

Index

- AAIB, 159, 198, 199, 208, 231, 643
Accessibility Act (US), 751
Accident Analysis Framework, 405
Administrative Decisions Legislation Amendment Act (New South Wales, Australia), 804
Adverse Incident Tracking System, *see* AITS
AIMS, 39, 141, 735, 739–741, 745–747, 749, 752, 773, 775, 816
Air Accidents Investigation Branch, *see* AAIB
AITS, 745
Anaesthesia, 902
APSF, 740, 749, 752, 773, 774, 816
ASRS, xi, 26–28, 35–37, 39, 41, 62, 82, 93, 99, 103–105, 123, 124, 131–133, 136, 138–145, 159, 164, 206, 207, 209, 345, 347, 478, 530, 533, 550, 553, 753, 771, 816, 913–916
ATSB, 49, 75, 89, 152, 347, 627, 649–653, 704, 705, 707, 804, 837, 840, 893, 903
Australian Army, 612, 613
Australian Incident Monitoring System, *see* AIMS
Australian Institute of Health and Welfare, 732, 812
Australian Marine Incident Investigation Unit, 69, 256
Australian Maritime Safety Authority, 49, 669, 670, 674
Australian Ministry of Defence, 560, 612
Australian National Occupational Health and Safety Commission, 6, 7
Australian Patient Safety Foundation, *see* APSF
Australian Reef Reporting System, 641
Australian Transportation Safety Bureau, *see* ATSB
Aviation Safety Action Programme, 30
Aviation Safety Reporting System, *see* ASRS
Aviation Safety Research Act (US), 260

Barrier Analysis, 353, 358–360, 362–364, 367–373, 377, 378, 386, 389–391, 393, 395, 415, 416, 422, 424, 425, 437, 438, 445, 454, 457, 461, 468, 493, 538, 544, 570, 571, 591–595, 603

validation, 528
barriers, 3, 22, 58, 66, 68, 188, 342, 359, 360, 362, 364, 369, 391, 397, 399, 402, 422, 441, 445, 453, 457, 459–461, 463, 465, 467, 479, 482, 484, 486, 494, 504, 507, 509, 511, 515, 516, 524, 529, 571, 591, 596, 623, 637, 640, 644, 646–648, 650, 896, 897, 900, 901, 918
and recommendations, 593
failure modes, 360
types of, 359, 593
Bayesian Analysis, 341, 503, 507–512, 521, 523, 526, 538, 830
Bayesian Networks, 511, 512
Conditional Probabilities, 511, 512
limitations of, 513
bias, 37, 63, 97, 133, 145, 162–164, 168, *see* witness, 195, 207, 276, 346, 385, 445, 515, 521, 528, 535, 644, 680, 701, 878, 890, 894, 899
analytical bias, 904–906, 919
author bias, 519, 539
checklist bias, 479, 583
confidence bias, 168, 169, 171, 172, 180, 539
confirmation bias, 71, 92, 189, 539, 905
frequency bias, 539, 836, 838, 905
group bias, 59, 559
guilt, 144, 161
hindsight bias, 418, 539
implicit bias, 189
interpretation bias, 153
introduced by analysis, 165, 261, 417, 422, 447, 479, 481
judgement bias, 154, 539
political bias, 282, 457, 539, 905
professional bias, 539, 905
recency bias, 71, 539, 836, 838
recognition bias, 154, 539, 905
regional bias, 38, 41
reporting bias, 113–115, 118, 119, 147, 599, 720, 735, 811, 902–903, 919
rhetoric, *see* rhetoric
salience bias, 342

- salience bias, 386
 simulation bias, 231, 232, 238, 239, 250, 251
 sponsor bias, 539, 905
 tracking, 802, 838
 weapon bias, 539, 545
 Black boxes, *see* Data recorders
- CAA, 16, 27, 132, 193, 786, 852
 CAD, *see* visualisation
 CAE diagrams, 310–316, 319, 320, 546
 CAIRS, 31, 38, 134, 816
 Canadian Coast Guard, 672
 Canadian National Defence
 General Accident Information System, 548
 Safety Digest, 548, 550, 553, 563–565, 902, 910
 Canadian Transportation Safety Board, 803, 812
 Case-based reasoning, 56, 126, 775, 786–789, 791, 793–796, 799, 801, 913
 Causal trees, 469, 471, 478, 502, 523, 530, 532–535, 537, 538
 validation, 531, 533
 causation
 and recommendations, 545
 Bayesian analysis, *see* Bayesian Analysis
 causal asymmetry, 500, 502, 503, 524, 593, 603, 666, 699, 787, 870, 875, 897, 906, 909, 919, 920
 causal complex, 186–188, 207, 210, 344–345, 386, 398, 402, 441, 604, 906, 909, 918, 920
 causal fields, 186, 207, 210, 218, 385, 386, 906, 919
 causal independence, 188
 contextual factors, 104, 200, 210, 215, 219, 284, 333, 335, 342, 346, 445, 469, 545, 551–554, 643, 644, 650, 801
 definition, 187, 333
 contributory factors, 3, 24, 32, 50, 79, 148, 163, 186–188, 200, 210, 215, 219, 272, 282, 284, 333–335, 342, 346, 365, 371, 372, 399, 507, 545, 569, 608, 613, 628, 657, 663, 811, 875
 definition, 188, 333
 counterfactual reasoning, *see* counterfactual reasoning
 distal factors, 24, 25, 50, 52, 53, 64, 187, 215, 239, 266, 321, 334, 339, 344, 363, 393, 440, 545, 663, 664, 699, 709, 710, 713
 exacerbating factor, 221, 252, 666
 definition, 333
 general causes, 187, 207, 210, 220, 335, 407, 417, 469, 523, 545, 918, 921
 definition, 386
 genotypes, 50–53, 58, 60, 62, 76, 77
 initial reports, 142–143
 particular causes, 210, 333, 335, 386, 453, 469, 500, 503, 523, 545, 604, 660, 664
 definition, 386
 phenotypes, 50, 52, 76
 presentation issues, 664–667
 proximal factors, 24, 50, 52, 53, 64, 187, 215, 239, 266, 281, 321, 335, 339, 344, 440, 545, 662, 664, 699, 710, 713
 root causes, 15, 24, 26, 27, 40, 101, 143, 182–185, 187–189, 200–206, 210, 215, 216, 219, 223, 271, 282, 284, 333–335, 339, 341–346, 348, 353, 358, 359, 363, 365, 371, 372, 386, 391, 404–405, 407, 409–417, 419–423, 437, 453, 466, 468, 469, 471, 473, 476, 478, 479, 485–487, 514, 516, 517, 522, 523, 525, 530, 531, 533, 535, 537, 545, 563, 581–583, 585, 593, 656, 737, 801, 807, 834, 836, 846, 860–863, 865, 905, 907, 916
 definition, 188, 333
 singular causes, 186–188, 207, 210, 333, 342, 386, 398, 407, 469, 604, 918, 921
 stochastic analysis, 4, 53, 57, 69, 249, 251, 272, 285, 501–513, 518, 545
 Cause-context summaries, 402, 404, 406, 407, 409, 411
 CD-ROM, 730, 740–744, 797
 Central Cardiac Audit Database, 749, 751
 chain of events, 202, 353, 391, 395, 469, 488, 518, 563, 656, 657
 Change Analysis, 353, 371–373, 375, 376, 378–380, 382, 383, 385, 386, 388, 391, 393, 415, 418, 422, 430, 437, 454
 Chemical Safety and Hazard Investigation Board (US), 47, 73, 133, 189, 191, 722, 840
 CHIRP, 27, 29, 34, 131, 132, 816, 915, 916
 CIRAS, 24, 31, 38, 102, 105, 121, 148, 150, 164, 724, 736, 802, 808, 819, 821–823, 832, 834, 843, 846, 849, 853, 857, 859, 883, 918
 CIRS, 31, 71, 104, 138–145, 149, 176, 202, 203, 778
 Civil Aeronautics Act (US), 47
 Civil Aviation Authority, *see* CAA
 Clean Air Act (US), 47
 Coast Guard (US), 191
 Cockpit Voice Recorders, *see* Data recorders
 coding, 905

- Computerised Accident Incident Reporting System, *see* CAIRS
Conclusion, Analysis and Evidence diagrams, *see* CAE diagrams
Confidential Human Factors Incident Reporting Programme, *see* CHIRP
Confidential Incident Reporting and Analysis System, *see* CIRAS
controls, 10, 188, 359, 455, 457, 460, 462, 463, 566, 596, 597, 603
and barriers, 359, 459
and MORT, 462, 463
and risk assessment, 603
Cooperative Complinace Program, *see* OSHA
counterfactual reasoning, 187, 310, 342, 363, 391, 397, 398, 663, 666, 825, 909
and causation, 342, 389, 397
and recommendations, 611
by proxy, 472
contrastive explanation, 491
counterfactual disjunctions, 390
in WBA, 494
Lewis on cause, 185, 204, 205, 344, 407, 688
limitations, 386, 390, 501, 502
Crew resource Management, *see* CRM
CRM, 24, 82–85, 150, 151, 585, 786
cryptography, 740, 748–750
digital signatures, 750
electronic signatures, 750
electronic watermarks, 750
PGP, 749
private key, 749, 797
public key, 749, 750, 797
S/MIME, 749
Secure Socket Layer (SSL), 749
CVR, *see* Data recorders

Data recorders, 90, 113–114, 125, 149, 157–161, 194, 224, 235, 236, 249, 251, 449, 689
Air Data Acquisition Systems, 126
Air Traffic Control requirements, 157
audio recordings, 166, 349, 869
cameras, 145
Cockpit voice recorders, 34, 80, 82, 125, 126, 158, 160, 179, 184, 198, 235, 247, 251, 303, 709
custody battles, 159
Digital flight data recorders, 125, 198
disclosure rules, 102, 160
Flight Data Monitoring programmes, 199
Flight data recorders, 30, 198
ICAO requirements, 157

limitations, 157–159, 197–200, 246
maritime systems, 194, 642
Quick Access Recorders, 199, 235
traffic studies, 872, 895
train systems, 102, 121, 157, 158, 199, 200
Universal Flight Data Recorder, 198, 199
video recordings, 125–126, 158, 161, 166, 223, 235, 248, 349, 564, 867, 869, 895, 897, 899, 900
Voyage Data Recorders, 194, 197
watchman monitors, 195
databases, 19, 31, 42, 101, 114, 133, 200, 209, 343, 389, 468, 469, 523, 547, 567, 568, 619, 630, 632, 667, 668, 735, 740, 741, 744–746, 748, 752–754, 757, 758, 761, 762, 765–767, 769, 771, 785, 786, 795, 801, 806, 808, 812, 912
accessibility, 751
benefits, 735, 752
coding schemes, 771, 772
coding systems, 762
dynamic querying, *see* Dynamic Querying
limitations, 752–754, 759, 760, 771, 905
monitoring, 673, 842, 880
private, 745, 746
public access, 745
queries, 775
query paradox, 769
relational systems, 126, 754, 768, 769, 779, 781, 797, 799, 838, 882, 892, 911–913, 920
benefits, 754, 764
limitations, 756, 760, 765, 798
scale, 752, 753
schemas, 756, 766, 785
security, 105, 747
SQL, *see* SQL
visualisation, 882, 883
decision theory, 510
Decision trees, 791, 828
Department of Justice (US)
guidelines on witness statements, 162
depression, 65, 877
digital signatures, *see* cryptography
domino theory, 466, 655

ECF analysis, 389, 391–398, 438, 523–525, 537, 569, 640, 641, 647, 661, 664
benefits, 393
counterfactual reasoning, 389–391, 393, 395, 397, 422
heuristics, 404
limitations, 389, 390, 402

- with Cause-Context Summaries, 398–402
- with Non-compliance analysis, 416, 417
- with Tier analysis, 405–407, 414, 415
- ECF charts, 353, 355, 358, 414, 415, 422, 437–439, 442, 445, 447, 454, 464, 468, 469, 471, 477, 479, 483–486, 494, 501, 516, 521, 523, 569, 640, 661
- benefits, 445
- components, 354
- interim analysis, 355
- limitations, 366, 377, 380, 382, 385, 386, 402, 422, 438
- modelling causation, 385
- symbols, 354, 378, 380, 385
- with Barrier Analysis, 359, 361, 363, 364, 366–369, 371
- with Change Analysis, 371, 372, 376, 378, 380, 382, 385, 388, 426–428
- Eindhoven Classification Model, 473, 474, 476–479, 516, 523, 530–535, 538, 773, 794, 795
- Rasmussen's SKR model, 473
- Electronic mail, 31, 739–740, 746, 773, 797
 - contributory factor, 362, 368
 - limitations, 572
 - report dissemination, 723, 726, 727
 - security, 140, 749
- electronic watermarks, *see* cryptography
- encryption, *see* cryptography
- ESA Alert System, 174
- Eurocontrol, 14, 24, 35, 43, 75, 157, 255, 550, 635, 875, 879
- European Air Traffic Management Organisation, *see* Eurocontrol
- European Space Agency Alert System, *see* ESA Alert System
- European Turbulent Wake Incident Reporting System, 158
- Event trees, 828
- Events and Causal Factor Charts, *see* ECF charts
- Events and Causal factors Analysis, *see* ECF analysis
- evidence, 47, 90, 92, 102, 115, 121, 169, 182, 263, 339, 341, 447, 450, 452, 576, 611, 627, 634, 636, 638, 698, 817, 825, 831, 850, 909
 - acquisition, 157–173
 - ambiguity, 168, 222, 329, 332, 348
- Bayesian Analysis, *see* Bayesian Analysis
- CAE diagrams, *see* CAE diagrams
- chain of evidence, 159, 160
- checklists, 157
- circumstantial, 449, 658
- collection, 184–210
- collection bias, 189, 281, 282, 341, 342, 665, 699, 850
- contradictory, 71, 77, 172, 191, 219, 224, 328, 330–332, 665, 666, 679, 694, 703, 712, 909
- corroboration, 149, 170, 302, 305, 614
- documentary, 203, 454
- falsification, 355
- for grounding, 80
- format, 388
- generated by reporting, 907
- hearsay, 162, 167, 168, 190
- identifying missing evidence, 157, 184, 218, 219, 331, 342, 441, 445, 454, 491, 509, 612, 614, 665, 702
- inferences, 169, 206, 494, 688, 714
- inquiry by evidence, 658
- interpretation, 181
- interviews, *see* interviews
- lack of, 79, 80, 169, 214, 222, 224, 226, 271, 328–330, 459, 478, 479, 483, 535, 692, 714, 795, 836
- new, 185, 215, 222, 559, 562
- of analytical rigour, 23, 348, 450, 664, 665, 697
- of intention, 349, 665, 666
- photographic, 159, 170, 232, 256, 705
- physical evidence, 112, 154, 159, 170, 181, 200, 213, 224, 295, 313, 328, 658, 689
- Police and Criminal Evidence Act (UK), 160
- presentation issues, 185, 225, 545, 687, 689, 697, 699, 700
- problems of partial, 345, 346, 348, 762, 910
- protection, 154, 157–160, 183, 203, 232
- Safety Cases, *see* Safety Cases
- scientific evidence, 727
- simulation, 239, 245, 256
- statistics, 195, 509, 687, 807, 861
- supporting analysis, 312, 313
- supporting argument, 313
- supporting conclusions, 348
- timings, 215, 230, 323, 326, 328, 329, 703
- Toulmin, *see* Toulmin
- witness statements, *see* witness

- FAA, 29, 30, 33, 35–37, 39, 46–48, 53, 62, 65, 82, 83, 93, 103, 105, 123, 136, 138, 139, 141, 143, 208, 224, 235, 260, 608, 753, 902
- Factory Act (Singapore), 13

- Failure Modes, Effects and Criticality Analysis, *see* FMECA
Failure Reporting, Analysis and Corrective Actions (FRACAS), 86
Fairchild decision, UK Court of Appeal, 875
False Memory Syndrome, 196, 214
Fault trees, 266, 269, 271, 272, 279–281, 283, 284, 291, 314, 322, 324, 333, 335, 339, 359, 365, 375, 379, 380, 422, 438, 454, 469, 518, 527–529, 538, 656, 664, 710
 different to causal trees, 469
 editors, 340
 implemented as image maps, 710
 limitations, 281, 284
 minimal cut set, 270
 reliability, 529
 trigger events, 272
 validation, 528, 529
fax machines, 701, 719, 734–735, 797, 814, 868
 for incident feedback, 317
FDA, 41, 103, 105, 155, 173, 175–179, 207, 717, 719–722, 724–731, 733, 734, 736, 744–747, 750, 752, 753, 756–759, 761, 762, 764, 769, 773, 774, 776, 778, 779, 781, 794, 796, 798, 799, 811, 867, 877, 897, 902, 911, 912
 Adverse Event Reporting System, 752
 Drug Quality Reporting System, 753
 MAUDE, *see* MAUDE
 Vaccine Adverse Event Reporting, 753
 Vaccine Adverse Event Reporting System, 753
FDA Modernisation Act (US), 720
Federal Aviation Administration, *see* FAA
Federal False Claims Act (US), 12
Federal Railroad Administration, *see* FRA
Federal Railroad Safety Enhancement Act (US), 846
Flight Operations Quality Assurance programmes, 30, 199, 200
FMECA, 380
Food and Drugs Administration, *see* FDA
Food, Drug, and Cosmetic Act (US), 178
formal methods, *see* logic, *see also* Petri Nets
FRA, 95, 197, 201, 204, 803, 807, 818, 820–822, 824, 825, 832, 834, 835, 839, 841, 846, 852, 854, 855, 857, 858, 875, 895, 897, 900, 904–906
 Highway-Rail Crossing Web Accident Prediction System, 818
Freedom of Information Act (US), 808
fundamental attribution error, 189, 575
GAIN, 29, 30, 41, 103, 725, 740, 771, 785, 902, 907
GEMS, 74, 75
Generic Error Modelling, *see* GEMS
Generic Occurrence Classification, 740, 774
German Air Traffic Control, (Deutschen Flugsicherung GmbH), 42
Global Aviation Information Network, *see* GAIN

Hawthorne effect, 114, 635, 868, 889, 899
HAZOPS, 599
Health and Safety at Work Act (UK), 14
Health and Safety Commission, *see* HSC
Health and Safety Executive, *see* HSE
Her Majesty's Railways Inspectorate, *see* HMRI
HMRI, 45, 121, 122, 183, 184, 343, 348, 805, 808, 810, 822, 824, 835, 836, 838, 842, 843, 852, 853, 860–866, 892, 893, 903, 905, 908, 912, 913, 916
Hong Kong Marine Accident Investigation Section, 675
Hong Kong Marine Department, 631, 639, 701
HSC, 13, 34, 102, 859
HSE, xi, 7, 8, 13, 14, 19, 24, 34, 47, 50, 52, 102, 186, 188, 189, 343, 805, 806, 819, 832, 834, 852, 857, 858, 864, 876–879, 883, 907
human error, 4, 40, 45, 67, 101, *see also* situation awareness, 116, 118, 139, 140, 150, 151, 179, 220, 281, 346, 347, 349, 402, 409, 454, 480, 482, 529, 544, 558, 578, 658, 660, 661, 714, 728, 788, 789, 791, 794, 847, 861, 908, 916, 920
 ‘no blame’ reporting, 122, 473, 658, 665, 903
 ‘perfective’ reporting, 34, 118, 122, 571–576, 658, 660, 665
 anticipation, 73
 blame cycle, 575
 design error, 269, 912
 distraction, 65, 76, 82, 85, 123, 128, 132, 252, 563, 585, 602, 839, 848, 900
 driver error, 607, 819, 864, 872
 drugs and alcohol, 35, 64, 94, 252, 581, 589, 642, 666, 837
 encysting, 75, 259
 error classification, 22, 97, 458–459, 491, 607, 771, 772, 780
 error in incident analysis, 298, 310, 395, 397, *see also* bias, 491, 512, 526, 615, 620, 838, 909
 error in incident reporting, 226, 773
 error in incident retrieval, 736, 785

- error in knowledge-based performance, 75
 error in reading reports, 707, 713
 error in teams, 76–85, 126
 error inducing environments, 27, 188, 252, 623
 error logs, 114, 122, 126
 errors in rule-based performance, 75
 errors of commission, 75, 335, 457, 544, 576, 607, 695
 errors of omission, 75, 335, 397, 445, 488, 544, 576, 607, 695, 709
 fatigue, 64, 65, 72, 76, 94, 138, 247, 252, 581, 589, 590, 785, 823, 837, 869, 891, 905, 909
 frequency estimates, 64, 115, 126, 700, 855, 905, 914
 habituation error, 590
 human reliability analysis, *see* human reliability analysis
 impact of training, 1, 581, 847
 individual characteristics, 64–73
 lapse, 73–76, 86, 113, 146, 322, 525, 530, 665
 medication error, 34, 101, 117, 152, 203, 753, 772, 780
 misjudgement, 836
 mistake, 73–76, 86, 322, 530, 608, 665
 overconfidence, 581, 589
 performance shaping factors, *see* performance shaping factors
 procedural errors, 16
 road rage, 563
 slip, 73–76, 86, 146, 322, 525, 665
 stress, 26, 65, 138, 602, 877
 thematic vagabonding, 75
 US Army reporting requirements, 544
 violations, *see* violation
 workload, *see* workload
 human reliability analysis, 276
 Hyperbaric Incident Monitoring Study, 752
 ICAO, 14, 16, 21, 23, 34, 39, 97, 100, 116, 135, 157–159, 173, 175, 343, 625, 626, 853
 data recorder requirements, 157
 Iceberg model, 23, 24
 IEC 61508, 63
 Illinois' Whistle Blower Protection Act, 12
 IMO, 84, 155, 196, 625, 629, 634, 641–644, 647, 649, 652, 656–661, 664, 673, 676, 713, 725
 INES, 129, 135
 Institute of Medicine, 21, 42, 100, 101, 203, 712, 918
 institutional racism, 171
 International Civil Aviation Organisation, *see* ICAO
 International Maritime Organisation, *see* IMO
 International Nuclear Event Scale, *see* INES
 Internet, 31, 91, 120, 132, 136, 138, 149, 635, 668, 706, 730, 744–747, *see* cryptography, *see* Electronic mail, *see* World Wide Web, 756, 814, 815, 834
 chat rooms, 796
 US Air Force Automated Security Incident Measurement, 120
 Irish Railways (Iarnród Éireann), 844
 Japanese High Marine Accidents Inquiry Agency, 658, 661, 664, 673
 Japanese Maritime Accidents Inquiry Agency, 659
 Japanese Maritime Incident Reporting System, 658, 659
 Japanese Maritime Labour Research Institute, 918
 Japanese Maritime Safety Agency, 660
 Japanese Ministry of Public Welfare, 918
 Law Commission (UK), 190
 Lessons learned systems, 22, 99, 141, 344, 550, 551, 555, 557, 558, 634, 657, 668–671, 678, 706, 724, 809, 813, 828, 847, 858, 866, 901, 915, 918
 ABCA Coalition Operations Lessons Learned Database, 553
 Canadian Army's Lessons Learned Centre, 561, 562
 Joint Center for Lessons Learned, 557
 US Army Center for Engineer Lessons Learned, 557
 US Army Contracting Lessons Learned Centre, 557
 US Army Lessons Learned Information Warehouse, 551
 US Army Medical Lessons Learned Unit, 557
 logic, 261, 297–314, 333, 615
 benefits, 297
 causal analysis, *see* WBA, 487–501
 counterfactual reasoning, 494
 limitations, 493, 494, 499–501
 proof, 487, 488, 494–498
 state predicates, 488
 causal logic, 685
 deontic logic, 490, 494
 differences between causal and rhetorical analysis, 685
 Explanatory Logic, 488, 490, 521, 523, 525

- First order logic, 340
 graphical representations, 271, 489
 incident modelling, 297–314
 axioms, 299
 CAE diagrams, *see* CAE diagrams
 communication, 302
 limitations, 310
 proof, 303
 sorts, 298
 usability issues, 317–320
 modal logic, 272
 rhetorical analysis, 684
 conclusion checking, 688
 enthymeme, 684
 evidence checking, 687
 proof, 686–687
 syllogism, 685
 temporal logic, 300–306, 315, 317, 328, 488
 tool support, 298, 322, 491
 Toulmin’s critique, 688–695, 714
 Logs, *see* Data recorders
- Machinery and Occupational Safety Act (South Africa), 554
 Macpherson Inquiry, 171
 MAIB, 628, 641, 642, 652, 654, 655, 659, 668, 669, 671, 677, 703–707
 Major Hazard Incidents Data Service, *see* MHI-DAS
 Management Oversight and Risk Trees, *see* MORT
 Manufacturer and User Facility Device Experience database, *see* MAUDE
 Marine Accident Investigation Branch, *see* MAIB
 MAUDE, 57
 MDA, 91, 112, 119, 150, 718–720, 722–726, 730–732, 734, 737, 744, 745, 785, 796
 Medical Devices Agency, *see* MDA
 MES, 438–450, 452–454, 460, 469, 471, 477, 479, 483–485, 501, 521, 524, 526, 537, 544, 867
 causation, 441, 445
 conditions, 440, 442
 counterfactual reasoning, 445
 event blocks, 440
 flowchart, 440, 447
 limitations, 445
 notation, 439
 P-Theory, 439, 442
 MHIDAS, 174, 175
 mitigating factors
 initial reports, 143–144
- MORT, 455–469, 471, 473, 477–482, 486, 500, 514, 515, 518, 521, 522, 524, 537, 544, 576, 582, 640, 641, 661, 870
 assumed risks, 455
 Briscoe classification, 466
 Multilinear Events Sequencing, *see* MES
- NASA, xi, 11, 35, 36, 39, 57, 65, 82, 85, 93, 105, 136, 138, 139, 141, 164, 235, 243, 254, 342, 343, 345–352, 355, 361, 367, 372–379, 381–383, 385–389, 392, 393, 404, 405, 407–409, 411, 412, 414, 415, 417–423, 435, 437, 464, 478, 518, 526, 576, 608, 616, 753, 836, 873
 National Aeronautics and Space Administration, *see* NASA
 National Air Traffic Services, *see* NATS
 National Defence Act (Canada), 572
 National Defence Authorisation Act (US), 566
 National Patient Safety Agency, *see* NPSA
 National Patient Safety Database, 101
 National Patient Safety Foundation, *see* NPSF
 National Transportation Safety Board, *see* NTSB
 NATO, 555, 561
 NATS, 42, 807
 New Zealand Department of Labour, 163
 New Zealand Transport Accident Investigation Commission, 632, 673, 674, 801, 805
 NPSA, 816
 NPSF, 455, 771, 903
 NTSB, 1, 47–49, 57, 70, 125, 145, 191, 192, 199, 200, 207, 209, 210, 215–217, 219–222, 224, 225, 235, 237–239, 245, 247, 248, 257, 259, 261–264, 271, 277, 278, 280–283, 287, 292, 293, 295, 298–301, 303, 305–313, 322, 323, 325, 326, 328, 332, 333, 335, 339, 342, 345, 347, 518, 659, 667, 672, 673, 675, 684, 708, 740, 786, 812, 836–841, 846, 852, 905, 906, 909, 914
 Academy, 837–838
 ASRS, 36
 biomechanical models, 249
 budget, 852
 counterfactual argument, 221, 312, 909
 different approach to OSHA, 339
 drug and alcohol testing, 841
 exclusions, 666
 Go Team, 836, 838
 incident coding concerns, 905
 interaction with other US agencies, 47, 262, 263, 905, 906
 party system, 48, 518, 836–837

- rail data recorders, 195, 198
 Rand report, 48, 57, 213, 220, 258, 512, 712
 recommendations, 84, 675, 839, 840
 interim measures, 667
 status, 841
 report ambiguity, 225
 report format, 257, 708
 simulation and reconstruction, 237, 238, 245–247, 258
 special investigations, 208
 support cockpit video recorders, 125
 systems approach, 334
 wake vortex tests, 235
 We Are All Safer, 839, 842
- Occupational Health and Safety Act (South Africa), 554
 Occupational Safety and Health Act (US), 47, 168
 Occupational Safety and Health Administration, *see* OSHA
 Occupational Safety and Health Review Commission (US), 169
 OSHA, 2, 3, 6, 9, 10, 12, 14, 15, 47, 67, 92, 100, 134, 161, 163, 166–168, 170, 192, 193, 266, 275, 276, 281, 285, 292, 324, 333, 334, 339, 372, 518
 Cooperative Compliance Programme, 14, 100
- P-Theory, 439, *see* MES, *see* STEP, 440, 442, 447, 448, 453, 521, 647
 Patient Safety and Errors Reduction Act (US), 101, 102
 perfectability, 571–576, 605, 607, 623, 915
 performance shaping factors, 64–73, 153, 252, 502, 574, 575, 582, 907, 916
 Petri Nets, 261, 284–298, 317, 326, 327, 331, 333, 340, 359, 438
 ambiguity and uncertainty, 330
 annotations, 332
 construction, 285
 modelling concurrency, 287
 modelling dynamic systems, 287
 modelling interactive systems, 285, 293, 295
 non-determinism, 291, 292
 real time variants, 285
 reasoning, 318
 relationship to Fault Trees, 319
 syntax and semantics, 286
 tool support, 321, 322
 Peturbation Theory, *see* P-Theory
- physiology, 3, *see* slips, trips and falls, 66–67, 70, 72, 77, 79, 86, 98, 491, 581, 582, 707
 carpal tunnel syndrome, 67
 coronary heart disease, 3
 hypertension, 3
 upper limb disorders, 67
 Police and Criminal Evidence Act (UK), 160
 Police Complaints Authority (UK), 171
 pollution, 155, 642, 676
 Postal service, 858
 legal constraints, 159
 limitations, 734
 report dissemination, 557, 729–731
 strengths, 737
 precautionary principle, 78, 156, 543, 622
 Prevention and Recovery Information System for Monitoring and Analysis, *see* PRISMA
 PRISMA, 469–479, 482, 485–487, 516–518, 522–524, 527, 530, 531, 533, 535, 537, 538, 544, 584, 739, 867
 causal trees, 469–471, 473
 different to fault trees, 469
 disjunctions and uncertainty, 472
 classification model, 469, *see* Eindhoven Classification Model, 471–476
 classification/action matrix, 469, 476–478, 584
 medical example, 477
 counterfactual reasoning, 472
 counterfactual reasoning by proxy, 472
 limitations, 478
 mitigating factors, 471
 Public Interest Disclosure Act (UK), 904
- Rail Safety Act (New South Wales, Australia), 804
 Rail Safety Act (Western Australia), 804
 Railway Safety Act (Canada), 803
 Rand report, *see* NTSB
 reconstruction, 16, 56, 110, 111, 149, 185, 193, 194, 213–227, 230–234, 252, 342, 347, 348, 358, 359, 441, 520, 528, 544, 626, 641–646, 650, 659, 662, 663, 665, 674, 677, 679, 680, 683, 701, 713, 797, 867
 and causal analysis, 281, 297
 for training, 220, 221
 incident modelling, 261–340
 physical reconstructions, 213, 214, 235–236, 867
 post-event biases, 169, 170, 196, 214, 287
 presentation in incident reports, 627, 628, 636–645, 647–649, 651

- simulations, *see* simulations
summaries, 652–655
uncertainty, 219, 222, 224, 274, 276, 287, 292, 293, 295, 328–332
virtual reconstructions, 214, 226, 228, 232, 236–241, 245–248
Reportable Injuries, Diseases and Dangerous Occurrences, *see* RIDDOR
rhetoric, 348, 680–684, *see also* logic, 686, 687, 698, *see also* simulation, 717, 910, 911
spatial rhetoric, 872, 873
tropes, 680, 714, 910
 amplification, 681
 anaphora, 681, 910
 antithesis, 682, 910
 asyndeton, 682
 conduplicato, 682
 diazeugma, 683
 enthymeme, 684
 expletive, 683
 procatalepsis, 684
RIDDOR, xi, 13, 34, 66, 913
risks, 11, 26, 181, 206, 221, 284, 360, 523, 529, 550, 603, 663, 834, 917
assumed risks, 455, 458, 477
consequence assessment, 204, 598, 600, 602, 603, 632, 653, 831, 865
decision theory, *see* decision theory
from precipitate actions, 616, 632
likelihood assessment, 598–600, 603
likelihood of injury and disease, 6–9
Management Oversight and Risk Trees, *see* MORT
of future incidents, 34, 35, 156, 173, 177, 526, 559, 602, 603, 722, 735, 826–832, 863, 864
of reconstruction, 235, 236
precursor models, 828–831
probabilistic risk assessment, 53, 502
residual risk, 604, 624
risk analysis, 19, 60, 184, 324, 343, 345, 383, 385, 388, 412, 413, 415, 420, 455, 458, 463, 465, 566, 570–571, 596–605, 611, 612, 638, 827, 834, 865, 897, 907–908, 919
risk analysis matrix, 600, 640
using reporting data, 41, 52, 108, 155, 521, 526, 597, 598, 603, 624, 735, 813, 818, 826–832, 908
risk avoiding behaviour, 85
risk classification, 181, 466, 689, 700, 705, 733, 824, 834, 863
risk exposure, 23, 36, 37, 192, 598, 803, 818, 874
risk homeostasis, 542, 547, 563
risk management, 50, 91, 361, 374, 375, 378–383, 408, 411, 455, 458, 466, 519, 520, 531, 534, 556–558, 563, 597–599, 604, 625, 724, 794, 815, 827, 828, 831, 835, 844, 845, 848, 854, 867, 911, 914, 915
Transport Canada's risk management process, 828
US Army 5 stage model, 597
risk perception, 37, 66, 69, 72, 477, 510, 513, 521, 551, 563, 575, 784, 846, 872, 894–895
 group attitudes, 77–79
risk reduction, 520, 597, 604, 831, 864, 865, 895
risk signature, 379, 677
risk taking behaviour, 11, 17, 66–67, 72, 122, 629, 872
risky shift, 77
safety monitoring, 811, 813
security risks, 749
Robens Report, 14
Royal Commission on Criminal Justice (UK), 190

Safe Medical Devices Act (US), 116, 752
Sequentially Timed and Events Plotting, *see* STEP
Shift patterns, 128
simulations, 10, 11, 64, 213–260, 276, 329, 342, 347, 359, 442, 502, 519, 545, 711
 animated simulations, 234–241
 biomechanical models, 247, 248
 court room applications, 711
 declarative simulations, 228–234
 finite element analysis, 897
 from event recorders, 196, 200, 247
 hybrid simulations, 254–257
 limitations, 61, 64, 84, 153, 248, 251–254
 Monte Carlo techniques, 86, 249–251, 276
 multi-user simulation, 251–254
 NASA APEX project, 254
 of human error, 276
 presenting accident reports, 708–709
 reconstructions, *see* reconstruction
 rhetorical effects, 711
 simulation bias, *see* bias
 subjunctive simulations, 242–254
US Department of Labour's Mine Simulation Laboratory, 235
US National Crash Analysis Centre, 256
US National Simulation Capability Program, 260

- using Fault Trees, 277, 278
- Singapore Army, 549
- situation awareness, 77, 82–85, 126, 146, 153–154, 179, 541, 542, 546, 552, 772
- Skills, Knowledge, Rules, 75
- slips, trips and falls, 66, 188, 563
- SQL, 883
- STEP, 441, 447–454, 460, 468, 469, 471, 477, 479, 482, 485, 486, 501, 503, 514, 521, 524, 526–529, 537, 538, 544
- cards, 447, 449, 450
- determinism, 450
- limitations, 452–454
- matrix, 447–449
- no conditions, 448, 450
- P-Theory, 448, 453
- supports investigation, 449
- stress, *see* human error, 3, 65, 99, 138, 167, 245, 252, 328, 416, 869
- stress counselling, 94, 163
- Surface Transportation Assistance Act (US), 12
- Swedish Air Traffic Control (Luftfartsverket Flygtrafikjänsten), 18, 30, 31, 35, 38, 96, 107, 736
- Swedish Board of Accident Investigation (Statens haverikommision), 658, 661, 664, 665, 673, 677
- Swedish Civil Aviation Administration, 17
- Swedish Maritime Agency, 916
- telephones, 31, 104, 105, 150, 175–177, 222, 232, 701, 734–736, 773, 797, 814, 867, 868
 - involved in incidents, 900
 - telephones in incidents, 274, 300, 301, 305, 309
- terrorism, 560
- time-lines, 230, 231, 254, 255, 259, 261, 274, 281, 291, 293, 301, 305, 315, 329, 333, 340, 359, 388, 422, 642, 645, 646, 650, 651, 884
- ‘God’s eye view’, 231
- continuous changes, 330
- granularity of events, 266, 440, 645
- graphical form, 645
- graphical forms, 262–266
- implemented using virtual reality, 239–240, 710–712
- imprecise timings and lack of evidence, 329
- in MES, 439, 440, 442, 445
- in STEP, 453, 454
- in Tripod-Beta, 485
- informal annotations, 328
- location information, 230
- presentation of reports, 710–713
- spatial layout, 262–264, 266, 328
- synchronisation, 285
- temporal ambiguity, 222
- textual format, 222–223, 226, 234
- usability issues, 315
- Toulmin’s argumentation, 688–697
- domain-dependent discourse, 689
- Transport (Rail Safety) Act (Victoria, Australia), 804
- Transport Canada, 154, 682, 684–686, 813, 826, 828, 831, 835, 845, 847, 854
 - guidance on risk management, 828
- Transportation Safety Board of Canada, 22, 78, 461, 465, 471, 476, 496, 499, 643, 644, 646, 672, 678, 681, 691, 707
- Tripod, 479–487, 516, 521, 524, 537, 544, 867, 907
 - event analysis diagrams, 487
 - General Failure Types, 479, 480
 - Functional Failures, 481
 - Source Failures, 481
 - preconditions, 482–484
 - software support, 481, 486
 - Tripod-Beta, 479, 482, 484
 - defences, 484
 - preconditions, 486
 - strengths, 485
 - Tripod-Delta, 479, 481, 482
- under reporting, 113, 116, 118, 150, 877
- US Center for Biologics Evaluation and Research’s Error and Accidents Reporting System, 752, 753
- US Defence Messaging System, 618
- USS Cole, 560
- Utah Public Officers and Employees’ Ethics Act, 12
- violation, 4, 11, 16, 18, 21, 27, 67, 73, 75, 76, 86, 122, 349, 521, 525, 555, 574, 598, 621, 657, 658, 665, 679, 831, 872, 897
- air proximity violation, 15, 17, 102, 131, 148, 201, 204, 635
- attitude violation, 126
- deliberate, 73
- disregard, 581, 624, 836
- human rights violation, 556
- misunderstanding, 621
- necessary violation, 73, 74
- normal violations, 73, 74, 216, 373, 481, 522, 525, 563, 584, 682, 694, 845, 846, 897

- optimising violation, 73, 75
speeding violation, 126, 195
unintended violation, 73
violation and blame, 30, 35, 570, 572, 575, 593, 595, 665
violation and error, 73
violation and safety culture, 570, 572, 584, 855
violation model, 518
violation of health and safety legislation, 9, 19, 34, 35, 168, 169, 525, 575, 656, 810, 831, 842, 908
violation-inducing conditions, 481, 658
workplace rule violation, 75, 502, 563, 575, 581, 607, 694, 823, 845, 846
virtual reality, 214, *see* reconstructions, 238, 246, 260, 640
desktopVR, 232, 236, 239–242, 251, 257, 711–712, 742–744
QuicktimeVR, 232–234, 239, 241, 258, 260, 711
VRML, 236, 237, 258, 708–710, 712, 713
immersive systems, 112, 226, 232
visualisation, 200, 226, *see* simulations, *see also* reconstruction, 238, 255, 260, *see also* Fault trees, *see also* time-lines, 707–713, *see also* databases, 878–897
3D cross referencing, 710
3D object rotations, 711
3D time lines, 240, 710, 712–713
Computer Aided Design, 242–245
data mining, 883, 892
dynamic querying, 884–887, 889
eccentric labelling, 887–888
empirical evaluation, 891, 893
evaluation heuristics, 889
graphs and charts, 878–882
imagemaps, 229–231, 711–713
limitations of visualisation, 711–712
maps and plans, 229–232
perspective wall, 241, 242
photorealistic models, 232–234
radar displays, 879–880, 882
visualising argument structures, 696–697
- WBA, 487–503, 507, 513, 518, 525, 527, 538, 543, 544, 681, 685, 907, 909
Explanatory logic, 488–500, 521, 523
Hausman's causation, 500
Lewis' causation, 185, 487, 491, 500, 685
Lewis' contrastive explanations, 491
limitations, 494, 500
PARDIA, 491
- Source Node Analysis, 499
tool support, 491
Why-Because graphs
analysis, 487, 493–500
construction, 487–491
whistle blowing, 12, *see also* Illinois' Whistle Blower Protection Act, *see also* Surface Transportation Assistance Act (US), *see also* Utah Public Officers and Employees' Ethics Act, 33–35, 49, 74, 146, 735, 846, *see also* Federal Railroad Safety Enhancement Act (US), 848, 904, *see also* Public Interest Disclosure Act (UK), 919
Mary Schiavo, 33
Paul van Buitenen, 33
Stephen Bolsin, 904
Why Because Analysis, *see also* WBA
witness, 23, 37, 92, 164, 165, 245, 353, 626, 634
analytical bias, 144, 171, 180, 539
anonymity, 168, 869
corroboration, 195–196, 328, 330
culture, 170–173
difficulty predicting consequences, 17, 143
disagreement, 92, 161, 170, 190, 219, 224, 238, 245, 328, 339
expert witness, 169, 189–194, 211, 347, 622
guidelines, 190
eye-witness statements, 92, 146, 151, 156, 159, 161–162, 167, 168, 180, 219, 246, 249, 287, 298, 301, 325, 326, 328, 373, 689
Department of Justice guidelines, 170
general public, 90, 149
guilt, 144, 161
hearsay, *see also* evidence
interpretation, 92, 168–170, 665, 869
lack of witnesses, 811, 813, 816, 869
legal issues, 167–168
liar paradox, 298
location, 93, 162, 219, 300, 452
Post-Traumatic Stress, 3
preliminary statements, 92, 162, 181, 182, 452
reliability, 92, 161, 168, 169, 172, 195, 341, 665, 666, 684
reporting bias, 92, 161, 168, 171, 539, 813, 896, 903, 918
Repressed Memory Syndrome, 170
triggering recollections, 214
triggering report, 19, 136, 138
violation, 18

- weapon focus, 168, 169, 539
 - workload, 3, 28, 39, 65, 82–84, 94, 117, 118, 123, 124, 137, 152, 153, 156, 165, 181, 191, 193, 194, 213, 348, 378, 665, 774, 798, 837, 915, 918
 - World Wide Web, 240, 257, 704, 710, 712, 715, 785, *see* visualisation
 - accessibility issues, 751, 808
 - Accessibility Act (US), 751
 - disseminating incident reports, 105, 136, 141, 229, 239, 620, 622, 630, 631, 704, 727, 733, 745, 912, 920
 - disseminating reporting procedures, 176, 389, 803
 - limitations, 707, 730–731
 - retrieving incident reports, 754, 778, 784, 786, 799, 883
 - security concerns, 32, 140, 144, 553, 729,
 - see* cryptography, 749
 - SGML, 739
 - submitting incident reports, 104, 141, 143, 745
 - worst plausible outcome, 102, 204, 211, 221, 599, 600, 638, 663, 720, 754, 908, 920
- Youth Justice and Criminal Evidence Act (UK),
160