

Forthcoming - Michigan State Law Review

Essay: A Safety Doctrine for the Criminal Justice System

Boaz Sangero & Mordechai Halpert*

Introduction

- I. Safety in Aviation, Engineering, and Medical Devices**
- II. The Need for Safety in the Criminal Justice System**
 - 1. A Proposed Definition**
 - 2. A Moral Duty**
 - 3. Economic Justification**
 - 4. Examples of Absence of Safety**
- III. Toward Safety in the Criminal Justice System**
 - 1. The Hidden Accident Principle**
 - 2. Assessment of Risks**
 - 3. The Adaptation of "Reasonable Doubt" standard to the Safety Doctrine**
 - 4. Some Specific Safety Solutions**

Conclusion

Abstract

Criminal law, unlike other risk-creating fields, currently lacks any modern safety doctrine. In light of the proven phenomenon of wrongful convictions and the severe harm it causes to both those wrongly convicted and society, this Essay focuses on the necessary preliminary stages in developing a safety doctrine for the criminal justice system. Under our conception, criminal law is a "safety-critical system": it deals with matters of life and death. We view false conviction to be a type of accident, similarly to a crash of a fighter airplane. This comparison is not only metaphorical, but quite literal when the damage is assessed from an economic standpoint. Care and safety in criminal law do not merely operate to raise the beyond-reasonable-doubt threshold in that the number of acquittals increases at the expense of the number of convictions. Rather, care is an investment of resources in reasonable safety measures whose cost is less than their expected harm, since the number of both false acquittals and false convictions will be reduced. The divergence in safety awareness between the aviation, engineering, and medical fields, on the one hand, and the criminal justice system, on the other, is linked to what we term as the "Hidden Accident Principle" of

* Dr. Mordechai Halpert is a physicist who deals with research and development in the industry. Prof. Boaz Sangero is the Head of the Criminal Law & Criminology Department at the Academic Center of Law & Business, Israel. We wish to thank Ron J. Allen, Alon Harel, Rinat Kitai-Sangero, Doron Menashe, Dana Meshulam, Shay Ozari, Iddo Porat, Michael Risinger, Emily Schaeffer and Alex Stein for their comments and feedback during different stages in the writing of this Essay. We thank also the participants in workshops and conferences at the European University, Fiesole, Florence, Italy (2011 International Evidence Conference), The Academic Center of Law & Business, Israel, the China University of Political Science and Law, Beijing, China (2011 International Evidence, Science and Justice Conference), and Goethe University, Frankfurt, Germany (2011 Law, Science & Technology Conference).

criminal law. False convictions are typically unseen. We demonstrate how the legal system is completely unaware of its poor safety practice. Accordingly, we propose some preliminary principles for safety in criminal law, in particular, the idea of understanding modern safety from other fields such as engineering.

Introduction

Imagine an airline that markets its flights as follows:

Our airplanes are exceptionally comfortable, with lots of space between the passenger seats. Our food is gourmet, and our crew completely professional and polite. We show newly-released movies and even offer massages to passengers during the flight. Our prices are modest; our crashes rare (only 1%).

Would anyone buy a ticket with this airline given its crash rate of 1 out of 100 flights? Of course not. But as we will show in this Essay, although conviction of the innocent is at a far more prevalent rate than 1% of those accused, criminal law, unlike other risk-creating fields, currently lacks any form of a modern safety doctrine.

The Innocence Project, which has exposed thus far over 270 wrongful convictions through DNA comparison testing,¹ and recent studies show that conviction of the innocent is not an uncommon phenomenon.² This Essay looks at ways to reduce the rate of false convictions.

¹ It should be noted that the fact that the results of DNA testing could lead to an overturning of a conviction does not mean that they necessarily do. The results in fact usually lead to a reopening of the investigation of the incident. Convictions are overturned when, for instance, the defendant emerges as innocent in the renewed investigation, or when the true perpetrator is revealed, or errors are exposed in the gathering of the evidence that led to the conviction. DNA test results alone are not always sufficient to acquit. For discussion of an example of a case in which, despite the DNA test results' indicating the defendant's innocence, he was not acquitted, see Boaz Sangero & Mordechai Halpert, *Proposal to Reverse the View of a Confession: From Key Evidence Requiring Corroboration to Corroboration for Key Evidence*, 44 U. MICH. J. L. REFORM 511 (2011).

² *Id.* See also INNOCENCE PROJECT, KNOW THE CASES, available at <http://www.innocenceproject.org/know/Browse-Profiles.php>; Steven A. Drizin & Richard A. Leo, *The Problem of False Confessions in the Post-DNA World*, 82 N. C. L. REV. 891 (2004); Boaz Sangero & Mordechai Halpert, *Why a Conviction Should Not Be Based on a Single Piece of Evidence: A Proposal for Reform*, 48 JURIMETRICS J. 43, 64-68, 72-76 (2007); Michael J. Saks & Jonathan J. Koehler, *The Coming Paradigm Shift in Forensic Identification Science*, 309 SCIENCE 892, 892 (2005).

In our view, the *legal system is a safety-critical system*.³ Since it deals with matters of life and death, any error in the system is likely to cause grave harm to both the individual and society.⁴ We maintain that a false conviction is an accident just like a fighter airplane crash. As we will show, this analogy is not only metaphorical, in the sense of the economic cost they both entail, but quite literal.⁵ Care and safety in law do not merely raise the beyond-reasonable-doubt threshold in that the number of acquittals increases at the expense of the number of convictions; rather, care is an investment in reasonable safety measures whose cost is less than their expected harm since the number of false acquittals *and* the number of false convictions will be reduced. Indeed, in tort law, the Hand formula stipulates that a tortfeasor's behavior is wrongful when the expected harm, given the probability of its occurrence, is greater than the cost of preventing it.⁶ It is our claim that this approach should be implemented in criminal law as well, which, to the best of our knowledge, completely lacks any elements of the modern notion of safety.

The path to safety in criminal law begins with scientific evidence. The needs of safety in the field of scientific evidence are comparable to its application in certain engineering fields, such as medical devices where safety measures are significantly developed and implemented. Indeed, the medical devices field offers proven, FDA-regulated safety solutions that could be applied to the context of scientific evidence, such as DNA testing.⁷ Yet in criminal law, there are no such precautionary measures,⁸ even, as we will see, with regard to non-scientific evidence, such as eyewitness testimony and confession.

Why have safety measures yet to be implemented in criminal law? Our answer is related to the fact that it is usually impossible to know that a wrongful conviction has occurred. This has led to a false sense of optimism that wrongful convictions are very rare. Thus, although there could conceivably be a very high rate of wrongful conviction, policymakers and the

³ Mordechai Halpert & Boaz Sangero, *From a Plane Crash to the Conviction of an Innocent Person: Why Forensic Science Evidence Should Be Inadmissible Unless It Has Been Developed as a Safety-Critical System*, 32 *HAMLIN L. REV.* 65 (2009). Definitions of a safety-critical system appear in engineering contexts: "A safety-critical system, subsystem, condition, event, operation, process, or item is one whose proper recognition, control, performance, or tolerance is essential to system operation such that it does not jeopardize public safety." 14 C.F.R. § 401.5 (2000).

⁴Life and death, given the existence of the death penalty in some states.

⁵ See *infra* Part II.2.

⁶B&P1. *United States v. Carroll Towing Co.*, 159 F.2d 169 (2d Cir. 1947) (Hand, L.); WILLIAM M. LANDES & RICHARD A. POSNER, *THE ECONOMIC STRUCTURE OF TORT LAW* 85-88 (1987).

⁷ Halpert & Sangero, *supra* note 3. See also *infra* Part II.3.

⁸ *Id.*

public are convinced that the system is almost perfect and see no need to invest any effort or resources in safety measures.

This issue is so fundamental in criminal law that we ascribe it the status of principle, what we term the “Hidden Accident Principle” in the criminal justice system. Any safety theory in criminal law must be based on this principle. Failure to understand and internalize it will only perpetuate the belief that the rate of accidents in the criminal justice system is negligible and that there is thus no need for safety measures in criminal law.

This Essay proceeds as follows: In Part I, we briefly describe safety in the aviation, engineering, and medical devices fields. In Part II, we explain why implementing safety in criminal law is necessary both morally and economically. We also show that existing simple safety measures currently being applied in other fields are not even considered in the criminal justice context. In Part III, we propose general principles for safety in the criminal justice system. We first offer a definition of safety, elaborate on the Hidden Accident Principle, and then assess the risk of false conviction. Risk assessment is an important component of any safety theory. We propose taking seriously the expected risk of the beyond-reasonable-doubt standard of proof as constituting a fundamental risk of false conviction and abandoning the erroneous belief that the system is close to perfection.

We further suggest augmenting the reasonable doubt standard with a safety component that will prevent anomalies by looking to other fields in which safety is crucial. Accordingly, conviction in a criminal trial would be possible only where (1) guilt has been proven beyond a reasonable doubt and (additionally) (2) all reasonable measures have been taken to ensure that false conviction does not occur. Moreover, we recommend specific, relatively easily-implemented solutions for several of the problems raised over the course of the discussion in the Essay. In the Conclusion, however, we explain why specific solutions are not a sufficient response to the general problem of wrongful convictions and call for the development of a comprehensive safety theory for criminal law.

I. Safety in Aviation, Engineering, and Medical Devices

The U.S. Air Force System Safety Handbook defines “safety” as follows: "Freedom from those conditions that can cause death, injury, occupational illness, or damage to or loss of

equipment or property, or damage to the environment."⁹ Until the end of World War II, the approach to safety in aeronautics was "Fly-Fix-Fly":¹⁰ an airplane would fly until an accident occurred, at which point, the reasons for the accident would be investigated, and the defects repaired. The airplane would then continue to fly. Sometimes, the lessons learned from a particular incident would be incorporated into the engineering rules and regulations for the specific aircraft. The aircraft would be operated accordingly until the next accident, when the process would be repeated. This approach is based on learning through past experience to repair defects, so that the same problems will not resurface. However, such a safety system cannot protect against other, unknown defects in an airplane that might cause mishaps of a different kind in the future.¹¹ But with the rapid development of technology and increasing cost of airplanes, it became clear that this approach was inadequate. The cost of learning from experience was too expensive. Thus, more than half a century ago, there was a shift in approach, and the modern science of safety was born.¹²

The following is one of the guiding principles in aviation safety developed by Stieglitz more than sixty years ago:

Safety must be designed and built into airplanes, just as are performance, stability, and structural integrity. A safety group must be just as important a part of a manufacturer's organization as a stress, aerodynamics, or a weights group.¹³

A second principle stated,

The evaluation of safety work in positive terms is extremely difficult. When an accident does not occur, it is impossible to prove that some particular design feature prevented it.¹⁴

The primary goal in the field of safety therefore became preventing accidents before they occur, without incurring the high costs of learning through experience: a "first-time-safe" approach.¹⁵ Accordingly, the Fly-Fix-Fly method was replaced by the "Identify-Analyze-

⁹ U.S. AIR FORCE, SYSTEM SAFETY HANDBOOK at vii (2000), available at http://www.system-safety.org/Documents/AF_System-Safety-HNDBK.pdf [hereinafter USAF HANDBOOK].

¹⁰ HAROLD E. ROLAND & BRIAN MORIARTY, SYSTEM SAFETY ENGINEERING AND MANAGEMENT 8-9 (1990); Halpert & Sangero, *supra* note 3, at 71.

¹¹ *Id.*

¹² *Id.* at 72.

¹³ ROLAND & MORIARTY, *supra* note 10, at 10.

¹⁴ USAF HANDBOOK, *supra* note 9.

¹⁵ Halpert & Sangero, *supra* note 3, at 71. See also Paul S. Ray, *System Safety Engineering*, in ADEDEJI B. BADIRU, HANDBOOK OF INDUSTRIAL AND SYSTEMS ENGINEERING 9.1 (2005); RICHARD A. STEPHANS, SYSTEM SAFETY FOR THE 21ST CENTURY (THE UPDATED AND REVISED EDITION OF SYSTEM SAFETY 2000) 51 (2004).

Control" approach.¹⁶ Under the latter, future threats are systematically identified, the probability of their occurrence analyzed, and their risk neutralized. From this perspective, safety must be built into the product for its entire lifetime, from its inception until the consumer ceases to use it.

Today, it is deemed essential that all devices in critical systems be developed using safety methods that prevent, to the greatest extent possible, any defects from being built into the device.¹⁷ The state supervises manufacturers of critical systems so as to ensure that they are developing their products employing appropriate safety practices. Regulatory agencies established for this purpose include the Federal Aviation Administration (FAA) and the Food and Drug Administration (FDA).

The underlying principle in safety engineering is that a product's safety is not necessarily guaranteed by testing the performance of the finished product alone, i.e., treating the product like a "black box" where only the output and not what goes on inside is of interest.¹⁸ Rather, the manufacturer is obligated to prove that its product is safe, by implementing accepted safety measures, such as safety development systems. Similarly, in software development, it is not sufficient to test only the completed software or performance of the end product to determine its safety; instead, from the outset, the software must be written in a way that prevents the inclusion of defects and allows for it to be tested for safety.¹⁹

The FDA's premarket approval of medical devices has been recognized by the Supreme Court as "a rigorous process."²⁰ The 1990 Safe Medical Devices Act ("SMDA") granted the FDA explicit authority to include in its standards for good manufacturing practices (GMP)

¹⁶ USAF HANDBOOK, *supra* note 9, at 3.

¹⁷ Halpert & Sangero, *supra* note 3, at 71.

¹⁸ The FDA's explicit policy on the issue is as follows:

[The] FDA believes that because of the complexity of many components used in medical devices, their adequacy cannot always be assured through inspection and testing at the finished device manufacturer. This is especially true of software and software-related components, such as microprocessors and microcircuits. Quality must be designed and built into components through the application of proper quality systems.

Medical Devices/Current Good Manufacturing Practice (CGMP)/Final Rule, 61 Fed. Reg. 52601, 52606 (Oct. 7, 1996) (codified at 21 C.F.R. pts. 808, 812 and 820 (1996)), *available at* <http://www.fda.gov/downloads/MedicalDevices/DeviceRegulationandGuidance/PostmarketRequirements/QualitySystemsRegulations/MedicalDeviceQualitySystemsManual/UCM122806.pdf>.

¹⁹ FOOD & DRUG ADMINISTRATION, CENTER FOR DEVICES & RADIOLOGICAL HEALTH, GENERAL PRINCIPLES OF SOFTWARE VALIDATION; FINAL GUIDANCE FOR INDUSTRY AND FDA STAFF 11 (2002), *available at* <http://www.fda.gov/cdrh/comp/guidance/938.pdf>.

²⁰ Riegel v. Medtronic, Inc., 128 S. Ct. 999, 1004 (2008).

for medical devices the pre-production condition of "design validation controls."²¹ Furthermore, the Act authorized the Agency to require manufacturers to provide data on the sensitivity of their testing,²² its specificity,²³ and its positive and negative predictive values.²⁴ The Supreme Court considers the FDA premarket approval so exacting that it released a manufacturer from liability for negligence because it had received this approval.²⁵ In other words, from the perspective of the Court, FDA approval signifies that the device is safe (and effective).

The scope of this Essay does not allow an exhaustive consideration of every safety standard set by the FDA and similar safety oversight authorities. For the purposes of the discussion, it will suffice to give only the example of Medical Device Reporting ("MDR") requirement.²⁶ As noted, in prevailing safety theory, great weight is placed not on experience but on preventing defects and problems before they occur. Consequently, there is a duty to report not only accidents but also "incidents,"²⁷ defined as situations in which there is the potential for harm to be caused and only by mere coincidence was this averted.²⁸ There is important recognition of the fact that "near-miss conditions, if not corrected, most likely develop into accidents."²⁹ Incident investigation is a critical element of safety, therefore. The FDA routinely releases what is known as "medical device safety alerts" based on the MDR requirement,³⁰ at times even ordering a recall of the particular product.³¹

²¹ R. C. FRIES, MEDICAL DEVICE QUALITY ASSURANCE AND REGULATORY COMPLIANCE 367-68 (1998).

²² Sensitivity = [1- false negative rate]. For example, if the false negative (the percentage of those for whom the medical test shows erroneously that they are healthy when they are in fact sick) is 1%, then the test's sensitivity is 99%.

²³ Specificity = [1- false positive rate]. For instance, if the false positive (the percentage of those for whom the medical test shows erroneously that they are sick when they are in fact healthy) is 1%, then the specificity of the test is 99%.

²⁴ COMMITTEE ON DEVELOPING BIOMARKER-BASED TOOLS FOR CANCER SCREENING, DIAGNOSIS, & TREATMENT, CANCER BIOMARKERS: THE PROMISES AND CHALLENGES OF IMPROVING DETECTION AND TREATMENT 74 (2007). The positive predictive value (PPV) of a test is defined as:

PPV = Number of True Positive / (Number of True Positive + Number of False Positive).

The negative predictive value (NPV) of a test is defined as:

NPV = Number of True Negative / (Number of True Negative + Number of False Negative).

²⁵ *Riegel*, 128 S. Ct. 999.

²⁶ HOW TO REPORT A PROBLEM (MEDICAL DEVICES), available at <http://www.fda.gov/MedicalDevices/Safety/ReportaProblem/default.htm#1> (last visited July. 9, 2011).

²⁷ INTERNATIONAL CIVIL AVIATION ORGANIZATION, SAFETY MANAGEMENT MANUAL 4.3 (2006), available at <http://www.icao.int/osg/isd/afi/Reference%20Material%5CSafety%20Oversight%20Manuals%5CSafety%20Management%20System%5CSMS%20Manual.pdf>.

²⁸ *Id.*

²⁹ Stephans, *supra note* 15, at 23.

³⁰ "Medical device safety alert: issued in situations where a medical device may present an unreasonable risk of substantial harm. In some cases, these situations also are considered recalls." FDA, BACKGROUND AND DEFINITIONS (June 24, 2009), available at <http://www.fda.gov/Safety/Recalls/ucm165546.htm>.

In contrast, in criminal law, incidents are not investigated at all, and as we will show, even accidents are not always investigated. Ironically, incidents such as cases in which we suspect X, almost convict him, and then find out he is innocent are regarded as the success of the criminal justice system.³² In aviation, in contrast, if two planes had almost crashed, this luck would be deemed absolutely inadequate, and the incident would be investigated thoroughly.

II. The Need for Safety in the Criminal Justice System

1. A Proposed Definition

In criminal law, the counterpart to an accident such as a plane crash is false conviction. Before proceeding to discussing safety in criminal law, the concept itself requires definition in this specific context. In its intuitive sense, safety can be conceived of in criminal law as precaution-tasking against false conviction by raising the evidentiary standard for conviction. In light of this definition, there will probably be those who would oppose introducing new safety mechanisms into the criminal justice system. Indeed, finding the optimal balance between false acquittals and false convictions is a problem that is innate to criminal law.³³ On the one hand, as a social value judgment, we are more concerned about false convictions than false acquittals, to the point that we would rather see many (ten? one hundred?) guilty persons acquitted than one innocent person convicted.³⁴ Yet on the other hand, we would not want to abandon the criminal justice system altogether by acquitting all defendants in order to reduce false convictions to zero. Presumably, safety means increasing the number of offenders who are acquitted. We will show below that this is not necessarily so.

One possibility for defining safety in criminal justice could be a variation of the U.S. Air Force's definition of safety:³⁵

Safety in criminal law—Freedom from those conditions that can cause false conviction.

³¹ Recalls are actions taken by a firm to remove a product from the market, by the firm's own initiative, FDA request, or FDA order as per its statutory authority. *Id.*

³² *Kansas v. Marsh*, 548 U.S. 163, 193 (2006).

³³ *In re Winship*, 397 U.S. 358, 371 (1970); see also ALEX STEIN, FOUNDATIONS OF EVIDENCE LAW 14 (2005).

³⁴ Alexander Volokh, *n Guilty Men*, 146 U. PA. L. REV. 173, 174 (1997).

³⁵ USAF HANDBOOK, *supra* note 1o: "Safety—Freedom from those conditions that can cause death, injury, occupational illness, or damage to or loss of equipment or property, or damage to the environment."

Clearly, absolute safety cannot be attained without undermining criminal law's fundamental objectives. However, resources can, and must, be invested in safety in order to reduce the rate of error.

Another way to define safety in the criminal justice system is on the basis of the safety measures that should be implemented:³⁶

Safety is the state in which the risk of harm to innocent people is lessened through a continuous process of hazards identification and risk management, without hindering criminal law's fundamental objectives.

In line with Packer's two-model paradigm of the criminal process—crime control versus due process³⁷—people tend to conceive of the process as a zero-sum-game: greater due process and fewer wrongful convictions come at the cost of less crime control and more wrongful acquittals. However, integrating safety into the criminal justice system could, in fact, be a win-win situation.³⁸ Resources should be allocated to the systematic assessment of threats, identification of risks, and implementation of safety measures that reduce the rate of *both* false conviction and false acquittal. It is important to understand in this context that there is no contradiction in terms here: as safety increases (for instance, by improving the reliability of certain types of evidence), we are in fact killing two birds with one stone, in reducing the grave danger of convicting the innocent while increasing efficiency in convicting the truly guilty.

2. A Moral Duty

There is no greater injustice than the conviction of an innocent person.³⁹ The fundamental damage is borne by the person convicted: the very fact of conviction, the accompanying stigma, and the punishment, which could be anything from monetary fine, to deprivation of

³⁶ "Safety is the state in which the risk of harm to persons or of property damage is reduced to, and maintained at or below, an acceptable level through a continuing process of hazard identification and risk management." INTERNATIONAL CIVIL AVIATION ORGANIZATION, SAFETY MANAGEMENT MANUAL 1.1 (2006), available at http://www.icao.int/fsix/_Library/SMM-9859_1ed_en.pdf.

³⁷ HERBERT L. PACKER, THE LIMITS OF THE CRIMINAL SANCTION 149-73 (1968).

³⁸ As we will demonstrate in section II.3, investing money in the safety of criminal law can be a win-win situation not only morally, but also economically.

³⁹ Especially if we did not invest enough in preventing false conviction or did not do what we ought to have done to prevent it.

liberty, to imprisonment. Indeed, in jurisdictions with the death penalty, wrongful conviction could even render the most drastic outcome: loss of life.

Only recently have researchers begun to examine the psychological damage inflicted on a person who is falsely convicted.⁴⁰ Some studies have applied methodology and models from the fields of psychology and psychiatry.⁴¹ One study of eighteen released convicts who had been wrongfully convicted revealed changes in their personalities; they exhibited symptoms of Post-Traumatic Stress Disorder, with other depressive disorders also common among them. The former convicts reported psychological difficulties and trouble with social adjustment, particularly in the context of intimate relationships.⁴²

The details of the individual cases are illustrative of the trauma and injury to the wrongfully convicted. For example, James Bain was convicted in 1974 for the kidnapping and rape of a nine-year-old girl and was sentenced to life imprisonment.⁴³ At the time of his arrest, he had been nineteen years old. In December 2009, thirty-five years after his conviction, he was acquitted on all counts and released. He had spent, and wasted, almost his entire adult life behind bars for crimes he had not committed. Another falsely convicted individual, William Jackson, was stabbed and repeatedly assaulted during his five years of incarceration.⁴⁴ Michael Evans and Paul Terry were both seventeen years old when they were arrested for raping and murdering a nine-year-old girl;⁴⁵ they were both convicted and sentenced to 200 to 400 years' imprisonment.⁴⁶ In 2003, however, the two men were acquitted and released, after having served twenty-seven years in prison. The court ruling in Michael Evans' suit against the state stated, despite rejecting his claim, that "what happened to Mr. Evans - his wrongful conviction and imprisonment for a substantial portion of his life - was a tragedy of epic proportions."⁴⁷

⁴⁰ Adrian T. Grounds, *Understanding the Effects of Wrongful Imprisonment*, 32 CRIME & JUST. 1 (2005).

⁴¹ *Id.* at 2-3.

⁴² *Id.*

⁴³ INNOCENCE PROJECT, FLORIDA MAN IS FREED AFTER 35 YEARS (Dec. 17, 2009), <http://www.innocenceproject.org/Content/2301.php>; *Man Exonerated, Freed from Prison after 35 Years*, CNN, Dec. 17, 2009, <http://www.cnn.com/2009/CRIME/12/17/florida.dna.exoneration/index.html>.

⁴⁴ David Crump, *Eyewitness Corroboration Requirements As Protections Against Wrongful Conviction: The Hidden Questions*, 7 OHIO ST. J. CRIM. L. 362, 370 (2009).

⁴⁵ CENTER ON WRONGFUL CONVICTIONS, MICHAEL EVANS AND PAUL TERRY, <http://www.law.northwestern.edu/wrongfulconvictions/exonerations/ilEvansTerrySummary.html> (last visited on Mar. 12, 2011).

⁴⁶ *Evans v. Katalinic*, 445 F.3d 953, 955 (2006).

⁴⁷ *Evans v. City of Chicago*, 513 F.3d 735, 747 (2008).

We maintain that any false conviction that results in incarceration is a tragedy of epic proportions. In addition to the harm caused to the individual, there is the harm, both direct and indirect, to the families and friends of the wrongfully convicted.⁴⁸ Moreover, wrongful conviction is significantly harmful to society as a whole, for the actual criminal continues to roam free and perhaps commit more crimes.⁴⁹

One of the central justifications for the state's failure to invest all available resources in safety in other contexts, such as in improving the roads infrastructure, is that there is not enough money for it to optimally achieve all of its objectives, such as security, education, and health. This argument, however, does not hold in the context of the criminal justice system.

Firstly, in other contexts, such as motor traffic, the risk of accidents is apparent, and the state tries to reduce that risk by setting mandatory safety standards. In the case of false convictions, however, it is in fact the state itself that creates the risk: by setting the offenses in law; by focusing on one specific suspect; by bringing people to trial; by using problematic evidence and inaccurate equipment to prove guilt; and by convicting and imposing harsh penalties. An accepted principle in both torts and criminal law is that the creator of a dangerous situation is duty-bound to eliminate or reduce the risk of harm deriving from that situation.⁵⁰ The "state-created danger doctrine" has a similar logic, imposing duties on the state when its actions create a risk.⁵¹ Thus, not only does the state have a moral duty to incorporate safety into the criminal justice system, even if this would entail resources, but it also bears a legal obligation to do so.

Secondly, under the social contract theory, the state was established to protect the rights of society's members and certainly not to cause them harm.⁵² The conviction of an innocent person is the greatest injustice that a state can inflict on its citizens. Consequently, in the context of criminal justice, the state, as the creator of the risk, has an enhanced moral duty (as

⁴⁸ *Limone v. United States*, 579 F.3d 79, 102 (2009). See also text accompanying *infra* note 58.

⁴⁹ For example, in the case of James Bain, see *supra* note 43, the true criminal has yet to be found. INNOCENCE PROJECT, KNOW THE CASES, JAMES BAIN, <http://www.innocenceproject.org/Content/2300.php>.

⁵⁰ See, e.g., *Delair v. McAdoo*, 324 Pa. 392, 188 A. 181, 184 (1936).

⁵¹ On the state-created danger doctrine, see Laura Oren, *Safari into the Snake Pit: The State-Created Danger Doctrine*, 13 Wm. & Mary Bill Rts. J. 1165 (2005).

⁵² Rinat Kitai, *Protecting the Guilty*, 6 BUFF. CRIM. L. REV. 1163, 1172-79, 1186-87 (2003).

compared to its duty in the area of road infrastructure, for instance) to employ measures to reduce the risk.⁵³

Thirdly and quite unfortunately, apart from the theoretical declaration that guilt should be proved beyond a reasonable doubt, no genuine effort is actually made to reduce the significant risk of wrongful conviction: the concept of modern safety is completely foreign to criminal law.⁵⁴ As we will show below,⁵⁵ even the most basic and easily performed measures for reducing that risk are not implemented.

Fourthly, in the context of criminal law, there is a particularly simple and straightforward solution to the problem of funding safety: The extent to which the law is enforced is determined by the budget allocated for law enforcement, and the extent of the safety precautions that will be implemented should be included in that budget. In other words, based on the (not inevitable) assumption of a fixed budget, it is possible to implement safety by making do with slightly fewer criminal proceedings. The goal is not maximum enforcement, which severely impairs our freedom and makes life insufferable. In fact, many already believe, as do we, that the system suffers from over-criminalization.⁵⁶

Finally, we will explain below that the investment in safety has proven to be beneficial in other fields, even under narrow economic analysis devoid of any moral considerations.

3. Economic Justification

In the context of fighter planes, safety is justified by cost-benefit analysis. Simply put, it would be too expensive not to implement safety. For example, the total cost of the safety program in the development of the F-14 planes was \$5 million, divided over ten years. Since

⁵³ See, e.g., *Deshaney v. Winnebago County Dep't of Social Services*, 489 U.S. 189, 201 (1989).

⁵⁴ See examples in *infra* Part II.4 regarding simple safety measures, many of which are currently employed in other fields but none of which are used in the field of scientific evidence. To the best of our knowledge, there appears to be no book or article that includes any discussion of safety in criminal law, the only exception being the article *From a Plane Crash to the Conviction of an Innocent Person*, Halpert & Sangero, *supra* note 3, which proposes introducing "safety-critical systems" into criminal law.

⁵⁵ In *infra* Part II.4.

⁵⁶ Sanford H. Kadish, *The Crisis of Overcriminalization*, in *BLAME AND PUNISHMENT: ESSAYS IN THE CRIMINAL LAW* 21 (1987); JONATHAN SIMON, *GOVERNING THROUGH CRIME: HOW THE WAR ON CRIME TRANSFORMED AMERICAN DEMOCRACY AND CREATED A CULTURE OF FEAR* (2007); DOUGLAS HUSAK, *OVERCRIMINALIZATION—THE LIMITS OF THE CRIMINAL LAW* (2007); *GO DIRECTLY TO JAIL: THE CRIMINALIZATION OF ALMOST EVERYTHING* (Gene Healy ed., 2004).

the cost of building one F-14 at the time was \$15 million, this investment in safety was economically justified even if it prevented only a single plane from crashing.⁵⁷

The economic cost of errors in the criminal justice system is no less considerable and is also quantifiable. In recent years, several plaintiffs have been awarded large sums in damages. In *Limone*, for example, the appellate court upheld the decision to award \$101,750,000 in compensation to four falsely convicted men and their immediate families.⁵⁸ This amounted to \$1 million for each year in prison. It can be inferred from this judgment that the incorrect “solving” of one crime that leads to the false conviction of a number of individuals can generate economic harm of over \$100 million, similar to the cost of a sophisticated twenty-first-century fighter plane. In other cases, even more damages have been awarded per year in prison. Juan Johnson, for example, received \$21 million in compensation for eleven years of false imprisonment,⁵⁹ amounting to nearly \$2 million for each year of incarceration.

Consequently, even if only one false conviction could be successfully avoided through safety measures, it would be economically worthwhile to invest even millions of dollars to do so. As shown further on,⁶⁰ false conviction is not merely a matter of isolated instances, its rate surprisingly high.

Some may claim that less economic harm is caused to society than what we described above, since the majority of false convictions are never uncovered and society is therefore not required to compensate for the harm. This reasoning should be rejected. Economic harm is clearly created, but its cost is actually, and unjustifiably, borne by the falsely convicted. The state makes them shoulder the burden of this grave harm, while refraining from implementing any precautionary measures to prevent its occurrence.

4. *Examples of Absence of Safety*

a. *Lack of Safety in Scientific Evidence*

⁵⁷ Halpert & Sangero, *supra* note 3, at 89.

⁵⁸ *Limone v. United States*, 579 F.3d 79, 102 (2009).

⁵⁹ Ben Meyerson, *Record Verdict: Former Gang Member Awarded \$21 Million for Wrongful Conviction*, CHI. TRIB., June 23, 2009, available at <http://www.chicagotribune.com/news/local/chi-federal-police-lawsuitjun23,0,3802704.story>.

⁶⁰ See *supra* Part III.2.

The risks inherent to scientific evidence are very similar to those entailed in medical diagnostic tests. As with any form of medical testing, there is always a likelihood of error with scientific evidence. However, while manufacturers of medical devices are fully regulated by the FDA, no such supervision exists vis-à-vis manufacturers of scientific evidence equipment.⁶¹ Thus, manufacturers of DNA testing equipment, for example, are not regulated,⁶² despite the many risks involved.⁶³ In particular, there is no reporting duty, which is accepted practice in the medical devices industry and automobile industry. This lack of safety mechanisms leads to anomalies.

One example can be found in the user manual of Applied Biosystems, a company that manufactures DNA testing kits. The manual includes the following statement in bold: "**For Research, Forensic and Paternity Use Only. Not for use in diagnostic procedures.**"⁶⁴ Thus, while a single piece of evidence is adequate basis for sentencing someone to extended jail time, life imprisonment, or even execution,⁶⁵ it is insufficient for medical diagnosis.

Applied Biosystems also included a disclaimer in its GeneMapper software user manual⁶⁶ that the company bears no liability for errors appearing in the booklet describing the software and the manner in which it should be used.⁶⁷ There is even a clarification that it takes no responsibility for any damage caused as a result of using the software and does not guarantee that the software is error-free.⁶⁸ Thus rather than providing declarations and proof that the software and its accompanying documentation are safe, as required by the FDA for medical devices, the manufacturer of a DNA testing kit that is used in criminal proceedings can

⁶¹ U.S. federal law and FDA regulations distinguish among three classes of medical devices intended for human use, in accordance with the level of risk posed to the public and the required degree of control: Class I, Class II, and Class III devices. Although Class III devices are subject to the strictest control system because they pose a significant risk to human life, even Class I devices--such as elastic bandages--must meet strict quality assurance requirements. See Halpert & Sangero, *supra* note 3, at 73.

⁶² Halpert & Sangero, *supra* note 3, at 74.

⁶³ E. Sobel et al., *Detection and Integration of Genotyping Errors in Statistical Genetics*, 70 AM. J. HUM. GENETICS 496, 496 (2002); Francois Pompanon et al., *Genotyping Errors: Causes, Consequences and Solutions*, 6 NATURE REV. GENETICS 847 (2005); William C. Thompson, *Tarnish on the "Gold Standard": Understanding Recent Problems in Forensic DNA Testing*, 30 CHAMPION 10, 14 (Jan.-Feb. 2006).

⁶⁴ See AMPFLSTR SGM PLUS, PCR AMPLIFICATION KIT USER'S MANUAL 2 (2006).

⁶⁵ Daryl Mack was convicted of murder based solely on DNA evidence collected during a scan of a pool of genetic profiles and subsequently sentenced to death. He was executed on June 6, 2006. Halpert & Sangero, *supra* note 3, at 83.

⁶⁶ APPLIED BIOSYSTEMS, GENEMAPPER ID SOFTWARE VER 3.1 USER GUIDE (2003).

⁶⁷ *Id.* at 2.

⁶⁸ *Id.* J-3.

declare the opposite. Not surprisingly, problems with Applied Biosystems software have arisen.⁶⁹

In fact, large-scale accidents and incidents are not a rarity in DNA testing. For example, researchers uncovered widespread contamination at the British Forensic Service,⁷⁰ where it emerged that the DNA of twenty employees of the microfuge tubes manufacturer had contaminated the DNA evidence in various cases. The researchers further reported that "contamination by police personnel has been detected at approximately 10% of the scenes."⁷¹ This illustrates how DNA is still governed by the outdated Fly-Fix-Fly approach. The preventative measures that were implemented following the discovery of contamination were all connected to flaws discovered in the past and not to future possible mishaps.⁷² Indeed, these measures didn't prevent other instances of large-scale contamination caused by unidentified sources. Thus, in 2008, the German police appealed to the public, offering 100,000 Euros for information leading to the arrest of the serial killer known as "the Phantom of Heilbronn." Traces of the killer's DNA had been discovered at approximately forty crime scenes in Germany, Austria, and France, six of them cases of murder. In 2009, the mystery was solved: there was no serial killer. Rather, the DNA found at the crime scenes belonged to an innocent female worker at the factory in Bavaria that produces the cotton swabs used in the DNA collection, and they had been contaminated by her DNA.⁷³

Optimists will continue to claim that, at worst, such instances of contamination result in the actual perpetrator remaining at large, but not the incrimination of an innocent person. However, from a safety perspective, this is flawed. Firstly, safety in DNA testing may achieve reduction of undesirable "false negatives," which allow the actual perpetrator to be free to commit additional crimes. Secondly, safety in DNA would also reduce the risk of false positives that derives from the relatively easy and undetected contamination of samples. One of the central dangers is "cross-contamination," where the genetic matter of an innocent

⁶⁹ Jason R. Gilder et al., *Systematic Differences in Electropherogram Peak Heights Reported by Different Versions of the GeneScan Software*, 49 J. FORENSIC SCI. 92 (2004).

⁷⁰ Kevin Sullivan et al., *New Developments and Challenges in the Use of the UK DNA Database: Addressing the Issue of Contaminated Consumables*, 146 FORENSIC SCI. INT. 175 (2004).

⁷¹ *Id.* at 176.

⁷² *Id.*

⁷³ See Tristana Moore, *Germany Hunts Phantom Killer*, BBC NEWS, BERLIN, <http://news.bbc.co.uk/2/hi/europe/7341360.stm>; *Reward for "Phantom Killer" Reaches Record €300,000*, LOCAL, Jan. 13, 2009, <http://www.thelocal.de/national/20090113-16739.html>; David H. Kaye, Commentary, *GINA's Genotypes*, 108 MICH. L. REV. FIRST IMPRESSIONS 51, 52 (2009); *"DNA Bungle" Haunts German Police*, BBC, Mar. 28, 2009, <http://news.bbc.co.uk/2/hi/europe/7966641.stm>.

suspect (or someone who becomes a suspect after the DNA test) contaminates the DNA sample taken from a crime scene, and the suspect mistakenly appears to be the perpetrator.⁷⁴

Problems with cross-contamination have occurred in Australia. Examples: first, in the Jaidyn Leskie murder investigation;⁷⁵ second, in Russell John Gesah case⁷⁶; and third, in the Farah Jama case - where it even led to a false conviction.⁷⁷

Cases of cross-contamination have arisen in the United States as well. For example, in 2004, a DNA sample taken in the 1968 Jane Durrue murder investigation was found to match the DNA of convicted sex criminal Jerry Bellamy.⁷⁸ In retrospect, it emerged that Bellamy's sample and the sample from the Durrue case had been processed in the same laboratory at the same time, giving rise to serious suspicions of contamination.⁷⁹ As a result, the prosecutor dropped the charges against Bellamy. In 2008, testing of the samples in other laboratories produced a different result, leading to charges being filed against another person, Robert Zarinsky, for the same murder.⁸⁰

⁷⁴ Thompson, *supra* note 63, at 10-12.

⁷⁵ Inquest into the Death of Jaidyn Raymond Leskie, Coroners Case Number: 007/98, available at http://www.bioforensics.com/conference09/Workshop/Leskie_decision.pdf.

In this case, DNA samples of a young "mentally challenged" girl (hereafter "P") matched the samples taken from the Leskie murder scene. The coroner's inquiry revealed that around the same period in which the blood stains from the murder had been tested, a sex crime committed against P had been investigated in the same laboratory. Although the lab personnel claimed contamination to be improbable, the coroner's final conclusion was that the DNA sample in the Leskie case had been contaminated with P's DNA. While he could not point to the exact manner in which the contamination had occurred, the coroner did note that additional cases of contamination had been uncovered at the same laboratory, whose precise sources had not been determined.

⁷⁶ In 2008, murder charges against Russell John Gesah based on DNA test results were dropped. It emerged that his DNA sample and a sample from the crime scene had been processed at the same time and at the same laboratory, raising suspicions of cross-contamination. Victoria Police, Media Release, DNA Review Finalized (Sept. 24, 2008),

http://www.police.vic.gov.au/content.asp?Document_ID=17223.

⁷⁷ Farah Jama was convicted and sentenced to six years' imprisonment. He served approximately a year and a half until 2009, when the prosecutor informed the court that the DNA sample had apparently been contaminated. The court overturned his conviction, and he was released from prison. FRANK VINCENT, REPORT: INQUIRY INTO THE CIRCUMSTANCES THAT LED TO THE CONVICTION OF MR. FARAH ABDULKADIR JAMA (Victoria Gov't May 2010),

<http://www.justice.vic.gov.au/wps/wcm/connect/justlib/DOJ+Internet/resources/5/a/5a103e804263c8da810e832b0760a79a/VincentReportFinal6May2010.pdf>

⁷⁸ Robert Hanley, *DNA Leads to Arrest in '68 Rape and Murder of Girl*, N. Y. TIMES, June 17, 2004, <http://www.nytimes.com/2004/06/17/nyregion/dna-leads-to-arrest-in-68-rape-and-murder-of-girl-13.html?sec=&spon=&pagewanted=all>; Maura Dolan & Jason Felch, *The Danger of DNA: It Isn't Foolproof Forensics*, L.A. TIMES, Jan. 1, 2009,

http://www.boston.com/news/nation/articles/2009/01/01/the_danger_of_dna_it_isnt_foolproof_forensics.

⁷⁹ WILLIAM C. THOMPSON, THE POTENTIAL ERROR FOR FORENSIC DNA TESTING (CRG National Conference, June 19-20, 2008), available at <http://www.councilforresponsiblegenetics.org/pageDocuments/H4T5EOYUZI.pdf>.

⁸⁰ Joe Ryan, *Robert Zarinsky Formally Charged in '68 Slaying of Keansburg Girl*, N.J. REAL-TIME NEWS, Mar. 11, 2008, http://www.nj.com/news/index.ssf/2008/03/robert_zarinsky_to_be_charged.html. Zarinsky, who had

Unfortunately, not all errors are discovered. In another case, DNA from John Ruelas and Gary Lieterman were found to match samples taken from a 1969 murder crime scene.⁸¹ However, Ruelas had been four years old at the time of the murder and was thus clearly not the murderer. Despite the lack of any logical reasonable explanation for the match between the murderer's DNA and Ruelas' DNA and even though it emerged that the samples taken from the victim and two suspects had been processed in the same laboratory at the same time, Lieterman was convicted of the murder.⁸² Moreover, it should be noted, under the Hidden Accident Principle, had the innocent suspect Ruelas been an adult and not a child at the time of the murder, he would probably have been convicted and the probably-cross-contamination never discovered.

Mishaps with DNA testing are often reported in the media. The information provided, however, is not always accurate. Yet since no reporting duty exist or any duty to investigate incidents or even accidents, the media is often the sole source of information. Thus, not only is there no safety approach aimed at preventing accidents from occurring, but no consistent attempt is made to learn from experience. Indeed, not even the Fly-Fix-Fly method is systematically implemented in criminal law.

Another example of the lack of safety in scientific evidence in criminal law is the *Chun*⁸³ case in New Jersey, which revolved around a breath alcohol testing device for drivers, manufactured by Draeger. The experts for the defense testified in court that the software would not have met the standards of any regulatory body, such as the FDA, FAA, or U.S. Department of Defense.⁸⁴ A programmer employed by the manufacturer testified that he did not know of any basic standards for software development and had instead relied on personal experience.⁸⁵ The same programmer had apparently single-handedly caused an unnecessary defect in the software. It also arose that there was no quality assurance supervisor or anyone

been incarcerated since 1975 for another murder, died in prison before the start of trial. John Appezzato, *Suspected Serial Killer Robert Zarinsky Dead at 68*, N. J. REAL-TIME NEWS, Nov. 29, 2008), http://www.nj.com/news/index.ssf/2008/11/suspected_serial_killer_robert.html.

⁸¹ Thompson, *supra* note 63, at 10, 14.

⁸² *Id.*

⁸³ State v. Chun, 943 A.2d 114 (N.J. 2008).

⁸⁴ Halpert & Sangero, *supra* note 3, at 78-82.

⁸⁵ *Id.* at 82.

who performed that function with respect to software development at Draeger.⁸⁶ Nonetheless, the court ruled that standards for software development are a matter of style and theory and not necessary for guaranteeing the safety and reliability of any given device.⁸⁷ The court was in fact implementing the Fly-Fix-Fly approach: having found a defect in the software, it ordered its repair and approved the continued use of the device (until the emergence of the next defect).⁸⁸

The 2009 National Academy of Science Report exposed basic problems with all forms of scientific evidence.⁸⁹ Indeed, for many years, supervision of laboratories was atrocious. The Houston Police Department Crime Laboratory, for example, has been described as follows:

The complete lack of outside scrutiny of the Crime Lab's operations, procedures, and reporting of results allowed serious deficiencies, particularly in the DNA/Serology Section, to become so egregious that analysts in the Lab simply had no perspective on how bad their practices were.⁹⁰

There is no justification for such a total disregard for safety in the criminal law context. When conducted, laboratory proficiency testing has revealed a significant error rate.⁹¹ In fact, erroneous forensic testimony has been found to constitute the second most significant factor in false convictions.⁹² Thus, mere awareness of the error rate in labs, as has been proposed in the literature,⁹³ is not sufficient for ensuring safety. Rather, instituting safety measures is crucial for reducing the incidence of error.⁹⁴ Furthermore, certain types of evidence, such as microscopic comparisons of hair, that are deserving of the title "junk science," unfortunately continue to be held admissible by some of the courts.⁹⁵

⁸⁶ Supplemental Findings and Conclusions of Remand Court, *State v. Chun*, No. 58,879 (N.J. Nov. 8, 2007), available at http://www.judiciary.state.nj.us/pressrel/supplemental_opinion.pdf.

⁸⁷ *Chun*, 943 A.2d at 160.

⁸⁸ Halpert & Sangero, *supra* note 3, at 78-82.

⁸⁹ NATIONAL ACADEMY OF SCIENCE (NAS), COMMITTEE ON IDENTIFYING THE NEEDS OF THE FORENSIC SCIENCES COMMUNITY, STRENGTHENING FORENSIC SCIENCE IN THE UNITED STATES: A PATH FORWARD (Nat'l Acad. of Sciences Feb. 18, 2009) [hereinafter NAS-2009].

⁹⁰ MICHAEL BROMWICH, INDEPENDENT INVESTIGATOR, FOURTH REPORT OF THE INDEPENDENT INVESTIGATOR FOR THE HOUSTON POLICE DEPARTMENT CRIME LABORATORY AND PROPERTY ROOM 3 (Jan. 4, 2006).

⁹¹ Saks & Koehler, *supra* note 2, at 895. On the results of proficiency tests for DNA laboratories, see Jonathan J. Koehler, *Error and Exaggeration in the Presentation of DNA Evidence at Trial*, 34 JURIMETRICS J. 21, 26 (1993); Jonathan J. Koehler et al., *The Random Match Probability in DNA Evidence: Irrelevant and Prejudicial?*, 35 JURIMETRICS J. 201, 206-11 (1995).

⁹² Saks & Koehler, *supra* note 2, at 892.

⁹³ *Id.*

⁹⁴ Halpert & Sangero, *supra* note 3, at 86-87.

⁹⁵ Brandon L. Garrett & Peter J. Neufeld, *Invalid Forensic Science Testimony and Wrongful Convictions*, 95 VA. L. REV. 1, (2009); BARRY SCHECK ET AL., ACTUAL INNOCENCE: FIVE DAYS TO EXECUTION AND OTHER DISPATCHES FROM THE WRONGLY CONVICTED 158-71 (2000); Erica Beecher-Monas, *Blinded by Science: How*

b. *Disregard of Organizational Theories*

False convictions can also be analyzed through the prism of organizational theories.⁹⁶ The criminal justice system features a significant amount of built-in redundancy,⁹⁷ which is presented as a sort of back-up safety mechanism: there is the expectation that where one function in the system fails (such as false lineup identification), other units functions will compensate (the forensics laboratory; the prosecution, which supervises the police; the defendant's lawyer, who knows how to present or uncover errors; or the judges and the juries, which consider the facts of the case, and the appellate courts). Yet, as the famous Josiah Sutton case⁹⁸ demonstrates,⁹⁹ these various parts of the system are in fact intertwined and impact one another. Accordingly, the risk of all the parts collapsing at once is greater than what might be expected.

Studies of fingerprint experts have shown how external information can shape their determinations.¹⁰⁰ Exemplifying this is the case of the investigation of a terrorist attack in Madrid. Over the course of the investigation, an American lawyer named Brandon Mayfield became the main suspect after an automatic fingerprint identification system pointed to a similarity between the fingerprints taken from the crime scene and Mayfield's fingerprints, which were in the computer's database. The information given to the fingerprints experts, namely, that Mayfield was a Muslim married to an Egyptian and had, in the past, represented a terrorist in legal proceedings, emerged as having influenced the possibility of detecting an error when doubts first arose regarding the match between his fingerprints and the prints from the crime scene.¹⁰¹

Judges Avoid the Science in Scientific Evidence, 71 TEMP. L. REV. 55 (1998); Michael J. Saks & Jonathan J. Koehler, *The Individualization Fallacy in Forensic Science Evidence*, 61 VAND. L. REV. 199 (2008).

⁹⁶ William C. Thompson, *Beyond Bad Apples: Analyzing the Role of Forensic Science in Wrongful Convictions*, 37 SW. U. L. REV. 1027 (2008).

⁹⁷ *Id.* at 1032 n.32, and accompanying text.

⁹⁸ INNOCENCE PROJECT, KNOW THE CASES , JOSIAH SUTTON available at: http://www.innocenceproject.org/Content/Josiah_Sutton.php

⁹⁹ Thompson, *Beyond Bad Apples supra* note 96 at 1032.

¹⁰⁰ I. E. Dror & D. Charlton, *Why Experts Make Errors*, 56 J. FORENSIC IDENTIFICATION 600 (2006).

¹⁰¹ U.S. DEP'T OF JUSTICE, OFFICE OF THE INSPECTOR GENERAL, OVERSIGHT AND REVIEW DIVISION, A REVIEW OF THE FBI'S HANDLING OF THE BRANDON MAYFIELD CASE (UNCLASSIFIED AND REDACTED) 12 (Mar. 2006), <http://www.usdoj.gov/oig/special/s0601/final.pdf> (last visited July. 9, 2011).

Non-scientific evidence has also been shown to be susceptible to bias. A control study showed how a significant percentage of eyewitnesses changed their minds about the suspect they identified in a police lineup after having been provided with information from the investigation, such as the fact that one of the lineup participants had confessed during interrogation.¹⁰² Thus, criminal law seems to lack a safety policy aimed at ensuring autonomy of the various pieces of evidence.

c. *Lack of a Serious Attempt to Reduce Government Misconduct*

A central source of false conviction is misconduct on the part of police investigators, lab technicians, or prosecutors.¹⁰³ Misconduct includes any of the following: deliberate suggestiveness in identification procedures; withholding of evidence from the defense; deliberate mishandling, mistreatment, or destruction of evidence; coercion of false confessions; deliberate contamination of confessions; and reliance on unreliable government informants or snitches.¹⁰⁴ The number of documented cases of prosecutorial misconduct has tripled over the last two decades.¹⁰⁵

We propose distinguishing between two types of criminal behavior by the police. The first type is corruption on the part of police investigators, as in the well-known Rampart¹⁰⁶ and Tulia¹⁰⁷ scandals, where the police know that the suspect is not guilty but seek to incriminate her. The second type of criminal conduct arises when police investigators are truly convinced that the suspect is guilty but are concerned that the court will not convict her. Investigators

¹⁰² Lisa E. Hasel & Saul M. Kassin, *On the Presumption of Evidentiary Independence, Can Confessions Corrupt Eyewitness Identifications?*, 20 PSYCHOL. SCI. 122 (2009). Thus, Michael Evans was convicted of the murder and rape of a young girl. His conviction was based solely on questionable eyewitness identification. Twenty-seven years later, he was released from prison when a DNA test proved that he was not the rapist. The witness had not been certain in identifying him as the rapist, and had been told that he had confessed during interrogation; this information had bolstered her confidence in her identification. *Evans v. City of Chicago*, 2006 U.S. Dist. LEXIS 9831 15 (2006). See also *supra* notes 45 - 47 and accompanying text.

¹⁰³ INNOCENCE PROJECT, GOVERNMENT MISCONDUCT, <http://www.innocenceproject.org/understand/Government-Misconduct.php>.

¹⁰⁴ *Id.* For additional examples of misconduct, see Andrew M. Hetherington, *Thirty-First Annual Review of Criminal Procedure: III. Trial: Prosecutorial Misconduct*, 90 GEO. L.J. 1679, 1679-89 (2002).

¹⁰⁵ Alexandra White Dunahoe, *Revisiting the Cost-Benefit Calculus of the Misbehaving Prosecutor: Deterrence Economics and Transitory Prosecutors*, 61 N.Y.U. ANN. SURV. AM. L. 45 (2005). See also Natasha Minsker, *Prosecutorial Misconduct in Death Penalty Cases*, 45 CAL. W. L. REV. 373, 374-76 (2009).

¹⁰⁶ Samuel R. Gross et al., *Exonerations in the United States, 1989 Through 2003*, 95 J. CRIM. L. & CRIMINOLOGY 523, 534-36 (2005). In the LAPD Rampart scandal, a corrupt police officer who was awaiting trial for dealing in cocaine revealed how he and his colleagues in the unit had incriminated defendants by fabricating evidence, false testimony, and more. At least one-hundred defendants were incriminated and convicted in this way, with most pleading guilty to the charges against them.

¹⁰⁷ In the Tulia scandal, thirty-eight defendants were brought to trial for drug offenses as a result of a single piece of false testimony given by an undercover police detective. Most of the defendants pleaded guilty and were convicted. *Id.*

thus take matters into their own hands, either concealing evidence that would prove the suspect's innocence or "enhancing" or even fabricating incriminating evidence. This second type of criminal behavior is more dangerous, as it is apparently more prevalent. A distorted perception of their role - supposedly to ensure conviction - is certainly likely to be the cause of this behavior among police investigators and even prosecutors. To contend with this phenomenon, it is vital to acknowledge its existence and to deem such conduct criminal, because it misleads the court in exercising its discretion.

The case of John Kelly illustrates how even negligent behavior that does not amount to misconduct should not be tolerated. Kelly spent a year in prison awaiting trial on charges that were eventually dropped.¹⁰⁸ Already at the outset of his trial, when the evidence against him was handed over to the public defender, two fundamental flaws in the prosecution's case became clear: the one was that Kelly did not fit the description of the drug dealer provided by the investigating detective;¹⁰⁹ the second was that the rock-like substance found in the apartment was determined not to be a drug in a lab test conducted a week after Kelly's arrest.¹¹⁰ Consequently, Kelly was released, and the charges against him dropped.¹¹¹

In the civil suit brought by Kelly, the court determined that the forensic report stating that the substance was not a drug was delivered to one of the detectives one day after the substance had been sent for lab testing and approximately one week after Kelly's arrest, whereas the prosecutor received the report only a full month after the arrest.¹¹² The court did not discuss the prosecutor's liability, despite the fact that nearly a year had passed between the receipt of the test results and Kelly's release. Under federal law, prosecutors enjoy absolute immunity from claims of misconduct in performing their job.¹¹³ With regard to the detectives in the Kelly case, however, the court held that they have qualified immunity.¹¹⁴ One of the detectives, Julie Gibson, had known about the forensics report but did not inform the prosecutor about it; in fact, she failed to mention the report even in her court testimony in an arrest proceedings a month after Kelly's first arrest, while he was still incarcerated.

¹⁰⁸ Kelly v. Curtis, 21 F.3d 1544, 1546 (11th Cir. 1994). This was the civil suit brought by Kelly in this matter, in which the details of the case were clarified.

¹⁰⁹ *Id.* at 1547.

¹¹⁰ *Id.* at 1547-48.

¹¹¹ *Id.* at 1549.

¹¹² *Id.* at 1548.

¹¹³ Imbler v. Pachtman, 424 U.S. 409, 424 (1976); Alexandra White Dunahoe, *Revisiting the Cost-Benefit Calculus of the Misbehaving Prosecutor*, 61 N.Y.U. ANN. SURV. AM. L. 45, 57 (2005).

¹¹⁴ Kelly v. Curtis, 21 F.3d 1544, 1550-51 (11th Cir. 1994).

In Kelly's claim against the state, the court ruled as follows regarding Gibson:

Although Gibson did receive the exculpatory report, she did not, on the facts of this case, have a clearly established duty to bring that report to the attention of the prosecutor or the state court....

The same is true of any failure of an officer to inform defense counsel or the court of exculpatory evidence: the officer has no such duty where she has reason to believe that the prosecutor is aware of that evidence. The Constitution places the duty to disclose known exculpatory evidence upon prosecutors.¹¹⁵

This case implies that not only is the law enforcement system negligent and perhaps even aware of the potential of an innocent person going to prison, but that it regards the policy facilitating this as appropriate.¹¹⁶ There is absolutely no justification for incarcerating someone for a year when from the outset the evidence clearly mandates his release. In the civil suit, the court in fact explicitly took an anti-redundancy approach, for it espouses leaving the decision in the hands of one person, namely, the prosecutor. It does not encourage actors within the law enforcement system to rectify the mistakes of other actors. It is not surprising, then, that, in many cases, exculpatory evidence has been kept from the defense. Indeed, this is a significant risk factor that materializes in many cases of false conviction.¹¹⁷

III. Toward Safety in the Criminal Justice System

Having demonstrated that there is no modern safety approach in the criminal justice system, we will now proceed to present a number of principles that can serve as the foundation for a core safety theory for the criminal justice system.

1. The Hidden Accident Principle

Why is the criminal justice system negligent in comparison to the aviation, engineering, and medical fields? In the latter three, the occurrence of an accident is both observed and observable. A defect in an airplane will cause its apparent crash; a defect in a bridge will cause its apparent collapse. An erroneous diagnosis of appendicitis will be discovered when

¹¹⁵ *Id.*

¹¹⁶ Stanley Z. Fisher, *The Prosecutor's Ethical Duty to Seek Exculpatory Evidence in Police Hands: Lessons From England*, 68 FORDHAM L. REV. 1379 (2000).

¹¹⁷ INNOCENCE PROJECT, *supra* note 103.

surgery reveals that the appendix is not infected.¹¹⁸ The fact that accidents and their ensuing damage are discernible led, as early as the 1940s,¹¹⁹ to the development and implementation of a science of modern safety in order to reduce defects in products and their resulting damage.¹²⁰

Assuming that false convictions are accidents, they are of the type that is never detected. There is no "gold standard" for determining whether a conviction was incorrect. Indeed, if one were to exist, it would be applied already at trial.¹²¹ When people who have been convicted of a crime proclaim their innocence, this is met with complete skepticism in light of the court's guilty verdict.

This inability to detect wrongful conviction is a highly significant feature of criminal law, which we call the "Hidden Accident Principle." This principle can be formulated as follows:

The criminal justice system is characterized by accidents (false convictions) that typically remain undetected. The inability to detect these accidents translates into optimism on the part of policymakers that false convictions only occur at a negligible rate.

In a reality in which false convictions go undetected, the criminal justice system in fact receives no feedback. As in the case of the Houston Crime Lab, the lack of external review means that the laboratory technicians have no notion of how deficient their practices are. Under the Hidden Accident Principle, effective feedback for the criminal justice system, even in theory, is implausible. The system does not know how poor its operation and safety practices are. The only way for it to grasp this is through comparison with other fields in which mishaps are liable to cause serious damage.

¹¹⁸ L. Graff et al., *False-Negative and False-Positive Errors in Abdominal Pain Evaluation: Failure to Diagnose Acute Appendicitis and Unnecessary Surgery*, 7 ACAD. EMERGENCY MED. 1244 (2000).

¹¹⁹ Halpert & Sangero, *supra* note 3, at 71-72.

¹²⁰ *Id.* at 71-74. In the 1980s, product liability litigation and other factors served as added incentive to manufacture safe products in additional fields – see Stephans, *supra* note 15, at 6.

¹²¹ Samuel R. Gross, *Convicting the Innocent*, 4 ANN REV. L. SOC. SCI. 173, 175 (2008):

False convictions are not merely unobserved, but in most cases are also unobservable. The problem is not simply that we do not know or sure whether a particular prisoner is innocent. We also may not know for sure whether he is HIV positive, but we can test him, or the prison population as a whole, or a random sample. There is no general test for the accuracy of criminal convictions. If there were, we would use it at trial.

In a historical window of opportunity, post-conviction DNA testing emerged as a gold standard for verifying a certain class of convictions. The results of some of these tests have led to the reopening of cases; thus far, for example, more than 270 convicted prisoners have been exonerated and released through the Innocence Project.¹²² Two-hundred-and-seventy cases of false convictions is considerably less than what the Supreme Court has indicated it is willing to “sacrifice.”¹²³ Moreover, this number is certainly far lower than the other, much higher estimates that will be discussed below.¹²⁴ Regardless, the uncovering of the false convictions in the framework of the Innocence Project’s work shocked not just the public at large but also jurists. The reason for this was the disclosure in the media of the names of some of those falsely convicted, their faces, and the great suffering they experienced. These details have quite a different impact than abstract, sterile awareness of the fact that there are people who are falsely convicted.¹²⁵

The Hidden Accident Principle demonstrates the almost complete ineffectiveness of the Fly-Fix-Fly safety method in criminal law, principally because it is extremely difficult to learn from the experience of past accidents when they are a hidden phenomenon. Below we proceed to the next stage of developing a safety theory for criminal law: a general assessment of the risks inherent to the criminal justice system.

2. Assessment of Risks Regarding the False Conviction Rate

Risk assessment is an integral part of the science of safety. Courts have always been optimistic regarding the possibility of false conviction. In fact, for many years, a great number of jurists believed false conviction to be almost impossible, with Justice Learned Hand’s oft-quoted description of the phenomenon as an “unreal dream”¹²⁶ reflective of this stance.

¹²² See references in *supra* note 2.

¹²³ *Kansas v. Marsh*, 548 U.S. 163, 197-98 (2006). See the discussion of this case at *infra* note 128 and accompanying text.

¹²⁴ See *infra* Part III.2.

¹²⁵ Gross, *supra* note 121, at 174.

¹²⁶ *United States v. Garsson*, 291 F. 646, 649 (1923).

In *Kansas v. March*, Justice Scalia revealed a similar approach to the possibility of false conviction.¹²⁷ He quoted a prosecutor who claimed in a newspaper article that the rate of false convictions at worst stands at only 0.027 percent:

[L]et's give the professor the benefit of the doubt: let's assume that he understated the number of innocents by roughly a factor of 10, that instead of 340 there were 4,000 people in prison who weren't involved in the crime in any way. During that same 15 years, there were more than 15 million felony convictions across the country. That would make the error rate .027 percent—or, to put it another way, a success rate of 99.973 percent.¹²⁸

Such estimations, however, contradict accepted practice: In American law, Blackstone's 1:10 ratio is commonly adopted, whereby guilt must be proven at a level of 90.91% (10/11).¹²⁹ This formula is based on his famous declaration that it is "better that ten guilty persons escape than that one innocent suffer."¹³⁰ Indeed, in a survey of 171 judges, the most common choice (56 participants) was a 90% proof threshold. The average choice was 90.3%, and the median 90%.¹³¹ If we assume Blackstone's theoretical ratio to be the actual average ratio,¹³² as it emerges from the survey, the results diverge significantly from the optimistic expectations regarding conviction reliability. In 2008, there were 2,310,984 inmates in U.S. prisons.¹³³ Assume that the distribution of the probability of guilt for each of the inmates is uniform,¹³⁴ ranging from a minimum threshold level of 90.91% to a maximum of 100%; in other words, there is a uniform number of cases for each level of probability of guilt. The average true conviction rate is then 95.46%, which is the median between the 90.91%

¹²⁷ 548 U.S. at 196-98.

¹²⁸ *Id.* (quoting Joshua Marquis, *The Innocent and the Shamed*, N.Y. TIMES, Jan. 26, 2006, at A23).

¹²⁹ Volokh, *supra* note 34, at 174.

¹³⁰ *Id.*

¹³¹ See C.M.A. McCauliff, *Burdens of Proof: Degrees of Belief, Quanta of Evidence, or Constitutional Guarantees?*, 35 VAND. L. REV. 1293, 1324-27 (1982). For an overview of additional surveys with similar results, see Lawrence M. Solan, *Refocusing the Burden of Proof in Criminal Cases: Some Doubt About Reasonable Doubt*, 78 TEX. L. REV. 105, 125-29 (1999).

¹³² This is doubtful, as there are many cases in which defendants are convicted based on a single piece of evidence, such as line-up identification or a confession, or a single item of scientific evidence—sometimes supplemented by a weak piece of evidence. In such cases, the fallacy of the transposed conditional (or false positive fallacy) is likely to arise, and the probability of guilt is much lower than it seems. See Sangero & Halpert, *supra* note 2; Sangero & Halpert, *supra* note 1. Furthermore, a judge's estimate of 90% certainty of guilt is, of course, subjective, and it is quite possible that, objectively, guilt has been proven to a much lesser extent.

¹³³ Stacy A. Hickox, *Justifying Rejection of Applicants with Convictions*, 8 DARTMOUTH L.J. 39, 43 (2010).

¹³⁴ For a similar assumption, see David Hamer, *Probabilistic Standards of Proof, Their Complements, and the Errors that are Expected to Flow from Them*, 1 U. NEW ENG. L.J. 71, 90 (2004).

threshold level and 100% ceiling.¹³⁵ But according to this, 4.54% of the 2,310,984 inmates, which amounts to 105,044, are in fact innocent!¹³⁶ This demonstrates the significant logical inconsistency in setting the beyond-reasonable-doubt threshold at the 1:10 ratio, which predicts 105,044 innocent inmates, and the optimistic belief that, over a period of fifteen years, "only" 4000 false convictions occurred and that the legal process is safe, with only a negligible rate of error.

Some may dispute our calculations, asserting that this does not take into account the fact that the majority of convictions are based on plea bargains, and that the error rate of plea bargains is significantly lower than the error rate of trials.¹³⁷ In our view, however, these assumptions are erroneous and indifferent to safety. It is not plausible that plea bargains somehow "magically" increase the accuracy of the system. On the contrary, a safety approach must assume a far riskier situation in plea bargains, where there is no 90% probative threshold. Indeed, it is sufficient that the defendant confessed in order to conceive the case as closed. Ironically, an accepted justification for the prosecution to offer a plea bargain is, in fact, that the evidence is not strong enough to convict at trial. The reality is that false convictions occur also when defendants confess as part of a plea bargain.¹³⁸ For example, in some cases of widespread police corruption, where many innocent suspects were brought to trial (as in the LAPD Rampart scandal¹³⁹ and the Tulia scandal,¹⁴⁰ the majority pleaded guilty.

Substantial empirical support for our assessment can be found in a recently published study by Risinger using empirical data from the Innocence Project. The analysis of the data revealed a 3.3% *minimum* rate of factually wrongful convictions in the 1980s for capital rape-murder.¹⁴¹ To calculate the minimum false conviction rate, Risinger used the following formula:¹⁴² the numerator was the known number of false convictions within a reference

¹³⁵ See the details of this calculation in Sangero & Halpert, *supra* note 1.

¹³⁶ For a non-uniform distribution of guilt assumptions, see Hamer, *supra* note 134, at 89-96. *See also* Sangero & Halpert, *supra* note 1.

¹³⁷ Morris B. Hoffman, *The Myth of Factual Innocence*, 82 CHI.-KENT L. REV. 663, 672 (2007). *See also* the interesting debate between Allen & Lauden and Risinger: Ronald J. Allen and Larry Laudan, *Why Do We Convict As Many Innocent People As We Do?: Deadly Dilemmas*, 41 TEX. TECH L. REV. 65 (2008); D. Michael Risinger, *Tragic Consequences of Deadly Dilemmas: A Response to Allen and Laudan*, 40 SETON HALL L. REV. 991 (2010).

¹³⁸ Brandon L. Garrett, *Judging Innocence*, 108 COLUM. L. REV. 55, 74 (2008).

¹³⁹ *Supra* note 106.

¹⁴⁰ *Supra* note 107.

¹⁴¹ Michael Risinger, *Innocents Convicted: An Empirically Justified Factual Wrongful Conviction Rate*, 97 J. CRIM. L. & CRIMINOLOGY 761, 780 (2007).

¹⁴² *Id.* at 768.

group with similar characteristics and the denominator was the total number of convictions within the same reference group. Seeking a reliably-sized reference group, Risinger chose a group of false convictions that were exposed by the Innocence Project in capital rape-murder cases between the years 1982 and 1989 where DNA samples had survived.¹⁴³ Eleven such cases were found in the Innocence Project database. Risinger (carefully) excluded 5% of the cases based on the possibility that some had been guilty despite the exonerating results of the DNA testing, leaving 10.5 relevant cases.¹⁴⁴ During the relevant period, there were 479 convictions in cases of capital rape-murder in the U.S. It emerged from the Innocence Project data that in one-third of the cases, no DNA samples had been preserved. Thus, it could be expected that of the 479 convictions, there was potential for DNA testing in only two-thirds of the cases (319 cases).¹⁴⁵ This yielded a $10.5/319=3.33\%$ *minimum* rate of false conviction,¹⁴⁶ for it was not at all clear whether all 319 had requested post-conviction DNA testing. Risinger assumed that at least half of those convicted would have requested a DNA test, since this would be their last chance for exoneration. This assumption yielded a *6.6% upper boundary*. However, because of the lack of accurate information, he chose a "*fair threshold*" of 5%.¹⁴⁷ While the calculation of the lower boundary was well supported, the calculation of the upper boundary and fair threshold was only an estimate and could be higher. Risinger's (empirical) results correspond closely to our calculations (5%), which we based on a 90% conviction threshold.

For the purposes of this discussion, we will assume a 5% false conviction threshold for all criminal offenses and not just capital rape-murder, for the following reasons: 1) This rate is the product of Risinger's calculations based on empirical data. 2) Our calculations, based on the accepted criminal conviction threshold in the United States (Blackstone's ratio), yield a similar result. 3) We maintain that a safety approach must take into account the possibility that in cases of offenses that are less grave than rape-murder, the courts are less cautious and the rate of false conviction is even higher.

It is important to note that we do not claim the false conviction rate to be exactly 5%. Indeed, it could be lower, and it could be higher. It is also possible that there are different rates for

¹⁴³ *Id.* at 774.

¹⁴⁴ *Id.*

¹⁴⁵ *Id.* at 778.

¹⁴⁶ *Id.*

¹⁴⁷ *Id.* at 779-80.

different offenses.¹⁴⁸ What we have sought to show, rather, is that the false conviction rate is *not insignificant*. Thus, a safety approach should not optimistically presume a low rate of false conviction, but instead assume matters to be much bleaker.

How, then, can we explain the Supreme Court's willingness to accept that there were only 4000 false convictions out of the 15 million felony convictions handed down over a fifteen-year period (a 0.027% false conviction rate)? Under the Hidden Accident Principle, since the majority of false convictions are undetectable, policymakers and judges continue to assume the system to be almost error-free, despite the possibly huge rate of false convictions.

3. The Adaptation of "Reasonable Doubt" standard to the Safety Doctrine

For years, beyond a reasonable doubt has been the accepted standard of proof in U. S. criminal law.¹⁴⁹ This standard of proof is applied in many other legal systems as well.¹⁵⁰

The reasonable doubt standard has been the subject of much discussion in both the case-law and literature.¹⁵¹ On the one hand, it supposedly ensures a high level of certainty in conviction. On the other hand, "beyond a reasonable doubt does not mean beyond any doubt,"¹⁵² for otherwise, we could never convict even the guilty, as imaginary and baseless doubts always exist. Thus, there is no absolute certainty in conviction: "the beyond a reasonable doubt standard is itself probabilistic."¹⁵³

In practice, when the law allows a defendant to be convicted based on the lineup identification of only one eyewitness or on the defendant's confession, there is hardly a high level of certainty to the conviction.¹⁵⁴ We therefore propose the following adjustment of the standard of proof:

¹⁴⁸ Gross, *supra* note 121, at 178.

¹⁴⁹ *In re Winship*, 397 U.S. 358 (1970).

¹⁵⁰ Thomas V. Mulrine, *Reasonable Doubt: How in the World Is It Defined?*, 12 AM. U. J. INT'L L. & POL'Y 195, 214-25 (1997). *See also* Volokh, *supra* note 34.

¹⁵¹ *Cage v. Louisiana*, 498 U.S. 39 (1990); *Sullivan v. Louisiana*, 508 U.S. 275 (1993); *Victor v. Nebraska*, 511 U.S. 1 (1994); *Note: Reasonable Doubt: An Argument Against Definition*, 108 HARV. L. REV. 1955 (1995); *Note: Winship on Rough Waters: The Erosion of the Reasonable Doubt Standard*, 106 HARV. L. REV. 1093 (1993); Robert C. Power, *Reasonable and Other Doubts: The Problem of Jury Instructions*, 67 TENN. L. REV. 45 (1999).

¹⁵² Alex Stein, *Constitutional Evidence Law*, 61 VAND. L. REV. 65, 83 (2008).

¹⁵³ *Victor*, 511 U.S. at 14.

¹⁵⁴ Sangero & Halpert, *supra* note 1; Sangero & Halpert, *supra* note 2. *See also supra* note 132.

Conviction in a criminal trial will be possible only where: (1) guilt has been proven beyond a reasonable doubt; and (additionally) (2) *all reasonable measures have been taken to ensure that false conviction does not occur.*

The first requirement will create a certain level of certainty in convictions, in line with current practice. Yet although high, this would be far from absolute certainty. The second requirement is thus intended to ensure the necessary safety in criminal convictions. In other words, applying one, fixed probability threshold for conviction (such as 90%, which is accepted practice in American courts¹⁵⁵) in each and every case is not adequate.¹⁵⁶ If, in a given case, the evidence points to guilt beyond a reasonable doubt but there are reasonable measures available to bolster certainty, they must be pursued.¹⁵⁷

Anomalies arise if the second requirement is disregarded, something that can be illustrated in the context of other safety critical systems. For example, if the reasonable doubt standard were to be implemented in the field of fighter planes (at 90%? 99%?), as soon as the accident rate were to reach 1% per flight, it would be determined that the planes are safe to fly. However, in the 1940s, a 100-times-lower accident rate--0.01% of all flights--was found to be too costly even given the lower cost of the airplanes in that period.¹⁵⁸ Thus, the industry began to employ safety methods to reduce the incidence of accidents. We see, then, that, in other fields, implementing the beyond-reasonable-doubt standard would lead to an unacceptable outcome. We maintain that it is the Hidden Accidents Principle of criminal law that enables the justice system to settle for the uniform beyond-reasonable-doubt level of certainty, without any attempt to improve the system so as to reduce the number of accidents--i.e., false convictions. Indeed, is it conceivable that the Air Force would be content with a 1% crash rate and not attempt to minimize this?

The following example can illustrate another anomaly. Assume that substantial evidence has been brought against a defendant in a murder trial, such as fingerprint match and lineup identification. This evidence (or even each piece of evidence on its own) is certainly

¹⁵⁵ See *supra* note 131, and accompanying text.

¹⁵⁶ Even a requirement to prove guilt at a level of 99% (if this is the understanding of the level of probability required by "beyond a reasonable doubt") should not be considered adequate in itself, given that on a large scale, this probability level will still lead to a large number of errors (0.5%).

¹⁵⁷ See the example of Stephan Cowans at *infra* note 159, and accompanying text.

¹⁵⁸ USAF HANDBOOK, *supra* note 9, at 2.

sufficient to convict the defendant beyond a reasonable doubt as it is currently interpreted. In the case of Stephen Cowans, for instance, evidence of this very kind was sufficient to convict him.¹⁵⁹ But assume also that a DNA sample was taken from the crime scene that can be tested. Without the proposed requirement to exhaust all possible means to increase safety in convictions and to not rely solely on proof beyond a reasonable doubt, there would be no imperative to conduct DNA testing, for the existing evidence would be sufficient for conviction. Yet Cowans' conviction was overturned, after having served six years in prison, based on post-conviction DNA testing and a reopening of the investigation in the wake of the test results. Accordingly, cumulative evidence (fingerprints and lineup identification) should be sufficient to convict beyond reasonable doubt *only* when there is no DNA sample available for testing. The reason for this is that conviction beyond a reasonable doubt does not amount to absolute certainty of guilt. Our proposed safety condition would require the examination of all reasonable potential evidence.

It is important to note that, in our view, the mere failure to examine any potentially exculpatory evidence creates reasonable doubt and mandates acquittal.¹⁶⁰ Any doubt as to guilt must work in favor of the defendant. But how can a given set of evidence be sufficient for conviction in one case but insufficient in another simply because there is reasonable potential for additional evidence in the latter? The explanation, in our opinion, lies in an understanding of the need for safety in the criminal justice system.

4. *Some Specific Safety Solutions*

In this section, we will suggest seven safety measures that arise as possibilities from the discussion in this Essay. It is not our intention to present here a safety theory for the criminal justice system, but rather only to demonstrate that there are many measures that are both feasible and necessary for ensuring safety in the system.

First, we recommend introducing *a regulatory regime* similar to the premarket approval required for medical devices that will be imposed on *manufacturers of devices producing*

¹⁵⁹ Simon A. Cole, *More than Zero: Accounting for Error in Latent Print Identification*, 95 J. CRIM. L. & CRIMINOLOGY 985, 1034, 1014-16 (2005).

¹⁶⁰ For a parallel approach in the tort context, see Ariel Porat & Alex Stein, *Liability for Uncertainty: Making Evidential Damage Actionable*, 18 CARDOZO L. REV. 1891, 1893 (1997).

scientific evidence, such as DNA kits, drug-testing kits, breathalyzers, and car-speed testing devices. This regulation would include a reporting requirement for both accidents and incidents involving accuracy, as is the case with medical devices. This would supplement existing safety recommendations relating to the accreditation of laboratories, such as those set forth in the Nation Academy of Science's 2009 report.¹⁶¹ Regulation would also be set for any device employed in criminal procedures, for example, audio and video recording devices used in investigations, so as to ensure that recordings capture crucial moments and expose the truth. Given that these are standard measures in other fields, set in law, they could be easily implemented in criminal law as well.

Second, the *protocols for police lineups* suggested in the professional literature must be adopted, including video documentation of the procedure.¹⁶²

Third, *all interrogations should be videotaped* to eliminate the secrecy shrouding them.¹⁶³

Fourth, an operative conclusion deriving from organizational theories is that *evidentiary autonomy must be sought in criminal law to the greatest extent possible*. In the context of scientific evidence, for example, sequential unmasking protocols are necessary for ensuring that certain details regarding a case and its investigation are withheld from lab technicians working on case-related evidence, such as the fact that the victim identified the suspect.

Fifth, *safety must be implemented throughout the entire duration of the criminal procedure, including the investigation and trial stages and following conviction*. Because conviction does not require absolute certainty of guilt, post-conviction DNA testing must be granted to anyone requesting it.¹⁶⁴

Sixth, safety considerations and the need to prevent a high false conviction rate mandate *a legal rule prohibiting convictions based on a single piece of evidence*. As we have shown

¹⁶¹ See *supra* note 89.

¹⁶² See, e.g., Gary Wells, *Eyewitness Identification: Systemic Reforms*, 2006 WIS. L. REV. 615.

¹⁶³ On the need to record the entire interrogations, see Brandon L. Garrett, *The Substance of False Confessions*, 62 STAN. L. REV. 1051, 1113-1115 (2010).

¹⁶⁴ Innocence Project, *Access To Post-Conviction DNA Testing*, http://www.innocenceproject.org/Content/Access_To_PostConviction_DNA_Testing.php.

elsewhere,¹⁶⁵ not only is classic evidence such as confessions¹⁶⁶ and lineup identifications not sufficiently accurate to establish guilt beyond a reasonable doubt, but even the strongest scientific evidence, including fingerprints and DNA matches, may be flawed. Therefore, *a requirement for additional evidence to convict is crucial.*

Seventh, when there is a confession, there must be an at least 91% probability of guilt arising from the rest of the evidence in order to reach a probability of 99% based on the confession. This was the result of a mathematical calculation we presented in a recent article, using Bayes' theorem.¹⁶⁷ Moreover, even if the legal system is willing to take a serious risk and allow conviction according to Blackstone's ratio, which can be translated into a 91% certainty of guilt, this threshold can be met only if a 50% probability of guilt arises from the evidence not including the confession.¹⁶⁸ The perhaps surprising ramifications of this is that a confession should be treated as only *corroboration* for other solid evidence, if any exists, and not as the main piece of evidence requiring corroboration in order to convict.

In closing, it must be emphasized again that we do not purport here to cover the full gamut of necessary changes for achieving safety in the criminal justice system, or even all of the central ones. Rather, we seek to offer only some examples of possible specific measures that would comprise only part of a comprehensive safety program in the criminal justice system.

Conclusion

In this Essay, we have described safety and how it is currently implemented in various fields and industries, while showing that criminal law lacks safety mechanisms. We presented examples of safety measures in other areas so as to illustrate the possibility of safety implementation at minimal, if not negligible, cost to significantly reduce the risk of false conviction without impairing law enforcement. Some of safety measures, such as improving the accuracy of scientific evidence, would reduce not only the rate of false positives--i.e., conviction of the innocent--but also the false negative rate--i.e., acquittal of the guilty--thereby killing two birds with one stone.

¹⁶⁵ Sangero & Halpert, *supra* note 2.

¹⁶⁶ See Sangero & Halpert, *supra* note 1.

¹⁶⁷ *Id.*

¹⁶⁸ *Id.*

Under the Hidden Accident Principle in criminal law, even from a theoretical perspective, the criminal justice system does not usually benefit from feedback. And like any system that does not receive feedback, the criminal law system has become negligent, perhaps even aware of the possibility of false conviction.

If we use the rate set in *Limone* (\$1 million per year of incarceration)¹⁶⁹ to translate into economic terms the cost of all false convictions and incarcerations in the United States at any given point in time (approximately 105,000 people), we arrive at direct damage of over 100 billion dollars per year. This calculation does not incorporate the cost of unnecessary trials and the fact that the true perpetrators of the crimes roam free and are liable to continue in their criminal behavior. These both represent huge harms, the reduction of which entails significant resources.

Our specific, non-exhaustive recommendations are not sufficient to fully address the issue of safety in the criminal justice system. Given the considerable damage caused by false convictions, there is a need to develop a comprehensive and systematic safety theory for the criminal justice system. In light of the Hidden Accident Principle in criminal law, that theory must be guided by safety models from other fields, such as aviation, engineering, or medicine, without taking any shortcuts or relying on the unfounded belief that the criminal justice system is error-free. Safety must be incorporated into the law enforcement system. It must be implemented at all stages of criminal proceedings and thereafter as well. Police investigators, experts, prosecutors, defense attorneys, and judges must all receive the necessary education, guidance, and training so that the notion of safety is internalized in every law enforcement body and an atmosphere of safety is created. As part of a comprehensive safety theory, we call for the establishment of a centralized federal body to oversee safety in the criminal justice system, along the same lines as the National Highway Traffic Safety Administration and FDA. Included in its duties would be to investigate accidents (false convictions) and incidents (averted accidents) in the criminal justice system and to formulate concrete recommendations to prevent them, something that currently almost never occurs.

¹⁶⁹ *Limone v. United States*, 579 F.3d 79 (2009); *see also* text accompanying *supra* note 58.

Developing a comprehensive safety theory for criminal law will require much research in various fields. Researchers from law as well as other disciplines should be called on to contribute to the formulation of such a theory. The legal system must make greater use of scientific research and rely less on so-called common sense and "life experience." Such research will enable an assessment of the risks innate to the system and raise possibilities for eliminating those risks without undermining the objectives of criminal law. Only once this has been accomplished will society be able to celebrate its legal system in which more actual criminals and fewer innocent people are convicted.