

Index

Abreu, D., 75

absolute continuity, 172–177, 180

abstract family, 201

- Archimedean, 202
- commutative, 203
- positive, 202
- solvable, 203
- strictly monotonic, 202

abstract models of learning, 1

accuracy epistemology, 16–19, 131–133

- and measuring beliefs, 18
- and pragmatic approaches, 17–19

Acemoglu, D., 150, 185

Achinstein, P., 57

Adams, E. W., 147

agreeing to disagree, 151

Akiyama, E., 68

Aldous, D. J., 27, 90, 191

Alexander, J. M., 98

all-things-considered rationality, 131

analogical inductive logic, 161

Armendt, B., 13

Arntzenius, F., 128

Arslan, G., 50, 65, 67

Ash, R. B., 169

Aumann, R., 38, 58, 61, 67, 150

Börgers, T., 42, 101

Bacchus, F., 128

bandit problems, 34–37, 41, 52, 174

- and inductive logic, 192–195

Banerjee, A., 138

Bayes, T., 13, 25, 77, 86

Bayesian conditioning, 19, 106, 110, 177, *see also* conditionalization

Beggs, A. W., 41, 59, 69–71

Belot, G., 171

Benaïm, M., 62

Bernstein, S. N., 16

Berry, D. A., 35

best estimate, 132

- and conditional expectation, 133–135, 139
- and conditioning, 135–136
- and general distance measures, 137–139
- and reflection, 136–137
- and the martingale principle, 137

Binmore, K., 19, 22, 75, 82, 144

black box learning, 6, 112, 115, 120, 126, 136, 141, *see also* generalized learning

Blackwell, D., 171

Block, H. D., 47

Borel–Cantelli lemma, 193

bounded rationality, 30, 37–38, 74, 82–85, 101, 102

Bovens, L., 128

Bradley, R., 153, 156

Brandenburger, A., 58

Bregman distance function, 138

Brier score, 132, *see also* quadratic loss function

Briggs, R., 128, 130, 145

Brighton, H., 82

Brown, G. W., 33

Buchak, L., 46

Bush, R., 101

Camerer, C., 39

Carnap, R., 3, 28, 56, 86, 94, 103, 113, 190

case-based reasoning, 52

Cesa-Bianchi, N., 199

chance, 26–28

chaotic behavior, 68

Chen, R., 170

Chernozhukov, V., 150, 185

Chihara, C. S., 17

Chinese restaurant process, 90

choice probability, 5, 41, 43, 48

- conditional, 69, 72

Christensen, D., 13, 14, 21, 128, 153, 165

common knowledge, 151

commutativity, 83, 97, *see also* learning operator, commutative

complexity and learning, 73–76

conditional expectation, 121

conditional probability, 122

conditionalization, 19, 106, 111, 114, 181, *see also* Bayesian conditioning

- and the reflection principle, 115

conglomerability, 147

consistency, 3, 4, 9, 13–16, 44, 103, *see also* dynamic consistency

consistent embeddability, 6, 81, 85, 98

- convergence to the truth, 168–171
- correlated equilibrium, 67, 74
- countable additivity, 127, 134, 146–148, 170
- Döring, F., 182
- de Finetti's representation theorem, 27, 191
- de Finetti, B., 3, 5, 11, 16, 22–23, 27–28, 40, 56, 62, 86, 106, 132, 143, 146, 170, 196, 197
- de Groot, M., 155
- de Morgan, A., 86
- deference, 154, 179
- Diaconis, P., 63, 109, 111, 169, 182, 191
- Dietrich, F., 156
- Dirichlet distribution, 28, 191
- Dirichlet process, 93
- disagreement, 149, 160
 - and synergy, 165
 - individual and group perspective, 152
 - rational, 185–188
- divergence of opinions, 181–184
- Doléans-Dade, C., 122, 169
- Dubins, L., 90, 147, 171
- Durrett, R., 193
- Dutch book argument, 12–15
 - and consistency, 13–14
 - dynamic, 20–21, 129–131
- Dutch book theorem, 13
- dynamic consistency, 3, 7, 19–24, 54, 83, 102, 116, 118, 120, 123
- dynamic probability, 112
- Earman, J., 169
- Easwaran, K., 132, 136, 138, 154, 156, 161, 165
- Elga, A., 153–155, 157
- epistemic accuracy, 131
- epistemic disagreement, 149
- epistemic rationality, 7, 23, 29, 53, 129–132, 139
- Erev, I., 41
- ex ante and ex post evaluation, 21, 130
- exchangeability, 9, 27–28, 52, 64, 189
 - and periodic learning environments, 57
- exchangeable random partition, 88–90
 - and inductive logic, 93
- expected accuracy, 131–133
- exploitation–exploration tradeoff, 36
- Farmer, J. D., 68
- Fenton-Glynn, L., 154, 156, 161, 165
- fictitious play, 33–34, 39
 - in large worlds, 94–96
 - in periodic learning environments, 57–59
- Field shift, 183
- Field, H., 182
- finite de Finetti representation theorem, 191
- finite patterns, 73
- finite state automata, 74
- Fisher, R. A., 86
- Fitelson, B., 153, 155, 156
- Fortini, S., 62
- Foster, D. P., 175, 176
- foundationalist epistemology, 105
- Freedman, D., 63, 169, 191
- Fristedt, B., 35
- Fudenberg, D., 33, 37, 59, 62
- Gaifman, H., 171
- Gaissmaier, W., 82
- Gaunersdorfer, A., 64
- Geanakoplos, J. D., 152
- general foundations theory, 105
- generalized learning, 7, 55, 102, 112, 126, 142,
 - see also* black box learning
- Genest, C., 155, 156
- Gigerenzer, G., 82
- Gilboa, I., 52
- Gittins index, 36
- Gittins, J. C., 36
- Goldstein, M., 6, 115, 129
- Good, I. J., 22, 28, 38, 105, 112, 114, 139, 182
- Goodman, N., 11, 105
- Greaves, H., 132, 136, 138
- Guo, X., 138
- Hacking, I., 22
- Hájek, A., 107
- Hammond, P. J., 46
- hard Jeffrey shift, 179–181
- Harman, G., 105
- Harsanyi doctrine, 185
- Harsanyi, J. C., 103, 150, 185
- Hart, S., 65, 67, 199
- Herrnstein, R. J., 41
- Hirsch, M., 62
- Hitchcock, C., 154, 156, 161, 165
- Ho, T., 39
- Hofbauer, J., 40, 54, 59, 62, 64
- Hopkins, E., 40, 41, 59, 71
- Hoppe urn, 91, 96
- Howson, C., 13, 14, 19, 21, 30, 103
- hypergeometric distribution, 192
- inductive assumptions, 3, 34, 50, 52, 53, 55, 73, 83, 96, 98, 105, 118, 165
- Jaynes, E. T., 103
- Jeffrey conditioning, 6, 7, 30, 110, 163, 167
 - and merging of opinions, 178–184
- Jeffrey, R. C., 4, 6, 12, 14, 30, 43, 79, 94, 102, 104, 106–114, 130, 182

- Jehle, D., 153, 155, 156
 Johnson's sufficientness postulate, 28, 40, 52, 94, 189
 for Markov exchangeability, 63
 Johnson, W. E., 28, 86, 190
 Johnson–Carnap continuum of inductive methods, 29, 40, 42, 52, 107, 189–191
 and martingales, 119
 and the reflection principle, 117
 Jonker, L., 59
 Joyce, J. M., 6, 16, 17, 79–81, 100, 114, 132, 137, 138, 154, 179, 181, 182
 judgment aggregation, 152
 judgmental probability, 113–114
- Kadane, J. B., 22, 141, 146
 Kalai, E., 171, 174
 Kelly, K. T., 64, 186
 Kelly, T., 153, 182
 Kemeny, J. G., 13
 Kennedy, R., 17
 Keynes, J. M., 103, 111
 Kingman's representation theorem, 91–93
 Kingman, J. F. C., 91
 knowledge partition, 80, 84
 Kolmogorov, A. N., 121
 Krantz, D. H., 16
 Kuipers, T. A. F., 28, 60, 190
 Kulkarni, S., 105
 Kyburg, H. E., 128
- Lévy, P., 193
 Ladelli, L., 62
 Lam, B., 153
 Lane, D. A., 22
 Lange, M., 182
 Laplace, P. S., 25, 86
 large world, 5, 78
 large world problem
 for learning, 82–85
 in decision theory, 79–82
 Laslier, J.-F., 41
 Lasonen-Aarnio, M., 164
 learning operator, 48, 201
 commutative, 5, 48–50
 Lehrer, E., 171, 174
 Lehrer, K., 155
 Leitgeb, H., 14, 17, 132, 137
 Levi, I., 21, 103, 124, 128
 Levine, D. K., 33, 37, 59, 62
 Lewis, D. K., 20, 106–108, 129
 linear averaging, 155, 161
 List, C., 152, 156
 logic of decision, 79
 logical probability, 103
- Luce's choice axiom, 5, 6, 43–47, 97
 and conditional probabilities, 44
 and independence, 45–46
 and large worlds, 98–101
 and random utility models, 47
 Luce, R. D., 5, 16, 32, 43, 48, 98
 Lugosi, G., 199
- MacFadden, D., 47
 Maher, P., 128
 Mahtani, A., 130
 Marden, J. R., 50
 Markov exchangeability, 62–64
 Markov fictitious play, 59–62, 65
 and correlated equilibria, 61
 Markov inductive logic, 60, 63
 Markov learning operators, 72–73
 commutative, 73
 Markov reinforcement learning
 payoff based, 69–71
 state based, 71–72
 Marley, A. A. J., 49, 201, 203
 Marschak, J., 47
 martingale, 119, 177
 martingale condition, 120–123
 martingale convergence theorem, 120–121
 martingale principle, 7, 102, 121
 Mas-Colell, A., 65, 67, 199
 maximally informed opinion, 33, 121, 169, 177
 merging of opinions, 171–173
 Miller, R. I., 175
 Moss, S., 129
 Mosteller, F., 101
- Nachbar, J. H., 175
 Narens, L., 44
 Nash equilibrium, 58–59, 66
 and convergence, 174–177
 Nielsen, M., 181
- objective prior, 103–105
- paintbox process, 91
 Pareto principle, 152
 Paris, J., 103
 partial exchangeability, 40, 196–198
 and Markov exchangeability, 62
 partition invariance, 81
 and Luce's choice axiom, 100
 Paul, L. A., 47
 payoff-based learning model, 5, 37, 84, 199
 and Markov learning environment, 69
 Pedersen, A. P., 107
 peer disagreement, 7, 153
 Peirce, C. S., 167, 181

- periodic learning environment, 57
 perturbed best response rule, 193
 Petris, G., 62
 Pettigrew, R., 16, 17, 53, 132, 137
 Pitman, J., 90
 Poisson–Dirichlet distribution, 93
 Polemarchakis, H. M., 152
 Polya urn, 91
 Posch, M., 41, 59, 71
 Press, W. H., 35
 Price, R., 77
 principle of indifference, 30, 104
 probabilism, 10–12, 103, 106
 probability kinematics, 6, 30, 110, 114, *see also*
 Jeffrey conditioning
 and commutativity, 182–183
 and merging of opinions, 178–184
 probe and adjust, 50–52, 73
 procedural rationality, 38
 propensities in reinforcement learning, 5, 41,
 48, 201
 conditional, 69, 72
 propriety, 138
 Purves, R. A., 147, 170
 Putnam, H., 5, 56, 57

 quadratic loss function, 16, 132, 133
 and best estimates, 133–137
 qualitative probability, 16
 quasi-additive abstract family, 201
 quasi-additive learning models, 49

 Rabinowicz, W., 124
 radical probabilism, 6, 102, 104, 111–114, 149,
 167
 and convergence to the truth, 121, 177
 and merging of opinions, 178, 186
 Raiffa, H., 98
 Ramsey, F. P., 11, 13, 19–20, 23, 139, 144
 and radical probabilism, 111
 random partitions, 88
 Rawls, J., 105
 reflection principle, 7, 102, 115–118, 123, 127
 violations of, 128
 Regazzini, E., 62, 146
 regret learning, 73, 199–200
 regularity, 106–108, 189
 Reichenbach, H., 160
 reinforcement learning, 39
 and the reflection principle, 117
 average, 36, 39–41, 73, 95, 194, 198–199
 basic model, 5, 41–43, 204–205
 Bush–Mosteller, 101
 in large worlds, 96–98
 Rescorla, R. A., 101
 Rescorla–Wagner model of learning, 101
 Robbins, H. E., 35
 Romeijn, J.-W., 30, 156
 Rosenkrantz, R., 17
 Roth, A., 41
 Rothschild, M., 36
 Rubinstein, A., 38, 75
 rule of succession, 25, 86
 de Morgan's, 87, 93
 generalized, 26
 Rusticchini, A., 69

 Saari, D. G., 44
 sampling of species problem, 6, 86
 Samuelson, L., 40, 52, 75
 Sanchirico, C. W., 175
 Sandholm W. H., 62
 Sarin, R., 101
 satisficing, 50
 Sato, Y., 68
 Savage, J. E., 75, 76
 Savage, L. J., 6, 11, 15, 22, 33, 39, 43, 78, 106,
 139, 144
 Schervish, M. J., 22, 141, 146, 155, 156, 169,
 184
 Schmeidler, D., 52
 Schoenfeld, M., 132
 Seidenfeld, T., 14, 22, 46, 103, 141, 146, 169,
 184
 Selten, R., 137
 Shamma, J. S., 50, 65, 67
 Shapley game, 64
 Shapley, L. S., 64
 Shimony, A., 107
 Sigmund, K., 40, 54, 59
 Simon, H. A., 4, 30, 38, 50, 74, 82
 Skyrms, B., 6, 13, 20, 22, 50, 52, 57, 61, 65, 74,
 98, 102, 112, 120, 130, 139, 169, 177, 194
 small world, 5, 78, 80
 Snir, M., 171
 social choice, 152
 soft Jeffrey shift, 179, 182, 183
 and divergence of opinions, 181–184
 Spohn, W., 124
 square integrable random variable, 134
 Steele, K., 153, 154, 163
 Stewart, R. T., 181
 straight averaging, 155
 and inductive logic, 156–161
 strict coherence, 107
 substantive rationality, 38
 Sudderth, W. D., 22, 147, 170
 sufficient statistic, 197
 Suppes, P., 16, 46

- symmetry, 3, 4, 9, 25, 27–29, 32, 50, 73, 118,
 see also inductive assumption
- Taking Turns game, 58, 61, 74
- Talbott, W., 128
- Taylor, P. D., 59
- Teller, P., 20
- Thalos, M., 128
- Thorndike, E. L., 39
- Thurstone, L. L., 47
- Titelbaum, M. G., 129
- Topol, R., 41
- tower property of conditional expectations,
 137, 157
- Turing, A., 89
- Tversky, A., 16, 46
- Type I and Type II rationality, 38
- Ulysses and the Sirens, 128, 130
- uncertain evidence, 6, 109, 177, 179
 - and soft Jeffrey shifts, 182, 183
 - fluid, 7, 181, 186
 - solid, 7, 181, 186
- uncoupled dynamics, 65, 67
- Urbach, P., 14, 21, 103
- utility and consistent preferences, 15
- value of knowledge, 139–141
 - and reflection, 141–143
 - relation, 140
 - theorem, 139–140
- van Fraassen, B. C., 6, 25, 102, 103, 115, 116,
 127, 129, 130, 181
- van Inwagen, P., 187
- Vanderschraaf, P., 57, 61, 65, 74
- Velasco, J., 154, 156, 161, 165
- Vencovská, A., 103
- Venn, J., 25
- Wagner, A. R., 101
- Wagner, C. G., 155, 182, 183
- Wagner, E. O., 68
- Wallace, D., 132, 136, 138
- Walliser, B., 41
- Wang, H., 138
- Weisberg, J., 116, 144
- Weyl, H., 25
- White, R., 103
- Williams, D., 120, 135
- Williams, J. R. G., 18
- Williamson, J., 103
- Williamson, T., 103, 113, 144
- Yellott, J. I., 47
- Yildiz, M., 150, 185
- Young, H. P., 33, 37, 50, 174–176, 199
- Zabell, S. L., 28, 63, 86–94, 98, 103, 109, 111,
 116, 120, 152, 170, 182, 190, 191, 199
- Zollman, K. J. S., 35, 50