

Index

- Abney effect 684, 686
Abralia trigonura (squid) 362
 abstractable color 459
 accessorization 327
 achievement 568–77
 color-in-context theory 568–9
 red influence 569
 intellectual performance 572–5
 meaning of 569–70
 sporting contexts 570–2
 see also competitive ability, color signals
 achromatic adjustments 644–7
 color-neutral objects 646
 achromatic colors 10
 face recognition 588
 hazard perception 384, 386
 mourning 341
 weddings 341
 see also black; gray; white
 achromatic (L-type) channels 153
 achromatic (luminance) mechanisms 51
 achromatic matching 88
 achromatic processing 45–8
 achromatopsia *see* monochromacy
 acquired color-vision deficiencies (CVD) 229–32
 cortical cardiovascular disorders 230–1
 optic neuropathies 230
 progressive retinopathies 230
 toxicity 231–2
 activation map 487
 active colors 402, 405, 441
 adaptation 52, 74, 75
 and color constancy 89
 individual differences 208–10
 and memory color effect 651
 von Kries 208
 adaptive optics 31
 adaptive orthogonalization 75
 adaptive significance of color
 sexual selection 546–8
 see also camouflage
 additional singleton paradigm 491
 additivity theory of color emotion 405–6
 Adelson's checker-shadow illusion 694
 AdobeRGB 24–5
 affect-related influences *see* emotion, color associations
 affordances 435
 afterimages 644, 686–7
 age differences 180–93
 color preference 469–72
 infants 164–6, 447–8
 color thresholds 186–8
 color-flavor mismatch 607
 color-vision changes 191–3
 monocular/binocular thresholds 186
 subject selection criteria 184–7
Agelaius phoeniceus (red-winged blackbird) 512
 aggression *see* anger
 agnathan fishes 115
 air crew, CVD issues 227–8
 Air Quality Index ratings 380
 akinetopsia 97
 alcohol toxicity 231
 alertness 628–32
 aliasing 56
 All Hallows' Eve 345
Alouatta (howler monkey) 121
 alpha amylase 626
 alpha attenuation coefficient 630
 Alzheimer's disease 181
 amacrine cells 42–4
 amphibians, mating behavior 512, 514
 amygdala 660
 analogous colors 410
 see also color harmony
Anartia fatima (banded peacock butterfly) 368
 anger 661
 color associations
 purple 464
 red 424–5, 569, 594, 668–70
 animals 354
 aposematism 364–9
 black 344, 348
 camouflage 358–60
 background matching 359–60
 behavioral adaptations 360–4
 color in competition 546–61
 color use 358

- animals (cont.)
 color vision 124–5, 133
 evolution of 116–19, 312
 utility of 123–5
 dichromats 123, 357, 369
 environmental influences on coloration 504–5
 mating behavior 502–22
 choice of mate 519
 color in 505–19, 589
 colors exhibited 503–5
 Fisherian (runaway) selection 519
 form and function 519–20
 sexual selection *see* sexual selection
 monochromats 357
 nocturnality 118–19, 122
 phase shifting 626
 photopigments 113–15
 tetrachromats 358
 trichromats 357, 369
 visual systems 504
 warning coloration 364–9
 white 348
see also primates; and individual species
Anolis carolinensis (anole) 512
 anomaloscopy 232–3
 anomalous trichromacy 134, 137, 220, 223,
 ANSI Z535 standard 378, 379, 380, 383, 388, 390, 394
 aposematism 364–9
 and mimicry 366–7
 utility of 364
 apparent motion 134
 appearance of color 679–701
 achromatic settings 204, 206–7
 binary hues 204
 and color sensitivity 206–8
 individual differences 204–6
 models 22–3, 440
 CIECAM02 23, 680, 682, 683
 definition 22–3
 sRGB 24
 related colors 10, 686
 surround impact 682–3
 unique hues 204, 207–8
 unrelated colors 10, 686
 appearance phenomena 679–80
 Abney effect 684, 686
 Adelson's checker-shadow illusion 694
 afterimages 644, 686–7
 chroma crispening 700
 Craik-O'Brien-Cornsweet effect 692–4
 discounting the illuminant 684–6
 Helmholtz-Kohlrausch effect 683–4
 Hermann's grid 689–91
 Hunt effect 22, 680–1
 Mach bands 134, 689
 Munker-White effect 691, 696
 neon spreading 699–700
 scintillating grid 690
 spatial 696
 spatially complex 687, 691–2
 Stevens effect 22, 681–2, 688
 surround effect 682–3, 688
 watercolor effect 699–700
Aptenodytes patagonicus (king penguin) 512,
 514–15
 arachnids, mating behavior 512, 513
 archeological context of color 349–51, 353
Argia apicalis (blue-fronted dancer) 512
 armed forces, CVD issues 228
 Arnauld, Antoine 296
 arrangement tests 235–6
 Farnsworth Panel D15 test 181, 235
 Farnsworth-Munsell 100-hue test 162, 181, 235
 Minimal Colour Vision Test 236
 artifaction hypothesis 321
Ateles (spider monkey) 121
 attention 162–8, 313
 and color preference 164–6
 maintenance 393
 ratings 387
see also entries under attentional
 attention switch, color and 389–93
 behavioral compliance 392–3
 eye movements 392
 fluorescent colors 392
 reaction time 391
 attention-demanding search 487–9
 attentional blink paradigm 489
 attentional capture 490
 attentional control settings 493
 nature of 493–4
 attentional disengagement 495–6
 attentional selection 481–98
 and color 482
 color-specific effects 496–7
 definition 481
 involuntary (bottom-up) 482, 490–6
 attentional control settings 493–4
 attentional disengagement 495–6
 color singletons matching working memory
 content 494
 contingent attentional capture 493
 feature-based 490–1
 irrelevant color singletons 491–3

- reward association 495
- space-based 491
- temporal 496
- unexpected color singletons 494
- voluntary (top-down) 482–90
 - feature-based 481, 483–5
 - guided search 487–9
 - pop-out search 486
 - space-based 481, 483, 484, 485–6
 - temporal 481, 489–90
- average color preference 437
- avoidance motivation/behavior 575
 - see also* warning coloration; warning labels
- baboons, color categorization 287
- BabyCol test 190
- background color 696–8
- background matching in camouflage 359–60
- bananas, color of 641, 652
- bandpass shape 54
- Bartleson–Breneman equations 682–3
- basic color terms 246–7, 304, 310
- Bates, Henry Walter 367
- Batesian mimicry 367–9
- Battus philenor* (pipevine swallowtail) 505, 512
- Bayesian decision theory 607–8
- beads, as social signal 326
- behavioral adaptations in camouflage 360–4
 - countershading 361–2
 - disruptive coloration 361
 - distractive markings 362–3
 - masquerade 363
 - motion dazzle 363
- behavioral compliance 392–3
- behavioral ecology 502
- behavioral studies 4
 - domain of behavior 575
- Berinmo language 254, 255, 270, 271, 272
- Berkeley Color Project 32 437,
- beverages, color of 604
 - wine 608
 - see also* flavor perception; foods
- Bezold–Brücke hue shift 686
- binary hues 204
- binding problem 482
- binocular threshold 186
- biofeedback 402
- biological clock 619, 622
 - see also* circadian system
- birds
 - dominance signaling 570
 - health color cues 590
 - mating behavior 512, 514–15
 - tetrachromacy 358, 504
 - see also individual species*
- Biston betularia* (peppered moth) 359
- black 347–9
 - animals 344, 348
 - attraction effect in males 537–8
 - calendar customs 346
 - definition of 247
 - emotional associations 663, 665
 - fear 344, 348
 - mourning 341, 464
 - romance 537–8
 - foods 347
 - metaphoric use 422–5
 - protective properties 343
 - as universal color 464
 - warning coloration 365
 - warning labels
 - attention rating 387
 - hazard rating 382, 383, 386, 387, 390, 394
 - as wedding color 343, 345, 353
- black manganese 329
- black pigments 329
- blackness 15, 16
- Blombos Cave (South Africa) 329, 350
- blood
 - color terms for 307–9
 - symbolism 324, 333, 346, 349, 662
- blood-oxygen-level-dependent signal *see* BOLD
- blue 131, 306, 464
 - color preference 456, 459–60, 463
 - and changing meanings 465
 - color terms 285
 - company logos 576
 - definition 304
 - display in animals 503
 - emotional associations 461, 662, 664, 668
 - foods 346
 - gender preference 463
 - lip color 595
 - skin coloration 549, 552, 553, 557, 592
 - sky descriptors 305–7
 - universal preference for 465, 468, 470, 472
 - warning labels 380
 - attention rating 387
 - hazard rating 382, 383, 385, 387, 390, 395
- blue light
 - alertness effects 630, 631–2
 - cortisol awakening response 628
 - melatonin suppression 630
 - SAD therapy 633

- blue-yellow 72, 74
 age-related defect 229, 230
 colorblindness 223
 cone opponency 217, 218
 threshold
 aging effects 186–8, 192
 literature studies 190–1
 monocular/binocular 186
- blushing 531
- body decoration 348
- body painting 319, 322
 cost-effectiveness of 326, 331, 332
 and individuality 321
- BOLD 85
- bottom-up selection by color *see* involuntary (bottom-up)
 attentional selection
- Brentano, Franz 138
- bridal colors *see* wedding colors
- brightness 10, 11, 28, 163, 663, 687, 691–2
 emotional alignment 663, 665–8
 Helmholtz–Kohlrausch effect 683–4
 variations in 663
 systematic 158
 unsystematic 157
- brightness problem 156–9
- British Institute of Non-Destructive Testing 228
- Brodmann area 5 *see* visual cortex, V1
- brown 10, 464
 emotional associations 438, 662, 664, 671
 bad luck 344
 hazard rating 383, 390
- Brown, Donald 311, 312
- brunescence of lens 198, 207, 223
- Burarra language 299–303, 312
gungaltja (bright) 301, 313
gungundja (dark) 301, 302, 303, 313
- butterflies
 mating behavior 505, 512
see also individual species
- C-HIP model 381–2, 396
- C-opsins 112, 113
- Cacajao calvus* (bald uacari) 557
- CAD test 182, 237–8
 retinal luminance 183–4
 standard normal observer 182
 stimulus size 183–4
- calendar customs 346
- Callinectes sapidus* (blue crab) 512, 513
- Callipepla gambelii* (Gambel's quail) 512
- Callipepla squamata* (scaled quail) 512
- Callitrichidae 121
- calming colors 457, 461
- Cambrian explosion 114
- Cambridge Colour Test 190, 237
- camouflage 358–60
 background matching 359–60
 behavioral adaptations 360–4
 countershading 361–2
 disruptive coloration 361
 distractive markings 362–3
 masquerade 363
 motion dazzle 363
 types of 358
- Canthigaster valentini* (tropical puffer fish) 368
- Caprimulgus fossii* (Mozambique nightjar) 359
- cardinal color directions 71
- carotenoids 358, 589, 590
 dietary consumption 590–1, 592
 skin yellowness 590–1, 597
- Carpodacus mexicanus* (house finch) 512,
 514–15
- catarrhines 120
- categorical judgment 402
- categorical perception 265, 266, 282, 284–5, 287
 avoidance of labeling 267–8
 cross-lingual studies 266, 268
 odd-one-out task 268–70
 two-alternative, forced-choice paradigm 265–6
 utility of 266–7
 visual search tasks 267–8
- categorization of color 4, 88, 90–4, 245–56
 basic color terms 246–7
 cross-cultural studies 288
 cultural differences 259–60
 development of 279–90
 emergence hypothesis 249
 encoding sequence after 1969 247
 evolutionary theory 260, 312
 hard-wiring of 286
 infants 166–7, 279–87
 challenges to 283–5
 as cognitive response 287
 color-term acquisition 287–90
 evidence for 279–83
 linguistic gap 285
 theoretical issues 285–7
- linguistic 254–5, 285
 development of 287–90
- non-linguistic 286
- perception *see* categorical perception
- primates 287
- relativist view 260, 285, 288, 289
- Rosch's studies 264

- universality 270–3, 311
 arguments against 255–6
 and visual environment 260
 see also World Color Survey
 category learning tasks 270
 Cebidae 121
 cephalopods, mating behavior 512, 513
 Cercopithecinae 549
 cGMP 33
 Chalmers, David 141–2
Chamaelo chamaeleon (Mediterranean
 chameleon) 512
 cheerleader effect 332
 chemosensation-to-color synesthesia 708–9
 children
 color-flavor mismatch 607
 screening for CVD 224–6
 see also infants
 China, significance of red color 573
Chlorocebus aethiops (vervet monkey) 516
 scrotal coloration 554
 skin coloration 546, 553–4
 chloroquine toxicity 231
 Christmas 346
 chroma 9, 10, 11, 13, 15, 466, 609
 crispening 700
 emotional context 402, 405
 equal 410, 411, 415
 Munsell system 14
 and sexual attraction 540
 chromatic (C-type) channels 153
 chromatic motion 94–9
 chromatic processing 45–8
 chromatic purity 680–1
 chromatic sensitivity
 retinal illuminance 183–4
 stimulus size 183–4
 tests for 181–2
 chromatic stimuli 72
 Chromatic Vision Simulator 229
 chromaticity 15, 16, 209, 463
 aberrations 30
 and color preference 471
 mechanisms 51, 73
 chromophores 112
 CIE xy chromaticity diagram 19
 CIECAM02 23, 680, 682, 683
 CIELAB 20–2, 405, 462
 CIELAB L* 21, 586, 589
 CIELUV 21, 284, 285
 circadian system 622–6
 peak spectral sensitivity 623
 phase shifting 626
 seasonal affective disorder (SAD) 633
 circularity 297,
 City University Colour Vision Test 234–5
 classic color-appearance phenomena 679–80
Coccinella septempunctata (seven-spot ladybird)
 365, 366
 coding 27, 228, 352
 and hazard perception 396
 see also hazard ratings; warning labels
 cognition 162–8
 and color categorization 287
 cognitive penetrability 490, 641, 653
 Cohen, Jonathan 132, 143
Colias philodice eriphyle (clouded sulfur butterfly) 512
Collins COBUILD English Language Dictionary
 304, 305
 Colobinae 549
 color 3–4, 9, 295
 assimilation/spreading 698–9
 associations 4
 attributes of appearance 10, 11
 camouflage 357–69
 categorization *see* categorization of color
 circumstances 3
 colloquial description 310–11
 concepts 301
 confusions 223, 224
 definition 9, 297, 309–10
 disposition 136
 distribution in face recognition 595–7
 emotion *see* emotion, color associations; emotional
 responses to color
 experience *see* phenomenology of color
 focal 163
 harmony *see* harmony
 heritability 521
 image 401
 meaning 401
 and color preference 459
 memory *see* memory for color; memory color effect
 metrics 284–5
 modes 3
 motion 94–9
 nonfocal 163
 objectivism 132–4
 philosophy 131–43
 preference *see* preference for color
 production in animals 503–4
 qualia *see* phenomenology of color
 realism 641, 654–5
 related 10, 686

- color (cont.)
 relationalism 132, 136–8, 143, 654
 science of 4
 sensitivity to *see* sensitivity
 subjective dimensions 163–4, 654
 symbolism *see* symbolism of color
 technicalities 311
 temperature 401, 402, 403–4
 cool colors 401, 402, 403–4, 441, 663
 warm colors 401, 402, 403–4, 441, 457, 663
 transformations 99–100
 triad *see* triad colors (black, red, white)
 unrelated 10, 686
see also individual colors
- color axes 72, 74, 78
- color cues
 product-extrinsic 610–11
 product-intrinsic 603
- color diagnostic 641, 647, 651
- color eliminativism 132, 134–6, 143
- color matching 35–7
 and spatial frequency 55–6
- color-matching functions 35, 37
 fundamental 37
- color models 9–25
 terminology 9–12
- color modules 84–7
- color-order systems 12–17
 definitions and types 12
 Munsell system 12–15
 Natural Color System (NCS) 12, 15–16
 OSA Uniform Color Scales 12, 17
- color processing 5, 27–58, 218
 higher order 70–100
- Color Pyramid Test 455
- color-responsive cells 80
 distribution 81
 intermediate 82
- color singletons
 irrelevant 491–3
 matching working memory content 494
 unexpected 494
- color space 19–22
 asymmetries of 651
 CIELAB 20–2
 CVD 224
 definition 20
 MacLeod–Boynton diagram 19, 165, 201
 natural divisions 261
 personalization of 201–3
 “color talk” 295
- color terms 299, 304–9, 310
 acquisition of 287–9
 basic 246–7, 304, 310
 blue/green 285
 cross-lingual studies 295–314
 blood 307–9
 sky 305–7
 languages without 299–304
 learning of 289–90
 in oral tradition 341
see also linguistic color categorization; naming of colors;
 words, function of
- color thresholds
 aging effects 186–8, 192
 infants 190
 literature studies 190–1
 monocular/binocular 186
- color vision 4, 32–40, 309, 310
 age effects 180–93
 contributing processes 191–3
 animals 124–5, 133
 evolution of 116–19, 312
 New World monkeys 124–5
 utility of 123–5
 basics 216–19
 cone opponency 217–18
 higher visual centers 218–19
 photoreceptors *see* photoreceptors/photoreception
- deficiencies 39–40
 red-green 39
- definition 111
- development of 149–70
- dichromacy *see* dichromacy
- evolution 110–25, 312
 early vertebrates 113–15
 mammals 116–19
 primates 119–22
 triggers for 116
 and experience 169–70
- foveal-peripheral differences 57–8
- higher-order color processing 70–100
- individual differences 197–210
 loss of *see* color-vision deficiencies (CVD)
- mechanisms of 197–8
- monochromacy 35, 36
- photopigments *see* photopigments
- phototransduction and univariance 33–4
- polymorphic 39, 221, 585
- spatial aspects 55–8
- temporal aspects 54–5
- terminology 151–2
- trichromacy *see* trichromacy

- twin studies 197
 utility of 123–5
- color-vision deficiencies (CVD) 216–39
 acquired 229–32
 cortical cardiovascular disorders 230–1
 optic neuropathies 230
 progressive retinopathies 230
 toxicity 231–2
- blue-yellow 223
- congenital 219–29
 childhood screening 224–6
 consequences of 223–4
 ergonomics 228–9
 genetics 221–2
 mechanism and classification 220
 occupational issues 226–8
 prevalence 222–3
 treatment 229
- measurement of 232–4
 anomaloscopy 232–3
 arrangement tests 235–6
 City University Colour Vision Test 234–5
 computer-based tests 236–8
 genetic tests 239
 lighting for 239
 Neitz Test of Color Vision 235
 occupational tests 238
 pseudo-isochromatic chart tests 233–4
 see also individual tests
- red-green 39, 159, 220, 222–3
- color weight 402, 404–5
- color-coded cells 89
- color-flavor mismatch *see* disconfirmation
 of expectation
- color-in-context (CIC) theory 568–9
 further considerations 575–7
- color-neutral objects 646
- color-object match ratings task 438
- color-to-object associations task 438
- color-word matching 385, 387, 389
- colorblindness *see* color-vision deficiencies (CVD)
- colored light, non-visual effects 619–34
 alertness and sleepiness 628–32
 cortisol awakening response 628
 hunger 632
 iris reflex 621–2, 623, 626
 nocturnal melatonin suppression 622–6
 seasonal affective disorder (SAD) 632–4
 see also specific colors
- colorfulness 10, 11
- colorimetry 17–19
 definition 17–18
- sRGB 23
 xyY and u'v'Y 19
 XYZ 18–19
- Colour Assessment and Diagnosis Test *see* CAD test
- combined-WAVE (C-WAVE) 443
- Commission Internationale de l'Éclairage 71, 131
- communication-human information processing model
see C-HIP model
- company logos, blue in 576
- competitive ability, color signals 548–9
 drills 553
 geladas 555
 mandrills 550–3
 rhesus macaques 554–5
 vervet monkeys 553–4
- complementary colors 410
see also harmony
- complementary hue theory of color harmony
 410, 411
- complexity of lightness 402
- computer-based tests for CVD 236–8
 CAD test *see* CAD test
 Cambridge Colour Test (CAD) 190, 237
 cone-contrast test 238
- computerized warning displays 394
- concept accessibility 427
- conceptual metaphor theory 419, 420–2
 abstract target concept 421
 color emotion 661, 665, 666
 physical source concept 421
 see also metaphoric use of color
- conceptualization of color 168
- cones 31, 85, 110, 152, 216, 587
 age-related changes 181, 192, 229
 gap junctions 43
 L-type *see* L-cones
 M-type *see* M-cones
 personal distributions 71
 relative numerosity 53–4
 S-type *see* S-cones
 sensitivity regulation 40–2
 signal pathways 41, 42, 45–8
 spectral sensitivity 37–8, 155
- cone contrast
 model 440, 462
 space 50, 79
 test 238
- cone fundamentals 37–8
- cone-isolating stimuli 82,
- cone mosaics 31, 32, 200
- cone opponency 217–18, 286
 blue-yellow 217, 218

- cone opponency (cont.)
 pathways leading to 218
 red-green 217, 218, 286
- cone ratios 200
 and unique hues 207
- cone-opponent codes 44, 49–53
 relative cone numerosity 53–4
- congenital color-vision deficiencies (CVD) 219–29
 childhood screening 224–6
 consequences of 223–4
 ergonomics 228–9
 genetics 221–2
 mechanism and classification 220
 occupational issues 226–8
 prevalence 222–3
 treatment 229
- conjunction search task 486
- consciousness 141–2
 “hard question” 141
- constancy of color 73, 82, 84, 87–90, 649–50
 adaptation 89
 definition 89
 estimation of 88–9
- constructivism 641, 654
- containers, colors and labels 385–6
- contingent attentional capture 493, 498
- contrast 687
 cone contrast
 model 440, 462
 space 50, 79
 test 238
 and induction 696–8
 luminance 182, 217
 Michelson 688
 Munker–White effect 691
 sensitivity 54, 56–7, 162
 infants 162
 simultaneous 687–8
- cool colors 401, 402, 403–4, 441, 663
see also blue; green
- Coolidge, Fred 322, 330, 331, 332
- cooperative breeding 320
- corrugator electromyography 402
- cortical cardiovascular disorders 230–1
- cortisol 626
 awakening response 628
- cosmetics 595
 lipstick hypothesis 322, 331, 332
Cosmophasis umbratica (jumping spider) 512, 513
Coturnix japonica (Japanese quail) 361
- countershading in camouflage 361–2
- Craik–O’Brien–Cornsweet effect 692–4
- crispening 700
- cross-cultural differences *see* cultural differences
- cross-lingual studies 266, 268
 color descriptors
 blood 307–9
 sky 305–7
 languages without color words 299–304
- cross-linguistic semantics 311
- Crotaphytus collaris* (collared lizard) 512
- Crustacea, mating behavior 512, 513
- Ctenophorus ornatus* (agamid lizard) 512, 514
- cultural differences 259–60
 categorical perception *see* categorical perception
 color categorization 259–73, 288
see also individual languages
 color emotion 407–8, 457
 color preference 443–4, 464–8
 color space 261
 color terms 295–314
 hazard perception 382–4
 linguistic 254–5
 optional use of color 262–4
- CVD *see* color-vision deficiencies
- cytochrome oxidase 81
- Dalton, John 219
- Daltonism *see* color-vision deficiencies (CVD), congenital
- damselflies, mating behavior 505, 512
- danger, red association 569, 663
 attack threat 380
 emergency equipment/signs 380
 warning coloration 365, 570
 warning labels 380
 workplace safety 380
see also entries under hazard
- Darwin, Charles 149, 366, 502, 503, 546,
- Darwin, Erasmus 358
- daylight axis 651
- decoration *see* esthetics
- definitions
 black 247
 blue 304
 color 9, 297, 309–10
 color appearance 22–3
 color constancy 89
 color space 20
 color vision 111
 colorimetry 17–18
 grue 247
 isoluminance 72
 luminance 71–2
 red 304

- sRGB 23
 white 247
- Delitzsch, Franz 464
- demultiplexing 47
- Dendrobates imitator* (poison-dart frog) 367,
Dendrobates pumilio (strawberry poison-dart frog) 366,
 512, 514
- depression 426
 color-preference effect 667
- depth of field 30
- derogation behavior 540
- Derrington–Krauskopf–Lennie (DKL) space 645
- Descartes, René 132, 136, 296
- detection thresholds 49
- deuteranomaly 39, 206, 220
- deuteranopia 39, 156, 159, 160, 220, 223
- developmental health cues 592–3
- diagnostic plates 233
- dichromacy 35, 39, 134, 137, 155, 159, 220, 224
 animals 123, 357, 369
- difference threshold 41
- diffraction 28
- diffuse bipolar cells 42
- digitalis toxicity 231
- dimensional weighting 486
- directional photoreception 111
- disconfirmation of expectation 606
 consumer response to 606–7
- discounting the illuminant 684–6
- discrimination 647
 ellipses 76
 Rayleigh 159,
 infants 159, 169
 threshold 653
 tritan 159, 169
 wavelength 156–9
- dispersion 251
- disruptive coloration 361
- Dissanayake, Ellen 321
- distal stimulus 27
- distractive markings 362–3
- DKL color space 19
- domain of behavior 575
- dominance
 ocular 80
 social *see* social status
- double-opponent receptive field 82
- drills *see* *Mandrillus leucophaeus* (drill)
- driving, CVD issues 227–8
- Dugum Dani people 264
- duplicity theory 110
- Durkheim, Émile 330, 333
- dynamism 402,
- dyschromatopsia 230
 and prosopagnosia 231
- ecological objects 435
- ecological valence theory (EVT) 435–40, 441, 450, 461, 463
 color emotion 662, 671
 testing 436
see also WAVE model
- ecology of color preference 435–51
 causal evidence 448–50
 cultural differences 443–4
 individual differences 441–3
- education, effect of CVD on 224–6
- eggs, dying of 347
- eigenface approach 520
- electroencephalography (EEG) 402, 628
- electromyography, corrugator 402
- electroretinogram 201
- elemental hues 254
- Elliot, Andrew 312
- ellipse test 237
- emergence hypothesis 249
- emergency equipment/signs 380
- emergency services, CVD issues 228
- “emic” 312
- emotion, color associations 660–72
 black 663, 665
 fear 344, 348
 mourning 341, 464
 romance 537–8
 blue 461, 662, 664, 668
 brightness 665–8
 brown 438, 662, 664, 671
 bad luck 344
 color perception 664–70
 color properties 663–4
 green 661, 662, 663, 670
 bad luck 342, 344
 orange 664
 pink 661, 664
 purple 664
 red 662, 663
 anger 424–5, 569, 594, 668–70
 blood symbolism 324, 333, 346, 349, 662
 danger 569, 663
 good luck 451
 white 663, 665
 mourning 341, 342, 464
 peace 464
 yellow 664, 670, 671
see also emotional responses to color

- emotional responses to color 42–5, 401–8
 additivity 405–6
 chroma-related factors 405
 color-emotion model 440
 cultural differences 407–8, 457
 hue-related factors 403–4
 impact 401, 402
 lightness-related factors 404–5
 meaning of 660–1
 message 401
 psychophysiological assessment 402
 underlying factors 402–3, 661–3
see also specific colors
- emotional tone 402
- Enallagma civile* (familiar bluet damselfly) 512
- encoding *see* coding
- environment
 and animal coloration 504–5
 and color terms 260
- epistemology of color 138–42
- equal chroma theory of color harmony 410, 411, 415
- equal hue theory of color harmony 410, 411, 415
- equal lightness theory of color harmony 410, 411
- Equus quagga crawshayi* (zebra) 364
- ergonomics of CVD 228–9
- Eristalis arbustorum* (hoverfly) 368,
- error theories 134
- Erythrocebus patas* (patas monkey) 553
- esthetics 321–2
 body decoration 348
 body painting 319, 322
 cost-effectiveness of 326, 331, 332
 and individuality 321
 evolutionary esthetics 321
 pigment use 321–2, 327
 henna 342, 345,
- ethambutol toxicity 231
- “etic” 312
- Eulemur fulvus* (brown lemur) 516
- Eumeces laticeps* (broad-headed skink) 512
- Euplectes ardens* (red-collared widowbird) 512
- Eurema hecabe* (large grass yellow butterfly) 512
- event-related potentials (ERPs) 484–5
- evolutionary context
 color vision 110–25, 312
 early vertebrates 113–15
 mammals 116–19
 primates 119–22
 triggers for 116
- esthetics 321–2
 artifaction hypothesis 321
 body decoration 348
 body painting 319, 322
 pigment use 320–2, 327
 face perception 585–6
 face recognition 586–9
- exemplars 91
- experience of color 169–70
- eye
 color processing 5, 27–58
 lens of 198
 brunescence 198, 207, 223
 macular pigment 198, 207
 movements 392
 thyroid disease 230
see also cones; rods; photopigments
- face perception 585–97
 evolutionary significance 585–6
 sexual dimorphism 585, 593
 symmetry 585, 593
- face recognition 586–9
 achromatic images 588
 age 596
 caricaturing 588
 color distribution 595–7
 fusiform face area 587
 geometric morphometric methods 593
 human color center 587
 luminance 587, 595
 masculinity 593
 skin texture 596
- factor analysis 198, 402, 403
- familiarity 651
- Farnsworth Panel D15 test 181, 235
- Farnsworth–Munsell 100-hue test 162, 181, 235
- Fauresmith stone tools 327, 328, 329
- FCCH 313, 323–4, 330, 332, 333
- fear 660
- feature integration theory 486, 487
- feature maps 482
- feature search task 486
- feature-based selection
 involuntary (bottom-up) 490–1
 voluntary (top-down) 481, 483–5
- female cosmetic coalitions hypothesis *see* FCCH
- females
 color preference 468
 pink 468
 red 441, 463, 468, 469
 competition between 322
 cosmetic use 322, 331, 332, 595
 FCCH 313, 323–4, 330, 332, 333
 lip color 595

- ornaments 557
- perception of attractiveness by males
 black 537–8
 red 532–3
- primates
 color and dominance rank 558
 competition and color 557–9
 female attendance to female color 558
- red
 approach-oriented behavior by males 533–4
 color preference 441, 463, 468, 469
 use as sexual signal 531–2, 536–7
 sexual receptivity 534–6
 tetrachromacy in 200, 206
see also gender differences
- first-order motion detectors 97
- first-site adaptation 41, 51
- fish
 health color cues 590
 mating behavior 512, 513–14
 phase shifting 626
- Fisherian (runaway) selection 519
- flavor perception 603–12
 age differences 607
 and color name 611
 disconfirmation of expectation 606–7
 food color 604–6
 failure to affect 608–10
 multisensory integration 607–8
 orthonasal 605, 609
 predictive coding 605, 606
 priming effects 611
 product-extrinsic color cues 610–11
 product-intrinsic color cues 603
 retronasal 609
 supertasters 607
 visual-flavor responses 604
- floating colors 459
- fluorescent colors
 and attention switch 392
 hazard ratings 388–9, 390, 395
 neon spreading 699–700
- fMRI 81, 85, 86, 219
 synesthesia 704
- focal colors 163
- folklore 340–54
 oral tradition 340–7
 triad colors 344, 347–9
see also specific ceremonies
- food coloring 603, 612
 and flavor perception 604–6, 608–10
- foods 346–7
 appearance 346
 black 347
 color perceptions 577
 fruit and vegetables 591, 641, 644, 652
 green 346
 flavor perception 605
 memory color effect 641, 644, 652
 red 346, 347
 flavor perception 605
 rice 347
 taste 606
see also flavor perception
- Fourier analysis 75
- fovea 44, 57–8
- free-sorting task 262
- fruit and vegetables 591
 memory color effect 641, 644, 652
- functional magnetic resonance imaging
see fMRI
- functional segregation 641, 652
- fundamental color-matching functions 37
- funeral colors 342, 350
 red 342, 351
 white flowers 342
see also mourning colors
- fusiform face area 587
- G-protein-coupled receptors *see* GPCRs
- Gallus gallus* (red junglefowl) 512, 514–15
- ganglion cell layer 43
- gap junctions 43
- Gasterosteus aculeatus* (three-spined stickleback) 512, 513–14
 color health cues 590
- gelada *see Theropithecus gelada* (gelada)
- gender differences 206
 age-related 470
 color preference 459–60, 468–9, 660
 blue 463
 pink 468, 470
 purple 470
 red 441, 463, 468, 469
- CVD 222
 red-green 222–3
- red preference 441
- sex stereotyping of color 469
- tetrachromacy 200, 206
see also females; males
- gender solidarity 332
- genetic variability 39–40

- genetics
 CVD 221–2
 testing for 239
- geometric morphometric methods 593
- Geotria australis* (lamprey) 115
- German mailbox, yellow color 641, 642
 achromatic adjustment 645
- ghrelin 632
 sleep deprivation 632
- glaucoma 193, 230
- Go/RGR opsins 112
- Gobiusculus flavescens* (two-spotted goby) 512, 513–14
- gold, as mourning color 464
- Gorilla* spp. 546
- GPCRs 111, 112
- grapheme-color synesthesia 703, 709
- Grassmann's laws of additive color mixture 18
- gray 10, 464
 hazard rating 383, 390
 mourning 341
- green 464
 as bridal color 345
 calendar customs 346
 changing meanings 465
 color preference 465
 color terms 285, 304
 emotional associations 661, 662, 663, 670
 bad luck 342, 344
 foods 346
 flavor perception 605
 healing properties 344–5
 Ireland 343, 464
 protective properties 344
 warning labels 380
 attention rating 387
 hazard rating 382, 383, 387, 390, 395
- green light
 alertness effects 631
 melatonin suppression 630
- greenish-yellow, emotional associations 664
- group color preference 445–7
 political affiliation 445–7
 university affiliation 445
- group displays 323–7
 FCCH *see* FCCH
 intergroup “badging” 325, 331, 332
 low-cost signaling 326, 330
 non-symbolic rites of passage 325
 ritual 324
 within-group cohesion 325
- grue
 definition of 247
 languages 254, 259, 269, 270
- Grundempfindungen* 37
- guided search 487–9
- habituation *see* adaptation
- Habronattus pyrrithrix* (jumping spider) 512
- hair color 348
- half-wave rectification 81, 91
- handicap principle 321
- Hapalemur griseus occidentalis* (bamboo lemur) 516
- Haplochlax lunulata* (blue-ringed octopus) 365
- Haplorhini 119
- “hard question” of consciousness 141
- Hardin, C. L. 131, 133, 135, 142, 143
- Hardy–Rand–Rittler Test 234
- Hardy–Weinberg equilibrium 222
- Hargrave, Susanne 299
- harmony 409–16
 common principles 415
 theories of 409–11
 complementary hue theory 410, 411
 equal chroma theory 410, 411, 415
 equal hue theory 410, 411, 415
 equal lightness theory 410, 411
- three-color 414–16
 Ou *et al.* theory 415
 Szabó *et al.* theory 414–15
- two-color 410–14
 Nayatani and Sakai theory 412–13
 Ou and Luo theory 410–12
 Szabó *et al.* theory 413–14
- hazard control 377–81
 C-HIP model 381–2
 dead man's switch 377
 designing out 377–8
 guarding 377–8
 see also warning labels
- hazard perception 382–9
 color with signal words *see* signal word panels
 cross-cultural differences 382–4
- hazard ratings 382, 383–4, 385
 by color system 390
 color-word combinations 387
 fluorescent colors 388–9, 395
 inconsistent findings 388
 multicolor bars 386
 see also warning labels
- head-to-tail tandem array 221
- healing properties of color 344–5, 352

- health, color cues 589–92
 blue 592
 developmental vs. current 592–3
 red 535, 539
 yellow 589, 590
- Health and Safety Executive (UK) 227
- heart rate 402
- heavy colors 402, 404–5, 441
- Hegel, G. W. F. 138
- Heidegger, Martin 138
- Heliconius* butterflies 366, 368
- Helmholtz, Hermann von 642–3
- Helmholtz theory of color vision 152
- Helmholtz–Kohlrausch effect 683–4
- hematite 327
- henna 342, 345,
- Hering, Ewald 642
- Hering unique hues 90
- Hermann's grid 689–91
- heterochromatic flicker photometry 53, 71, 203
- heterochromatic modulation photometry 53
- n*-hexane toxicity 231
- hidden defect plates 233
- high-resolution vision 111
- higher-order color processing 70–100
 psychophysical investigations 73–9
- Hilbert, David 132, 142, 143
- Himba people 262, 265, 268
 color categorization 288
 color preference 444, 461, 465–7
 gender differences 469
- Holmgren, Frithiof 226
- Holmgren wool test 226, 238
- Homo erectus* 320
- Homo heidelbergensis* 320, 324, 325, 327, 328, 330
- honeybees 134
- horizontal cells 44
- hostility *see* anger
- hue 9, 10, 11, 13, 15, 135, 163–4, 297, 609, 663
 Abney effect 684, 686
 Bezold–Brücke hue shift 686
 binary 204
 cancelation 48
 and color preference 469
 complementary 410, 411
 elemental 254
 emotional alignment 402, 403–4, 663, 671
 equal 410, 411, 415
 and flavor 609
 Munsell system 14
 Natural Color System (NCS) 15
 scaling 643, 644
 and sexual attraction 540
 unique 90–4, 204, 644
 color appearance 204, 207–8
 and cone ratios 207
- hue, saturation, value (HSV) transform 25
- hue-saturation-lightness (HSL) transform 25
- human color center 587
- Hume, David 132, 136
- Hungarian language 307–9
- hunger, light effects on 632
- Hunt effect 22, 680–1
- Hurlbert–Ling model 165
- Husserl, Edmund 138
- hydroxychloroquine toxicity 231
- 5-hydroxyindoleacetic acid 554
- Hyla arborea* (European tree frog) 512, 514
- Hymenoptera 358
- Hypolimnas bolina* (great eggfly) 512
- Ignatieff, Michael 313
- illuminance, retinal 183–4
- illuminant, discounting of 684–6
- illusions *see* appearance phenomena
- impact 1237, 402
- Implicit Associations Test 424
- index recognition memory 795, 284
- indigo as food color 346
- individual display 322–3
 creative ability 322
 female–female competition 322
 uniqueness 322–3
- individuality of color metaphors 427–8
- individuality of color preference 461–4
- individuality of color vision 197–210
 adaptation 208–10
 appearance 204–6
 and color sensitivity 206–8
 color space 201–3
 gender differences 200, 206
 mechanisms 197–8
 naming 205–6
 sources of 198–201
 cone ratios 200
 photopigments 200
 postreceptor differences 201
 prereceptor screening 198–9
- infants
 attention 162–8
 and color preferences 164–6
 brightness problem 156–9
 cognition 162–8
 color categorization 166–7, 279–87

- infants, color categorization (cont.)
 challenges to 283–5
 as cognitive response 287
 color-term acquisition 287–90
 evidence for 279–83
 linguistic gap 285
 theoretical issues 285–7
 color memory 167–8, 169
 color perception 150, 162–8
 color preference 164–6, 447–8, 471–2
 red 471
 color thresholds 190
 color vision 149–70
 development of 161–2
 conceptualization of color 168
 flavor perception 606
 recognition memory 284
 spectral sensitivity 153–5, 168
 photopic 154–5
 scotopic 153–4
 trichromacy 159–61, 280
 wavelength discrimination 156–9
 inner nuclear layer 43
 inner plexiform layer 43,
 insects, mating behavior 505, 512
 integration time 40
 intellectual performance 572–5
 intelligence 320
 intergroup “badging” 325, 331, 332
 International Commission on Illumination (CIE) 3, 9, 401
 International Organization for Standardization
 (ISO) 380, 390
 intersexual attraction 547
 intrasexual attraction 539, 547
 intrinsically photosensitive retinal ganglion cells
see ipRGCs
 introns 222
 involuntary (bottom-up) attentional selection 482, 490–6
 attentional control settings 493–4
 attentional disengagement 495–6
 color singletons
 irrelevant 491–3
 matching working-memory content 494
 unexpected 494
 contingent attentional capture 493
 feature-based 490–1
 reward association 495
 space-based 491
 temporal 496
 ipRGCs 30, 31, 619, 623
 Ireland, green as symbol of 343, 464
 iris reflex 621–2, 623, 626
 irrelevant singleton paradigm 491
Ischnura elegans (blue-tailed damselfly) 512
 Ishihara test plates 181, 234
 isobrightness 164–6
 isochromatic modulation 54
 isoluminance 164
 definition 72
 red-green modulation 50, 56
 isoluminant patches 86
 Jackson, Frank 140, 143
 Jacobs, Gerald 143
 Japan
 color preference 443–4
 Girl’s Day ceremony 346, 347
 Jastrow, Joseph 454, 456, 468
 Jehs, Dieter 321
 job candidates, influence of red in evaluation of 576
 Jones, Rhys 299
 jumping spider 512
Junco hyemalis (dark-eyed junco) 512
 just noticeable differences (JNDs) 93, 487, 520
 Karajá language 272
 Karolinska Sleepiness Scale 628, 630
 Kathu Pan (South Africa) 327–8
 Köllner’s rule 230
 koniocellular (KC) pathway 70, 72, 80, 90, 218
 Kuhn, Steven 322, 326, 330, 332
 Kurgan burial mounds 350
 Kwanyama language 268
 L-cones 43, 70, 71, 152, 358, 440, 619, 620,
 absence of *see* protanopia
 evolution of 216
 infants 169
 monochromacy 220
OPN1LW gene 39, 221
 photopigments 200
 pigment defects *see* protanomaly
 relative numbers 200
 labeling 267–8
Lacerta viridis (European green lizard) 512, 514
 Ladd-Franklin, Christine 110
 lateral geniculate nucleus (LGN) 27, 42, 45, 70, 72,
 218, 620
 koniocellular layers 44–5
 lateralized category effect (LCE) 91–2
 Leber’s hereditary optic neuropathy 230
 Leibnitz, Gottfried Wilhelm von 297, 298, 309
 lens of eye 198
 brunescence 198, 207, 223

- leptin 632
 and sleep deprivation 632
- letter-to-color synesthesia 707
- lexical universals 295
- life-dinner principle 369
- light
 colored 402, 404–5, 441
 blue *see* blue light
 green 630, 631
 non-visual effects *see* colored light,
 non-visual effects
 red 630, 631–2
 detectors 357
 hunger effects 632
 mesopic levels 31
 narrowband stimuli 619–34
 photopic levels 31
 scotopic levels 31
- light therapy for SAD 633
- lighting for CVD tests 239
- lightness 9, 10, 11, 15, 135, 297, 609
 and color preference 469
 complexity 402
 emotional context 402, 404–5
 equal 410, 411
 high 415
 and sexual attraction 540
 spatial quality 402
 unequal 415
- linguistic color categorization 254–5, 285
 cross-cultural studies 295–314
 development of 287–90
 NSM approach 297–9
see also color terms
- lip color in females 595
- lipstick hypothesis 322, 331, 332
- LMS cone space 70
- local field potential (LFP) 83
- Locke, John 132, 135, 136, 138, 143
- locus control region 221
- long-wavelength-sensitive cones *see* L-cones
- Lovibond Tintometer 12
- low-resolution vision 111
- luminance 157
 contrast 182, 217
 definition 71–2
 face recognition 587, 595
 Hunt effect 22, 680–1
 modulation 50, 54
 relative 201
 sensation 202
 sexual dimorphism 595
 Stevens effect 22, 681–2
 variations 71
- luminance (achromatic) mechanisms 51
- luminance pathway *see* magnocellular (MC) pathway
- luminosity curve 71,
- luminous efficiency 18
- Lüscher Color Test 455, 457
- LWS opsin 117, 118
- lyonization 222
- M-cones 43, 70, 71, 152, 358, 440, 619, 620
 absence of *see* deuteranopia
 evolution of 216
 infants 169
 monochromacy 220
OPN1 MW gene 39, 221
 pigment defects *see* deuteranomaly
 relative numbers 200
- Macaca fuscata* (Japanese macaque) 546
- Macaca mulatta* (rhesus macaque) 516, 518
 coloration 546
 skin coloration 554–5
- Mach bands 134, 689
- machine classifiers 521
- MacLaury, Robert E. 250
- MacLeod–Boynton color space 19, 165, 201
- macular pigment 198
 age-related changes 207, 223
- Maevia inclemens* (jumping spider) 512
- Maffi, Louisa 249
- magenta 488
 hazard rating 383
- magnocellular (MC) pathway 70, 80, 90, 94, 218
- Maier, Markus 312
- major histocompatibility complex (MHC) 549
- males
 black, attraction effect 537–8
 blue preference 463
 CVD 222
 red-green 222–3
 primates, competition and color 550–7
 red skin coloration 594
 approach-oriented behavior to females 533–4
 perceived attractiveness to others 538–9
 perceived attractiveness in viewing women 534–6
see also gender differences
- mammals
 dichromatic 123
 evolution of color vision 116–19
 mating behavior 512, 514
 nocturnal 118–19, 122, 357
 red as female sex symbol 532

- mammals(cont.)
 S-cone-opsin pseudogenes 122–3
 utility of color vision 123–5
see also animals
- Mandrillus leucophaeus* (drill) 515–18
 skin coloration
 blue 549
 and competition 553
 red 569, 593
 social status 593
- Mandrillus sphinx* (mandrill) 515–18
 skin coloration 546
 blue 549, 552
 and competition 550–3
 red 551, 552, 569, 593
 socially induced suppression 551
 social status 593
- Marr, David 481
- Martu Wangka language 303,
miji-miji (blood-blood) 303
- masquerade 363
- mating behavior in animals 502–22
 choice of mate 519
 color in 505–19, 589
 non-primates 505–15
 primates 515–19
 colors exhibited 503–5
 Fisherian (runaway) selection 519
 form and function 519–20
 sexual selection *see* sexual selection
- mating behavior in humans *see* romance
- Maund, Barry 135, 143
- Maxwell, James Clerk 19
- MBDKL space 71, 72, 76, 78, 79, 87, 90, 94
 orthogonal S/L-M isoluminant cardinal axes 74
- medium-wavelength-sensitive cones *see* M-cones
- Meehan, Betty 299
- meiosis 221
- melanin 358, 589, 590, 592
- melanopsin 31, 45
- melatonin
 nocturnal suppression 622–6
 light color effects 630
 and SAD 633
 synthesis 626
- memory for color 167–8, 169, 641, 649
 achromatic adjustments 644–7
 classic studies 643
 and color appearance 642–8
 and color perception 641–55
 errors in 264
 index recognition 282, 284
 neurobiological evidence 647–8
 recent developments 643–4
 in synesthetes 710–11
 warning labels 393–4
- memory color effect 641, 642–50, 655
 cognitive penetrability 490, 641, 653
 color constancy 73, 82, 84, 87–90, 649–50
 color naming *see* naming of colors
 color realism 641, 654–5
 constructivism 641, 654
 determinants of 650–2
 adaptation and measurement precision 651
 asymmetries of color space 651
 color diagnostic 641, 647, 651
 daylight axis 651
 perceptual information and recognizability 650–1
 fruit and vegetables 641, 644, 652
 functional segregation 641, 652
 scene and object recognition 648–9
- mesopic light levels 31
- metameric match 220
- metameric stimuli 133
- metamers 35, 155
- metaphoric use of color 419–28
 conceptual metaphor theory 419, 420–2
 green, yellow, and blue 426
 individual differences 427–8
 mediation and moderation 426–7
 and social life 422–5
 black and white 422–5
 red 424–5
- Michelson contrast 688
- Microlophus occipitalis* (knobbed Pacific iguana)
 512, 514
- Middle Pleistocene 319, 320, 323, 329, 332
- Middle Stone Age 327, 328, 329
- midget bipolar cells 42, 44
- Miller, Geoff 322
- mimicry
 and aposematism 366–7
 Batesian 367–9
 Müllerian 366–7
- mind 4
- Minimal Colour Vision Test 236
- minimally distinct border 53, 71, 203
- minimum motion 53, 71, 203
- Miopithecus talapoin* (talapoin) 553
- Mithen, Steven 325
- mobile contingency task 283
- modularity 653
- molecular genetics 39–40
- Mollon-Reffin Test *see* Minimal Colour Vision Test

- monochromacy 35, 36, 220, 313
 animals 357
- monocular threshold 186
- Monte Carlo tests 251
- Moreland equation 233
- motion dazzle 363
- motion-nulling paradigms 158
- mourning colors 341, 342
 black 341, 464
 gold 464
 purple 342
 silver 464
 white 342, 464
see also funeral colors
- moving colors 94–9
- Müller, Friedrich Theodor 366–7
- Müllerian mimicry 366–7
- multicolor warnings 386
- multidimensional scaling 198
- multiple realizability 133
- multiple regression 402
- multiplicative adaptation 89
- Munker–White effect 691, 696
- Munsell Book of Color* 14
- Munsell space 92
- Munsell system 12–15, 261, 264, 281, 283, 284
 chroma 14
 hue circle 14, 284
- Munsell Value 13–14, 20
- music, color associations 660
see also synesthesia
- Nagel anomaloscope 233
- Nagel, Thomas 139, 143
- naming of colors 205–6, 265, 310, 649
 constraints on 249
 language-based 254–5
see also color terms
- narrowband light stimuli 619–34
- Nathans, Jeremy 39
- national colors 342–3
- Natural Color System (NCS) 12, 15–16
 hue circle 15
- natural semantic metalanguage (NSM) 256, 297–9, 301
- Ndonga language 268
- Neanderthals 329, 330, 340, 351
- Neitz Test of Color Vision 235
- Neochromis omnicaeruleus* (Lake Victoria cichlid) 512
- neon spreading 699–700
- neural encoding 463
- neural processing of wavelength information 152–3
- neuroticism, and color preference 667
- neutral point 159,
- neutral zones 160
- New World monkeys 121
 color vision in females 200
 trichromacy 585
 utility of color vision 124–5
- Newton, Isaac 135, 136
- night-blindness 47
- nighttime vision *see* scotopic vision
- nocturnal mammals 118–19, 122, 357
- nocturnal melatonin suppression 622–6
 light color effects 630
- noise masking 76–7, 78
- non-color prototypes 307
- non-cone-opponent codes 49–53
 relative cone numerosity 53–4
- non-directional photoreception 111
- non-focal colors 163
- non-human primates *see* primates
- non-isoluminant patches 86
- non-linguistic color categorization 286
- non-visual responses to light *see* colored light, non-visual effects
- novelty preference/habituation technique 280, 283
- NSM *see* natural semantic metalanguage (NSM)
- number-to-color synesthesia 707
- object-association task 466
- object-based selection 481
- object recognition 482
 memory color effect 648–9, 650–1
- object valence ratings task 438
- objectivism in color ontology 132–4
- occupational issues of CVD 226–8
 armed forces 228
 emergency services 228
 testing 238
 transport 227–8
- ocelli 357
- ocular dominance 80
- odd-one-out task 268–70
- Old World monkeys 120
 coloration 546
 trichromacy 585
- olive 438
- ontogeny of color vision 149–70
- ontology of color 132–8
- OPNLW* 39, 221
- OPNI MW* 39, 221
- OPNISW* 39, 221
- opponent theory 135
- opponent-process cells 270

- opsins 33, 39, 111–13, 200
 LWS 117, 118
 phylogeny 114
 Rh1 113
 Rh2 113, 117
 S-cone pseudogenes 122–3
 SWS1 117, 118
 SWS2 117
see also specific types
 optic atrophy 230
 optic neuritis 230
 optic neuropathies 230
 optical aberrations 30
 optical blurring 27, 28
 optical density 38
 optimal colors 88
 optokinetic nystagmus (OKN) 150
 oral tradition 340–7
 color words 341
 economic driving force 341–2
 historical driving force 342–4
 social driving force 344–7
 orange 464
 emotional associations 664
 foods 346
 Protestantism 464
 warning coloration 365
 warning labels 380
 attack threat 380
 emergency equipment/signs 380
 hazard rating 382, 383, 385, 386, 387, 389, 390, 391, 394
 orthonasal flavor perception 605, 609
 OSA (Optical Society of America) Uniform Color Scales 12, 17
 Ostwald system 12
 outer nuclear layer 42
 outer plexiform layer 43
 ovulation, reddening of skin during 532
 owl monkeys (*Aotus*) 121

Pan troglodytes (chimpanzee) 516
Panthera leo (African lion) 512, 514
Papio ursinus (chacma baboon) 516
 Papua New Guinea 254
Paraluteres prionurus (puffer fish) 368
 parasite-mediated sexual selection 552
 parasol ganglion cells 44
Parus caeruleus (blue tit) 512, 514–15
 parvocellular (PC) pathway 47, 70, 72, 80, 90, 91, 218
 Pascal, Blaise 297
 passive colors 402, 405, 441

Patagioenas spp. (pigeon) 512, 514–15
 patriotic colors 342–3
 pelage color 560
Pelvicachromis taeniatus (African cichlid) 512, 513–14
 perception
 categorical 265, 266, 282, 284–5, 287
 avoidance of labeling 267–8
 cross-lingual studies 266, 268
 odd-one-out task 268–70
 two-alternative forced-choice paradigm 265–6
 utility of 266–7
 visual search tasks 267–8
 color 3, 5, 9, 28, 576
 changes in 209
 cross-cultural differences 382–4
 early development 149–70
 emotional associations 664–70
 importance in early life 150
 infants 162–8
 memory effects 641–55
 and psychological functioning 609
 synesthetes 709
 female attractiveness 532–3
 hazard 382–4, 386
 sexual receptivity 534–6
 perceptual fluency theory 439
 perceptual information 650–1
 perceptual learning 654
 personal-WAVE (P-WAVE) 442
 personification synesthesia 703
 Pettitt, Paul 321, 330, 331
 phase shifting 626
 and seasonal affective disorder 633
 phenomenology of color 132, 135, 138
 philosophy of color 131–43
Phintella vittata (jumping spider) 512
 phosphodiesterase 33
 photons 33
 photopic light levels 31
 photopic spectral sensitivity 154–5
 photopigments 111, 152, 619
 bleaching 40
 early vertebrates 113–15
 genetic changes 220–1
 isomerization 40–55
 as source of variation in color vision 200
 spectral sensitivity 33, 37–8, 118
see also opsins
 photopigment isomerization 40–55
 first-site adaptation and contrast-coding 40–2
 photoreceptors/photoreception 4, 5, 27, 30, 152, 216–17
 age-related changes 181, 192, 229

- color vision at 32–40
- directional 111
- non-directional 111
- see also* cones; rods
- photosensitivity 111
- photosynthesis 111
- phototransduction 27, 33–4, 619, 623–5
- Pieris occidentalis* (western white butterfly) 512
- Pieris protodice* (checkered white butterfly) 512
- Pieris rapae* (cabbage white butterfly) 512
- pigeons 134
- pigments 319, 321, 358
 - body painting *see* body painting
 - color selection 330
 - costs of use 331
 - early record 327–30
 - evolutionary background 320–1
 - henna 342, 345,
 - impermanence of 326
 - interlineage comparison 331
 - red ochre *see* red ochre
 - ritual use 319–20
 - symbolic use 321–7
 - esthetics/decoration 321–2, 327
 - group displays 323–7
 - individual display 322–3
- pineal gland 626
- pink 464
 - emotional associations 661, 664
 - gender preference 468, 470
 - hazard rating 390
- Pinnacle Point (South Africa) 325
- Pitjantjatjara language 304
- Pitohui dichrous* (pitohui) 365
- platyrrhines 121, 124–5
- Poecilia latipinna* (sailfin molly) 512, 513–14
- Poecilia reticulata* (guppy) 368, 512, 513–14
- Poephila bichenovii* (double-bar finch) 514–15
- Pogona vitticeps* (inland bearded dragon) 512
- point spread function 30
- Polish language 306–7
- political color affiliation 445–7
- polychromaticity 650,
- polymorphic color vision 39, 221, 585
- pop-out search 486
 - priming of pop-out 491
- postreceptoral differences 201
- predictive coding 605, 606
- preference for color 4, 454–72
 - age differences 469–72
 - average 437
 - and behavior motivation 454
 - and color meaning 459
 - cultural differences 443–4, 464–8
 - development of 447–8
 - ecological aspects 435–51
 - causal evidence 448–50
 - cultural differences 443–4
 - individual differences 441–3
 - ecological valence theory *see* ecological valence theory (EVT)
 - as feedback loop 450
 - gender differences 459–60, 468–9, 660
 - pink 468, 470
 - purple 470
 - red 441, 463, 468, 469
 - history of studies 455–8
 - and infant attention 164–6
 - infants 164–6, 447–8, 471–2
 - red 471
 - origins of 458–61
 - subcultural group differences 445–7
 - universality and individuality 461–4
- preceptoral screening 198–9
- pretectal nucleus 42
- primates
 - catarrhines 120
 - color categorization 287
 - coloration 549–50
 - dominance signaling 558, 570
 - female
 - competition and color 557–9
 - dominance rank 558
 - female attendance to female color 558
- Haplorhini 119
- male 550–7
 - drills 553
 - geladas 555
 - mandrills 550–3
 - rhesus macaques 554–5
 - vervet monkeys 553–4
- mating behavior 515–19
- platyrrhines 121
- strepsirrhines 122
- Strepsirrhini 119
- trichromacy 124, 504, 550, 585
- visual system 550
 - evolution of color vision 119–22
 - trichromacy 124, 504, 550
- see also individual species*
- priming effects 611
- priming of pop-out 491
- primitivism 142
- principle of adaptation of physical resources 341

- principle of univariance 33
- product-extrinsic color cues 610–11
 and apparent product color 611
- product-intrinsic color cues 603
- projection synesthesia 703
- ProPhoto RGB 24
- prosopagnosia 231
- protanomaly 39, 220
- protanopia 39, 156, 159, 160, 220, 223
- prototypicality 458
- proximal stimulus 27
- pseudogenes 122–3
- pseudoisochromatic chart tests 233–4
 design of 233–4
 diagnostic plates 233
 hidden defect plates 233
 transformation plates 233
 vanishing plates 233
 Hardy–Rand–Rittler Test 234
 Ishihara test plates 181, 234
- psychological functioning *see* achievement
- psychological science 5
- psychology 4
- psychophysical studies
 color harmony
 three-color 414–16
 two-color 410–14
 color processing 73–9
- psychophysiological assessment of color emotion 402
- pulse-coupled neural networks 521
- purple 464
 attentional selection 497
 emotional associations 664
 anger 464
 mourning 342
 foods 346
 gender preference 470
 royalty 464
 warning labels 380
- hazard rating 382, 390
- R-opsins 112
- rapid-serial-visual-presentation (RSVP) task 489
- Rayleigh discrimination 159
 infants 159, 169
- reaction time 391
- red 307–9, 347–9, 352
 achievement context 569
 meaning of 569–70
 artistic value 454
 attention rating 387
 attentional selection 497
 avoidance motivation/behavior 575
 as bridal color 342, 343, 345, 346, 464
 calendar customs 346
 color preference 441, 459–60, 463
 by age 471
 by gender 441, 463, 468
 definition 304
 display in animals 503, 504
 emotional associations 662, 663
 anger 424–5, 569, 594, 668–70
 blood symbolism 324, 333, 346, 349, 662
 danger 569, 663
 good luck 451
 romance *see* romance
 evaluation of job candidates 576
 as female sexual signal 531–2, 536–7
 foods 346, 347,
 flavor perception 605
 as funeral color 342, 351
 hazard rating 382, 383–4, 385, 386, 387, 388, 389, 390,
 391, 394, 396
 healing properties 344
 as health indicator 535, 539
 intellectual performance contexts 572–5
 lexical processing 574
 lip color 595
 metaphoric use 424–5
 perception of 619
 physiological response to 571
 protective properties 342, 352
 skin coloration 549, 551, 552, 570, 591–2
 body size 556
 health 535, 539
 male–male interactions 556
 social status 365, 556, 558, 569, 570
 sporting contexts 570–2, 594, 668
 as universal color 464, 472
 vegetable sources 351
- red light
 alertness effects 630, 631–2
 melatonin suppression 630
- red light district 531
- red ochre 327–30, 350
 applications of 327
 blood symbolism 324, 333
 ritual use 332, 531
 as sexual attractant 322, 324
 spread of use 329
see also pigments
- red-green 72, 74, 78
 anomalouscopy 232–3
 colorblindness 39, 159, 220, 222–3

- cone opponency 217, 218, 286
 isoluminant modulation 50, 56
 threshold
 aging effects 186–8, 192
 literature studies 190–1
 monocular/binocular 186
 reflectances 134
 related colors 10, 686
 relationalism in color ontology 132, 136–8, 143, 654
 relativist view of color categorization 260, 285, 288, 289
 reptiles, mating behavior 512, 514
 retina 217, 619
 postreceptoral physiology 42–5
 retinal ganglion cells (RGCs) 70, 72, 218
 age-related decline 192
 retinal illuminance 183–4
 retinal image 28
 retinal sampling 27, 30–3
 11-*cis* retinal 33, 112
 retinitis pigmentosa 230
 retinogeniculate pathways 70
 retinohypothalamic tract 622
 retinopathies, progressive 230
 retinotopic mapping 79
 retronasal flavor perception 609
 reward association and color capture 495
 RGB coordinates 92
 see also sRGB
 Rh1 opsin 113
 Rh2 opsin 113, 117
 rhesus macaque *see Macaca mulatta* (rhesus macaque)
 Rhino Cave (Botswana) 330, 331
Rhinopithecus roxellana (golden snub-nosed monkey) 546
 rhodopsin 153, 168
 rice 347
 rites of passage 325, 345–6
 All Hallows' Eve 345
 mourning 341, 342,
 weddings 341, 342, 343, 345
 ritual 319–20, 324
 collective 330
 semiotic evolution 325
 see also rites of passage
 rods 31, 110, 152, 169, 216
 age-related decline 192
 aging effects 181
 monochromacy 220
 role in color vision 123–4
 spectral sensitivity 155
 romance 531–41
 black association 537–8
 future research directions 539–41
 red association
 approach-oriented behavior 533–4
 female attractiveness 532–3
 male attractiveness 538–9
 perceived attractiveness for men viewing women
 534–6
 social and biological context 531–2
 women's use as sexual signal 536–7
 Rossano, Matt 325, 332
 Russian language 304, 305–6
 S-cones 42, 43, 44–5, 47, 70, 71, 152, 358, 440, 619
 absence of *see* tritanopia
 cone-opponent/non-cone-opponent mechanisms 53
 evolution of 216
 infants 160–1, 169
 monochromacy 220
 OPN1SW gene 39, 221
 opsin pseudogenes 122–3
 relative numbers 200
 Sacks, Oliver 313,
 SAD *see* seasonal affective disorder
 saffron 346
 Sahlins, Marshall 311
 sapient paradox 319, 325, 327
 Sartre, Jean-Paul 138
 saturation 10, 11, 135, 164, 297, 663
 and color preference 469
 emotional alignment 663
 variations in 663
Sauromalus obesus (chuckwalla) 512
Scaphiopus couchii (spadefoot toad) 512, 514
 scarifying 348–9
 scene recognition 648–9
Schizocosa uetzi (wolf spider) 512
 Schultze, Max 110
 scintillating grid 690
 Scotland
 New Year's Day 346
 weddings 345, 353
 scotopic light levels 31
 scotopic spectral sensitivity 153–4
 scotopic vision 152
 seasonal affective disorder (SAD) 632–4
 light therapy 633
 melatonin hypothesis 633
 phase-shifting hypothesis 632
 serotonin hypothesis 633
 second-order motion detectors 97
 second-site adaptation 41, 42, 52
 seeing, definition of 296–7, 312
 selective attention *see* attentional selection

- self-shadow concealment 362
 Sellars, Wilfrid 143
 semantic differential 402
 semantic molecules 298
 semantic primes 298, 299, 307
 sensation luminance 202
 sensitivity 206–8, 647
 chromatic *see* chromatic sensitivity
 and color appearance 206–8
 cone cells 37–8, 40–2, 155
 contrast 54, 56–7, 162
 rod cells 155
 spectral
 infants 153–5, 168
 peak 623
 photopic 154–5
 scotopic 153–4
Sepia officinalis (common cuttlefish) 360, 512, 513
 serotonin hypothesis of SAD 633
 severe weather ratings 380
 sex chromosomes 221
 sex differences *see* gender differences
 sex stereotyping of color 469
 sexual dimorphism 585, 593
 facial luminance 595
 red coloration 594
 sexual display 322, 330
 FCCH 313, 323–4, 330, 332, 333
 lipstick hypothesis 322, 331, 332
 sexual receptivity, male perception of 534–6
 sexual selection 332, 502–3, 546
 and adaptive significance of color 546–8
 intersexual attraction 547
 intrasexual attraction 539, 547
 parasite-mediated 552
 short-wavelength-sensitive cones *see* S-cones
 signal word panels 380, 384–5
 alternative configurations 395
 ANSI Z535 standard 378, 379, 380, 383, 388, 390, 394
 chromatic vs. achromatic 384
 color-word matching 1198, 1206, 389
 color-word mismatch 386–8, 396
 see also warning labels
 signals, pigments as 326, 331, 332
 silent substitution 53, 82
 silver, as mourning color 464
 simultaneous contrast 687–8
 sinusoidally modulated spectral distributions *see* SSPDs
 situated conceptualization 436
 skin coloration
 and blood oxygenation 585, 592
 blue 549, 552, 553, 557, 592
 and competition 550–3
 and dermal hydration 553
 health cues 589–92
 blue 592
 red 535, 539
 yellow 589, 590
 red 549, 551, 552, 570, 591–2
 body size 556
 health 535, 539
 male–male interactions 556
 social status 365, 556, 558, 569, 570
 social status 593–5
 red 365, 556, 558, 569, 570
 yellow 593, 597
 carotenoid consumption 590–1
 health 589, 590
 skin conductance 402
 skin texture 596
 sky
 color of 662
 descriptors for 305–7
 slabs 83
 sleep deprivation 632
 sleepiness 628–32
 Sloan notch 161
 smell-color synesthesia 708–9
 social status
 color cues 585
 red 365, 556, 558, 569, 570,
 skin coloration 593–5
 somatosensation-to-color synesthesia 708
 sound-to-color synesthesia 706–7
 space-based selection
 involuntary (bottom-up) 491
 voluntary (top-down) 481, 483, 484, 485–6
 spatial color phenomena 696
 spatial cuing task 485, 492
 spatial quality of lightness 402
 spatially complex visual illusions 687, 691–2
 spectral distribution 3
 spectral inversion 138–9
 spectral power distribution 28
 spectral sensitivity 33, 37–8, 118
 cones 37–8, 155
 infants 153–5, 168
 photopic 154–5
 rods 155
 scotopic 153–4
 specularite 327–8, 331,
 Sperber, Dan 218
 sport, red-color association 570–2, 594, 668
 sRGB 23–5

- AdobeRGB, ITU and transforms 24–5
 and basic colorimetry 23
 and color appearance 24
 definition 23
 SSPDs 94
 standard normal observers 131, 137, 201
 CAD test 182
 Stargardt's disease 230
 Sterelny, Kim 325, 331, 332
 Stevens effect 22, 681–2, 688
 stickleback *see Gasterosteus aculeatus* (three-spined stickleback)
 Stiner, Mary 322
 stone circles 350
 strepsirrhines 122
 Strepsirrhini 119
 styrene toxicity 231
 subjective dimensions of color 163–4, 654
 subjectivity of color experience 140
Sula nebouxii (blue-footed booby) 512
 sun, color of 464
 superior colliculus 42
 supernatural 343–4
 supertasters 607
 suprachiasmatic nucleus 42, 622
 surround effect 682–3, 688
 SWS1 opsin 117, 118
 SWS2 opsin 117
 symbolic material culture 319
 symbolism of color 4, 319–33, 352, 353, 401
 color selection 330
 early 333
 esthetics/decoration 321–2, 327
 group displays 323–7
 FCCH *see* FCCH
 intergroup “badging” 325, 331, 332
 low-cost signaling 326, 330
 non-symbolic rites of passage 325
 ritual 324
 within-group cohesion 325
 individual display 322–3
 creative ability 322
 female–female competition 322
 uniqueness 322–3
 quantitative aspects 330
 ritual, tradition, and folklore 340–54
 temporal predictions 330
 see also warning labels
 symmetry 585, 593
 synesthesia 703–11
 behavioral consequences 704
 causes 705
 color cognition 709–11
 memory for color 710–11
 mental imagery 709
 perception of color 709
 color correspondences 705–9
 chemosensation-to-color 708–9
 letter-to-color 707
 number-to-color 707
 somatosensation-to-color 708
 sound-to-color 706–7
 definition 703
 grapheme-color 703, 709
 neural basis 704
 personification 703
 projection 703
 testing for 704
 types of 703
 systematic variation of brightness 158

Taeniopygia guttata (zebra finch) 512, 514–15
 taste 606
 supertasters 607
 tattooing 348
 temporal selection 481
 involuntary (bottom-up) 496
 voluntary (top-down) 489–90
 terminology
 color models 9–12
 color vision 151–2
 see also color terms
 Terra Amata (France) 329
 tetrachromacy 200, 206
 birds 358, 504
 theory of mind 321
Theropithecus gelada (gelada) 546
 red display 569
 third-order motion detectors 98, 99
 Thompson, Evan 132
 threat cohesion 447
 three-color harmony 414–16
 Ou *et al.* theory 415
 Szabó *et al.* theory 414–15
 thyroid eye disease 230
 tilt illusion 76
 toluene toxicity 231
 top-down selection by color *see* voluntary (top-down)
 attentional selection
 toxic causes of CVD 231–2
 train drivers, CVD issues 227–8
 transducin 33
 transformation plates 233
 transport, CVD issues 227–8

- Trendelenberg screen 232
- triad colors (black, red, white) 344, 347–9, 351–2
 archeological context 350
 body decoration 348
see also individual colors
- trichromacy 18, 35, 39, 110, 121, 155, 220, 223
 animals 357, 369
 primates 124, 504, 550, 585
 anomalous 134, 137, 220, 223,
 and attentional selection 497
 infants 159–61, 280
 and social communication 585
- tristimulus values 18, 19
- tritan discrimination 159
 infants 169
- tritan pairs 159
- tritanomaly 223
- tritanopia 39, 156, 159, 220, 223
- tritanopic neutral point 160
- tritanopoly 220
- trivector test 237
- turmeric 343, 345
- Twin Rivers (Zambia) 329
- twin studies 197
- two-alternative forced-choice paradigm 265–6
- two-color harmony 410–14
 Nayatani and Sakai theory 412–13
 Ou and Luo theory 410–12
 Szabó *et al.* theory 413–14
- Uca mjoebergi* (fiddler crab) 512, 513
- ultraviolet colors 504
- unconscious inference 655
- unique hues 90–4, 204, 644
 color appearance 204, 207–8
 and cone ratios 207
- univariance 33–4, 152, 216
- universal words 295
- university color affiliation 445
- unrelated colors 10, 686
- unsystematic variation of brightness 157
- Urosaurus ornatus* (ornate tree lizard) 512
- US Department of Homeland Security 380
- US Environmental Protection Agency 380
- US National Weather Service 380
- US Occupational Safety and Health Administration 380
- Valentine's Day 531, 533
- value 13
- vanishing plates 233
- Varecia variegata* (red ruffed lemur) 516
- vermilion 343, 345
- vertebrates
 agnathan fishes 115
 photopigments 113–15
- vervet monkey *see Chlorocebus aethiops*
 (vervet monkey)
- visibility, and color words 302
- visible spectrum 28, 29
- vision 111
 high resolution 111
 low resolution 111
see also color vision
- visual acuity 620
- visual cortex 73, 218–19
 aging effects 181
 early 79–84
 hard-wiring of color categories 286
 later 84–7
 V1 79–83, 89
 V2 83, 84
 V3 84
 V4 84, 86, 219, 231, 271, 704
- visual descriptors 302
 without color words 299–304
- visual diet of colors 260
- visual difference 41
- visual evoked potentials (VEPs) 150, 154, 161, 162
- visual experience 654
- visual fields 45
 left 91
 right 91
- visual illusions *see appearance phenomena*
- visual search task 267–8, 483
- visual selectivity 481
see also selective attention
- visual short-term memory (VSTM) 168
- visual system
 animals 504
 primates 550
see also color vision
- visual-flavor responses 604
- Voland, Ekart 321
- voluntary (top-down) attentional selection 482–90
 feature-based 481, 483–5
 guided search 487–9
 pop-out search 486
 space-based 481, 483, 484, 485–6
 temporal 481, 489–90
- von Kries adaptation 208
- Wallach's ratio rule 163
- Waorani language 272
- Warlpiri language 299, 303–4, 310, 313

- karntawarra-karntawarra* (ochre-ochre) 303, 310
kunjur-piya (like smoke) 303
kunjuru-kunjuru (smoke-smoke) 303, 310
kurdujungujungu (freshwater crab) 313
walya-walya (earth-earth) 303
yalyu-yalyu (blood-blood) 303
yukuri-yukuri (grass-grass) 303, 304
 warm colors 401, 402, 403–4, 441, 457, 663
 see also red; yellow
 warning coloration 364–9
 color displays 365
 as indicator of toxicity 365–6
 warning labels 377–97
 attention maintenance 393
 attention rating 387
 C-HIP 381–2, 396
 color and attention switch 389–93
 behavioral compliance 392–3
 eye movements 392
 fluorescent colors 392
 reaction time 391
 color specifications 379–80
 computerized displays 394
 containers 385–6
 graphics 385
 hazard control 377–81
 hazard perception 382–9
 information 378
 legibility 393
 memory enhancement 393–4
 multicolor warnings 386
 purpose of 378
 signal word panels 380, 384–5
 alternative configurations 395
 ANSI Z535 standard 378, 379, 380, 383, 388, 390, 394
 chromatic vs. achromatic 384
 color-word matching 385, 387
 color-word mismatch 386–8, 396
 see also hazard ratings
 watercolor effect 699–700
 WAVE model 438–9, 441, 442, 443, 450, 451, 463, 466
 C-wave 443
 P-WAVE 442
 wavelength 28
 discrimination 155–62
 infants 156–9
 neural processing 152–3
 wavelength cells 89
 Weber's law 40, 41
 wedding colors 341, 343, 345
 black 343, 345, 353
 green 345
 red 342, 343, 345, 346, 464
 symbolism of 345
 white 345
 yellow 345
 weighted affective valence estimate model *see* WAVE model
 Whig Green Ribbon Club 343
 white 347–9
 animals 348
 as bridal color 345
 as comfort color 344, 349
 definition of 247
 emotional associations 663, 665
 mourning 341, 342, 464
 peace 464
 foods 346
 hazard rating 382, 383, 386, 390, 394
 intensity of 15, 16
 metaphoric use 422–5
 as universal color 464
 White effect 691, 696
 wine, color and flavor perception 608
 Wittgenstein, Ludwig 142, 313
 Wolfram's syndrome 230
 women *see* females
 Wonderwerk Cave (South Africa) 328, 331, 332
 words, function of 295–9
 “color talk” 295
 meaning of 296–7
 universal 295
 see also naming of colors; color terms
 workplace safety 380
 World Color Survey 204, 205, 247–8, 259, 271, 285
 color-naming constraints 249
 statistical studies 250–4
 Wynn, Thomas 322, 331, 332

 X-AB memory task 284, 287, 288
 xanthopsia (yellow vision) 231
Xiphophorus pygmaeus (pygmy swordtail) 512, 513–14
Xiphophorus nigrensis (swordtail) 512, 513–14

 Yali people, color preference 467
 Yankunyjtajara language 304
 Yéli Dnye language 254,
 yellow 464
 as bridal color 345
 emotional associations 664, 670, 671
 foods 346, 641, 652
 German mailboxes 641, 642, 645
 as sacred color 343

- yellow (cont.)
 - skin coloration 593, 597
 - carotenoid consumption 590–1, 592
 - health 589, 590
 - warning coloration 365
 - warning labels 380
 - attack threat 380
 - attention rating 387
 - emergency equipment/signs 380
 - hazard rating 382, 383, 385, 386, 388, 389, 390, 391, 394,
 - workplace safety 380
 - yellow vision (xanthopsia) 231
- Young, Diana 304
- Young–Helmholtz theory of color vision 152
- Young–Maxwell–Helmholtz theory 90
- Zuni language 264, 269