his innocence is the absence of any memory of having committed the crime. If he protests that "I'm innocent—if I had done this I'd remember it," the trustworthiness of his memory becomes the focus of the interrogation.

The crucial factor for eliciting a persuaded confession is getting the suspect to accept a seemingly plausible explanation for his lack of memory of having committed the crime. Even as he follows the logic of the evidence, the innocent suspect will continue to assert that he has no memory of the crime. To the interrogator, this claim represents merely another disingenuous denial by a presumably guilty suspect. The interrogator will thus attempt to counter the suspect's denial of memory in any way possible. Interrogators use routine counters to this assertion to neutralize a suspect's presumed disingenuous denial and in hopes of permitting a guilty suspect to *de facto* acknowledge culpability. Sometimes they suggest that the suspect's lack of memory is explained by a drug or alcohol-induced blackout, a momentary lapse in consciousness, a repressed memory or even Multiple Personality Disorder. When the tactic of suggesting an explanation for the report of no memory is used against an innocent suspect, a protracted debate is likely to develop during the interrogation.

The final step in eliciting a persuaded confession is the formulation of a post-admission narrative. Even though a suspect may have acknowledged guilt abstractly by agreeing to a memory blackout, he does not know how or why he committed the offense.

The following analysis illustrates the importance of the post-admission narrative for evaluating the reliability of a persuaded confession. Gathering a post-admission narrative from an innocent suspect poses for both the interrogator and the suspect the problem of having to collectively invent an account of a crime about which neither has actual knowledge. If carefully analyzed, the product of their collaboration will likely yield evidence that should be dispositive of the suspect's guilt or innocence.[34]

If a suspect lacks actual knowledge of the crime, the account that develops can only be built from accurate information known to the police and/or to the public, inaccurate distortions of fact, rumors and guesses the suspect makes during the interrogation. Typically, some elements of the suspect's account will be accurate because the interrogator has introduced some crime scene facts and cause-of-death information, because these facts are common knowledge in the community or because a guess was correct by chance (e.g., "Was the victim clutching a belt in her left or right hand?" has a 50-50 chance of being answered correctly, and so is not dispositive of whether a suspect possesses personal knowledge about the crime).

The information an innocent suspect uses to build the narrative must come from somewhere other than from his experience. A major contributor is likely

to be the interrogator, especially if he has developed a theory of the crime (e.g., a story about what happened). Since the interrogator's theory determines the questions he asks and the specific accusations he makes, the theory is likely to have been revealed to some degree during the pre-admission portion of the interrogation. The interrogator is also likely to rely on his theory to guide and shape the narrative of the crime that he and an ignorant suspect jointly build.

If the interrogator's theory goes beyond the facts available to him (i.e., is based in part on anticipated autopsy results, laboratory findings, etc.) and the theory is grossly wrong, the errors will likely be adopted by the innocent suspect and thereby be incorporated into the developing narrative. For example, in the interrogation of Edgar Garrett (Garrett Transcript, 1995), detectives theorized that Mr. Garrett killed his daughter, Michelle, by smashing her skull with a club—despite the fact that they had not yet found her body. Mr. Garrett's post-admission narrative of the crime incorporated this cause-of-death theory, including his guess that he used an axe handle he knew to be in his apartment. However, when Michelle Garrett's body was found weeks later, it had 34 stab wounds and no significant trauma to the head (see pp. 226-230).

In another example, the detectives who interrogated Tom Sawyer (Sawyer Transcript 1986) believed that Janet Staschak had been raped as well as murdered. At the autopsy, a detective observed what he thought to be a semen stain on the victim's lower body. As a result of direct suggestion during the construction of the post-admission narrative, Mr. Sawyer's confabulated account came to include both vaginal and anal penetration culminating in repeated ejaculations. The medical examiner, however, found no semen in any body cavity nor any semen stain on the victim's skin (see pp. 230-233).

During the post-admission phase, an interrogator will typically elicit from the suspect information discussed during the pre-admission phase. Unless it can be objectively demonstrated that the suspect introduced accurate information, the restatement or reference to this information during the pre-admission phase has little or no value as proof of the suspect's actual knowledge of the crime. The interrogator will seek corroboration of the suspect's guilt by attempting to obtain detailed information about the crime scene that was not previously discussed, elicit information deliberately withheld from the suspect and, most importantly, attempt to obtain information about physical evidence unknown to the police (e.g., location of the weapon, loot, etc.). What happens during this portion of the interrogation is crucial for objectively evaluating the reliability of the suspect's statement.

To understand how interrogation proceeds during the post-admission phase, the perspectives of both the interrogator and the suspect should be respected and their interaction viewed through the eyes of each. By the time he turns to the collection of the narrative of the crime, the interrogator has persuaded the suspect that he is guilty—despite having no conscious awareness of the crime. The interrogator has told the suspect that his memory impairment is

interfering with his normal ability to recollect events. The interrogator, however, believes that the suspect is fully knowledgeable of his actions and is merely feigning ignorance. He understands the suspect's tenacious claim to amnesia as an odd personality quirk.

Unable to elicit evidence of awareness of having committed the crime, the interrogator cannot accomplish corroboration of the "I did it" admission. Given this impasse, the interrogator is likely to use a tactic to facilitate obtaining corroborating information that will allow the suspect to continue to "pretend" ignorance. For example, the interrogator might, at this point, suggest that the suspect respond to the interrogator's questions by providing his best guess about what happened. He might assure the suspect that his unconscious, actual knowledge will guide his answers, and that he will come up with correct facts. Another tactic for facilitating a narrative of the crime is to suggest that the suspect visualize the scene as if it were a movie frame, roll the film forward and report what he observes happening. From the interrogator's perspective, all these techniques are simply ways to allow the suspect to confess and still maintain the facade of having no conscious awareness of guilt.

For the innocent suspect, the post-admission narrative phase of interrogation looks entirely different. Persuaded that he suffers a memory impairment that has rendered him ignorant of all the details concerning the commission of a complicated crime, the innocent suspect may find plausible the suggestion that he rely on the mind's unconscious operations to recover what he has concluded he must know but can't remember. The interrogator's use of this tactic effectively puts the suspect in a position to confabulate wildly (i.e., to make good faith guesses about something that he has in principle accepted as real, but about which he has no memory). The contents of the suspect's confabulations are constrained only by his understanding of what the interrogator will find acceptable (i.e., the agreed upon crime facts and the interrogator's theory), by having to conform the account to the agreed upon history of the suspect's activities before and after the crime, and by what is physically possible.

An innocent suspect's responses to the interrogator's search for corroboration yield two sorts of information consistent with factual innocence. First, recordings of suspects giving persuaded confessions reveal a strong tendency to select a grammar appropriate for his zero-level of actual knowledge. Since the appropriate grammatical form for such expressions is to use "hedging qualifiers" and "past auxiliaries that bear a speculative sense"[35]—*the grammar of confabulation*—the suspect's language during the narrative portion of the interrogation will likely demonstrate a significant reliance on phrases such as: "I would have done...," "I probably did...," "I could have...," and so forth (Gudjonsson 1992; Ofshe 1989). Kassin and Keichel (1996) have demonstrated—in a laboratory study of interrogation—the phenomenon of heightened usage of the grammar of confabulation when actual knowledge is lacking.

If a suspect is innocent, the *new* information he contributes during the post-admission narrative is no more likely to be accurate than would be expected by chance. Since the investigator's goal is to link the suspect to the crime in a way that can never be successfully repudiated, he will seek information that can be objectively evaluated. Taking into account how this information is elicited, an analysis can be conducted that leads to an objective evaluation of the quality of the fit between a suspect's narrative of the crime and the facts of the crime. If the fit is good, it is reasonable to infer that the suspect possesses personal knowledge of the crime; conversely, if the fit is poor, the requisite inference is that the suspect is ignorant of the crime facts.

When the interrogator and the suspect complete the confabulated narrative of the crime, the interrogation ends and the pressures and controls that were in play up to this point are withdrawn. The suspect is left with the logical conclusion that he probably committed the crime, the rationalization that the memory impairment suggested by the interrogator explains his amnesia and a constructed story of the crime that the suspect realizes (even as it is being offered) is rank speculation.

Not surprisingly, the minimal level of certainty the suspect attained during interrogation declines rapidly once he is free to reconsider the facts and fully consider alternative explanations. The end of the interrogation relieves the time pressure constraints attendant to real-time interaction. Under real-time conditions, it is not possible for the suspect to fully consider alternative explanations for the fact pattern the interrogator alleges. Clear thinking is even more difficult because the investigator's strategic moves are designed to cut off the suspect's ability to analyze evidence, and to reason that he cannot be guilty of the crime.

Coerced-Persuaded Confessions. Coerced-persuaded confessions follow the same structure, sequence and logic as non-coerced-persuaded confessions. The only difference is that whereas the latter are elicited solely in response to the influence tactics of accusatorial interrogation, an interrogation that produces a coerced-persuaded false confession also incorporates threat, promise or other classically coercive interrogation techniques. In some interrogations, the impact of the interrogator's persuasive techniques is sufficient to undermine the suspect's confidence in his innocence and convince him that the proffered evidence establishes his guilt, but the suspect continues to resist the interrogator's demands that he make an unconditional statement.

The suspect's inability to retrieve any memory of the crime may inhibit him from reaching the level of subjective certainty that justifies making a statement in declarative grammar. He may be willing to agree that he "probably" committed the crime or "would have" acted in a certain manner, but is unwilling to convert his tentative, speculative expressions into the straightforward statements desired by the interrogator (e.g., "First I did X, then I did Y"). Under

these circumstances an interrogator may resort to the introduction of classical coercion in order to overcome the suspect's continuing resistance to stating the persuaded confession in the grammar preferred by the interrogator.

ILLUSTRATING FALSE CONFESSIONS

The following illustrates the classification scheme by summarizing the characteristics of interrogations that produce reliable confessions and by reporting excerpts from interrogation transcripts that illustrate unreliable confessions.

Voluntary and Reliable Confessions

Voluntary and factually reliable confessions are ideal. They are offered spontaneously, when an investigator questions an individual or suggests that the person has some involvement in a crime or when an interrogator carries out a legally permissible interrogation. For some individuals the impulse to confess is due to genuine remorse whereas for others only being confronted with certain knowledge that they are caught leads to confession. As in all confession evaluations, the truth of the suspect's confession can only be estimated from the information gathered in the post-admission narrative. A voluntary and reliable confession can be distinguished from a voluntary and unreliable confession by the fit between the facts reported in the crime narrative and the objectively established crime facts.

Voluntary and Unreliable Confessions: The Case of Michael McGraw[36]

Michael McGraw gave Arizona sheriff's officers a voluntary false confession to participating in a mass murder. On August 10, 1991 at the Wat Promkunaram Buddhist Temple west of Phoenix, six Thai Buddhist monks, a novice, a temple-helper and an elderly nun were murdered by being shot in the head by a .22-caliber Marlin rifle. The "Temple Murders" were the worst mass murder in modern Arizona history. The Sheriff's Department formed the Maricopa County Major Crimes Task Force, which involved ten state and federal agencies (including the Federal Bureau of Investigation, the Immigration and Naturalization Service, the Drug Enforcement Agency, the State Department of Public Safety, the Air Force Office of Special Investigations, Scottsdale Police, Tucson Police, the Pima County Sherriff's Office), fifty-six investigators, and a staff of 226 people working around the clock (Kimball and Greenberg 1993a). The Task Force was under so much public pressure to solve the Temple Murders that they eventually collected four false confessions—Michael McGraw's voluntary unreliable confession as well as three coerced-compliant unreliable confessions—to the same crime.

For this reason it is perhaps the most troubling known false confession case in recent American history.

On September 10, 1991, Michael McGraw, an in-patient at the Tucson Psychiatric Institute, called police to pass along information about the Temple Murders. Identifying himself as John, he implicated a friend, Kelsey Lawrence. John and Kelsey Lawrence turned out to be pseudonyms McGraw used when referring to himself. McGraw told police that Kelsey Lawrence had driven to Phoenix to commit a violent robbery at a church. In a conversation with Officer Larry Troutt—that was not tape-recorded and would later be disputed—McGraw is alleged to have asked if the perpetrators had written the word BLOOD on a wall of the temple.[37] As a result, police believed that McGraw possessed "uncommon knowledge" that only the killer or an accomplice could know (Kimball and Greenberg 1993b). McGraw was transported from the Psychiatric Institute in Tucson to Phoenix and questioned from 1:15 a.m. to 6 a.m.

A twenty-four-year-old hispanic with a history of psychiatric problems and a criminal record for car theft, McGraw claimed to have committed himself to the mental hospital due to the guilt he experienced over killing the monks. During questioning McGraw was pressed to name his accomplices. His resistance was overcome when he was threatened with arrest if he did not give up the names of those who supposedly did the murders. McGraw was assured that his information would be checked out and if it proved worthless he would be returned to the hospital in Tucson. If he did not provide the names he would be arrested and charged with giving false information to a police officer. McGraw implicated among others nineteen-year-old Mark Nunez, twenty-year-old Dante Parker, twenty-eight-year-old Leo Bruce and Victor Zarate. According to McGraw, on August 9th he and the others had driven a stolen Ford Bronco and a Chevy Blazer from Tucson to Phoenix, where they were joined by four more individuals. McGraw claimed that he waited in the car while the others robbed the temple and returned with a black bag full of possessions. McGraw described his position as the lookout man, the guns his comrades used, and the physical appearance of the victims. Following the robbery, the killers supposedly drove to California before returning to Tucson (McGraw Transcript 1991). Though he would be charged with nine counts of first degree murder, McGraw's fanciful confession was entirely false, the product of his imagination and tendency to lie. If the investigators had evaluated the fit of McGraw's statement with the known facts of the crime as soon as they had his narrative, they would have realized that he did not have personal knowledge of the crime, and that the details he provided were demonstrably false.[38] More than two months later, after the true killers were apprehended, McGraw was released from jail.

Stress-Compliant Reliable Confessions

The pre-admission elements of a stress-compliant reliable confession are illustrated in the description of the stress-compliant unreliable confession. The information reported in the post-admission narrative phase should distinguish between the two types of confessions.

Stress-Compliant Unreliable Confessions: The Case of Johnny Lee Wilson[39]

On April 13, 1986, Pauline Martz, a seventy-nine-year-old widow, was beaten, bound with duct tape, and left to die in her burning home in Aurora, Missouri. Five days later, police arrested Johnny Lee Wilson, a timid, retarded twenty-year-old janitor with no prior record of violence.[40] They focused on Wilson after Gary Wall, a special education classmate, told them that Wilson had made incriminating comments. Unbeknownst to the investigators, Wall had lied because he hoped to receive a reward from a state arson fund. In 1995, Wall recanted his original statement, claiming that he kept quiet for nine years because he feared that he might get in trouble for lying to police.

Wilson thought he was being asked to help solve the murder when police asked to talk with him. After waiving his Miranda rights,[41] Wilson was interrogated for three and a half hours on the night of April 18th, and again on April 19, 1986. From the beginning, Detectives Steve Carr and Bill Merrit repeatedly accused Wilson of killing Martz. In response to Wilson's denials and claim to know nothing about the crime, the interrogators became relentlessly accusatorial. They repeatedly confronted Wilson with their single piece of evidence, Wall's witness statement. Carr and Merrit told Wilson that it was a sworn statement, that Wall had passed a polygraph test, and that the polygraph operator would testify that Wall was telling the truth. They also attempted to overcome Wilson's protestations of innocence by falsely telling him that eyewitnesses had seen him at the murder scene before the fire started; by insinuating that he would fail a lie detector test but they would not test him (even though Wilson repeatedly asked to take a polygraph); and by accusing him of making inconsistent statements (Wilson Transcript 1986, Tape 2, pp. 8-9):

Interrogator: Now, we're not playing games. You can sit there and tell all the stories you want to your mother or something, or to whoever else you think will believe it, but we can't. We have evidence right here, have the evidence on tape. We have the eyewitness who put you at the scene. We have the lie detector test that says the man who was testifying about you was telling the truth. We have the signed statement. We have the fact that you're the one who started the story about the lady being tied up and in there and gagged before we even knew it. Before we'd even found the body! We didn't even know she was in there when you knew it.

Wilson: I didn't know it.

Interrogator: Oh yes you did! Yes you did! And we can prove it. Now what are you going to do? When you stand up in front of that judge, you say, "Judge" after we present our case, and I think we have an adequate case, "Judge, I didn't do any of this. I don't know anything about it. Those guys are lying on me. But I sure hope you'll take it easy on me." Or are you going to tell the judge the truth at that time hoping he'll take it easy on you? You better start figuring out what's going to happen to John Wilson. That's what you'd better do.

Wilson: Uh huh.

Interrogator: Because if you don't, we'll take care of it. You know what I mean? If you don't do anything, we'll just take care of it. We've had, we've got a big case here. We been here all week. We're tired. We've been working day and night. We have finally solved the case. We have a man who said you did it. We've got a signed statement. We've got the lie detector test. We've got the witnesses. We've got the circumstantial evidence of you knowing about it before anybody else. We've got a case made. Doesn't it look to you like someone would be convinced that you did it based on what I just told you? Doesn't it look pretty incriminating.

Wilson: Yeah.

At the same time, the detectives portrayed themselves as Wilson's allies, insisting that he needed their help and that they would gladly offer it to him to get him out of this situation (Wilson Transcript 1986, Tape 1, p. 9):

Interrogator: He says, he says you told him that you did. He said you were there. He said you told him that you had tied her up and beaten her and burned her. He was given the polygraph test again, John, and he passed it.

Wilson: I wouldn't do nothing to her. My mom knows that. I didn't, I was...

Interrogator: Alright no, John, now let's just... if this did occur, John...

Wilson: Uh huh.

Interrogator: And you know, this isn't, isn't the end of the world for anybody. We want to know. And so, you got a problem. And you need help. And we're the people that can get that done, John.

The purpose of Carr and Merrit's two-prong approach—coupling irrefutable assertions of guilt with vague offers of help—was to convince Wilson that he would be convicted and to provide him with an incentive to confess. Wilson's continuing resistance led the detectives to shift to an incremental approach,

seeking to elicit the admission in small steps—starting with the *possibility* that he may have committed the crime (Wilson Transcript 1986, Tape 1, p. 32):

Interrogator: I think you're, I think you're telling us a lie, John, and it's time, you know, that we get down to the nitty gritty of this thing. One way or the other. Now we've been nice to you half the night here.
Wilson: Uh huh.

Interrogator: And we, we been at it now over an hour. And, but we need to get into the nitty gritty. You know, we're not going to waste our time all night here either. You know, and we, I believe, you're involved in this John. I want to help you, John. But I can't if you're not going to tell me the truth and cooperate. You think there's a possibility you might have [untranscribed] to Pauline's house and not remembered it?
Wilson: But I didn't.
Interrogator: Do you think there's that possibility?
Wilson: Yeah, that's a possibility, but...

Although Wilson had insisted on his innocence for nearly two hours, he began to give in once he accepted the possibility that he was present at the murder. Shortly before his resistance collapsed, the detectives told Wilson (Wilson Transcript 1986, Tape 2, p. 7):

Interrogator: You can swear to God or whoever you like, that ain't going to get you out of trouble.
Wilson: Uh huh.
Interrogator: For you are in serious trouble right now. Murder is what you're in. Murder! Premeditated, willful, malicious, burning up an old lady in her house. That's what you're in on Wilson. Ain't no sense kidding around about it.
Wilson: I wasn't near that house, though.
Interrogator: I think it's despicable.
Wilson: I was with Mom all along. I was at Ramey's with her, and I was, I was...[42]
Interrogator: Yeah, you may need a lot of statements from your mother and things like that, we got statements from other people here that say that you were there, and that you admitted doing it. We got a lot of people that saw you there that night,[43] and they're going to put you right inside that house, torching that lady, robbing her, tying her up. No one else knew she was tied up. We didn't even know it!

Within a few minutes, Wilson started to comply and attempted to supply the answers the interrogators were seeking. Since the interrogation consisted

almost entirely of grossly leading questions, Wilson either fed back the information that police gave to him or simply guessed at answers to questions such as how the victim was bound, the color of her blouse and where her body was found. Wilson's guesses were wrong, but the detectives either didn't notice or didn't care (Wilson Transcript 1986, Tape 3, pp. 1-2):

Interrogator: OK. Whenever you looked in and you seen Mrs. Martz tied, gagged, laying on the floor, what was she wearing? What did you see?
Wilson: A blouse of some sort. I can't tell the color.
Interrogator: OK. How about bluish. I'll go for that.
Wilson: Yeah.
Interrogator: How about bluish-green maybe?
Wilson: Yeah.

Martz, it turned out, was not wearing a blouse at all. When Wilson was unable to guess correctly, the interrogators simply provided the answer and attributed it to him (Wilson Transcript 1986, Tape 3, p. 8):

Interrogator: OK. What besides a rag was on her mouth?
Wilson: I don't remember anything that was over her mouth.
Interrogator: What besides, what besides a rope was around her ankles. Something else. This is a test. I know. And you know. Just think. Come on, John.
Wilson: I'm thinking.
Interrogator: What are some things that could be used?
Wilson: Handcuffs, I think?
Interrogator: No. No. Wrong guess. What are some things you could tie somebody up with?
Wilson: Rope is all that he had but...
Interrogator: That tells me something, John. That tells me something. That tells me something. I told you that it's important that you be straight with me. You took the tape up there.

The recordings reveal with dismaying clarity that Carr and Merrit repeatedly told Wilson the key details of the crime and that Wilson readily blended them into his responses. By the conclusion of the interrogation, Wilson had confessed to hiding stolen jewelry, arson, beating Pauline Martz and attempted rape. Initially he admitted he had two accomplices, but when the officers accused him of acting alone, Wilson shifted to their version of the crime.

Although Wilson's confessions contradicted each other, were all demonstrably false and wholly lacking in corroboration, both police and prosecutors steadfastly maintained their belief that Wilson was guilty. Johnny Lee Wilson eventually entered an "Alford Plea"—an acknowledgement that

the state had enough evidence to convince a jury that he was guilty even though he did not admit guilt—to first degree murder charges in order to avoid the death penalty. When his plea was taken, Wilson did not seem to understand its meaning, telling the judge: "I'm guilty, I guess." Wilson was sentenced to life imprisonment without possibility of parole for fifty years. The Missouri Supreme Court rejected his appeal in 1991.

In 1988 Chris Brownfield, who was in prison for the beating, robbery and murder of an elderly woman shortly after the Martz murder, voluntarily confessed that he and another man had killed Pauline Martz. Brownfield supplied police with facts about the crime that had been deliberately withheld from the public. On September 30, 1995—eight years and five months after Johnny Lee Wilson had been convicted—Missouri's governor pardoned him.

Coerced-Compliant Reliable Confessions

The pre-admission elements of a coerced-compliant reliable confession are illustrated in the description of the coerced-compliant unreliable confession. The information reported in the post-admission narrative phase of the interrogation should distinguish between the two types of confessions.

Coerced-Compliant Unreliable Confessions: The Case of Dante Parker[44]

In his confession to the Phoenix Temple Murders, Michael McGraw named, among others, Leo Bruce, Mark Nunez, Victor Zarate, and Dante Parker as his collaborators in the Temple Murders. Maricopa County Sheriff's detectives took custody of all four individuals and subjected them to extensive and prolonged incommunicado interrogation. Three of the four—Nunez, Bruce and Parker—eventually succumbed to the pressure, prodding, bullying and death penalty threats used by their interrogators and gave false confessions (see McGraw, Nunez, Parker and Bruce Transcripts 1991). As with McGraw's statement, the confessions from Nunez, Bruce, and Parker were riddled with inconsistencies and did not match the known facts of the case.[45]

The interrogation of Dante Parker—in which seven officers participated over the course of fifteen hours—vividly illustrates how some contemporary American interrogators seek to communicate a death penalty threat without saying the words "electric chair," "gas chamber," or "lethal injection." With Michael McGraw's confession in hand, Sheriff's Detectives Pat Riley and Wayne Scoville began a lengthy and intensely accusatorial interrogation of Parker from whom they sought to elicit a confession that matched McGraw's statement.

After Parker waived his Miranda rights, Riley and Scoville accused him of being at the scene of the murder, and demanded that he acknowledge guilt and confirm McGraw's confession. Parker insisted that he was not at the

murder scene, and did not know why they were accusing him, asked the interrogators to check out his alibi, and volunteered to take a polygraph test. The interrogators ignored Parker's denials and requests.

Riley and Scoville's interrogation of Parker followed the two-prong approach. First, they reported incontrovertible evidence of Parker's guilt, so much so that there was no question that a judge and jury would find him guilty and sentence him harshly if he did not confess. They told Parker they could establish his involvement beyond any doubt; that his accomplices—who had knowledge that only the killers could know—had told them about Parker's role; that he had been identified in a photo line-up; that the victims' blood had been found on his clothes and shoes; and that his fingerprints would be in the getaway vehicle. According to the interrogators, no judge or jury would believe his denials. The detectives even accused Parker of personally executing several of the victims. Responding to Parker's frequent protestations of innocence, Riley and Scoville maintained that his guilt was established, and called him a liar (Parker Transcript 1991, Tape 1, p. 8):

Scoville: Let me explain something to you, you're in an unfortunate situation okay, you're one of the last persons that we talk to, right, we already know the majority of the story, okay. You're hooked up on the fact that hey I wasn't there or anything, we already know it's not true. Without a doubt, there's no, let me finish, there's no doubt in our mind that you were there, okay, the only way that you can help yourself right now is to start telling the truth and the reason being if you want us to believe what happened inside there, you have to be honest with us as far as even being there. Okay? Other people are going to tell us that you did, it's already happened.

Parker: But that's the thing.

Scoville: That's not the thing.

Parker: That's the thing, you can—I was with Renee. I didn't...I didn't do anything, I've never been to Phoenix since I've been in Tucson in March, never came to Phoenix, never.

Scoville: How come we have everybody telling us you were there?

Second, the detectives applied coercive pressure to Parker in several ways. They offered a strong incentive to confess by minimizing his participation and culpability. They suggested that the murders were accidental rather than planned; that Parker did not intend to hurt or kill anyone; that Parker was not a cold-blooded murderer—as the judge and jury would believe if he did not confess—but someone who just made a mistake; and that the only way he could help himself would be by admitting his involvement and supplying them with the details about what happened. Confessing now, they told Parker, would be his only opportunity to present his side of the story in a favorable light to the judge and jury (Parker Transcript 1991, Tape 2, pp. 4-5):

Riley: Put yourself in a jury box, Dante, you listen to the story, okay, you listening to the story about the people that got killed, okay, you have to make a decision when all this is over and you have to say hey does this make sense, what about this person, is this person a real bad individual or is this person a person that has needs or some other motive did something and unfortunately some people got hurt...

Scoville: You've got the opportunity right now to make those people think that hey, Dante is a person who made a mistake instead of hey, Dante's a cold-blooded killer and that's a big difference and I think you know that's a big difference. When they make the decision what's gonna happen to you, which do you want them to think? You...you need to think about that cause, partner that's...that's the bottom line and that's gonna be your decision that you're gonna have to live with for a long time. How do those people that made a decision on what can happen to you, think about you? Cold-blooded killer or person who made a mistake?

Despite the detective's accusations and their endless demands that he confess, Parker was not immediately moved to comply. He denied the accusations dozens of times throughout the fifteen hour interrogation.

Failing to get Parker to confess by indirect suggestion, Riley and Scoville moved up the incentive scale and introduced direct threats and promises of prosecutorial leniency. They eventually threatened Parker with the death penalty several times (Parker Transcript Tape 2, 1991, pp. 13-14):

Scoville: You've been sentenced before...you've been sentenced before for little things and you know that if that judge gets pissed off at you it's a lot different than if he's not. And you right now can make a decision to make a difference about how the judge feels about you and you need to take it.

Riley: What if he might send you to the gas chamber, and I don't say that to scare you, Dante, but in this situation that's a real possibility and I'm not gonna sit here, Wayne's not gonna sit here and lie to you about these things cause that's not gonna serve us any purpose...

Scoville: So you're sitting here thinking it's us against you, that's not the case. We're here to help you out...

Scoville: You need to think ahead to that sentencing time and have you walk before that judge, that's something to think about. Because you've been there before, think about how it was, think about how it's gonna be.

Even an explicit death threat, however, failed to cause Parker to confess. The detectives also promised leniency by suggesting that Parker could confess to a lesser version of the crime (Parker Transcript 1991, Tape 3, p. 3):

Scoville: You've heard about premeditated murder?

Parker: No.

Riley: Have you heard about that?

Parker: No. What's that?

Riley: You know first degree murder, second degree murder?

Parker: Yeah.

Scoville: Premeditated murder is the worst kind, I planned it, I went in and killed 'em. You're the only one that can say that's not how it happened. You're the only one that can help yourself out and say no hey wait a minute, yeah I was there but hey it wasn't planned and that is (inaudible) truth from me was it planned or not, alright? You understand the difference, I know you do. Cause you're a smart person (inaudible) but we don't think it went down the way you planned it, that's the key for you. I don't want to see you because you know, you probably don't trust police, you know, you grew up on the streets, you've been in prison you probably don't trust us, okay, that's natural for you. But you've got to believe me when I'm tellin ya, the difference between premeditation...go in there to do this and go in there and it happens, are bigger then...I'm sure you understood. If you understood that you'd come clean you really would (inaudible) and you're gonna feel better once you do.

Parker: Oh I understand but there's nothing to come clean with.

Scoville: No doubt in my mind, no doubt in his mind and we have the exact same facts that the jury's gonna have. Okay? Exact same facts. They're gonna get everything we've got. And they're gonna know the answers just like we do. The only thing that they're not gonna know is did he plan it, did he plan to kill 'em or did it just happen. And...and we've been in enough juries to know they think the worst unless somebody says no that's not how it happened.

Despite Scoville and Riley's coercive methods, Parker's resistance did not collapse until a second set of detectives, Rick Sinsabaugh and Larry Troutt, relieved the first team. They too badgered Parker with accusations of guilt, false evidence ploys, and leading questions, and they continued to accuse him of lying and acting against his self-interest when he denied all involvement. Sinsabaugh and Troutt added another coercive element to the interrogation: they threatened to arrest and humiliate Parker's brothers, Peter and T.C., if he did not confess (Parker Transcript 1991: Tape 7, pp. 8-10).

Troutt: Dante, if T.C.'s not involved in this man, give it up.

Sinsabaugh: Make some right out of it, Dante.

Troutt: We need to get that stopped.

Sinsabaugh: Everyone's here Dante, the games' up. All I need to know is Dante.

Parker: Leave T.C. out of it. T.C. don't have anything to do with this.

Sinsabaugh: Peter either.

Parker: Peter either.
Sinsabaugh: He's being brought in. What happened Dante, did you pull the trigger?
Parker: I didn't pull no trigger.
Sinsabaugh: But you were there. Dante, just get it out man, just get it out once and for all so we don't have to go over this again. Were you there? I know you were there my man.
Troutt: We're gonna...
Sinsabaugh: Right?
Troutt: We're gonna be in Tucson Dante...
Sinsabaugh: This is not a game my man, this is your one chance, I mean that, like Larry told you I just want to know if you're a killer Dante.
Troutt: They're gonna hit that house big time, T.C.'s gonna go down right in front of his kids.
Sinsabaugh: And...and it's...it's not a game Dante, I'm talking to you as a man, that's all I can do, I'm showing you the respect I can cause I'm...I'm praying that you're not a you know, a cold blooded killer and...and I'm asking for your help to sort this fucking thing out. If you got messed up with some punks I want to hear about it. What happened Dante?

This additional threat precipitated Parker's false confession, and he began the process of inventing answers to the interrogators' questions. For several hours, seven interrogators pressed Parker for information about the crime and a confession to planning and participating in the murders, sometimes relying on the same kinds of threats and promises that provoked Parker's first false admission. The interrogators tried to shape Parker's confession to fit the facts as they knew or believed them to be, and Parker either fed back what they had given him or made up answers. By the end of the interrogation, Parker confessed only to being a minor accomplice who knew little about and did not participate in the planning or the commission of the Temple Murders.

Although the fit of Parker's confession to the facts of the case was poor—full of inconsistencies, obvious guesses, implausible conjectures and demonstrably false statements—he was charged with multiple counts of murder and, like the other Tucson defendants, was incarcerated for 70 days until the real murderers were caught by straightforward, basic police work.[46]

Even after the real killers were caught, the Maricopa County Sheriff, Tom Agnos, and the County Prosecutor, Rick Romley, refused to admit that their subordinates had forced false confessions to mass murder from three people. In reaction to public protests and intense media pressure, Romley dropped all charges, admitted that the Tucson Four were innocent, and blamed the sheriff's department for having made all the mistakes in the case.

The Parker, Nunez and Bruce coerced-compliant unreliable confessions contained many differences and contradictions but were, at a certain gross level of description, consistent with each other's accounts. Since these men had nothing to do with the murders, the only explanation for the similarities is

that poor police training and improper use of interrogation methods combined to create a potentially deadly collective reality that bore no resemblance to what had actually happened at the Wat Promkunaram Temple.

Non-Coerced-Persuaded Confessions: The Case of Edgar Garrett[47]

The police in Goshen Indiana believed Edgar Garrett killed his sixteen-year-old daughter, Michelle Nicole Garrett, who had mysteriously disappeared one Sunday morning. Mr. Garrett's interrogation illustrates how contemporary interrogation techniques can cause an innocent person to become so persuaded of his guilt that—without the use of coercion—he confesses to a crime about which he has no knowledge.

Garrett's interrogators used the basic twofold strategy of confronting him with supposedly incontrovertible and damning evidence of his guilt while stressing an incentive for confessing. Police told Garrett that multiple witnesses had seen him with his daughter shortly before she disappeared; that they had provided statements against him; and that they were willing to testify. The interrogators accused Garrett of giving them inconsistent statements, and claimed that his suspicious behavior following his daughter's disappearance (i.e., searching for her) also suggested his guilt. And they informed Garrett that he had failed a polygraph test—a machine that they insisted did not make mistakes. According to his interrogators, the weight of evidence against him was so overwhelming that no reasonable jury could reach any conclusion other than that Edgar Garrett murdered his daughter.

The interrogators offered Garrett psychologically compelling incentives to confess. They told him that they could only help him if he first confessed, and they pleaded with him to confess for his family's sake, his daughter's sake and his own sake. Though he was confused, Garrett resisted the accusations until detective Converse suggested that Garrett, an occasional drunk, may have had a blackout on the morning of his daughter's disappearance (Garrett Transcript 1995, pp. 319-320):

Converse: Let me talk about something else here. Now, we know you were far enough—now you might have had a blackout, right? It's possible.
Garrett: Possible.
Converse: Possible that you were down—well, we know that, you were down at the river bank, down at the river bank.
Garrett: Looking for my daughter.
Converse: Right, okay. The only question is what day were you down at the river bank? Well, maybe you were in a blackout. Maybe you were down there with your daughter at the river bank because you're in a blackout. I don't know. But before I leave this room today there's one thing that you and I are going to know, I'm going to help you remember this shit so we can be done.

Trading on Garrett's guilt about having once hit his daughter during an alcoholic episode, Converse was able to make progress in his attack on Garrett's confidence in his memory. Garrett began to shift away from absolute certainty that he had not seen his daughter the morning she disappeared to expressing doubts about his memory of his whereabouts immediately before Michelle's disappearance (Garrett Transcript 1995, pp. 322-323):

Garrett: But I just don't remember if I went out—if I did talk to Michelle Sunday morning or not.
Converse: You did. And you're starting to remember. It's written all over you.
Garrett: I just don't—don't remember.

From this point on, Converse sought to move Garrett from the position that he did not remember whether he was with his daughter shortly before her disappearance to accepting responsibility for her death. While confronting Garrett with fabricated incriminating evidence, the interrogator suggested the broad outline of the confession he was seeking from Garrett (Garrett Transcript 1995, p. 327):

Garrett: I can't remember fighting with Michelle on Sunday.
Converse: You did. Not only did you fight but you thumped her. You didn't mean to hurt her.
Garrett: What did I thump her with?
Converse: I don't know.
Garrett: I don't know either.
Converse: But you thumped her.
Garrett: Well, I killed my own daughter?
Converse: Yeah.

Despite pressure and suggestions about the crime scenario, Garrett continued to insist that he lacked knowledge of the killing until the interrogator returned to the possibility of amnesia. Emphasizing the blackout hypothesis, Converse persuaded Garrett that he may have killed his daughter (Garrett Transcript 1995, pp. 332-333):

Converse: Tell me about hitting her. Now, you remember that part of it and I know that and you know that and you know that I know that.
Garrett: Maybe I did thump her on top of the head.
Converse: Okay. Where did this happen at?
Garrett: Oh, man, I don't know.
Converse: Yes, you do. Yes, you do. You know exactly where it happened at.
Garrett: Well, apparently this happened out at Studebaker Park.
Converse: Tell me exactly where it happened at. There's—I know there's—remember you're talking to a drunk. You're talking to a guy that's had blackouts himself. Okay, I know how them damn things work. Because I am one. I'm just like you, and that's why you and I are connected. Don't you understand that?
Garrett: It must have been on that road there. I don't know where—that's where most of the blood is, I guess.

Having no actual memory of the murder, Garrett answered Converse's questions either by confabulating answers about how he could have killed his daughter or by reasserting his lack of factual knowledge. To accommodate the contradictory cognitions that he committed the crime but could not remember any of the details, Garrett's confession was conditional, tentative, and conjectural. Lack of actual knowledge forced Garrett to offer a qualified story by parroting back information that Converse had introduced and inferring from Converse's leading questions what he expected to be told happened (Garrett Transcript 1995, pp. 338-339):

Converse: How did you cross the river?
Garrett: I must have went all the way to that school lot over there...That must have been the only way I could have got around—over there to get to the other side of the river.
Converse: Okay, then what happened next?
Garrett: I must have just left her there.
Converse: Okay.
Garrett: And I must have went home.
Converse: All right. What did you do with the stick.
Garrett: It's in the house. I must have took it back to the house.

Pressing Garrett to confess the details of his daughter's murder, Converse countered resistance and attempts to recant earlier admissions by restating the evidence against Garrett and emphasizing the emotional and self-image benefits of confessing. When Garrett's confabulations fit the few facts known about Michelle's disappearance or the officers' speculative theory of her murder, Converse reinforced Garrett's answers. When Garrett struggled with the crime details, the detective facilitated his confession by asking leading questions or by explicitly telling him facts of the crime, as the detective thought them to be (Garrett Transcript 1995, pp. 344-345):

Converse: I'm going to give you another hint. Detectives don't ask questions unless they have pretty good reasons for asking that. You thought about blood being on your clothes, right? Right?
Garrett: Yeah.
Converse: Okay. Where was the blood on your clothes?
Garrett: Probably on my jeans somewhere.

Although persuaded that he murdered his daughter and trying to comply with the interrogator's demands, Garrett nevertheless periodically questioned whether he was admitting to a crime he did not commit. Confusion and distress explains why Garrett denied that he had anything to do with his daughter's murder at one moment, and at the next tried to supply Converse with the details he was seeking. Garrett repeatedly told the interrogators that he did not know or was not certain of his answers, that he was exhausted (Garrett Transcript 1995, p. 357), frightened (Garrett Transcript 1995, p. 377), and had felt railroaded (Garrett Transcript 1995, p. 377). By the end of the fourteen-hour interrogation, Edgar Garrett had signed four increasingly detailed statements describing how he murdered his daughter. Garrett recanted his confession shortly after the interrogation ended.

Multiple discrepancies between Garrett's statements and the physical evidence demonstrate that his confession was unreliable: (1) He confessed to bludgeoning his daughter following a walk through new-fallen snow in a park, and then dumping her body in a river. However, Michelle's coat was not found with her body, and it lacked stab marks (suggesting she had been killed indoors and then transported to the river bank). (2) The police officer who first arrived at the crime scene saw tire tracks and bloody drag marks from the point where the car stopped and Michelle's body was unloaded, yet Edgar Garrett had no car. (3) The officer did not see any footprints in the snow-covered field leading to the river's edge. (4) The only footprints and drag marks in the snow led from the tire tracks to the river's edge. The footprints showed that the killer returned to the car after dumping Michelle's body in the river. (5) Michelle Garrett was stabbed to death. When her body was found weeks after Edgar Garrett confessed, it had 34 wounds. Garrett confessed to clubbing Michelle to death—which the police admitted was their theory of what happened. (6) The axe handle with which Garrett allegedly hit his daughter did not carry any traces of her hair or blood. (7) Michelle Garrett's head showed no evidence of blunt force trauma.

On November 7, 1995, a jury acquitted Edgar Garrett of capital murder. It was the prosecutor's first loss of a homicide case in thirty-one years. Following the verdict, police in Goshen, Indiana reversed their policy and stopped tape-recording interrogations.

Coerced-Persuaded Confessions: The Case of Tom Sawyer[48]

On November 3, 1986 Police in Clearwater, Florida discovered the nude body of Janet Staschak, who had been tortured and brutally murdered in her apartment. During a routine neighborhood canvass, a detective interviewed her next door neighbor, Tom Sawyer, and decided he was their prime suspect. This decision was reached solely because Sawyer's face flushed and he appeared embarrassed by their questions. The Clearwater police did not know that Tom

Sawyer was a recovering alcoholic who suffered a severe anxiety affliction and personality disorder that started when he was a teenager. The disorder caused him to sweat profusely and blush a deep red in the course of ordinary social interaction, especially when he felt himself being observed by others. Sawyer's personality disorder contributed to his suggestibility and made him desire to please others, especially authority figures.

The police lured Sawyer to the station for an interview the following day; thinking that they needed his help, he eagerly agreed. Sawyer had only slept three and one-half hours the night before, and had gone to the police station immediately after eight hours of physical labor.

Clearwater police detectives Peter Fire and John Dean interrogated Tom Sawyer for sixteen-hours—from 4 p.m. on November 6, 1986 until 8:00 a.m. on November 7, 1986. The detectives initially questioned Sawyer about his family life, personal history and relationship with the victim. Straining to be cooperative, Sawyer hoped that his answers would help solve the murder. He never imagined that he might be a suspect. During this part of the interrogation, Sawyer revealed his background as an acute alcoholic, his blackout experiences, and the long-standing anxiety he experienced in social settings.

Flattering Sawyer, the detectives insisted that they needed his help to solve the murder. They wanted him to help create a "scenario" in which the crime could have taken place. They plied him with leading questions in order to supposedly work out the scenario. The purpose of Fire and Dean's scenario technique was to get Sawyer to reveal independent knowledge of the crime facts so that they could confront him and thus commence an accusatory interrogation. As the procedure played out, all that happened was that Sawyer repeated facts introduced by the interrogators. Nevertheless, the detectives accused him of committing the crime, and claimed he had provided details only the murderer could have known.[49]

The interrogation continued for another twelve hours, during which Sawyer repeatedly denied his guilt until he was persuaded that he could have committed the crime and not remembered it. The detectives claimed that the evidence established Sawyer's guilt beyond any reasonable doubt. After all, his scenario was identical to how the crime actually happened, and thus Sawyer possessed the uncommon knowledge that only the killer could know; later they told Sawyer that scientific evidence confirmed his guilt. They also repeatedly suggested that Sawyer did not intend to harm Janet Staschak, but accidentally killed her because she sexually aroused him and then refused him. "It was an accident...You're not a murderer. Not a murderer" (Sawyer Transcript 1986, p. 135).

Believing the result would clear him, Sawyer agreed to take a lie detector test. Prior to the polygraph, Detective Fire angrily told Sawyer that he was guilty of the murder and should just get on with the confession, a strategy that surely primed Sawyer to fail the test. Yelling, Fire claimed that they had fingerprint and hair evidence that would work against him, and that they

believed Sawyer had intentionally killed Staschak. Visibly shaking, nervous and sweating, Sawyer took the test, in violation of a well known industry standard that the reactions of an aggressively interrogated suspect are meaningless. Tom Sawyer's polygraph had been improperly administered and the results were, in fact, uninterpretible. Detective Dean, however, immediately pronounced Sawyer guilty, declaring that the test proved him "a fucking liar" (Sawyer Transcript 1986, p. 167) and that his "heart pumped the needles right off the screen" (Sawyer Transcript 1986, p. 167).

The false polygraph results shattered Tom Sawyer's confidence in his innocence and thus diminished his ability to resist the detectives' demands that he confess. Following the test, the detectives no longer offered Sawyer the escape that he must have killed Staschak accidentally, but instead emphasized that only by "cooperating" and "telling the truth" could he avoid a charge of first degree murder. They emphasized the scientific basis of the polygraph examination and added that the fingerprint and hair samples would also conclusively demonstrate Sawyer's guilt. Though Sawyer maintained that he had no memory of having committed the crime, the detectives responded by suggesting that he was blocking out his memory of killing Staschak.

The contrived explanation for his memory gap was that Sawyer denied the truth of his guilt just as he had for years denied his alcoholism, that the polygraph results showed his unconscious mind expressing guilt, and that he must have had a "dry blackout" during the murder. Sawyer had not had a drink in over thirteen months, and had never heard of a dry blackout—a phenomenon that does not exist. Shaken by the polygraph result and exhausted from his lack of sleep, Sawyer entertained the possibility that a blackout explained his lack of memory. "You got me almost convinced I did, but...I don't know," replied Sawyer (Sawyer Transcript 1986, p. 182). When Dean next told Sawyer that his hair samples matched hairs found on Staschak's body—a complete lie—Sawyer's confidence in his innocence collapsed altogether. "I still can't believe I did it. I guess all the proof's in" (Sawyer Transcript 1986, p. 204). Sawyer thus accepted the hypothesis that he inexplicably "blacked out" during the killing.

Once Sawyer acceded to the interrogators' demands and conceded his guilt in the abstract, the focus of the interrogation shifted to eliciting details of the crime. Though he had become persuaded of his guilt, Sawyer was unable to provide any new information. The detectives suggested that he talk about mental pictures of the murder. They told him to trust the "pictures" even if they were not in the correct sequence and that they would check out the facts later (Sawyer Transcript 1986, p. 211):

> Dean: You want to make this story up. Let the pictures roll and let's hear the story. Let's hear the story. Let's hear the story and then we'll ask at the end is this something you remember.

> Fire: One, two, three, go. Let's go Tom.
> Dean: Make up a story. Let's hear the story.

The confabulations that Sawyer described were taken as the substance of his confession, despite his inability to actually remember anything about the crime and the gross factual errors in his statement. Even after coming to accept as fact that he had killed Ms. Staschak and confabulating an account of the crime, Sawyer still resisted the interrogators' demands that he make an unconditional admission of guilt. "I think I just threw her on the floor in the bedroom" (Sawyer Transcript 1996, p. 237); "Maybe I took the keys with me out of the car" (Sawyer Transcript 1996, p. 243); "I would have cut [the tape], I guess" (Sawyer Transcript 1996, p. 264).

More than fifty times, the detectives threatened Sawyer with the charge of first degree murder if he did not confess. They were attempting to get him to realize that he faced a possible death penalty that could be avoided only if he cooperated and confessed. Despite their repeated attempts to frame his choice as one between life and death, Sawyer gave no indication that he perceived or appreciated the choices. The tactic of communicating a death threat by implication had failed with Sawyer.

This failure denied the interrogators the motivator they needed to coerce a straightforward confession. Their problem was exacerbated by the fact that the interrogation was being tape-recorded. Far from constraining Sawyer's willingness to talk, the taping constrained the detectives from explicitly threatening Sawyer with the death penalty. They waited until Sawyer could be separated from the bugged interrogation room to make their next move. According to Sawyer, during a bathroom break Detective Fire stopped him in the hallway and let him know, in no uncertain terms, that he would receive the death penalty if he did not cooperate. In the final period of the interrogation, Fire overcame Sawyer's lingering resistance to giving an unqualified confession and gained compliance by reminding Sawyer about the hallway conversation.[50]

Tom Sawyer's confabulations were labeled as a confession to the murder and rape of Janet Staschak, despite the fact that his post-admission narrative was demonstrably false. For example, the detectives persuaded Sawyer to admit to both vaginal and anal intercourse, yet the medical examiner subsequently reported no evidence of sexual assault. Moreover, Sawyer was still unable to supply police with any information about the victim's missing clothing, missing keys, or the tape used to bind her. Nevertheless, prosecutors charged him with both the murder and sexual assault of Janet Staschak. Following a six-week-long suppression hearing in the Spring of 1988, Pinellas County Judge Gerard J. O'Brien, Jr. (*State v. Sawyer* 1990, pp. 290-291) ruled that the confession had been coerced as a result of:

[t]he cumulative weight of enforced sleeplessness, doubtful polygraph test results, the lengthy sixteen-hour serial interrogation with no meaningful breaks, the "scenario" of unabashedly leading questions, the denial of requests "to rest," the implied inducements to make a deal for favored consideration, the threat of a return to drinking, the use of Sawyer's known blackout history to undermine his reliance on his own memory, and the refusal to honor his Miranda rights...

With his improperly obtained confession excluded from evidence, Tom Sawyer was released from jail after more than fourteen months in pre-trial incarceration.

CONCLUSION

Three procedural safeguards are necessary to protect innocent defendants against the admission of false confession evidence into trial proceedings and the subsequent likelihood of wrongful conviction. First, courts should adopt mandatory tape recording requirements in felony cases, as is already done in Alaska (*Stephan v. State* 1985) and Minnesota (*State v. Scales* 1994) and by many police agencies (see Geller 1992).[51] Recording creates a complete record of the interrogation, and thereby permits police, prosecutors, judges, juries and experts to accurately assess the voluntariness and reliability of confession statements.

Perhaps most notably, taping would permit an objective adjudication of the "swearing contest" between interrogators and suspects about who said what during the interrogation. Each side would be protected against errors and false allegations made by the other. Finally, judges would be relieved of the embarrassment of having to rationalize their choice to believe one side or the other when a swearing contest erupts by relying on the fiction of making a "credibility judgment" based on the demeanor of the witness.

Equally important, taping would insure the legality and improve the quality of interrogation, as it has done in England (see Rose 1996). Without the use of recording, numerous American false confession cases—including several discussed in this paper—probably would never have been acknowledged, and innocent citizens almost certainly would have been tried, convicted of murder, and imprisoned or executed.

Second, the admissibility of confession evidence should be allowed only when the accused's guilt is corroborated by independent evidence. Properly taken true confessions can provide information that confirms the confession's trustworthiness and leads to new corroborating evidence; false confessions will not. Research demonstrates that police interrogators all too frequently come to believe that a suspect is providing them with key details of the crime that only the perpetrator could know when, in fact, an innocent suspect is merely regurgitating information that police fed to him in the first place, inferring what the interrogators suggested through leading questions, or making guesses that will later be proven wrong.

Police officers should be trained (1) to seek clear-cut corroboration for every confession; and (2) to recognize that a suspect's failure to satisfy this requirement is a red-flag that he may be innocent. Police will not be in a position to be self-monitoring and self-critical until they are given adequate training about how and why interrogation works. Only awareness that false confessions happen and reliance on objective standards for evaluating a confession statement will allow police to stop themselves from making the all too frequent mistake of arresting an innocent suspect.

Third, because confession is as damning and persuasive as any evidence that can be brought against a defendant, all confessions should meet a reasonable standard of reliability before being admitted. Because confession evidence is potentially dispositive, it can either badly mislead or greatly assist a jury. The decision to admit a confession should be based not only on voluntariness but also on the fit between a defendant's post-admission narrative and the facts of the crime.

A confession that cannot withstand objective evaluation and reach a minimum standard of accuracy should be excluded because its prejudicial impact greatly outweighs its probative value. Such grossly defective confessions are dangerous because they have the potential to confuse and mislead jurors and thereby contribute to convicting the innocent.

Psychological interrogation very often produces evidence that, in one way or another, bears on a defendant's guilt. Unfortunately this method, along with torture and the third degree, can cause a defendant to say "I did it" even though he is innocent. The only trustworthy evidence of a defendant's guilt or innocence that comes from interrogation is his post-admission narrative of the crime. Because confession statements are sometimes evidence of guilt and sometimes evidence of innocence, jurors should be instructed to rely on the fit between the defendant's narrative and the facts of the crime when deciding how to classify and weigh confession evidence.

American society sometimes requires jurors to take up the heavy burden of determining whether a person will be freed, imprisoned or executed based entirely on the words he spoke while undergoing interrogation. Social science research has led us to an understanding of why confessions can be evidence of guilt or innocence and how to understand why people sometimes give false confessions. The jurors' sobering task can be made far less awesome by allowing them to know precisely what the damning words were and exactly what techniques elicited them. This can be accomplished by adopting a mandatory recording requirement and informing jurors about the range of influence responses that can be caused by interrogation tactics. Empowered by information and education, jurors can intelligently decide whether the defendant's words are evidence of guilt or evidence of innocence (*Stephan v. State*, 1985; *United States v. Hall*, 1996).

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NOTES

1. Mock jury research shows that people find it difficult to believe that anyone would confess to a crime that he or she did not commit (see Kassin and Wrightsman 1981, 1980).

2. For the purposes of this paper, a false confession is defined as detailed admission to a criminal act that the confessor either did not commit or is, in fact, ignorant of having committed. As the term is used, false confession is not a matter of degree: rather, the cases discussed in this paper involve individuals confessing to offenses of which they are *entirely* innocent.

3. Incidence refers to the number of false confessions occurring in a specific time period.

4. Prevalence refers to the number of false confessions in the population accumulated across all time periods.

5. In addition, innocent individuals—even if they are convicted—do not always publicly retract their false confessions (Gudjonsson 1992).

6. The dark figure of false confession refers to the actual number of unknown false confessions that occur every year.

7. We have been unable to find empirically well-founded estimates of error in the criminal justice system. At one end of the spectrum of published opinion, Paul Cassel (1996, pp. 480-481) has speculated that 35 convictions based on false confession occur every year. At the other end, Huff et al. (1996, pp. 53-66) have speculated that approximately 840 (8.4% × 10,000) wrongful convictions based on false confessions occur annually.

8. In England, where police interrogation techniques are far milder than in America, researcher have also recently documented numerous cases of false confessions to police (see Gudjonsson, 1992). Since 1986, English police have been required to contemporaneously record custodial interrogation (see Zander 1990).

9. "*Pragmatic implication*" refers to information processing that occurs "between the lines" or is inferred from what the speaker is saying or suggesting. Cognitive and language research indicates that this phenomenon is commonplace and normal (see Harris and Monaco 1978).

10. Police interrogation training courses and seminars (including the introductory and advanced courses put on by the Chicago-based firm Reid & Associates) rarely, if ever, even mention the subject of false confessions (see Leo 1994). American police interrogation training manuals also fail to advise police of the social psychology of false confessions or instruct them how to recognize when their tactics are leading an innocent suspect to falsely confess. In short, text writers and interrogation trainers demonstrate a studied indifference to the extensive psychological research literature on false confessions (see e.g., Jayne and Buckley 1992; Inbau et al. 1986). In contrast, English police interrogation manual writers are well aware that psychological interrogation methods may induce confessions from the innocent (see Walkley 1987).

11. For example, the police interrogators who elicited demonstrably false confessions in the well-known cases of Peter Reilly, Tom Sawyer, and Paul Ingram still insist that these individuals are factually guilty (see O'Brien 1993; Weiss 1989; Wright 1994). For an example of a forthright post-hoc analysis of an investigation and series of interrogations gone horribly wrong, see Kimball and Greenberg (1993a, 1993b, 1993c).

12. Jurors appear to simultaneously weight confession evidence too heavily and to be generally unaware of the reality of false confessions (see Wrightsman and Kassin 1993).

13. This happened in the well known cases of Paul Ingram and Bradley Page (see Ofshe 1992; Page 1990).

14. For an introduction to maximization of expected utility approaches to decision-making see generally (Ofshe and Ofshe 1970; Edwards and Tversky 1967; Luce 1967; Rapoport and Chammah 1965; Von Neumann and Morgenstern 1944). For application of decision-making theory to confession, see (Hilgendorf and Irving 1981; Irving and Hilgendorf 1980).

The brief analysis of the decision to confess presented here sketches out only the general principles of interrogation influence and suspect decision-making in the context of an abstract rather than a concrete interrogation. (The case materials included in this article illustrate many of the influence tactics in operation and demonstrate suspects' responses to them). This presentation will forgo discussion of the interrogation environment and the details through which the strategies discussed are implemented. The present focus is on variables that directly influence the decision to confess. The decision model will be further explicated and directly applied to actual interrogations in Leo and Ofshe (1997).

15. Because the large majority of interrogators and criminal suspects are men, we will use male pronouns throughout this papers.

16. Despite the fact that Inbau, Reid and Buckley's (1986) text on interrogation methods offers neophyte interrogators lists of supposedly telltale signs of innocence and guilt that can be readily detected in the behavior of suspects, there is no impirical evidence that confirms their down home wisdom. As a practical matter, teaching interrogators that they can distinguish the guilty from the innocent based on behavioral symptoms is likely to do nothing more than reinforce their belief that the suspect they have chosen to interrogate is guilty. Because it confirms his presumption of the suspect's guilt, the interrogator will be likely to selectively perceive and remember out of context examples of behaviors he has been taught are indicators of deceptiveness or guilt (see Ekman 1992; Rosenthal 1976). There are no behavior cues that reliably distinguish a person who is upset and distressed about being accused of a crime he committed from a person who is upset and distressed about being accused of a crime that he did not commit.

17. See pp. 212-215 for further discussion about estimating the fit between the contents of a confession statement and the crime facts.

18. This discussion presumes that a homicide is being investigated.

19. Some innocent suspects report that they eventually give up trying to understand what is happening, accept that they will be unable to convince the interrogator of their innocence and decide to try to find a way to tell the interrogator what he demands to hear without admitting guilt—in other words, they try to explain away false inculpatory facts because the pressures of the interrogation have overwhelmed them. They continue to maintain their innocence, but defend themselves in terms of the interrogator's invented evidence. They find themselves trying to craft a story that offers an explanation for the fabricated evidence that does not involve them in a crime.

20. The major difference between the economist's hypothetical, rational, fully informed decision-maker and the social psychologist's analysis of the decision maker is that the economist assumes that the decision maker chooses among all the possible alternatives whereas the behavioral analyst seeks to determine what alternatives the decision maker considered when the decision was actually made. To be rational is to select the best of the alternatives under consideration. The classical economist's decision maker is thorough in his search for alternatives as well as rational, whereas actual decision makers often make choices based on incomplete or flawed information.

21. Whether a confession elecited by an interrogator's direct appeal to a system benefit, constitutes a coerced statement is obviously a legal decision. If, however, the facts of a particular interrogation fit the pattern outlined in the decision model, it would be appropriate to conclude that the confession was elicited because the interrogator succeeded in leading the suspect to believe that a significant benefit (in the form of lenient treatment) flowed from choosing to confess.

22. Following the interrogation, the detective administered a questionnaire to Wright. One of the questions asked was: Why did you decide to "tell the truth" (i.e., confess)? The reason, Wright answered, was that the interrogator could get the jury to believe a version of what happened that it would not accept from him.

23. Richard Ofshe served as a consultant to the defense in *State of Florida* v. *Martin Salazar* (1996), had access to the complete file and testified on Mr. Salazar's behalf at a motion to suppress his confession. Due to the events reported below, the suppression hearing was never completed.

In the interrogation of Martin Salazar, the interrogator used the accident scenario technique to describe a crime that was a strangulation by ligature following a vicious beating and a possible rape. The accident scenario recast the crime as an accidental death that happened in the course of the victim's requested "rough sex" and desire for a near asphyxiation sexual experience.

One of the problems with the accident scenario technique is that some interrogators appear to use it almost as a matter of regular practice in their cases, as in the Salazar case. If used without any thought about whether the technique could realistically work with someone actually knowledgeable of the crime and directed against a desperate and demoralized innocent suspect, the accident scenario can end up being more effective for eliciting confessions from the innocent than from the guilty.

Given the crime scene facts, the killer had to know that the victim had been severely beaten, that a knotted extension cord was pulled so tightly around her neck that it was buried deeply, and that her jewelry was stolen. A suspect who had actual knowledge of the crime facts would probably be less likely to take the accident lure, since he would recognize the impossibility of an accident explanation for the crime. The detective who formulated the accident scenario admitted that he recognized that the crime could not possbily have happened as he described it in the scenario presented to Martin Salazar (Deposition of James Mahoney 1996). Mr. Salazar, however, lacking actual knowledge of the crime scene, agreed to the accident scenario after detectives introduced erroneous and false evidence that placed him at the scene of the murder. If Mr. Salazar had known the crime facts, it would have been more difficult for him to agree to the detective's obviously false confession scenario.

The post-admission narrative was taken by detectives who were not present when Detective Mahoney used the accident technique. Mr. Salazar was asked to provide a detailed description of the crime and was unable to do so. He also refused to agree that he had done any of the acts that correctly described the crime. He eventually broke down and admitted that he was lying—he had not seen the victim the day she died and was only telling the false story because Detective Mahoney had told him he would never get out of jail if he did not confess, but could go home if he agreed her death was an accident (Salazar Transcript 1996).

Certain additional facts came to light after we selected the Salazar case to illustrate the use of the accident technique and after we wrote the preceding paragraphs. A fingerprint impression, in the victim's blood, had been found on the socket end of the extention cord used to strangle her. It was undoubtedly the fingerprint of the killer. Early in the investigation the procecutor, Bunnie Lenhardt, sent the extension cord along with Martin Salazar's fingerprint to the Florida Department of Law Enforcement for comparison. She had reported to Mr. Salazar's attorney, Peggy Natale, that although Mr. Salazar's print was not a match, he could not be excluded.

Shortly before trial, new information was discovered. Ms. Natale took the deposition of the technician who did the examination and learned that Mr. Salazar was excluded. The technician also reported that this fact had been passed on to both Ms. Lenhardt and to the police. Immediately after Ms. Natale filed a motion bringing this flagrant *Brady* violation (see *Brady v. Maryland* 1963) to the court's attention, the state's attorney for Palm Beach County dismissed charges against Mr. Salazar.

After months of awaiting trial in a death penalty case based on nothing but his false confession, Mr. Salazar was released on October 10, 1996.

24. For early research on the social psychology of police-induced false confessions in America, see Bem (1966, 1967), Driver (1968) Zimbardo (1967, 1971) and Maslach (1971). In England, the problem of false confessions has been the subject of extensive study for almost two decades (see Gudjonsson 1992 for a review).

25. This partial explanation of coerced-internalized false confessions builds on the work of Gudjonsson (1991, 1990, 1989, 1988, 1987, 1986, 1984b, 1984a) and his colleagues (Gudjonsson and Hilton 1989; Gudjonsson and Clark 1986; Hansdottir et al. 1990).

26. Even the famous interrogation of Paul Ingram failed to produce an internalized belief (Ofshe 1992; Wright 1994), despite the fact that Mr. Ingram believed that he was the leader of a satanic cult for approximately six months. Once the social structure (police, authority figures and family) supporting and shoring up Mr. Ingram's fragile belief system was withdrawn, his confidence ebbed, he realized that his new beliefs were unsupportable by fact and he rejected them. Although Mr. Ingram's belief endured for an exceptionally long time, so did his interrogation. The beliefs he developed crumbled once his six-month long series of interrogations ended.

27. This appears to be common among juveniles who make voluntary false confessions (see Gudjonson 1992).

28. The stress factors involved in a stress-compliant confession are aversive (i.e., punishing and painful) and might reasonaly be termed coercive in the legal literature and in the law. For analytic purposes, however, it would be a mistake to lose the distinction between cognitive factors that influence a decision (e.g., promises of harsh or lenient punishment) and stressors that affect decisions (e.g. intense verbal aggression, displays or hostility, insult or even deprivation of a necessity such as food, water, or sleep). The classificatory system presented above distinguished between two causes of compliant confession and necessitates that a judgment be made in every case about the confession's principle cause.

29. See, for example, Inbau, Reid and Buckley's (1986) description of how to establish the power of the interrogator, how to control and design the physical setting of the room, the importance of the interrogator's demeanor and how to manipulate a suspect's anxiety.

30. Since both of the cases described below have not yet been resolved, as of this writing the names of the defendants have been changed. Sometimes interrogators discover and capitalize on a suspect's exceptional vulnerabilities. For example, the day-long interrogation of Jane Doe (*State v. Jane Doe* 1996) took place during an auto trip from Small City to a point a few hours away on the coast. Early in the day Ms. Doe revealed that she had a life-long intense fear of heights. When the group arrived at the beach and the adjacent high bluffs from which Ms. Doe's male friend had disappeared weeks earlier, the interrogators insisted that Ms. Doe accompany them up a narrow trail that worked its way up the sheer bluff. They believed that it was from this trail that the victim had fallen to his death in the ocean. Ms. Doe resisted going on the walk because of her fear of heights. She protested that she would be of no help on the trail since she had not accompanied the decedent on the walk from which he never returned. In fact, there was no evidence that the victim had fallen from the bluffs. All that was known was that he disappeared and his body washed up weeks later on the coast many miles north of the beach at which he was last seen.

Prior to maneuvering Ms. Doe onto the trail, the interrogators had been suggesting that she knew something about the killing that she was not telling them or that she had blocked out her knowledge. Ms. Doe maintained that she knew more about the circumstances of her friend's disappearance than what she had originally reported. The interrogators had also emphasized that if an accident happened there was nothing to be afraid of as far as the law was concerned and that they were overworkd and needed to close this file. Partway up the trail pressure was again directed at Ms. Doe to agree to the accident scenario. This time the additional distress caused by her fear and panic related to heights, in conjuction with the suggestion that admitting to the accident had no cost led Ms. Doe to comply.

John Doe was a seventeen-year-old middle-class black male at the time he was interrogated by police in Major City (*State v. John Doe* 1996) about his alleged connection to a murder in his neighborhood. Mr. Doe had been implicated by the statement of a young woman who claimed that her former boyfriend and Mr. Doe had conspired to murder and rob a local drug dealer. She subsequently recanted her statement and Grand Jury testimony explaining that she was angry at her former boyfriend because he had abandoned her for an other young woman. This left her

alone, pregnant and penniless. Mr. Doe was an acquaintance of her boyfriend's and was implicated simply because two people had to be involved in the killing.

Both John and his mother believed that he had been requested to appear at the police station because he was a witness who supported a complaint made by a group of neighbors that a certain young man was carrying a gun around their neighborhood. Mr. Doe was separated from his mother at the station. She was prevented from speaking with him when she realized that something unusual was happening. John was interrogated and denied any involvement in the killing.

At one point he was left to stew about the accusations and his situation in a very small, windowless room. Although he had always tried, unsuccessfully, to hide the fact from his friends and his family, Mr. Doe was claustrophobic and suffered intense anxiety when confined in a small space. His desire to escape the room in which he was being held became so intense that when a State's Attorney came to ask him if he was ready to confess he agreed on the condition that he be allowed to give the confession in another room. She was more than willing to comply with John's odd request and took his confession.

31. Gudjonsson and his colleagues have also conducted extensive research on individual differences in interrogative suggestibility, showing that it is related to personality traits such as intelligence, memory, assertiveness and self-esteem (see Gudjonsson 1992 for a review).

32. Some interrogations will incorporate both excessive stress and classical coercion. The classification of a confession as principally caused by one of the other variables depends on the facts of the interrogation under study.

33. Note that all beliefs that one did not do something are ultimately based on a persons; inability to retrieve memory of the event at issue after making a genuine attempt to do so. The failure to retrieve the memory is often the only evidence available to anyone that they did not do some particular act.

34. Disputes often arise as to who introduced crime scene information into the pre-admission phase of the interrogation and what the suspect independently knew. For a variety of reasons, all testimony about fine details of a complicated, lengthy, sometimes heated and often subtle interrogation is compromised if the session is not recorded. Problems of selective perception, lack of notes, memory decay, leading questions, guesses based on pragmatic implication and lying all contribute to the difficulties inherent in being sure that the pedigree of a fact discussed in the post-admission phase is uncompromised.

35. Frederick Crews (Personal Communication).

36. Richard Ofshe served as a consultant to the defense of the Tucson Four (as McGraw and three other young men came to be known). Both authors had access to the entire case files about the Temple Murders.

37. Since it was later established that McGraw had no involvement in the crime and the fact that the word "BLOOD" was found at the crime scene had been withheld from the public, McGraw probably learned this fact as a result of inept questioning by the detectives who interviewed him. This is far more likely than the alternative, that without leading, prompting, or giving hints, McGraw by chance answered that the particular word had been written on the wall in blood.

38. For example, McGraw named Robert Torres, Tony Torres, and Victor Zarate as co-participants in the murder, but when the crime occurred Robert Torres was in prison, Tony Torres was in California, and Victor Zarate's image was being recorded on a timed videotape at the Tucson dog track where he worked. In addition, McGraw told investigators that he had seen several guns (including a 9mm Glock, a .380 caliber automatic, and a nine millimeter Beretta) used during the crime that the investigators knew had not been fired in the Temple. And McGraw told investigators that one of his accomplices killed a young girl, but the only female murder victim was a seventy-one year-old nun.

39. Richard Ofshe served as a consultant to the Office of the Governor of Missouri in connection with the decision to pardon Johnny Lee Wilson.

40. Johnny Lee Wilson's IQ was estimated to be in the 60s or 70s, and psychologists described him as a slow-talking, slow-thinking individual who interacted with people like a 10 year old.

41. Like most people with retardation, Wilson almost certainly did not understand the content or the significance of the rights to whose waiver he consented. Wilson later told his court-appointed psychologist that he understood rights to mean "right from wrong. I'd rather do right" (see Shapiro 1994).

42. Had Wilson's alibi been evaluated, the detectives would have discovered that Wilson and his mother had been seen shopping at Ramey's Market prior to and through the moment when smoke from the fire was first observed by customers and staff of the store.

43. 13 year old Melanie Houser witnessed someone on Martz's property at the time of the arson. She thereafter helped police develop a composite sketch that did not hear any resemblance to Johnny Lee Wilson. After arresting Wilson, however, police did not reinterview her. When *U.S. News & World Report* later contacted Hauser, she insisted: "The man I saw definitely was not Johnny Wilson" (Shapiro 1994).

44. Richard Ofshe served as a consultant to the defense in the *State of Arizona v. Dante Parker* (1991). Both authors had access to the entire case file.

45. McGraw, for example, identified two individuals whose solid alibis excluded them. In addition, McGraw and the other three false confessors implicated Victor Zarate, yet he had been captured on timed videotape at the Tucson dog track at 11 p.m. on August 9, 1991, making it impossible for him to have committed the murders. In addition, none of the suspects could identify the weapons or even the location of the Temple with any specificity. Ballistics tests showed that the rifle that Leo Bruce identified as the murder weapon had not, in fact, been used; McGraw identified weapons that the investigators knew had not been fired in the temple. Despite their intense efforts, the multi-agency task force could find no physical evidence corroborating any of the four confessions. Concomitantly, each of the confession contained dozens of statements that contradicted the existing evidence.

46. The real Temple murderers, teenagers Alessandro Garcia and Jonathan Doody, were idendified after Air Force investigators discovered a report about a Marlin Rifle that a security officer had seen on the backseat of a car entering the air force base that adjoined the Temple. A task force member had taken the rifle for ballistics testing on the day Michael McGraw called from Tucson. In the excitement that followed, the rifle was left behind an office door for approximately a month before being sent to the lab. Testing proved the gun to be the murder weapon. Eventually Garcia confessed to the crime and pleaded guilty to first degree murder, and a jury convicted Jonathan Doody of felony murder.

47. Richard Ofshe served as a consultant to the defense in the *State of Indiana v. Edgar Garrett*. Both authors had access to the entire case file.

48. Richard Ofshe served as consultant to the defense in *State v. Sawyer*. Both authors had access to the entire case file.

49. Since Sawyer's interrogation was tape recorded, it was possible to establish that each of the nine facts Sawyer was accused of knowing was introduced by the interrogators. Nevertheless, Detective Dean's written account of the investigation reported Sawyer to have introduced each fact. Apparently Dean's perceptions were shaped by his position bias.

50. Detective Fire denies having issued a death threat in the hallway. The Detective's denial is inconsistent with the final recorded portion of the interrogation.

51. For further analysis of the benefits of tape-recording, (see White 1996; Schulhofer 1996; Cassell 1996; Schulhofer 1996; Leo 1996b; Berger 1993; Kane 1993; Geller 1992; Kamisar 1980; and Williams 1979).

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PRIMARY MATERIALS (In possession of the authors)

The Deposition of Detective James Mahoney (1996)
The Interrogation Transcript of Leo Bruce (1991)
The Interrogation Transcript of Edgar Garrett (1995)
The Interrogation Transcript of Michael McGraw (1991)
The Interrogation Transcript of Mark Nunez (1991)
The Interrogation Transcript of Dante Parker (1991)
The Interrogation Transcript of Martin Salazar (1996)
The Interrogation Transcript of Tom Sawyer (1986)
The Interrogation Transcript of Robert Smith (1991)
The Interrogation Transcript of Johnny Lee Wilson (1986)
The Interrogation Transcript of Cheval Wright (1994)
The case file in *State v. Jane Doe* (1996)
The case file in *State v. John Doe* (1995)