

Evolution and Human Behavior

Darwinian perspectives on
human nature

SECOND EDITION

John Cartwright

The MIT Press
Cambridge, Massachusetts

Full Contents

<i>Brief Contents</i>	vii
<i>List of Figures</i>	xvii
<i>List of Tables</i>	xxi
<i>List of Boxes</i>	xxiii
<i>Preface</i>	xxiv
<i>Acknowledgements</i>	xxvi
Part I Fundamentals of the Evolutionary Approach	1
1 Historical Introduction: Evolution and Theories of Mind and Behaviour, Darwin and After	3
1.1 The origin of species	4
1.1.1 New foundations	5
1.2 The study of animal behaviour	5
1.2.1 Comparative psychology and ethology: the 19th-century origins	5
1.2.2 Ethology and comparative psychology in the 20th century	7
1.2.3 Interactions between comparative psychology and ethology	14
1.3 Evolution and theories of human behaviour: Darwin and after	15
1.3.1 Herbert Spencer (1820–1903)	15
1.3.2 Evolution in America: Morgan, Baldwin and James	16
1.3.3 Galton and the rise of the eugenics movement	18
1.4 The triumph of culture	19
1.4.1 Franz Boas	19
1.4.2 The revolt against eugenics	21
1.4.3 Behaviourism as an alternative resting place	22
1.4.4 The ‘cognitive revolution’ and other challenges to behaviourism	22
1.5 The rise of sociobiology and evolutionary psychology	24
1.5.1 From sociobiology to evolutionary psychology	24
1.5.2 The influence of evolutionary psychology (EP)	26
2 Darwinism, Inclusive Fitness and the Selfish Gene	30
2.1 The mechanism of Darwinian evolution	30
2.1.1 The ghosts of Lamarckism	31
2.1.2 The central dogma in a modern form	32
2.1.3 Darwin’s difficulties	33
2.2 Some basic principles of genetics	33
2.2.1 The genetic code	33

2.2.2	From genes to behaviour: some warnings	40
2.2.3	Heritability	41
2.3	The unit of natural selection	42
2.3.1	The unit of selection: replicators and vehicles	42
2.4	Kin selection and altruism	43
2.4.1	Hamilton's rule	44
2.4.2	Coefficient of relatedness	44
2.4.3	Application of Hamilton's rule and kin selection	45
2.5	Kin recognition and discrimination	46
2.6	Levels of altruism	47
2.6.1	Selfish genes and compassionate vehicles	47
2.6.2	The stupidity of genes	48
3	Sex, Sexual Selection and Life History Theory	51
3.1	Why sex?	51
3.1.1	Why do males exist?	51
3.2	Sex and anisogamy	55
3.3	Describing mating behaviour: systems and strategies	55
3.3.1	Problems with the concept of mating systems	56
3.4	The sex ratio: Fisher and after	57
3.4.1	Why so many males?	57
3.4.2	Fisher's argument	57
3.5	Sexual selection	58
3.5.1	Natural selection and sexual selection compared	58
3.5.2	Intersexual and intrasexual selection	59
3.5.3	Parental investment	60
3.5.4	Potential reproductive rates: humans and other animals	61
3.5.5	The operational sex ratio	62
3.5.6	The operational sex ratio and contingent strategies	64
3.6	Consequences of sexual selection	64
3.6.1	Sexual dimorphism in body size	64
3.6.2	Post-copulatory intrasexual competition: sperm competition	66
3.6.3	Good genes and honest signals	67
3.7	Life history theory	69
3.7.1	Life history variables	69
3.7.2	Quantity and quality, mating and parenting	70
3.7.3	Age-related activation of mental modules	72
3.7.4	LHT and the demographic transition	72
3.7.5	Old age, the menopause and the function of grandparents	74
4	Foundations of Darwinian Psychology	79
4.1	Testing for adaptive significance	79
4.1.1	Pitfalls of the adaptationist paradigm: 'Just So stories' and Panglossianism	79
4.1.2	The testing of hypotheses	81
4.1.3	Adaptations and fitness: then and now	83
4.1.4	Evolutionary psychology or Darwinian anthropology?	85
4.1.5	The EEA: the land of lost content	87
4.2	Orders of explanation in evolutionary thinking	89

Part II	Human Evolution and its Consequences	93
5	The Evolution of <i>Homo Sapiens</i>	95
5.1	Systematics	95
5.1.1	How to classify humans and their relatives	96
5.2	Origins of the hominins	97
5.2.1	Speciation and earth history	97
5.2.2	Hominin speciation	98
5.2.3	Bipedalism	100
5.3	Phylogeny of the Hominoidea	101
5.3.1	Branching sequences and dates	101
5.3.2	Early hominins	103
5.4	Some important features of hominin evolution	108
5.4.1	Body size	108
5.4.2	Brain size	109
5.4.3	Reduced sexual dimorphism	109
5.5	The supremacy of <i>Homo sapiens</i>	110
5.5.1	Out of Africa or multiregionalism?	110
5.5.2	Mitochondrial Eve and Y-chromosome Adam	112
6	Encephalisation and the Emergence of the Human Mind	115
6.1	The sizes of animal brains	115
6.1.1	What makes humans so special?	115
6.1.2	Allometry	116
6.1.3	Ancestral brains and encephalisation quotients	117
6.2	Origins of primate intelligence and theories of human brain enlargement	118
6.2.1	The energetic demands of brains	119
6.2.2	Environmental factors: lifestyle, food and foraging	120
6.2.3	Tool use	122
6.2.4	Encephalisation and ballistics	124
6.2.5	The social brain hypothesis	124
6.2.6	Hardware–software coevolution: the stimulus of language	130
6.2.7	Sexual selection and brain size: the display hypothesis	131
6.2.8	Genomic imprinting and brain growth	131
6.2.9	Neoteny as a mechanism for brain growth	133
6.3	Language	134
6.3.1	Natural selection and the evolution of language	134
6.3.2	Localisation of language function in the human brain	135
6.3.3	Dating the origin of human language: anatomical evidence	136
6.3.4	Grooming coalitions and group size	137
6.3.5	Mirror neurons and the origin of language	139
Part III	Cognition and Emotion	145
7	Modularity, Cognition and Reasoning	147
7.1	The modular mind	147
7.1.1	Epistemological dilemmas: rationalism or empiricism?	147
7.1.2	The localisation of brain function	149
7.1.3	The manifesto of Tooby and Cosmides	150

7.1.4	Some potential candidates for domain-specific modules	151
7.2	Problems with rational thought	153
7.2.1	The problem of optimisation	153
7.2.2	Errors of thought and reasoning: heuristics and cognitive illusions	154
7.3	Cognitive illusions and the adapted mind	156
7.3.1	Bounded rationality and adaptive thinking	156
7.4	Biases and fallacies revisited	159
7.4.1	Overconfidence bias revisited	159
7.4.2	The conjunction fallacy revisited	160
7.4.3	The base rate fallacy revisited	160
7.5	Case study: the Wason selection task: cognitive adaptations for social exchange	161
7.5.1	Logical reasoning and the social contract	161
7.5.2	The Wason task and the payoff to the participant	164
7.6	Sex differences in cognition	165
7.7	Problems with the modular approach	167
8	Emotions	171
8.1	Some early theories of emotions	172
8.1.1	<i>The Expression of the Emotions in Man and Animals</i> (Darwin, 1872)	172
8.1.2	The James–Lange theory	173
8.2	The functionality of emotions	174
8.2.1	The case for functionality	174
8.2.2	Evidence of functionality	174
8.2.3	Homology	175
8.2.4	Universality	176
8.2.5	Neurophysiological correlates	177
8.3	Brain structure	178
8.3.1	The central nervous system	178
8.3.2	The two hemispheres	180
8.3.3	The amygdala	181
8.3.4	Mirror neurons and the understanding of emotions	183
8.4	Emotions and some specific functions	184
8.4.1	Emotion, commitment and decision-making	184
8.4.2	Emotions as superordinate cognitive programmes	184
8.4.3	Resolving the paradox of emotions	186
Part IV	Cooperation and Conflict	189
9	Kin Selection and Altruism	191
9.1	Kin and parental certainty	191
9.2	Sibling affection and r values	192
9.3	Discriminating grandparental solicitude	193
9.4	The distribution of wealth: inheritance and kin investment	194
9.4.1	Inheritance of wealth: practice in a contemporary Western culture	195
9.4.2	Inheritance rules and marriage systems	196
9.4.3	Paternity certainty, patrilineality and matrilineality	197
9.5	Reciprocal altruism	198

9.5.1	Mutualism, parasitism, altruism and spite	198
9.5.2	Reciprocal altruism or time-delayed discrete mutualism	199
9.5.3	Conditions for the existence of reciprocal altruism	200
9.6	Game theory and the prisoners' dilemma	201
9.6.1	The prisoners' dilemma	202
9.6.2	Tit for tat	203
9.6.3	Applications of game theory	205
9.6.4	Indirect reciprocity and reputation	207
9.7	Game theory and the moral passions	208
10	Conflict Within Families and Other Groups	211
10.1	Parent–offspring interactions: some basic theory	211
10.1.1	Parental altruism	211
10.1.2	Parent–offspring conflict and sibling rivalry	212
10.2	Maternal–fetal conflict	213
10.2.1	Conflicts over glucose supplied to the fetus	214
10.2.2	Conflicts over decision to miscarry	214
10.2.3	Conflicts over blood supply	216
10.2.4	Conflict after parturition	216
10.3	Human violence and homicide	217
10.3.1	Infanticide	218
10.4	Human sexual conflicts	222
10.4.1	Marriage as a reproductive contract: control of female sexuality	222
10.4.2	Jealousy and violence	224
10.4.3	Divorce and remarriage	225
Part V	Mating and Mate Choice	229
11	Human Sexual Behaviour: Mating Systems and Mating Strategies	231
11.1	Contemporary traditional or preindustrial societies	231
11.1.1	Cultural distribution of mating systems	231
11.1.2	Hunter-gatherer societies	232
11.2	Physical comparisons between humans and other primates	235
11.2.1	Body size dimorphism	235
11.2.2	Testis size	235
11.2.3	Testis size and bodily dimorphism applied to humans	236
11.3	Pluralistic sexual strategies	240
11.3.1	Sex differences in long- and short-term mating strategies	241
11.3.2	Sexual strategies in relation to context	242
12	Human Mate Choice: the Evolutionary Logic of Sexual Desire	247
12.1	Evolution and sexual desire: some expectations and approaches	248
12.2	Questionnaire approaches	249
12.2.1	Cross-cultural comparisons	249
12.2.2	Urgency in copulation	250
12.2.3	A qualified parental investment model: the effect of levels of involvement	251
12.3	The use of published advertisements	252
12.3.1	Origin of mate choice preferences: evolutionary psychology or structural powerlessness	253

12.4	The use of stimulus pictures to investigate body shape preferences	254
12.4.1	Waist to hip ratios (WHRs): male assessment of females	254
12.4.2	Waist to hip ratios (WHRs): female assessment of males	255
12.4.3	The cultural variability of attractiveness judgements	256
12.4.4	The female breast	262
12.5	Facial attractiveness: honest signals, symmetry and averageness	263
12.5.1	Honest signals	263
12.5.2	Symmetry and fluctuating asymmetry	264
12.5.3	Averageness	265
12.5.4	The enigma of the beard	266
12.5.5	Other aspects of attractive faces	266
12.5.6	Female facial preferences: a potential hormone-mediated adaptive design feature	268
13	Incest Avoidance and the Westermarck Effect	271
13.1	Early views about inbreeding and the incest taboo	271
13.2	Westermarck's alternative Darwinian explanation	272
13.3	Testing Westermarck's hypothesis	273
13.3.1	Inbreeding as injurious to offspring (inbreeding depression)	274
13.3.2	Early association inhibiting inbreeding by generating an aversion	275
13.3.3	Aversion through co-socialisation as an evolutionary adaptation	277
13.3.4	Inbreeding depression and cultural norms: the representational problem	278
13.4	Keeping it in the family: incest, paternity confidence and social stratification	281
13.5	Incest and morality	283
Part VI	The Disordered Mind	285
14	Mental Disorders: Some Theoretical Approaches	287
14.1	Problems of taxonomy and definition	287
14.1.1	DSM systems	287
14.1.2	Sociological considerations	288
14.2	Conceptual pluralism in psychology	289
14.3	Evolutionary classifications of mental disorders	291
14.4	Evolutionary accounts	293
14.4.1	Genetically based disorders: mutations	293
14.4.2	Defence mechanisms	293
14.4.3	The smoke detector principle	294
14.4.4	Preparedness theory	295
14.4.5	The trait variation argument	299
14.4.6	Out of Eden hypothesis	299
14.4.7	Design trade-offs	302
15	Mental Disorders: Some Case Studies	305
15.1	Depression	305
15.1.1	Types of depression and their incidence	305
15.1.2	Depression as an adaptive strategy	307
15.1.3	Depression as a means of seeking help and conserving resources	308
15.1.4	Depression as a bargaining strategy	310
15.1.5	Social competition hypothesis	310

15.2 Psychopathology	311
15.2.1 Psychopathy as psychopathology	311
15.2.2 Evidence for psychopathy as design	312
15.2.3 Psychopathy as a genetically based and adaptively functional single strategy	313
15.2.4 Psychopathy as an environmentally contingent strategy	313
15.3 Schizophrenia	313
15.3.1 Biology and genetics of schizophrenia	314
15.3.2 Evolutionary explanations of schizophrenia	315
15.3.3 The group-splitting hypothesis	316
15.3.4 The brain lateralisation and language development hypothesis	317
15.4 Autism	318
15.4.1 Autism and mind blindness	318
15.4.2 Autism and genomic imprinting	321
15.4.3 Autism and mirror neurons	321

Part VII Wider Contexts **325**

16 The Evolution of Culture: Genes and Memes	327
16.1 Modelling culture	327
16.2 Culture as autonomous	328
16.3 Cultural evolution as the natural selection of memes	329
16.4 Dual inheritance theories	332
16.4.1 Imitation and bias	332
16.4.2 Changing environments and social learning	334
16.4.3 Maladaptive cultural variants	334
16.4.4 Culture and life history	335
16.5 Gene–culture coevolution	336
16.6 Culture as a consequence of genotype: culture as extended phenotype	338
16.6.1 The extended phenotype	338
16.6.2 Culture as sexual display	339
17 Ethics	343
17.1 Does Darwinism signal the end of ethics?	343
17.1.1 The challenge of evolution	343
17.1.2 Existence of God and a basis for objective moral standards	344
17.1.3 Freedom of the will	345
17.1.4 Transcendentalism, empiricism and the slide to relativism	348
17.1.5 The fact–value dichotomy	349
17.2 Prospects for a naturalistic ethics	350
17.2.1 The naturalistic fallacy	350
17.2.2 A Darwinian updating of Hume	352
17.2.3 The behavioural ecology of morality	354
17.2.4 Game theory and moral philosophy	355
17.2.5 Moral development	356
17.2.6 But is it right?	358
17.3 Applied ethics: moral problems	358

Epilogue: The Use and Abuse of Evolutionary Theory	361
18.1 Evolution and politics: a chequered history	361
18.1.1 Race, IQ and intelligence	365
18.1.2 A poisoned chalice	365
18.2 The eugenics movement	366
18.3 Evolutionary biology and sexism	366
18.4 Evolutionary biology and racism	369
18.5 The limits of nature	370
18.5.1 Reductionism and determinism	370
18.5.2 The perfectibility of man	371
18.6 So human an animal	372
18.6.1 Fine intentions	372
18.6.2 Retrieving our humanity	373
<i>Glossary</i>	376
<i>Bibliography</i>	387
<i>Index</i>	411

List of Figures

1.1	Charles Darwin (1809–82)	3	3.8	Influences on the operational sex ratio	64
1.2	Konrad Lorenz (1903–89)	7	3.9	Elephant seals	65
1.3	Composite drawing of the ideal infantile face	9	3.10	Human sexual dimorphism	65
1.4	Herbert Spencer (1820–1903)	15	3.11	Alternative growth, reproduction and repair strategies	70
1.5	The American biologist Edward Wilson	25	3.12	Divorces as a result of adultery as a percentage of total in each age group plotted against age of petitioning party for population of England and Wales, 1995	72
1.6	Coverage of EP in introductory psychology texts 1975–2004	27	3.13	The demographic transition illustrated by the UK	72
2.1	A Darwinian wheel of life	31	3.14	Birth intervals, reproductive rates and other variables for women in foraging, rural and modern societies	73
2.2	The germ line and information flow, according to Weismann	32	3.15	Future life expectancy of 47-year-old women by their age at the birth of the last surviving child	75
2.3	The central dogma of the molecular basis of inheritance	33	4.1	How the elephant acquired a long trunk	80
2.4	DNA as a double helix of complementary polynucleotide chains	34	4.2	The hypothetico-deductive method applied to evolutionary hypotheses: an idealised view	82
2.5	James Watson and Francis Crick	35	4.3	Reverse engineering and adaptive thinking	84
2.6	Complementary pair of chromosomes showing homozygosity for allele B and heterozygosity at A and C	37	5.1	Traditional (phenetic) classification of apes and humans	96
2.7	Simplified picture of meiosis and spermatogenesis	37	5.2	Classification of humans and the great apes based on phylogenetic information	96
2.8	Fertilisation of an ovum	38	5.3	Diagrammatic illustration of speciation around a reproductive barrier	99
2.9	Haemophilia in the monarchies of Europe	39	5.4	Hypothetical relationship between three species A, B and C	103
2.10	Conditions for the spread of a helping gene	44	5.5	Evolutionary tree of the primates based on haemoglobin and mitochondrial gene sequences	103
2.11	Coefficient of relatedness between siblings	45	5.6	Current distribution of the African apes and find spots of early hominin species	105
3.1	Relative dimensions of an egg from a human female and a sperm from a male	55	5.7	Time chart of some early hominids	105
3.2	Sexual selection as found in the hummingbird species <i>Sparthura underwoodi</i>	59			
3.3	Sexual dimorphism in the beetle species <i>Chiasognathus Grantii</i>	60			
3.4	Inter- and intrasexual selection	60			
3.5	Moulay Ismail Ibn Sharif (Ismail the Bloodthirsty) emperor of Morocco (1646–1727)	62			
3.6	Intrasexual competition and the OSR	63			
3.7	Detail from <i>The Rake's Progress</i> by William Hogarth	64			

5.8	The diaspora of <i>Homo erectus</i> and <i>Homo sapiens</i>	111	7.4	Percentage responses to Wason's task as revised by Gigerenzer and Hug	164
5.9	Mitochondrial DNA is inherited from the mother only	112	8.1	The James–Lange theory of emotions	173
6.1	Brain size as a percentage of body size for selected mammalian species plotted on log–log coordinates	116	8.2	Chimpanzee–human homologues in facial expressions	175
6.2	Growth of brain size in relation to body size for mammals	116	8.3	Facial expressions used by Darwin in <i>The Expression of the Emotions</i> (1872)	176
6.3	Logarithmic plot of brain size against body size	117	8.4	The structure of neurons	180
6.4	Growth in brain size during human evolution	117	8.5	The forebrain, midbrain and hindbrain	180
6.5	Brain volume in relation to body weight for the great apes and selected hominins	118	8.6	Lateralisation of some brain functions	181
6.6	Some possible evolutionary stimuli on the growth of hominid brains	119	8.7	Location of the amygdala, the hippocampus and the insula	181
6.7	Relationship between brain size, gut size and energy availability in the evolution of the hominin brain	120	8.8	Schematic diagram of how the amygdala may be involved in memory storage	182
6.8	An interpretation of deceptive behaviour in baboons, <i>Papio ursinus</i>	126	8.9	Pathways of fear	183
6.9	Triune model of the brain as proposed by MacLean	128	9.1	Measures of affection and solidarity between full and half-siblings in a religious community	192
6.10	Plot of group size against neocortex ratio for various species of primate	129	9.2	Differing degrees of grandparental certainty	193
6.11	Relationship between neocortical ratio and index of tactical deception for a variety of primates	129	9.3	Solicitude of grandparents as experienced by grandchildren	194
6.12	Conjectured relationship between various factors acting synergistically to exert a selective pressure on brain size in hominins	130	9.4	Distribution of matrilineal or patrilineal inheritance according to paternity certainty	197
6.13	Comparison of head and neck of a human adult and an adult chimpanzee	134	9.5	Matrix of relations defining mutualism, altruism, selfishness and spite	198
6.14	Broca's and Wernicke's areas	135	9.6	Food sharing in vampire bats shown in terms of a cost–benefit analysis	201
6.15	Mean percentage of time spent grooming versus mean group size for selected species of apes and Old World monkeys	137	9.7	Payoff matrix for two prisoners caught in a dilemma	202
6.16	The brain of a macaque showing the area F5, the location of mirror neurons	140	9.8	Prisoners' dilemma values for cooperation and defection	203
7.1	Some possible evolved domains of the mind	152	9.9	A decision tree for a prisoners' dilemma scenario	203
7.2	Some alternative concepts of rationality	159	9.10	Hypothetical payoff matrix for mutualism	205
7.3	Percentage of correct responses in Wason's selection task according to context	163	9.11	A ration party of the Royal Irish Rifles in a communication trench during the Battle of the Somme	206
			9.12	Some possible emotional reactions to moves in the prisoners' dilemma	209
			10.1	Coefficients of genetic relatedness (r values) between parents and offspring, between siblings and between nieces or nephews	212

10.2	Schematic representation of the effort by the mother and fetus to drive the blood glucose level to different optima	214	11.10	Levels of women's sociosexuality in relation to operational sex ratios across 48 nations	244
10.3	Relative incidence of DS according to age of mother and whether birth is primiparae or not	215	12.1	Responses to questions on casual sex expressed as a percentage of the respondents answering	250
10.4	The incidence of DS in relation to two maternal age categories and birth order of the DS child	216	12.2	Minimum level of acceptable earning capacity at different levels of involvement	251
10.5	Rate of infanticide versus age of biological mother	218	12.3	Percentage of advertisers seeking and offering physical appearance and financial security	252
10.6	Child's risk of homicide	219	12.4	Features of 'lonely hearts' advertisements: those seeking resources according to age group	252
10.7	Cinderella	220	12.5	Responses to personal advertisements as a function of the advertiser's age	253
10.8	Risk of a child being killed by a step-parent compared with a natural parent in relation to the child's age	221	12.6	Stimulus figures given to subjects in Singh's study	255
10.9	A Bengali Muslim woman covered in a hijab	223	12.7	Distribution of WHR according to gender and hormone levels	256
10.10	Differences between males and females in their emotional response to sexual and emotional infidelity scenarios	225	12.8	Stimulus pictures of men with various WHRs in the normal weight category	256
10.11	Percentage of divorces as a function of the grounds given by male and female petitioners for England and Wales, 1995	225	12.9	Attractiveness of female body shape in relation to WHR judged from line drawings by US and Hadza males	258
10.12	Percentage of divorces granted in England and Wales, 1995	226	12.10	WHR, BMI and WCR	259
11.1	Human mating systems in 186 traditional cultures prior to Western influence	232	12.11	BMI values for humans of differing heights and weights	259
11.2	Yanomami Amerindians washing vegetables	233	12.12	Comparison of the attractiveness ratings by three groups of observers according to BMI	260
11.3	<i>Favourites of the Harem</i> (Constantinople, c.1900)	234	12.13	Conjectured relationship between resistance to parasites, secondary display characteristics and honest signals	264
11.4	Body size dimorphism versus mating system for various species of primate	235	12.14	Measurement of relative and absolute fluctuating asymmetry	265
11.5	Relative testis size versus mating system for various species of primates	236	12.15	Facial attractiveness: averaging and sexual dimorphism	268
11.6	Relative testes mass in relation to mating systems for various species of birds	236	12.16	Percentage of female subjects choosing a face as most attractive in relation to their conception risk and masculinity of chosen face	269
11.7	Body size dimorphism: female's view of males, illustrating the relative size of the body (circle), penis (arrow) and testes (dark ovals)	237	12.17	Typical images used in Johnston et al.'s facial morph movie to assess attractiveness of faces	269
11.8	A comparison of the number of sexual partners desired over different time intervals for males and females using a large cross-cultural sample	241	13.1	Sigmund Freud (1856–1939) taken in about 1938	272
11.9	Mean number of sexual partners desired by men and women over 30 years	242	13.2	Edvard Westermarck (1862–1939) (c.1926)	273

13.3	Fertility of Chinese marriages plotted against age of adoption of girl	276	15.3	The Sally–Ann false belief test	319
13.4	Copulations between chimpanzee mothers and sons observed in the Gombe National Park, Tanzania	277	16.1	A spectrum of models of gene–culture interactions	328
13.5	The presence or absence of marriage rules including affinal kin (in-laws and so on) according to patrilocal or matrilocal residence	282	16.2	Brain size in relation to the length of juvenile period for selected primates	336
14.1	<i>The Scream</i> , from a lithograph by Edvard Munch (1863–1944) made in 1895	290	16.3	Global distribution of adult LM in a sample of 91 populations	337
14.2	Mental pathologies and fitness	292	16.4	Albums of jazz music produced by males and females	340
14.3	Decision matrix (costs and benefits) faced with a signal of a potential threat	294	16.5	Typical Acheulean hand axe from the Douro valley, Zamora province in Spain	341
14.4	Covariation bias in the estimation of the conditional probability of outcomes	297	17.1	A spectrum of responses to Darwin expressed as a series of boundaries	347
14.5	Fear reactions to subliminally presented images	298	17.2	David Hume	352
15.1	Conditions associated with postpartum depression	309	17.3	Typical payoff values for a prisoners' dilemma scenario	355
15.2	A comparison of the incidence of obstetrical problems in psychopathic and non-psychopathic criminal offenders	312	18.1	Francis Galton (1822–1911)	363
			18.2	Margaret Mead (1901–78)	372
			18.3	A child chipping away at the Berlin Wall	374

List of Tables

1.1	Differences between comparative psychology and ethology	14	7.1	Empiricism and rationalism in European thought	147
2.1	Coefficients of relatedness r between kin pairs in humans	45	7.2	Levels of explanation in evolutionary neurophysiology	153
3.1	Characteristics of mating systems	56	7.3	Improvements in Bayesian reasoning by frequency presentations of the medical diagnosis problem	160
3.2	Four basic mating systems	57	7.4	Summary of results from two separate studies on sex differences in cognitive tests	167
3.3	Mechanisms of intersexual competition	68			
3.4	Some features of K and r selected organisms	71	8.1	Selected research on some postulated functions of emotions	185
4.1	Contrast between the methods and assumptions of Darwinian anthropology and evolutionary psychology	86	9.1	Comparative grandparental care from a study on two Greek communities	194
4.2	Types of explanation in evolutionary thinking	89	9.2	Bequests made to relatives as a percentage of total estate for 1,000 people in British Columbia	195
5.1	Traditional taxonomy of humans and a hypothetical classification of a motor vehicle illustrating Linnaean classification	95	9.3	Distribution of estate to offspring according to sex	196
5.2	Some key events in life history	97	9.4	Male bias in inheritance system of a culture according to mating behaviour	196
5.3	Data on early hominins	104	9.5	End states of marriage system and inheritance rules following a cultural transition	196
5.4	Summary of features of selected hominids	106			
5.5	Origin of modern humans: competing hypotheses	111	10.1	Abuse and neglect of children by genetic and non-genetic parents	222
6.1	Absolute brain weights of selected organisms	115	11.1	Physical characteristics of humans and the great apes in relation to mating and reproduction	237
6.2	Body weights, brain weights and EQs for selected apes and hominids	118	11.2	Differences in male and female long- and short-term mating strategies	241
6.3	Expected and observed masses of human organs (for a 65 kg primate)	120	11.3	Sex differences in sociosexuality among six nations	243
6.4	Comparison of brain sizes of howler and spider monkeys	121	11.4	Correlations of SOI with selected cultural variables	244
6.5	Comparison of diet of hunter-gatherers with chimpanzees	122			
6.6	Predicted percentage grooming times for fossil and modern hominids	138			

12.1	The top five cosmetic surgery procedures in the USA for 2005	248	13.7	The application of rules concerning marriage in stratified and non-stratified societies	282
12.2	Predictions on cross-cultural mate choice preferences	249	14.1	Some models of mental disorders	289
12.3	Number of cultures supporting or otherwise hypotheses on gender differences in mate preference	250	14.2	Panksepp's postulated relationship between basic emotional systems (endophenotypes), commonly experienced emotions and major psychiatric disorders	292
12.4	Degree of involvement and expected implications for investment according to gender	251	14.3	Defensive responses to threats	294
12.5	Research pertaining to reproductive and health implications of high female WHRs and varying BMI values	254	14.4	Selection of results of an epidemiological study of phobias on sample of 20,000 American subjects	299
12.6	Comparison of preferred frontal and side-view WHRs for US and Hadza men	258	15.1	Clinical names for some depressive states	306
12.7	A comparison of mean WHR for samples of Hadza and American women	258	15.2	The top 10 leading causes of the global burden of disease (2001)	306
12.8	Suggested associations between BMI and SES in two different cultures	261	15.3	Concordance values for depressive disorders showing data from several sources	307
12.9	The effect of decreasing SES on male preferences for female body shape ('female figures') and female preference for male body shape ('male figures') in British and Malaysian groups	261	15.4	Selected symptoms of a major depressive disorder and their possible function according to the bargaining model of depression	310
12.10	Facial features and possible function in natural or sexual selection	267	15.5	Concordance rates for the development of schizophrenia	314
13.1	Coefficients of inbreeding	274	15.6	Approximate risk ratios for various disorders	315
13.2	Scientific studies on effects of inbreeding in humans	275	15.7	Results from the Sally-Ann false belief test	319
13.3	A selection of rules governing consanguineous marriages from various authorities	279	16.1	Estimates of the juvenile period of selected hominins	335
13.4	Moral aversion to third party incest in relation to childhood experience	280	16.2	The production of hand axes in the light of sexual selection theory	341
13.5	Male and female aversion to incest	281	17.1	Kohlberg's stages of moral development and some possible evolutionary parallels	357
13.6	Testing for an association between rules against biological and affinal incest	282			

List of Boxes

1.1	Fixed action patterns	8	7.6	Wason's task: social contract and perspective change	164
2.1	Queen Victoria's gene: haemophilia and the breaking of nations	39	7.7	Three exercises used to test for sex differences in cognition	166
4.1	Behaviour that is genetic but not adaptive, or adaptive but not genetic	80	8.1	The central nervous system	179
4.2	Case study: pregnancy sickness	82	9.1	Application of reciprocal altruism to trench warfare in the First World War	205
5.1	The great apes (Hominidae): our nearest relatives among the primates	102	11.1	Power, wealth and sex in early civilisation	233
6.1	Turner's syndrome	132	11.2	Concealed ovulation	238
7.1	Some classic optical illusions	149	14.1	Defining mental disorders	288
7.2	The base rate fallacy and Bayesian reasoning	155	16.1	The spread of memes	330
7.3	Basic form of Wason's selection task	162	16.2	Fast and frugal heuristics for acquiring a culture	333
7.4	Wason's selection task in a social exchange context	162	17.1	David Hume (1711–76)	352
7.5	Wason's selection task in unfamiliar context of social exchange	163			