

# Index

```
action-rule programmes for behaviour, 42, 43,
                                                  'emic' and 'etic' research options in, 428
                                                  move towards ethology in, 430
activation, levels of, 162, 164
                                                Aporosaura anchietae (Namib desert lizard),
  and boundaries of behaviour system, 137
                                                     67-75, 89
  and relations of different behaviour systems,
                                                appetites, hierarchy of, 40-1
    152 - 3
                                                Arenicola, 12
adaptation, use of term in ecological anthropol-
                                                arousal, level of
    ogy, 445, 447
                                                  and attention, 123-4
Aëdes, 336
                                                  and copulatory behaviour of male rat, 76
Aepyceros melampus (impala), 203
                                                  in new-born altricial mammals, 369, 370,
                                                     371, 372, 373
Agapornis spp., 332
age, in non-human primates
                                                  and response to stimuli, 112
  and aggressiveness, 207
                                                artificial intelligence, work on, 13, 14, 42
  and dominance, 219-20
                                                attention
  and frequency of different types of vocaliza-
                                                  arousal and, 123-4
    tion, 242, 243, 244, 245, 249, 251-3,
                                                  assumptions of model on processes of, 100-3
    254-6
                                                  in learning experiments, 388-9
  and status, 467
                                                  shifts of, 99
aggression, aggressiveness
                                                  theory of, 95, 191; application of, to chicks,
  functions of, 204-5, 518
                                                     104,
                                                            (distractibility
                                                                             tests)
                                                                                       107-8.
  genetics of, 328, 329, 336
                                                     (extinction tests) 110-11, (novel stimulus
  in humans, 431, 432, 439, 516-18, 522-3
                                                     tests) 109-10, (search tests) 105-8, and to
  more common where result of encounter is
                                                     mice, 108, 113; mismatch in, 99-100;
    not predictable, 220
                                                     selection and recognition of stimuli in,
  reduced by dominance, 216
                                                     96-8
                                                  threshold model for, 13
  sexual dimorphism and, 205-7
  and vocalizations in chimpanzee and gorilla,
                                                attenuation, of irrelevant signals, 96, 97
    263
                                                'aunting', in non-human primates, 200-1
                                                babbler, Arabian, 289
  in humans, 431-2, 433, 439; appeal to, in
                                                baboons, see hamadryas, Papio, Theropithecus
     re-evolution', 523
  reciprocal, 202-3, 210
                                                behaviour
                                                  analysis of, by optimality theory, see opti-
Ammodramus
                 savannarus
                                (grasshopper
    sparrow), 174
                                                     mality theory
amphetamines, and appetite and movement,
                                                  development of, see behaviour development
    156 - 7
                                                   genetics in study of, see under genetics
anaesthesia, recovery of behaviour after, 155
                                                  hierarchical organization of, see hierarchical
Anas platyrhynchos (mallard) and A. acuta
                                                     organization
                                                  human, see under man
    (pintail), 333
                                                  'learned' and 'instinctive', 323, 505
anthropology
  ecological, 435-9; behavioural ecology and,
                                                  neural analysis of, 7, 191-2, 534
    439-47
                                                  patterns of, see behaviour patterns
```



# INDEX

behaviour (cont.)	bullfinch, 180
'software' explanations of, 8, 48, 191	bunting, corn, 174
two types of programme for, 42-3	Bushmen, 431, 444
units of, 329-36, 422	bushbuck, 203
behaviour development	3 4 5 1 5 1 5 1 5 1 5 1 5 1 5 1 5 1 5 1 5
in altricial mammals, 345-6, (home orien-	Caenorhabditis (nematode), 332
tation) 362–7, (huddling) 359–62,	calibration, 392–3
(suckling) 346–57; stimuli in, see olfactory	of events in play of rhesus monkey infant,
and thermotactile stimuli, and under	394, 395–7
vision	Calliphora erythrocephala (blow-fly), compo-
genetics in, 176, 336–9	nents of grooming in
play in, see play	computer recognition of pattern in sequence
theories of control leading to equifinality in,	of, 38, 39, 40
407-10, and of interaction with environ-	mutual replaceability analysis of, 22, 25, 32
ment in, 401–2, 423; synthesis of control	transitions between, 22, 23, 29, 31
and interaction theories for, 410–16, 418;	Canis lupus, see wolf
rules in proposed theory for, 416-17	carnivores, see cat, Crocuta, dog, fox, hunting
behaviour patterns, 36-7	dog, lion, mongoose, wolf
algorithms for, 37-40, 46	cat
in bird-song, see bird-song	activity in learning by, 392
changing of, during ontogeny, 422	early behavioural development in: contact
clustering of, see clustering	with mother, 348, 349, 370; home orienta-
concept of specific and non-specific factors	tion, 365, 367; huddling, 360, 361; suck-
in, 138-9	ling, 346, 347, 350, 358-9, (olfactory
dynamic boundaries of, 135-6, 152-3, 159,	stimuli in) 354, 355, 372, 373, (pre-
164, 191	feeding and) 351–2, (visual stimuli in)
intrinsic and extrinsic factors in, 139-47	356, 373
natural selection and order of, 55, 75	imitation of mother's mouse-catching by,
systems of, 136–7; interactive and self-	503
organizing principles in, 135, 137–8, 141,	
	recovery of behaviour after hypothalamic
159, 164; relations between different, 147–58	lesions in, 155-6
	Cercocebus albigena (mangabey), 204, 263
see also stereotyping of movement	Cercocebus spp., 211
bird-song, 6, 47	Cercococcyx mechowi, C. montanus, C. olivinus
detection of 'errors' in, 181-8	(African cuckoos), 176
different developmental pathways in,	Cercopithecus aethiops (vervet), 213, 264
409–10	Cercopithecus ascanius, C. mitis, 264
genetics of, 176, 337	Cercopithecus spp., 211, 212
Gestalt theory and, 174–81	chaffinch, 324
imitation of alien species in, 178, 179-80	chicks
birds	cycloheximide and visual learning by, 128
imprinting in, see imprinting	exposure learning by, 460-1
see also chicks, and individual species	pecking and drinking sequences in, 142
blackbird, see Turdus	theory of attention applied to, 104, 105-10,
blood vessels, design of, 57-9	130
blow-fly, see Calliphora	children, 428, 430
boss-ship, 9, 11, 46	attachment behaviour of, 486-7
shifting of, 13, 14	effect of rearing conditions on, 483-4,
boundaries, dynamic: of behaviour patterns,	487–8, 530
135-7, 152-3, 159, 164, 191	relations between mothers and, see
brackets	mother-child relations
analogy between tree diagrams and notation	chimpanzee (Pan trogodytes)
using, 26–7	dominance and grooming in, 466–7
closing of, in grammatical models, 44, 46, 47	less social in years of poor harvest, 311–12
nesting of, and hierarchical organization, 10,	movement of females of, between groups,
32, 43, 49	222
brain, lateralization of, 274–5	sexual swellings in females of, 211, 212
branching hierarchies, 9, 10–11, 48	transmission of acquired behaviour pattern
'British Museum algorithm', 42	
Dinion Museum algoridim, 72	by, 455



## INDEX

chimpanzee (cont.)	formulation of, 67
types of vocalization of, 240, 241, 246-7,	minimized by optimal desig
258, 268, 275; frequency of use of, 242-3,	75–6, 82
248-51, 253-6; functional significance of,	of optimal behaviour, 89
266-8; intergradations of, 268, 269-70;	separability of components o
sex and individual differences in use of,	courtship behaviour, see Leb
251–2	Streptopelia spp., Triturus,
Chrysococcyx cupreus, C. flavigularis, C. klassi	cowbird, 337
(African cuckoos), 177	crayfish, 146
cichlid fish, aggression in, 78	cricket, 145-6, 332
Cisticola nigriloris, 180	Crocuta crocuta (hyena), 46, 21
Clamator spp. (African cuckoos), 175	cuckoos
Clethrionomys britannicus (vole), 143	African, see Cercococcyx,
closure law, in Gestalt theory, 173, 181	Clamator, Cuculus
clustering of behaviour patterns, in time, 20-3	sexual imprinting to be avoid
analysis of, 387; mutual replaceability	Cuculus cafer, C. gularis, C. soli
analysis, 23, 31-2, 34, 39; single linkage	cuckoos), 175
analysis, 22, 23	cultural engineering, 519-23
not evidence for hierarchical organization,	cultural evolution, 440, 502, 50
23, 29, 49	culture
Colobus badius, 211, 213, 264	assessment of normal child
Colobus verus, 211, 213	dependent on, 487
Colobus polykomos (black-and-white colobus	as factor in human relati
monkey), 204, 264	459
command interneurones of invertebrates,	as outcome of interactions
function as hierarchical network, 12	viduals, 443
commitment, 459	cuttlefish, 392
common movement (good continuation) law,	cycloheximide, in chicks, 128
in Gestalt theory, 173, 179–81	D ::: : : 1 424 407 9
communication	Darwinists, social, 434, 497–8,
between chimpanzees, 455	decision points, 24
characteristic of humans, 502–3	at confluence of two hierarch
in formation of relationships, 454	decisions
in mother-child relations, 481-4	hierarchy of, 24–5; assumpt
natural-selection approach to, 433–4, 442	for, 14-17, 49; evidence
competitiveness, hypertrophied in human	assumptions, 27–31
society, 514	organization of making of: a
computer analysis, 11, 12–13, 37–40	62, 75, 191; control law for,
concentric purposiveness, 41	examples of, 62–5; expressi
conditioning, classical and operant, 461–2 conflict	isoclines, 64–7
in socialization of humans, 432	possible binary nature of, 25- deer mouse, 337
stereotyping of behaviour in periods of, 160	dehydration monitors, in Aport
in weaning process, 202	design
contingency tests, on transitions between com-	optimal, 57
ponents of behaviour, 29–31	principles of, 15–16, 49
control law (decision rules) for behaviour, 80,	development
82, 88	of behaviour, see behaviour d
cooperation	of children: importance of
between animals, 289	approach to study of, 430;
human potential for, 524	aspect of, 485, 530
cormorant, 40–1	genetic units in models of, 40
'correctness' and 'incorrectness', in animal	diopsid flies, see Calliphora
behaviour, 187	displacement activities, 47, 160
Cossypha heuglini (white-browed robin-chat),	distractibility tests
179, 180–1	on chicks, 107–8, 130
cost-benefit analysis of behaviour, 59-62, 191	on mice, 108, 113
cost function	distributed control, 13, 14
for courtship in newt, 82-8	distributive justice, law of, 466

67 optimal design, 57, 58, 59, viour, 89 components of, 87–8 our, see Lebistes, pigeons, pp., Triturus, Xiphophorus 2 yena), 46, 210 Cercococcyx, Chrysococcyx, culus ng to be avoided in, 337 gularis, C. solitarius (African ng, 519–23 440, 502, 508-10 normal child development numan relationships, 456, interactions between indichicks, 128 434, 497-8, 503 two hierarchies, 19 4-5; assumptions of model 49; evidence bearing on 27-31 making of: and behaviour, ontrol law for, 80, 82, 88, 89; 2-5; expression of, as sets of nature of, 25-6, 31 tors, in Aporosaurus, 71 -16, 49 e behaviour development mportance of multi-level tudy of, 430; 'self-righting' , 530 models of, 403-7 alliphora ities, 47, 160, 161 3, 130 13 l, 13, 14



# INDEX

dog	and other sciences, 504, 536; and social
early behavioural development in: contact	sciences, 427–30
with mother, 349, 371; home orientation,	and problems of mankind, 426, 512, 515-16,
365; huddling, 360, 361; suckling, 351,	523-5
(olfactory stimuli in) 354, 372, 373, (prefeeding and) 358, 374, (visual stimuli and)	Eupomacentrus partitus (fish), 21, 30–1, 32, 33 evolution
356, 357	of behaviour, 319–20, 533
genetics in analysis of supposed association	of bird-song, 176
of aggression and timidity in, 328, 334	cultural, 440, 502, 508–10
see also hunting dog	effects of awareness of, 48, 498
dominance hierarchies, 215–18	'exogenetic' ('exosomatic') in humans,
aggression in, 209	502–3, 504
and grooming in monkeys, 466-7	hierarchical organization and rate of, 16
sex relations in, 212	of intelligence, 210, 443
variations in, 218-20	interpretations of human behaviour based
dopamine and dopaminergic stimulation, and	on, 427, 430
movement stereotypes, 156-7, 163	of language, 43
doves, see Streptopelia	reproductive success in, 281
drinking, in mammals in absence of food, 111	selective pressures in, 300
Drosophila (fruit-fly)	experience
genes affecting eye development in, 336, and	and behaviour, 323
eye function, 333	and identification of mother by young altri-
genetics in analysis of behaviour of, 328-9,	cial mammals, 355
339–40	part played by expectancy in, 462-3
polygenic inheritance in, 335–6	transfer of, 509
Drosophila melanogaster, D. simulans, 330	see also learning
and and	exploration, 390
ecology	of new environment by wolf, 151-2 exposure learning, 460-1, 463
behavioural, and ecological anthropology, 439–47	extinction procedure, 473
and economics, 437, 444	eye (vertebrate)
education, 515, 521	cortex of, functions as hierarchical network,
y-efferent servo loops, 43	12
egg-shell removal, 59-60, 60-1, 320	form and function in, 55-7
elephant (Loxodonta africana), 289	redundancy reduction in retina of, 18
Emberiza schoeniclus (corn bunting), 174	,
embryology, on internal regulation of develop-	family (human), weakening of bonds of, 515
ment, 402, 403-7	fear
models of, and behavioural development,	appeal to, in human 're-evolution', 523
407–10	in chicks, not affected by testosterone,
'emic' and 'etic' research options, 428-9, 434	112–13
environment	evoked by large mismatch? 100, 124
behavioural development by interaction	feedback
with, 401–2, 423	in copulatory behaviour of male rat, 78
change of, made possible by cultural evolu-	in development of behaviour, 405, 408, 417
tion, 509, 510	in hierarchical systems, 12
interactions between genes and, 323–4, 330,	negative: produced by cultural evolution,
338, 408–9 equifinality, concept of	510, 524; in stopping-rule programmes, 42
in development, 404	negative and positive, in effects of inter-
in development of behaviour, 407–10	actions on subsequent interactions, 471,
Erythrocebus patas (patas monkey), 206	472
Eskimos, infanticide by, 440	relation of motor performance to, affected by
ethology	practice, 392
of animals, and elucidation of human	feedforward, in hierarchical systems, 12, 40
behaviour, 427, 498-9, 501, 504-6, 529,	feudalism, functions of, 442-3
531	fight-flight balance, 517
of humans, and elucidation of animal	'filtering' ('stimulus set') selection of stimuli,
behaviour, 427, 454, 498-9, 504-6	96, 102, 105, 106, 130



# INDEX

grammatical models, of behavioural organization, 11, 32, 43-7, 49 greeting gestures, 470
gregarious behaviour, selection for, 297 grooming
components of, in Calliphora, see Calliphora of face in mouse, see under mouse in non-human primates, 465-6, 467
groups agonistic behaviour between, 517
of chimpanzees, 260, 261 dynamics of, 220–6
genetic relations in, 281
of gorillas, 260, 261, 263
multi-male, 265
sex ratio in, 206, 214-15
guinea pig, 328, 330
gulls, see egg-shell removal, kittiwake, Larus guppy, 32, 34, 66-7
habituation
demonstrating perception of speech sounds, 274
to human observers, and vocalizations of
chimpanzee and gorilla, 249-50, 256, 275
Hadza people, 444
hamadryas baboons, 213, 219
Hamiltonian function, 88-9 hamster, early behavioural development in,
349, 375
home orientation, 363, 365, 367 suckling, 356, 373
hearing, Gestalt characteristics of, 174
hen, Tasmanian native, 283, 289
herbivores, absence of hierarchical food access
among, 218
Hermissenda crassicornis (mollusc), 149
heterarchy, 13–14 hierarch, 10
hierarchical organization of behaviour, 7, 8,
48, 444 of behaviour machinery, 517–18
in development? 332
functional significance of, 15-19, 49, 191
near-decomposability as property of, 21 in relation between genes and behavioural
units, 334-5
hierarchies, 9–14, 48
of appetites, 40-1
classification of, 14–15
of classification and of connection, 48
of decisions, 24–5 of goals, 11, 40–3, 49
of instincts, 11, 40, 334–5
interactions of low-level and high-level ele-
ments of, 20
·
home orientation, among young of altricial mammals, 346, 362

541



# INDEX

home orientation (cont.)	functions of, 194, 303-4
olfaction and, 356, 364-6, 376	as product of social living, 307-12
thermotactile basis of, 362–4	and subsistence technology, 305-7, 310, 311
	suited primarily to social problems, 312–16
vision and, 366–7	
honey-bees, genetics of nest-cleaning be-	intelligence tests
haviour of, 330	after perinatal stress, 491–2
huddling, among young of altricial mammals,	below two years of age, 337, 492
345–6, 359	on group-reared and family-reared children,
olfaction and, 356, 360-1	485–6
thermotactile basis of, 360	imitativeness and teachability not assessed
vision and, 361-2	by, 503
hunting dog, Cape, 142-3, 153-4, 289	interactions between individuals
hyenas, 46, 210	effects of, on subsequent interactions, 470-2
Hylocichla fuscescens (veery), 180	as parts of relationships, 451-4, 457-8
Hylocichla ustulata swainsoni (Swainson's	reciprocal and complementary, 472-3
thrush), 180	investment, relation of concepts of status and
Hymenoptera, kin selection in, 200, 294	of, 466–7
hypothalamus, lesions in, 155-6	01, 100 .
nypotnaiamus, iesions in, 155–6	kin selection, 200-2, 208
ideas, and human behaviour, 436.7	
ideas, and human behaviour, 436–7	in humans, 432
Ik tribe, effects of extreme stress on behaviour	in Hymenoptera, 200, 294
of, 519	in lions, 289–93, 299; strength of, 293–6
imitativeness	kinship, and aggression, 207–8
in bird-song, 324, 337	kittiwake, 61
of humans, 502–3	
imprinting, 535	language, human, see speech
in birds, 324, 337	langur, see Presbytis
in chick of domestic fowl, 128, 411-12;	Laniarius aethiopicus major (Boubou shrike),
model for, 412-13	178, 179
linking of studies of perception and of, 535	Larus ridibundus (black-headed gull)
patterns of perception in, 6	predation by foxes on nests of, 61
inbreeding, avoidance of, 221, 222	egg-shell removal from nest by, 59-60, 320;
in lion prides, 284	experiments on, 60-1
indifference curves (sets of isoclines), 67	reproductive behaviour of, 533
infanticide	laughter, evoked by mismatch, 125-6
by Eskimos, 440	learning
by male lions taking over a pride, 297	as component of behaviour, 323
information	in development of relationships, 454, 471
	experiments on, 389, 396, 422
excessive input of, in present human condi-	
tion, 513	in humans, see under man
gathering of, 411, 417	internal control of, 324
information distance, in hierarchical	in play, by rhesus monkey infant, 385, 388,
organization, 17	391–2, 397–8
inheritance	reinforcement in, 461-2, 464-7, 474, 475;
of bird-song in cuckoos, 176	dilemmas of, 467–9
cultural, 440, 447, 502	repetition in, 386, 393–4, 398
polygenic, analysis of, 335–6	three paradigms of, 460-2, 475; inter-
see also genes, genetics	digitation of, 463-4; not processes, 462-3,
insects, see Aëdes, Calliphora, cricket,	475
Drosophila, honey-bee, Hymenoptera,	two stages of, 126-7
locust, mantis	Lebistes reticulatus (guppy), 32, 34, 66-7
instincts	Lemur, 211
as components of behaviour, 323	Lemur catta (ring-tailed lemur) 206
hierarchy of, 11, 40, 334-5	linear hierarchies, 9, 10, 48
institutionalization, of human relationships,	lion (Panthera leo)
456, 473–4	average degree of relatedness in pride of,
intelligence, intellect	284-6, 299; effects of variation between
definition of, 304	prides in, 286–9
evolution of, 210, 443	kin selection pressures in, 289–90, 299–
CTOIGHOU DI, AIO, 110	iiii beleetion pressures in, 20/ /0, 2//-



### INDEX

ethology and, 427-30, 441, 498-9, 501, lion (cont.) 300, (communal suckling) 290, 298, 504-6, 508, 524 (competition for oestrous females) 292-3, evolution of behaviour in, 48, 210, 312-15, 427, 430-5, 443, 447, 497-8, 500; stage of (male tolerance of cubs at kill) 291; effects of, 296-9; strength of, 293-6 disadaptation in, 511, 513 reproductive system of, 193 evolution of language in, 43, 502-3 family bonds weakened in, 515 social dynamics of, 223 list-processing computer technique, 27 learning by, 33-6, 126-7, 173, 393, 460-3, 475, 500-1 lizard, sand-diving, see Aporosaurus moral judgements of behaviour of, 433, 501, local administration, hierarchical organization 523 and, 16-17 locusts, 339, 408 notation for movements in, 387-8 Lycaon pictus (Cape hunting dog), 142-3, perception by, 33-6, 392; see also Gestalt 153-4, 289 psychology populations of, 510, 518-19, 523 Macaca fuscata (Japanese macaque) problem of speed of change of behaviour in, age, and ranking of females of, 209 feeding tolerance in, 207-8 relationships, interpersonal, 451-74 group dynamics in, 220 war between groups of, 516, 517–18 punishment of aggression among, 210 see also anthropology, children, motherrank, and sexual activity of males of, 218 child relations, speech sexual colour changes in females of, 212 mangabey, see Cercocebus vocalizations of, 264, 266-7 Mandrillus, same display for submission and Macaca mulatta (rhesus monkey) reassurance in, 465 acculturation in, 505 mantis, praying, 392 adolescent males of, transfer between Markov models, 23, 44, 47 marmots, 206 groups, 221 dominance and grooming in, 220, 224-5 matriarchal groups departure of individuals from, 223-4 group dynamics in, 220, 224-5 low-protein diet and rank of, 218 dominance in, 225 mother and infant behaviour in, 415-16, matrices (transition), 20, 21, 30-1 Meleagris gallopavo (turkey), 289 471 Microtus agrestis (vole), 143 sexual swellings in females of, 212, 213 study of play in, see play Miopithecus talapoin (talapoin monkey) vocalizations of, 264 dominant females in, 206 Macaca speciosa, 212, 264 sexual swellings in females of, 211-12 Macaca spp., 211, 212 vocalizations of, 264, 266 macaque, Japanese, see Macaca fuscata mallard, 333 mismatch between stimulus and activation of recognition unit, 95, 99-100, 124-5 Malinowski, B., 436, 437 behaviour evoked by, 101; in newly hatched chicks, 411, 412 adaptation of, to reversing spectacles, 392 factors affecting, 125-9 altruism in, 431-3, 438, 439, 523 molluscs, see cuttlefish, Hermissenda Molothrus (cowbird: brood parasite), 337 behaviour development of, in monozygotic twins, 337 mongoose, banded, 289 behaviour and present environment of, 511, monkeys, Cercocebus, Cercopithecus, 513, 520-3 Colobus, Erythrocebus, hamadryas. Macaca, Mandrillus, Papio, Presbytis, Propithecus, Saimiri, Theropithecus behavioural flexibility of, 509 categorizations of behaviour of, 428 communication by, 125-6, 454, 481-4, monogamy, associated with small sex differences, 206 502 - 3competitiveness in, 516 moral judgements, 433 conflicts, in socialization of, 432, and in appeal to, in human 're-evolution', 523 weaning of, 202 in execution and application of science, cooperativeness in, 514, 524 and interpretation of science to laymen, criteria of normality in behaviour of, 513 501 cultural engineering in, 519-25 mother-child relations, human disorders of behaviour in, 331, 502, 512 complexity of predicting consequences of, dual standard of sexual behaviour in, 433 472, 491–3



#### INDEX

mother-child relations (cont.) grasping of, by newborn, 349-50 and development of speech, 485, 488, kittens' preferences for, 350, 355 temperature of, 347, 351 novelty, 390 and later development, 485-8, 493-4 observations on, 429, 481-4 in behavioural development of chick, motivation, 135-6, 454, 536 109-10, 130, 412 behaviour models based on, 139, 140 effect of increase in, on behaviour patterns, olfactory stimuli, in young of altricial mammals 149-50 dependence on, in second stage behavioural development, 372-3, 375-6, Lorenz's theory of, 5 motivational isoclines, 64, 65, 67 motor pathways in mammal in development of home orientation, 364-6, activation of, 145-7 of huddling, 360-1, and of suckling, coupling of output of different components 354-6 of, 148-9 optimal design, principle of, 57 system of animal, hierarchical optimality theory, analysis of behaviour by organization and redundancy reduction means of, 75-7, 433 in, 18-19 constraints on system, 77-80 mouse cost functions, 82-8 effects of testosterone on attentiveness in, decision rules, 80-2 108, 113, 114 and optimal sequence of behaviour, 88-90 face-grooming in: responsiveness to stimuli orientation reflex, mismatch and, 124 for, 150-1; transitions between elements overlapping areas, analogy between hierarchies of, 27, 29, (after denervation of face), and, 10 141-2, 145 oxygen debt, incurred by male Triturus in genetics of aggressiveness in, 328, 329, 336, courting, 85, 87, 88 of maze-running in, 338, 408-9, and of sexual behaviour elements in, 330-1 pair bonds, 198-200 recovery after anaesthesia in, 155 pandemonium' system of sensory pattern recognition, 13, 14 movement for, 165; Eshkol-Wachmann, notation Papio anubis (olive baboon), adolescent males transfer between groups of, 221 387 - 8perception of, 120-1 Papio hamadryas, sexual swellings in females rapid, isolation of sensory information of, 213 during, 145-7 Papio spp. stereotypy of, see stereotyping of movement adults of, warn juveniles of danger, 455 Mungos mungo (banded mongoose), 289 associations of, with bushbuck and impala, music in bird-song, 181 sexual swellings in females of, 211 Gestalt theory and, 180, 181 parent-child relation, 472; see also mother-Myiophoneus horsfieldii (Malabar whistling child relation thrush), 180 parental behaviour aggressive, 208-9 human, 'emic' and 'etic' approaches to, 429 natural selection, 441 consequences of pressures of, 296-9 in monogamous and polygamous species, favours genes rather than individuals, 320 197 - 8medical technology and, 510 parrots, 332 optimization techniques for studying, 441 Parus caeruleus (blue tit), 413-14 predictive power of theory of, 440 Parus major (great tit), 62, 82 and social behaviour in humans, 430-5 nervous system, hierarchical organization in, human learning of, 33-6, 49 19, 48 see also behaviour patterns see also motor pathways, motor system peck order, 9, 10 nesting, 289, 299 perception neural analysis of behaviour, 7, 191-2, 534 in Gestalt theory, 172 neuronal model, 100 problems of, 6 newt, smooth, 80-8 performance speed and coupling of output components, 148-9 nipples in development of suckling, 347, 368 and processing capacity, 142, 143, 146, 162

544



#### INDEX

Peromyscus maniculatus (deer mouse), 337 Phacrocorax carbo (cormorant), 40-1 phenylketonuria, 331 physiological state, and behaviour, 70-1 pig, 347 pigeons, 44-6 pilot, calibration in learning by, 393 pintail, 333 play: study of, in infant rhesus monkey, 385-7, 397-8 attaining of accomplished performances in, 394-5 calibration of events in, 392-3, 394, 395-7 categorization of events in, 390-1 framing of events in, 387-90, 398 repetition of events in, 386, 393-4, 398 pleasantness, judgements of, 127 politics, in implementation of human 'reevolution', 522 pollution, as result of cultural evolution, 511, 520, 521, 523 polyandry, in birds, 206 polygamy, 206 population density, 216-17 populations effect of different environments on, 60 human, growth of, 510, 518, 519, 523 practice, and relation of feedback to motor performance, 392 predictability of acts in a behavioural sequence, 149 in learning, 390, 395 of result of encounter, and aggressiveness, pregnance law, in Gestalt theory, 172, 181 pregnancy, changes in ano-genital colouring of some female primates during, 213 Presbytis spp. (langurs) aggression in, 204 intolerance of adolescent males by adult males of, 221 no sexual swellings in females of, 211 prey calibration of, by predator, 392 selection of, on cue of movement, 120-1 primates, non-human cognitive complexity in social behaviour of, cooperative behaviour in, 289 expressions of social approval in, 464-6 intelligence of, as adaptation to complexities of social living, 307-9, 316 social behaviour of, 193 see also Cercocebus, Cercopithecus, chimpanzee, Colobus, Erythrocebus, gorilla, hamadryas, Lemur, Macaca, Mandrillus, Miopithecus, Papio, Presbytis, Propithecus, Saimiri, Tarsius, Theropithecus priming, before search tests, 105, 106

priority-interrupt systems, 12-13 processing capacity of organism appearance of stereotyped behaviour on overloading of, 158-62, 162-3 phenotypically determined, 139, 141 Propithecus verreauxi (sifaka), 204, 219 proximity law, in Gestalt theory, 173-5 psychoanalytic psychotherapy, 502 psychology differentiation of, from ethology, 504 'emic' and 'etic' approaches in, 429 interactions between ethology and, 428, 441 psychosocial pressures, as result of cultural evolution, 511-16, 520 psychosomatic diseases, 512 Pyrrula pyrrula (bullfinch), 180 rabbit, early behavioural development in home orientation, 365 huddling, 361 suckling, 348, 353; olfactory stimuli in, 354-5; visual stimuli in, 356 rat control of weight gain in, 403-6 copulatory behaviour of male, 78, 79 early behavioural development in: home orientation, 363, 365-6, 367; huddling, 360; suckling, 350, 351-2, 353, (olfactory stimuli in) 354, 355, 372, 373, (pre-feeding and) 357-8, 369, 374, (thermotactile stimuli in) 348, 375, (visual stimuli in) 356-7 exposure learning by, 460 food deprivation, and killing of mice by, genetics of behaviour in, 328, 329, 334, 338 recovery of behaviour after hypothalamic lesion in, 155-6 thermoregulation lacking in newborn, 351, 364 recognition units, 97, 100-1 elaboration of new, 102, 110; mismatch in, single, activated by two separate stimuli, 126, 127 stability of, 127, 128 threshold value for activation of, 97, 98, 99; changes in, 101, 106, 122 redundancy in transfer of information, 17-19 're-evolution' of mankind, 519-21 choice between revolution and, 521 problems in implementation of plans for, 522-3; ethology in solution of, 523-5 refractory period, in copulatory behaviour of male rat, 78, 79 reinforcement in learning (operant conditioning), 461-2, 464-7, 474, 475 dilemmas of, 467-9 'internalized', 469



# INDEX

relatedness, 282 in lions, 282–3 in relationships, 469	sifaka, 206, 219 sign stimulus, concept of, 5–6 signals
relationships between human individuals,	detection of, 97, 98
451–4	detectability of, 97-8; after prolonged lack
dynamic stability of, 458–60, 469–73, 474	of sleep, 123; in search situations, 122
institutionalization of, 456, 473–4	in non-human primates: discrete and
learning in development of, 454, 460-9	graded, 264-5; significance of grading of,
nature of, 457–8	266-8; speculations on perception of,
study of, 454–7	273-5; visual combined with auditory,
reproductive success	265, 270; see also vocalizations
and evolution, 281, 298-9	similarity law, in Gestalt theory, 172–3, 178–9
of male lions, 292–3	skills
resources: depletion of, as result of cultural	acquisition of, 392, 393-4
evolution, 510, 511, 519–20, 523	calibration of, 393
response, see stimulus-response	social approval
'response set' type of selection of stimuli, 96,	as element in relationships, 464
102, 105, 106, 121, 130	in non-human primates, 464-6
responsiveness, in behavioural development,	social behaviour
401–2	in humans: cultural determinants of, 456;
rhythm, in perception of sound patterns, 175,	natural selection and, 430-5; three levels
176–7, 179	in, 451–4
Rissa tridactyla (kittiwake), 61	in non-human primates, 193
robin-chat, white-browed, 179, 180-1	social class, and development of child, 486,
rodents	490, 493
inbreeding in, 221	social life, intelligence as product of, 307-15
see also deer mouse, guinea pig, hamster,	social releasers, 451, 454
marmot, Microtus, mouse, Peromyscus,	social responsiveness, in young of altricial
rat, vole	mammals, 375
<b>,</b>	social sciences, ethology and, 427-30
Sacred Cow (in India), functions of, 442, 445	social structure, relations between individuals
Saimiri sciureus (squirrel monkey)	and, 451–4
dominance in, 21	socialization in humans, as an inevitable con-
movement stereotypy in, 154-5	flict, 432
vocalizations of, 264, 265	society
saltations, in cultural evolution, 509	as outcome of interactions between indi-
search image, concept of, 121	viduals, 443
search tests, on chicks, 104, 105-7, 130	and science, 508, 524
searching behaviour, 47	socio-biology, integration of ecological
advantage of 'filtering' selection in, 120, 121	anthropology and? 441
application of signal detection techniques in,	sound spectrograms
122	of bird-song, 176, 177, 178, 179, 180,
selection of stimuli, for examination and	185
response, 96–9	of chimpanzee and gorilla vocalizations, 240,
'response set' and 'stimulus set' (filtering)	246
types of, 96, 102–3, 105, 106, 130; in	sparrows: grasshopper, 174; white-crowned,
search situations, 120, 121	409–10
sex	species, assumption of evolution for benefit of,
and frequency of different types of vocaliza-	296
tion in chimpanzee and gorilla, 242,	speech, human
243–5, 249, 251–3, 254–6	different routes to competence in, 485
and numbers of vocalizations by chimpanzee	equifinality in development of, 407
and gorilla, 253-4	'exogenetic' evolution dependent on, 502
sexual behaviour, effect of injection of sex	interactions with adults and development of,
hormones on, 505	488, 489–91
sexual dimorphism, and aggression, 205-7	signal gradations in, and their perception,
sexual swellings in female non-human pri- mates, 211-13	270–1; evidence for categorical perception
shrike, Boubou, 178, 179	of, 272–3, 276 synthetic, 271–2
and the second s	-,,

546



#### INDEX

stability in relationships dynamic, 458-60; principles pertinent to, 469-73 global and asymptotic, 459, 460 stability boundary, in relationships, 459 status and interactions, 470 relation of concepts of investment and of, 466-7 stereotyping of movements, 142-4, 150, 154-5, 164 dopaminergic activation and, 156-7 elicitation and control of, 158-9, 160-2 function of, 162-3 processing capacity and, 158-61 stickleback, 82 stimuli conditioned and unconditioned, 461 selection of, see selection of stimuli stimulus-response, 97, 101 level of arousal and, 112 models of behaviour based on, 140 stochastic analysis, of readiness to attack in cichlid fish, 78 stomach: effect of pre-filling of, on suckling, 351 - 3stopping-rule programmes for behaviour, 42-3, 49 Streptopelia risoria (Barbary dove), 82, 88-9 Streptopelia spp., 333 behaviour of Ik tribe under extremity of, use of term, and of term stressors, 511 suckling communal, by lions, 290, 298 development of, in altricial mammals, 345, 346-7; interoceptive stimuli in, (early) 351-4, 369, (late) 357-9; nipple grasping and sucking in, 349-51; olfactory stimuli in, 354-6; thermotactile stimuli in, 347, 348-9; visual stimuli in, 356-7 superiority in hierarchy, 9 system plant, 76, 77-8, 80 systems of behaviour, see under behaviour patterns Tarsius spectrum (tarsier), 211 branching hierarchy as basis of, 10 hierarchies of both connection and classification in, 15 teachability, in humans, 502-3 teacher-pupil relation, 472 technologies, need for qualitative growth in, 521 Teleogryllus (cricket), 332

function relating survival and, 72, combined with hydration functions, 73, 74 and behaviour of newborn altricial mammals, 347, 351 of nipples in altricial mammals, 347, 351 young altricial mammals unable to regulate, 351, 364, 375 territoriality adaptive significance of, 214 associated with discrete vocalizations? 265 in chimpanzee and gorilla, 260, 261, 262 switch to dominance behaviour from, at high population density, 217 testosterone increases ability to sustain attention in humans, 114 increases persistence in use of rules of selection in chicks, 95, 103, 130; in distractibility tests, 108; in extinction tests, 110-11; in novel stimulus tests, 109-10; in search tests, 106-7 other explanations of effect of, 111-14, 130 possible biological value of effect of, 114-15; in adhering to established strategies, 119-20; in establishing attachment to particular place or conspecific, 118-19; in exclusion of distracting stimuli, 115-17; in securing particular resource, 117-18 thermoreceptors, in Aporosaurus, 71 thermotactile stimuli, in young of altricial mammals dependence on, in first stage of behavioural development, 368-71, 375 in development of contact with mother, 347, 348-9, of home orientation, 362-4, of huddling, 360, and of suckling, 349-51 Theropithecus gelada (gelada baboon), 206, 212 thrushes, see Hylocichla, Mylophoneus, Turdus, Turdidae titmice, see Parus toad, 145 tonal quality, in perception of sound pattern, 177 - 8tool instinct, concept of, 12 Tragolaphus scriptus (bushbuck), 203 transposition, in bird-song and human music, 180, 189 tree diagrams analogy between bracket notation and, 26-7 for programmes of behaviour, 36 Tribonyx mortierii (Tasmanian native hen), 283, 289 Triturus vulgaris (smooth newt), 80-8 Turdidae, 178 Turdoides squamiceps (Arabian babbler), 289 Turdus merula (blackbird) differences between sexes of, in foraging movements, 122 song of: errors in, 183-8; figures, phrases,

and behaviour of Aporosaurus, 68-9, 71;

temperature



#### INDEX

Turdus merula (cont.) and sentences in, 181-2; learning of repertoire of, 182-3; transposition of phrase in, turkey, 289 Turner's syndrome, 331 unemployment, psychosocial consequences of, ungulates, 203, 218, 347 veery, 180 vervet, 213, 264 vision in behaviour development of altricial mammals, (home orientation) 366-7, (huddling) 361-2, (suckling) 356–7; dependence on, in third stage of development, 373-5, 376, 377 Gestalt theory and, 173 of nocturnal and diurnal animals, 65-7 saccadic suppression of, 145 visual learning in chicks, blocked by cycloheximide, 128 vocalizations audible and ultrasonic, of newborn altricial

mammals: elicited by cooling or heating,

349, 364, by removal from home site, 362, 364-5, by separation from mother or litter

mates, 360, 361, 374, and by tactile

stimuli, 348

by newly hatched chick, 411 natural-selection approach to, 434 see also under chimpanzee, gorilla effect of ongoing behaviour on response to stimulus by, 139-40 movement stereotypy in, 143-4, 149, 154 war, 516, 517-18 warblers, 180 water balance, in Aporosaurus, 73, 74 weaning, conflict of interests in, 202 weight, gain of control of, in young rats, 403-4; model for, 405-6 effect of period of starvation on, at different stages of growth, 413, 414 witch doctors, functions of, 442 witches, functions of persecutions of, 442 wolf, 289 in new environment, ignores food until exploration is completed, 151-2 worms, 12, 332 Xenopus (toad), 145 Xiphophorus (fish), courtship patterns of hybrids of, 333 Zonotrichia leucophrys (white-crowned

sparrow), 409-10