

**EVALUATING THE ROLE
AND IMPACT
OF FORENSIC DNA PROFILING
ON KEY AREAS
OF THE
CRIMINAL JUSTICE SYSTEM**

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CERTIFICATE OF AUTHORSHIP/ORIGINALITY

I certify that the work in this thesis has not previously been submitted for a degree nor has it been submitted as part of requirements for a degree except as fully acknowledged within the text.

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Table of Contents

LIST OF FIGURES	VI
LIST OF TABLES	IX
LIST OF ABBREVIATIONS	XI
ABSTRACT.....	XIII
CHAPTER 1. INTRODUCTION.....	1
1.1. FORENSIC DNA PROFILING IN THE CONTEXT OF THE CRIMINAL JUSTICE SYSTEM.....	1
1.1.1. <i>Part One – Operational Impact</i>	3
1.1.2. <i>Part Two – Socio-Legal Impact</i>	5
1.2. TWO-PART PROJECT PLAN.....	7
CHAPTER 2. THE EVOLUTION OF FORENSIC DNA PROFILING	10
2.1. INTRODUCTION	10
2.2. EVOLUTION OF FORENSIC DNA PROFILING	11
2.2.1. <i>Molecular Basis</i>	11
2.2.2. <i>Technological Basis</i>	21
2.3. DISCERNIBLE TRENDS IN THE APPLICATION OF FORENSIC DNA PROFILING.....	32
2.3.1. <i>Refinement and Standardisation</i>	33
2.3.2. <i>Expansion and Sophistication</i>	34
2.3.3. <i>Diversification – New Technologies</i>	35
2.3.4. <i>Diversification – New Applications</i>	44
2.4. SUMMARY.....	46
CHAPTER 3. FORENSIC DNA DATABASES.....	48
3.1. INTRODUCTION	48
3.2. A BRIEF HISTORY OF NATIONAL DNA DATABASE PROGRAMS	51
3.2.1. <i>Australia</i>	52
3.2.2. <i>New Zealand (NZ)</i>	67
3.2.3. <i>The United Kingdom and Europe</i>	68
3.2.4. <i>United States of America (USA)</i>	77
3.2.5. <i>Canada</i>	82
3.2.6. <i>Asia and the Sub-Continent</i>	83
3.2.7. <i>Africa and the Middle East</i>	84
3.2.8. <i>Trans-National DNA Databases</i>	84
3.3. OBSERVATIONS AND LESSONS FROM DNA DATABASE DEVELOPMENT.....	89
CHAPTER 4. QUANTITATIVE SURVEY OF FORENSIC DNA DATABASE GROWTH	96
4.1. INTRODUCTION	96
4.2. METHODS	96
4.2.1. <i>CODIS</i>	98
4.2.2. <i>Canada</i>	104
4.2.3. <i>United Kingdom (UK)</i>	108
4.2.4. <i>The Netherlands</i>	115
4.2.5. <i>New Zealand (NZ)</i>	120
4.2.6. <i>Summary – Growth Characteristics</i>	126
4.3. IMPACT ON FORENSIC BIOLOGY PROCESSES	128

4.3.1.	<i>Focus Study – NSW State Forensic Biology Laboratory</i>	130
4.4.	SUMMARY.....	139
CHAPTER 5. MODELLING FORENSIC DNA DATABASE PERFORMANCE		145
5.1.	INTRODUCTION	145
5.2.	INFERRENTIAL STATISTICS – MODELLING DNA DATABASE PERFORMANCE	155
5.2.1.	<i>Deriving an Inferential Model</i>	156
5.2.2.	<i>Testing the Inferential Model using CODIS Data</i>	162
5.3.	APPLYING THE INFERRENTIAL MODEL TO OTHER NATIONAL DNA DATABASES	169
5.3.1.	<i>United Kingdom (UK)</i>	170
5.3.2.	<i>New Zealand (NZ)</i>	172
5.3.3.	<i>Canada</i>	173
5.3.4.	<i>Combined</i>	174
5.4.	FACTORING IN THE FINANCIAL AND ETHICAL COST	176
5.4.1.	<i>Financial Cost</i>	177
5.4.2.	<i>Ethical Cost</i>	179
5.5.	SUMMARY	183
CHAPTER 6. DNA, DATABASES AND FORENSIC INTELLIGENCE		186
6.1.	INTRODUCTION	186
6.2.	DEFINITIONS OF “INTELLIGENCE”	190
6.3.	LAW ENFORCEMENT INTELLIGENCE SYSTEMS.....	192
6.3.1.	<i>Violent Crime Linkage and Analysis System (ViCLAS)</i>	194
6.3.2.	<i>Violent Crime Apprehension Program (VICAP)</i>	197
6.3.3.	<i>Home Office Large Major Enquiry System (HOLMES)</i>	199
6.3.4.	<i>Forensic Science and Intelligence-Led Policing</i>	200
6.3.5.	<i>Linkage Blindness and Organisational Pathologies</i>	204
6.4.	FORENSIC SCIENCE: AN ENHANCEMENT TO LAW ENFORCEMENT INTELLIGENCE SYSTEMS	206
6.4.1.	<i>Forensic Science: Investigative versus Evidential Use</i>	208
6.5.	INVESTIGATIVE USE OF FORENSIC DATABASES	211
6.5.1.	<i>Level 1 – Discipline Database Model</i>	212
6.5.2.	<i>Level 2 – Managed Discipline Database Model</i>	215
6.5.3.	<i>Level 3 – Managed Multi-Discipline Database Model</i>	229
6.5.4.	<i>Level 4 – The Integrated Model</i>	230
6.6.	SUMMARY.....	236
CHAPTER 7. IMPACT OF DNA PROFILING ON SOCIO-LEGAL DEBATE.....		240
7.1.	INTRODUCTION	240
7.2.	IDEOLOGICAL ISSUES	246
7.3.	ISSUES OF PROFESSIONAL IDENTITY	255
7.4.	OPERATIONAL ISSUES	263
7.4.1.	<i>Contemporary Issues</i>	264
7.4.2.	<i>The Construction of DNA-based Legislation</i>	265
7.4.3.	<i>The Appropriateness of Increased Police Powers</i>	268
7.4.4.	<i>The Justification for DNA Databases and Associated Legislative Change</i>	270
7.5.	SUMMARY.....	273
CHAPTER 8. IMPACT OF FORENSIC DNA PROFILING ON AUSTRALIAN CASE-LAW.....		276
8.1.	INTRODUCTION	276
8.2.	DNA-BASED CASE LAW	277
8.2.1.	<i>Statistical Interpretation</i>	280
8.2.2.	<i>Reliability of DNA Profiling Systems and Experts</i>	293
8.2.3.	<i>Results and Profile Interpretation</i>	298
8.2.4.	<i>Absence of DNA Evidence</i>	305
8.2.5.	<i>Procedure and/or Reporting Issues</i>	305

8.2.6.	<i>Post-Conviction DNA Evidence</i>	308
8.3.	RULINGS BASED ON “ <i>FORENSIC PROCEDURES</i> ” LEGISLATION.....	310
8.4.	TRENDS IN AUSTRALIAN DNA-BASED RULINGS.....	324
8.5.	SUMMARY.....	330
CHAPTER 9.	EVIDENTIARY ISSUES ASSOCIATED WITH DNA DATABASES	338
9.1.	INTRODUCTION	338
9.2.	ADVENTITIOUS MATCHES.....	340
9.3.	ESTIMATION OF DNA MATCH STATISTICS	347
9.4.	SUMMARY.....	355
CHAPTER 10.	COMPLEX CASE EXAMPLE: <i>R V BROPHO</i>	357
10.1.	INTRODUCTION	357
10.2.	CASE BACKGROUND	358
10.3.	DNA EVIDENCE.....	360
10.4.	THE RULING	362
10.4.1.	<i>Understanding Substructure in the Aboriginal Australian Sub-population</i>	363
10.4.2.	<i>Interpreting the Results of Hypothesis Testing</i>	370
10.4.3.	<i>The reliability of the sub-population model</i>	374
10.5.	SUMMARY.....	378
CHAPTER 11.	CONCLUDING REMARKS AND FUTURE DIRECTIONS	383
CHAPTER 12.	REFERENCES	385
APPENDIX 1:	PUBLICATIONS ARISING FROM THIS RESEARCH	426

List of Figures

FIGURE 1-1 SIMPLIFIED REPRESENTATION OF THE INTERACTING DOMAINS OF THE CJS RELEVANT TO FORENSIC DNA PROFILING.	2
FIGURE 1-2: FRAMEWORK WITHIN WHICH FORENSIC DNA PROFILING FUNCTIONS IN THE CRIMINAL JUSTICE SYSTEM AND ARCHITECTURE FOR THE PRESENT RESEARCH PROJECT.	9
FIGURE 2-1: A DIAGRAMMATIC REPRESENTATION OF THE PHENOMENON OF A ‘SILENT’ ALLELE DUE TO A MUTATION IN THE PRIMER-BINDING SITE REGION AFFECTING THE PCR PROCESS.	13
FIGURE 2-2: A DIAGRAMMATIC REPRESENTATION OF THE DISTRIBUTION OF CODING AND NON-CODING REGIONS ON THE HUMAN GENOME.	14
FIGURE 2-3: AN EXAMPLE OF THE EFFECT OF ASSORTMENT IN GENERATING HAPLOID DIVERSITY.	17
FIGURE 2-4: DIAGRAMMATIC REPRESENTATION OF RECOMBINATION SHOWING ITS EFFECT IN SHUFFLING THE DISTRIBUTION OF GENETIC MATERIAL IN THE RESULTANT GAMETES.	18
FIGURE 2-5: AN EXAMPLE OF PATERNAL GERMLINE SINGLE-STEP MUTATIONS IN TWO AUTOSOMAL STR LOCI.	20
FIGURE 2-6: DIAGRAMMATIC REPRESENTATION OF THE USE OF RFLP TO DISTINGUISH THE DNA OF TWO DONORS.	22
FIGURE 2-7: DIAGRAMMATIC REPRESENTATION OF RFLP-TYPING OF VNTR LOCI.	23
FIGURE 2-8: FOUR PROFILES AT THE HUMD21S11 AUTOSOMAL MICROSATELLITE LOCUS.	30
FIGURE 2-9: DIAGRAMMATIC REPRESENTATION OF ALLELE DESIGNATION IN AN AUTOMATED SYSTEM.	31
FIGURE 2-10: THREE PHASES OF DEVELOPMENT OF FORENSIC DNA PROFILING (WALSH, <i>ET AL.</i> , 2004)	33
FIGURE 3-1: SUMMARY OF FUNCTIONALITY OF A STANDARD DNA DATABASE SYSTEM.	49
FIGURE 3-2: UTILISATION OF NCIDD AT OCTOBER 2008.	59
FIGURE 3-3: BRIEF SUMMARY OF DNA DATABASE OPERATIONS IN EACH AUSTRALIAN JURISDICTION INCLUDING NCIDD.	66
FIGURE 3-4: SUMMARY OF CURRENT STATUS OF GLOBAL DNA DATABASE DEVELOPMENT.	88
FIGURE 4-1: PLOT OF THE GROWTH OF THE CODIS OFFENDER DATABASE OVER TIME (UPPER PANE). THE LINEAR TRENDLINE DOES NOT FIT CLOSELY AND THE PLOT OF RESIDUALS RE-EMPHASISES THIS (LOWER PANE).	99
FIGURE 4-2: PLOT OF THE GROWTH OF THE CODIS OFFENDER DATABASE OVER TIME (UPPER PANE) WITH A QUADRATIC TRENDLINE FITTED. THE RESIDUAL PLOT (LOWER PANE) DEMONSTRATES A CLOSE FIT TO THE REGRESSED MODEL WITH A RECENT UPWARD INFLEXION AWAY FROM THE PREDICTED CURVE EQUATION.	100
FIGURE 4-3: PLOT OF THE GROWTH OF THE CODIS CRIME SAMPLE DATABASE OVER TIME (UPPER PANE). THE LINEAR TRENDLINE FIT IS POOR AS DEMONSTRATED IN THE RESIDUAL PLOT (MIDDLE PANE). THE GROWTH RATE OVER THE MOST RECENT 30 MONTH PERIOD IS LINEAR (LOWER PANE).	102
FIGURE 4-4: PLOT OF THE GROWTH OF THE CODIS CRIME SAMPLE DATABASE OVER TIME (UPPER PANE) WITH A QUADRATIC TRENDLINE FITTED. THE RESIDUAL PLOT (LOWER PANE) DEMONSTRATES A CLOSE FIT TO THE REGRESSED MODEL.	103
FIGURE 4-5: PLOT OF THE GROWTH OF THE CANADIAN OFFENDER DATABASE OVER TIME (UPPER PANE). THE CORRELATION COEFFICIENT ($R^2=0.9989$) AND THE RESIDUAL PLOT (LOWER PANE) INDICATE AN INCREDIBLY LINEAR GROWTH PROFILE OVER THE ENTIRE PERIOD OF OPERATION.	105
FIGURE 4-6: PLOT OF THE GROWTH OF THE CANADIAN CRIME SAMPLE DATABASE OVER TIME (UPPER PANE). WHILST THE CORRELATION COEFFICIENT ($R^2=0.981$) FOR THE LINEAR REGRESSION IS HIGH THE RESIDUAL PLOT (LOWER PANE) INDICATES A MILD DEGREE OF GENERAL NON-LINEARITY.	106
FIGURE 4-7: PLOT OF THE GROWTH OF THE CANADIAN CRIME SAMPLE DATABASE OVER TIME (UPPER PANE) WITH A QUADRATIC TRENDLINE FITTED. THE RESIDUAL PLOT (LOWER PANE) DEMONSTRATES A CLOSE FIT TO THE REGRESSED MODEL.	107
FIGURE 4-8: PLOT OF THE GROWTH OF THE UK NDNAD OFFENDER SAMPLE DATABASE OVER TIME (UPPER PANE) WITH A LINEAR REGRESSION TRENDLINE FITTED. WHILST THE CORRELATION COEFFICIENT IS	

REASONABLE ($R^2=0.933$) THE RESIDUAL PLOT (LOWER PANE) DEMONSTRATES A POOR FIT TO THE REGRESSED MODEL.	110
FIGURE 4-9: PLOT OF THE GROWTH PROFILE OF THE UK NDNAD OFFENDER SAMPLE DATABASE (UPPER PANE) WITH A QUADRATIC TRENDLINE FITTED ($R^2=0.9987$). THE RESIDUAL PLOT (LOWER PANE) DEMONSTRATES A CLOSE FIT TO THE DERIVED QUADRATIC FORMULAE.	111
FIGURE 4-10: GROWTH PROFILE (UPPER PANE) AND RESIDUAL PLOT (LOWER PANE) OF THE UK NDNAD CRIME SAMPLE DATABASE SHOWS A NON-LINEAR TREND.	112
FIGURE 4-11: GROWTH PROFILE (UPPER PANE) AND RESIDUAL PLOT (LOWER PANE) OF THE UK NDNAD CRIME SAMPLE DATABASE SHOWS A CLOSE FIT TO AN INCREASING EXPONENTIAL GROWTH RATE ($R^2=0.9987$).	114
FIGURE 4-12: THE GROWTH PROFILE (UPPER PANE) AND RESIDUAL PLOT (LOWER PANE) OF THE DUTCH OFFENDER DATABASE SHOWS A DISTINCT UPWARD INFLEXION AT MONTH 89 (MAY 2005).	116
FIGURE 4-13: GROWTH PROFILE OF THE DUTCH OFFENDER DATABASE SHOWING SERIES BEFORE AND AFTER MAY 2005 SEPARATELY SUBJECT TO LINEAR REGRESSION. THE STEEP UPWARD INFLEXION IS CLEAR AND A CONSIDERABLE DEGREE OF LINEARITY IS APPARENT AFTER MAY 2005.	117
FIGURE 4-14: RESIDUAL PLOT OF THE LINEAR REGRESSION OF PRE-MAY 2005 DATA FOR THE DUTCH OFFENDER DATABASE. A CLEAR UPWARD INFLEXION IS OBSERVED AT APPROXIMATELY MAY 2003.	118
FIGURE 4-15: GROWTH PROFILE (UPPER PANE) AND RESIDUAL PLOT (LOWER PANE) FOR THE DUTCH CRIME SAMPLE DATABASE. ALTHOUGH LESS PRONOUNCED, AN INFLEXION POINT APPEARS AT MONTH 62 (FEBRUARY 2003).	119
FIGURE 4-16: GROWTH PROFILE (UPPER PANE) AND RESIDUAL PLOT (LOWER PANE) OF THE NZ OFFENDER DATABASE SHOWS A REASONABLE FOLLOWING LINEAR REGRESSION. THE RESIDUAL PLOT INDICATES AN UPWARD INFLEXION AT MONTH 60 (FEBRUARY 2002).	121
FIGURE 4-17: GROWTH PROFILE (UPPER PANE) AND RESIDUAL PLOT (LOWER PANE) OF THE NZ OFFENDER DATABASE SHOWS A CLOSE FIT TO THE QUADRATIC REGRESSION ($R^2=0.9978$).	122
FIGURE 4-18: GROWTH PROFILE OF THE NZ OFFENDER DATABASE SHOWING SERIES BEFORE AND AFTER FEBRUARY 2002 SEPARATELY SUBJECT TO LINEAR REGRESSION. A MILD UPWARD INFLEXION IS APPARENT AS IS A CONSIDERABLE DEGREE OF LINEARITY BEFORE ($R^2 = 0.9827$) AND AFTER ($R^2 = 0.9989$) THIS PIVOT POINT.	123
FIGURE 4-19: GROWTH PROFILE (UPPER PANE) AND RESIDUAL PLOT (LOWER PANE) OF THE NZ CRIME SAMPLE DATABASE DEMONSTRATING A REASONABLE FIT FOLLOWING LINEAR REGRESSION ($R^2 = 0.9597$).	124
FIGURE 4-20: GROWTH PROFILE (UPPER PANE) AND RESIDUAL PLOT (LOWER PANE) OF THE NZ CRIME SAMPLE DATABASE DEMONSTRATING A BETTER FIT FOLLOWING QUADRATIC REGRESSION ($R^2 = 0.9987$).	125
FIGURE 4-21: GRAPHICAL REPRESENTATION OF CASE CATEGORIES THAT SHOW A NEGATIVE NET CHANGE IN THEIR PROPORTIONAL SUBMISSION BETWEEN 1998 AND 2005.	134
FIGURE 4-22: GRAPHICAL REPRESENTATION OF CASE CATEGORIES THAT SHOW A POSITIVE NET CHANGE IN THEIR PROPORTIONAL SUBMISSION BETWEEN 1998 AND 2005.	134
FIGURE 4-23: GRAPHICAL DISPLAY OF THE CORRELATION BETWEEN ITEMS SUBMITTED AND DNA SAMPLES PROCESSED IN THE NSW STATE DNA LABORATORY BETWEEN 2001-2005.	136
FIGURE 4-24: PIE-CHARTS DEMONSTRATING THE CHANGE IN PROPORTION OF SAMPLE TYPES ANALYSED FROM CRIMES BETWEEN 2001 AND 2005.	139
FIGURE 5-1: GRAPHING SUBMISSION AND HIT RATES FOR THE 12 NZ POLICE DISTRICTS (LABELLED A-L)....	150
FIGURE 5-2: GEOGRAPHICAL DISTRIBUTION OF CRIME-TO-PERSON MATCHES FROM TWO NZ POLICE DISTRICTS, REPRODUCED FROM WALSH <i>ET AL.</i> (WALSH, <i>ET AL.</i> , 2002A).	151
FIGURE 5-3: SUMMARY OF ATTRITION MODEL FOR UK NDNAD DATA SHOWING THAT FOR EVERY 100 REPORTED BURGLARIES BETWEEN 1-2% RESULT IN A CONVICTION FOLLOWING DNA ANALYSIS.	154
FIGURE 5-4: DOT-PLOT SHOWING THE RELATIONSHIP BETWEEN H AND N FOR 50 SDIS DATABASES OF THE CODIS. TWO DATASETS HAVE BEEN HIGHLIGHTED; TEXAS (IN RED) AND CALIFORNIA (IN BLUE).	163
FIGURE 5-5: DOT-PLOT SHOWING THE RELATIONSHIP BETWEEN H AND C FOR 50 SDIS DATABASES OF THE CODIS. TWO DATASETS HAVE BEEN HIGHLIGHTED; TEXAS (IN RED) AND CALIFORNIA (IN BLUE).	163
FIGURE 5-6: DOT-PLOT SHOWING THE RELATIONSHIP BETWEEN H AND NC FOR 50 SDIS DATABASES OF THE CODIS. TWO DATASETS HAVE BEEN HIGHLIGHTED; TEXAS (IN RED) AND CALIFORNIA (IN BLUE).	164
FIGURE 5-7: DOT-PLOT SHOWING THE RELATIONSHIP BETWEEN RI AND THE RATIO OF $C:N$ (LOG SCALE) FOR 50 SDIS DATABASES OF THE CODIS. TWO DATASETS HAVE BEEN HIGHLIGHTED; CALIFORNIA (IN RED) AND TEXAS (IN BLUE).	166

FIGURE 5-8: SCATTER PLOT SHOWING THE RELATIONSHIP BETWEEN HR AND THE PROPORTION OF THE POPULATION SAMPLED (N/P) FOR 50 SDIS DATABASES OF THE CODIS.....	168
FIGURE 5-9: SCATTER PLOT OF H VS. NC FOR THE UK NDNAD.	171
FIGURE 5-10: SCATTER PLOT OF H VS. NC FOR THE NZ NATIONAL DNA DATABASE.	172
FIGURE 5-11: SCATTER PLOT OF H VS. NC FOR THE CANADIAN NATIONAL DNA DATABASE.	173
FIGURE 5-12: SCATTER PLOT OF H VS. NC FOR THE UK, NZ AND CANADIAN DATA AGAINST A BACKGROUND OF THE CODIS DATA (LABELED AS BEFORE AS CALIFORNIA, TEXAS AND REMAINDER).....	175
FIGURE 6-1: THE INTELLIGENCE PROCESS DESCRIBED BY HARRIS (1976), ADAPTED FROM 'I2000'.....	190
FIGURE 6-2: DESCRIPTION OF KEY STEPS IN INTELLIGENCE PROCESS.	192
FIGURE 6-3: COMMON EXAMPLES OF DISCIPLINE FORENSIC DATABASES.	212
FIGURE 6-4: AN EXAMPLE OF A TYPICAL STRUCTURE OF A <i>DISCIPLINE DATABASE MODEL</i> . THIS HAS BEEN BASED ON FORENSIC DNA DATABASES AS THIS DISCIPLINE IS THE FOCUS OF THIS RESEARCH.	213
FIGURE 6-5: AN EXAMPLE OF A PROPOSED STRUCTURE OF A <i>MANAGED DISCIPLINE DATABASE MODEL</i> . ONCE AGAIN THIS MODEL IS BASED ON FORENSIC DNA DATABASES.	215
FIGURE 6-6: AN EXAMPLE OF A PROPOSED STRUCTURE OF A <i>MANAGED MULTI-DISCIPLINE DATABASE MODEL</i> . ONCE AGAIN THIS MODEL IS BASED ON FORENSIC DNA DATABASES.	229
FIGURE 6-7: AN EXAMPLE OF AN <i>INTEGRATED MODEL</i> . THIS MODEL EMBEDS THE MANAGED MULTI-DISCIPLINE MODEL WITHIN EXISTING CRIME ANALYSIS STRUCTURES.	230
FIGURE 8-1: LOOK-UP CHART OF CRITICAL DNA-RELATED COURT RULINGS MADE IN AUSTRALIAN COURTS.	280
FIGURE 8-2: TIME-SCALE GRAPH OF THE 67 ISSUES REVIEWED IN THE DNA-BASED RULINGS DOCUMENTED ABOVE.	325
FIGURE 8-3: TIME-SCALE GRAPH OF THE 66 REVIEWED RULINGS DOCUMENTED ABOVE CATEGORISED ON THE BASIS OF THE MAJOR ASPECTS CRITICALLY ANALYSED IN THE JUDGEMENT.	326
FIGURE 8-4: RELATIVE FOCUS OF QA SYSTEM ON DIFFERENT CATEGORIES OF FORENSIC ISSUES GRAPHED AGAINST THE LIKELIHOOD OF COURT CHALLENGE.	335
FIGURE 10-1: ABORIGINAL REGIONS OF AUSTRALIA DEFINED BY THE LANGUAGE MAP OF HORTON (1996). 365	
FIGURE 10-2: THESE MAPS SHOW THE GEOGRAPHIC DISTRIBUTION OF THE NON-ABORIGINAL AUSTRALIAN POPULATION (UPPER MAP) AND THE ABORIGINAL AUSTRALIAN POPULATION (LOWER MAP). ABORIGINAL AUSTRALIANS ARE MORE LIKELY TO LIVE IN REMOTE AREAS OF THE CONTINENT. FIGURES ADAPTED FROM (ABS, 2003).	366
FIGURE 10-3: PRINCIPAL COMPONENT ANALYSIS (PCA) OF THE FULL GENETIC DISTANCE MATRIX FOR THE FIFTEEN ABORIGINAL AUSTRALIAN REGIONS AND THE COMBINED CAUCASIAN DATASET (CC). THIS ANALYSIS SHOWS THE TIWI AND EAST ARNHEM LAND (EA) POPULATIONS CLEARLY DEPARTING FROM THE REMAINDER, WHICH THEMSELVES ARE DISTRIBUTED LOOSELY ALONG GEOGRAPHICAL GROUNDS. 368	
FIGURE 10-4: PLOT OF P -VALUE VERSUS SAMPLE SIZE.....	372
FIGURE 10-5: EXPANDED PLOT OF P -VALUE VERSUS SAMPLE SIZE FOR DATASETS CONTAINING LESS THAN 500 PROFILES.....	372
FIGURE 10-6: THIS EXPERIMENT SIMULATED A POPULATION WITH VARYING LEVELS OF INBREEDING AT THE SUB-POPULATION (θ_x) AND SUB-SUB-POPULATION (θ_z) LEVEL. DESPITE THE VARIATIONS IN THESE VALUES THE PERFORMANCE OF THE MODEL REMAINED CONSISTENT (SHOWN BY THE SIMILAR DISTRIBUTION OF THE POINT ESTIMATES IN ALL FIGURES A-D).....	376
FIGURE 10-7: RESULTS OF SIMULATION EXPERIMENTS DEMONSTRATING THE EFFECT OF USING A VARYING THETA ESTIMATE (θ_{Calc}) TO ESTIMATE A MATCH PROBABILITY FOR A SIMULATED POPULATION WITH A KNOWN LEVEL OF INBREEDING (θ_{Breed}).	377

List of Tables

TABLE 2-1: TYPES OF DNA POLYMORPHISMS AND THEIR BASIC CHARACTERISTICS.....	16
TABLE 2-2: STR MULTIPLEXES COMMONLY USED IN FORENSIC DNA PROFILING.	28
TABLE 3-1: LEGISLATIVE MODELS IN THE NINE AUSTRALIAN CRIMINAL JUSTICE JURISDICTIONS.	56
TABLE 3-2: NCIDD OPERATIONAL MATCHING TABLE – COMMONWEALTH	63
TABLE 3-3: NCIDD OPERATIONAL MATCHING TABLE – NEW SOUTH WALES.....	65
TABLE 3-4: CHRONOLOGY OF DNA DATABASE DEVELOPMENT IN THE UK AND EUROPE.	73
TABLE 3-5: QUALIFYING OFFENCES FOR DNA DATABASE LAWS IN STATES OF THE USA (DATA ADAPTED FROM AUSLINKAS ET AL. (AULINSKAS, <i>ET AL.</i> , 2000) AND THE DNA RESOURCE WEBSITE (2003 AND 2008).	78
TABLE 3-6: TEN LARGEST SDIS DATABASES AT JULY 2007. <i>N</i> REPRESENTS THE NUMBER OF PERSON PROFILES LOADED, <i>C</i> THE NUMBER OF CRIME PROFILES LOADED AND <i>H</i> THE NUMBER OF INVESTIGATIONS AIDED.	81
TABLE 3-7: TEN SMALLEST SDIS DATABASES AT JULY 2007. <i>N</i> REPRESENTS THE NUMBER OF PERSON PROFILES LOADED, <i>C</i> THE NUMBER OF CRIME PROFILES LOADED AND <i>H</i> THE NUMBER OF INVESTIGATIONS AIDED.	81
TABLE 4-1: GLOBAL DNA DATABASE DATA AVAILABLE FOR ANALYSIS.	97
TABLE 4-2: YEARLY AND CUMULATIVE FIGURES INDICATING THE GROWTH OF THE UK NDNAD WHERE <i>N</i> AND <i>C</i> ARE THE NUMBER OF PROFILES ON THE OFFENDER AND CRIME SAMPLE DATABASES, RESPECTIVELY. <i>N(CUM)</i> AND <i>C(CUM)</i> REFER TO THE CUMULATIVE TOTALS OF THESE INDICES.	109
TABLE 4-3: CASE SUBMISSION DATA FROM THE NSW STATE DNA LABORATORY (DAL).	131
TABLE 4-4: PROPORTIONAL CASE SUBMISSION PROFILE AT THE NSW STATE DNA LABORATORY BETWEEN 1998-2005. CASES WITH A PROPORTION <1.0% HAVE BEEN DELETED.	133
TABLE 4-5: DNA SAMPLE TYPES ANALYSED BETWEEN 2001-2005.	137
TABLE 4-6: PROPORTION OF SAMPLE TYPES ANALYSED FROM CRIMES BETWEEN 2001-2005.	138
TABLE 5-1: SUMMARY OF ANALYTICAL SUCCESS AND DATABASE HIT RATES FOR EACH MAJOR EVIDENCE TYPE, REPRODUCED FROM WALSH <i>ET AL.</i> (2002A).	151
TABLE 5-2: SUMMARY DATA UTILISED FOR THE ANALYSIS OF THE PERFORMANCE OF THE MODEL FOR UK NDNAD DATA (THE TERMS <i>N</i> , <i>C</i> AND <i>H</i> ARE AS DESCRIBED IN THE SECTION ABOVE AND “ <i>CUM</i> ” IS AN ABBREVIATION FOR “ <i>CUMULATIVE</i> ”).	170
TABLE 5-3: REPRESENTATION OF THE RELATIVE FINANCIAL AND ETHICAL COST OF CRIME AND PERSON SAMPLES.	176
TABLE 6-1: REDUCTIONS IN BREAK AND ENTER AND MOTOR VEHICLE CRIME ACHIEVED DURING OPERATION VENDAS.	217
TABLE 7-1: RESULTS FROM A PRELIMINARY SURVEY OF FIVE MAJOR FORENSIC JOURNALS INVESTIGATING FREQUENCY OF ARTICLES ON DNA AND LEGAL THEMES BETWEEN 1990-2005.	245
TABLE 8-1: GUIDELINES FOR INTRODUCING DNA EVIDENCE IN THE NT PROPOSED IN <i>LATCHA V R.</i>	288
TABLE 8-2: SUMMARY OF ISSUES AND RULINGS FROM <i>R V KARGER</i>	295
TABLE 8-3: DISTRIBUTION OF CATEGORIES BROADLY DEFINING FORENSIC ISSUE CONSIDERED IN DNA-BASED RULINGS.....	326
TABLE 8-4: SPECIFIC ISSUES ENCOMPASSED UNDER THE CATEGORY OF STATISTICAL INTERPRETATION.	327
TABLE 8-5: SPECIFIC ISSUES ENCOMPASSED UNDER THE CATEGORY OF RESULTS AND/OR PROFILE INTERPRETATION.	328
TABLE 8-6: SPECIFIC ISSUES ENCOMPASSED UNDER THE CATEGORY OF RELIABILITY OF SYSTEMS OR EXPERTS.	328
TABLE 9-1: SUMMARY OF THE SIZE AND EFFECTIVENESS OF MAJOR DNA DATABASE PROGRAMS.....	339
TABLE 9-2: CRUDE DEMONSTRATION OF EXPECTED NUMBER OF ADVENTITIOUS MATCHES IN DATABASES OF VARYING SIZE.	343
TABLE 10-1: THE EFFECT OF VARYING θ ON THE <i>PI</i> CALCULATION APPLIED IN <i>R V BROPHO</i>	364
TABLE 10-2: ESTIMATES FOR THE PARAMETER θ FOR THE FULL SET OF TRIBAL POPULATIONS FOLLOWING THE METHOD OF WEIR AND COCKERHAM (WEIR AND COCKERHAM, 1984).....	369

Simon J. Walsh

Evaluating the Role and Impact of Forensic DNA Profiling on Key Areas of the Criminal Justice System

List of Abbreviations

ABS	Australian Bureau of Statistics
ACT	Australian Capital Territory
AF	Alleged father
AFLP	Amplified fragment length polymorphism
AIMS	Ancestry informative markers
ALRC	Australian Law Reform Commission
AMOS	Automated Modus Operandi System
APMC	Australasian Police Ministers' Council
ARMS	Amplification refractory mutation system
ASIP	Agouti Signalling Protein
Aus	Australia
bp	Base-pairs
C	Number of crime profiles on a DNA Database
CCA	Court of Criminal Appeal
CJS	Criminal Justice System
CODIS	Combined DNA Index System
Cth	Commonwealth
DAB	DNA Advisory Board (USA)
DAL	Division of Analytical Laboratories (NSW, Aus)
DB	Database
DNA	Deoxyribonucleic acid
EDNAP	European DNA Profiling Group
EMPOP	European Mitochondrial DNA Population Database
ENFSI	European Network of Forensic Science Institutes
ESR	Institute of Environmental Science and Research Ltd. (NZ)
EU	European Union
FBI	Federal Bureau of Investigation
FSS	Forensic Science Service (UK)
<i>H</i>	Number of crime-to-person links arising from a DNA Database
HLA	Human Leukocyte Antigen
<i>HR</i>	Hit Rate
HV2	Hypervariable region 2
HVI	Hypervariable region 1
HWE	Hardy-Weinberg equilibrium
IAELIA	International Association of Law Enforcement Intelligence Analysts
IAM	Infinite alleles model
LCN	Low copy number
LDIS	Local DNA Index System (USA)
LE	Linkage equilibrium
LEIU	Law enforcement intelligence unit
<i>LR</i>	Likelihood ratio
MC1R	Melanocortin 1 Receptor Gene
MCCOC	Model Criminal Code Officers Committee

MCF	Major Crime File
McSNP	Melting curve SNP typing
mtDNA	Mitochondrial DNA
MW	Molecular weight
<i>N</i>	Number of person profiles on a DNA Database
NATO	North Atlantic Treaty Organization
NCIDD	National Criminal Investigation DNA Database
NDDB	National DNA Database (Canada)
NDNAD	National DNA Database (UK)
NFI	Netherlands Forensic Institute
NIFS	National Institute of Forensic Science (Aus)
NRC	National Research Council
NRY	Non-recombining portion of the human Y-chromosome
NSW	New South Wales
NT	Northern Territory
NZ	New Zealand
PACE	Police and Criminal Evidence Act 1984 (UK)
PAGE	Polyacrylamide gel electrophoresis
PCA	Principal components analysis
PCR	Polymerase chain reaction
Qld	Queensland
RCMP	Royal Canadian Mounted Police
RFLP	Restriction fragment length polymorphism
<i>RI</i>	Return Index
RMP	Random match probability
SA	South Australia
SBE	Single base extension
SC	Supreme Court
SCAG	Standing Committee of Attorneys-General
SDIS	State DNA Index System (USA)
SEA	South East Asian
SNP	Single nucleotide polymorphism
SOCOs	Scene of Crime Officers
SSM	Slipped strand mis-pairing
SSO	Sequence specific oligonucleotide
STR	Short tandem repeat
Tas	Tasmania
TWGDAM	Technical Working Group on DNA Analysis Methods
UAE	United Arab Emirates
UK	United Kingdom
UN	United Nations
USA	United States of America
Vic	Victoria
VNTR	Variable number tandem repeat
WA	Western Australia
YHRD	Y-chromosome haplotype reference database
Y-STR	STR loci on the human Y-chromosome

Abstract

The advent of the modern technique of forensic DNA profiling has resulted in a lively union between one of the more advanced and dynamic disciplines of modern science and what is, arguably, society's most revered, influential and complex institution, the criminal justice system (CJS). The alliance, begun over 20 years ago, has been fruitful in obvious ways. There has been profound technological advancement, and astonishing policing outcomes. But the years have also brought strains, evidenced in the on-going, and sometimes bitter, socio-legal controversy.

The sheer pace of the developments surrounding DNA profiling, and the scope of its impact, have meant that the forensic and legal agencies associated with its use have often been able to do little more than fight a rearguard action when it came to handling the pressures and complexities they faced. This has been particularly the case since the use of forensic DNA databases began expanding so notably around the globe.

Managing the demand for the forensic technology, and its remarkable potential, has required an unprecedented commitment of public funds. Both forensic and police operational practices have had to be modified. And very close attention has been called for on the part of judicial and legislative bodies in states and countries everywhere. Given the circumstances in which this substantial progress has occurred, the capacity of the forensic community to undertake reasoned strategic assessment of the future implications of change has been severely restricted. In fact, there has been a lack of reflection, and far too little evaluation of the outcomes of developmental efforts and achievements. The focus of the forensic community has been consumed with meeting the immediate demands and implementing the next generation of technology.

No matter how understandable it might be, this situation is unfortunate. Over recent years the field of forensic DNA profiling has matured from being an obscure, niche

discipline to become a mainstream, public-good science. The technological platform for it and its operational scope have both broadened notably; and the socio-legal ramifications of its use have intensified.

This vast increase in the scale and complexity of the operational context of the forensic DNA discipline makes it imperative that the forensic community understand its role in a more holistic sense so as to have a greater level of influence over its future impact. Achieving this requires developing a deeper awareness of the contextual environment within which forensic DNA profiling is applied. This research sets out to undertake such an evaluation. Its aim is to take a system-wide view of the role and impact of forensic DNA profiling on key areas of the CJS.