Index

Active inhibition, 53 Afferent projections, 130 Ambient vision, 226. See also Vision, attentive and ambient defined, 221 evidence for, 221-226 Ambiguous motion. See also Stream/bounce perception; Streaming/bouncing motion how attention influences, 194-196 Amplification of attention, 204, 207 Amplification principle, 198 Anterior fusiform gyrus (antFus), 16, 17 Anterior intraparietal regions (aIPs), 15-17 Associative learning hypothesis, 252 Attention. See also specific topics covert shifts of, 159 defined, xi distributed vs. focal, 92-94, 96-99 distribution across visual space, 298-301, 303 does not change appearance, 200 as mimicking an increase in contrast, 279 primary effect, 41 psychological and neural theories of, xi, 20-21 psychology of, 215-216 task-independence, 236 tracking neural activity during, 2-3 varying importance across different aspects of visual performance, 237-239 Attentional control as centralized vs. decentralized, 293, 297-298 frontal lobe and, 69, 81-84 measurement of, 77-84 Attentional control center (AC), 293, 297 Attention(al) episodes multiple, 190-191 two consecutive, 188–190 Attentional field, 298 Attentional focus, frontal cortex and, 76-77 Attentional load, 56. See also Perceptual load Attentional modulation index (AMI), 35, 98, 100 Attentional modulations, 4-10, 251-254, 262 defined. 5 dissociating them from expectation signals, 12-20 general rules about, 6-7 PET studies, 6-7 sensory interactions and, 123-127 Attentional representations, 115, 272 Attention capture, 251 Attention cues, exogenous, 251, 253, 255 Attention effects, quantitative, bottom-up model of, 231-237 "Attention filter," 172-174 Attention-gating function, 186 Attention-gating model, 185–188

Attention models, 177-178, 211. See also specific topics extended, 188-192 Attention reaction times (ARTs), 182 measuring, 178-185 Attention windows, determining time course and structure of, 178-192 Auditory context. See Sound Balint's syndrome, 60 Behavior, assumptions for comparing fMRI responses and, 41-42 Behavioral performance, and brain activity, 36-43. See also specific topics Biased/biasing competition, 69 bottom-up salience, 130 Biased competition model/hypothesis, 20, 123, 130-134 implementation, 128, 129 Bias network, functions of, 292 Bias units, 290, 292 Blood oxygenation level-dependent (BOLD) signals, 7, 12, 14, 19, 21 Bottom-up influences on eye movements, 140 Bottom-up model of quantitative attention effects, 231-237 Bottom-up processing, 216 defined, 140 Bottom-up salience of biased competition, 130 Bouncing judgments, 246-249, 252, 254, 255, 257 Brain, capacity to act as ideal observer, 266-272 Brightness discrimination, 96-98 Cellular response to stimuli, 91 Chance, contribution to target detection, 161-165. See also Target detection, spatial distribution of probability of Chromaticity difference, 197 Color, selective attention to, 197-200 Color grabber, 204 Color-sensitive areas, 4 Color-shape combination, searching for target based on. 145 Conjunction search, 145-146 Contextual facilitation, effect of attention on, 93 Contextual influences, attentional modulation of physiology, 95-100 psychophysics, 91-94 Contour integration, 91 Contour saliency, 93-94 Cortical connectivity, 292-293 Cramér-Rao bound, 269-271 Cue + noise/motion trials, 14 Cue trials, 13

"Data limits," 55 Degraded target/sensory information, 56-57 Delay activity, cue-related, 11-12 Delayed match-to-sample task, 104, 105 Demand attentional, 217 brain activation associated with cognitive, 73-77 Directional cue scans, 13 Discrete spotlight model, 190-191 Discriminations, similar vs. dissimilar, 219 Discrimination tasks, attentional requirements of various, 227 Distracting attention with concurrent task, 253, 255-258 with salient event, 252-254 Distraction, endogenous, 251, 255 Distractor effect, 62-64 Distractors. See also Negative priming; Relevant vs. irrelevant stimuli compatible vs. incompatible with correct response, 50.56 and effect of synchronous sound, 251-254 ipsilesional stimuli and, 60-62 neural response to, 57-59 processing, 55-56 reduced perception vs. increased inhibition of, 53 Distributed attention, 92-94, 96-99 Dorsal stream of processing, 133 Dorsolateral prefrontal cortex (DLPFC), 18, 19 Driven vs. undriven responses, 108 Dynamical systems model of salience and related processes, 201-203 Efficient vs. inefficient searches, 51 Estimators, 265-266. See also Fisher information Expectations, 11 Expectation signals, 4-6, 10-12 defined, 5 dissociating them from attentional modulations, 12 - 20top-down, 18-21 Eye movements, 137, 260-262. See also Saccadic eye movements bottom-up influences on, 140 Feature conjunction, 145-146 Feature-integration theory, 228, 238 Feature(s), attention to, 194-196 Feature selection, 286 Feedforward competitive neural networks, 128 "Figure"/"figureness," 194, 196 Figure-ground, and pattern recognition, 208-209 Fisher information, 266, 267, 272, 278-280

gain increase and, 275-278

sharpened tuning and, 272-275

Flanker facilitation, 96-100 Flanking lines, 91-93, 98 Flow fields, 193-196 fMRI, 3 event-related, 12-20 Focal attention, 92, 94, 96-99 Folding, 184, 185 Frontal activity, ipsilateral to attended field, 72 Frontal cortex, 150, 152 relations between specific and general functions of, 73-77 Frontal eye field (FEF), xiv, 140, 142-143, 145 dissociation from saccade production, 142 functions, 138, 150 as motor area, 148-149 motor function, 138-139 as salience map, 150-152 visual function, 139-140 Frontal eye field (FEF) neurons, 140-142, 144-148 visual vs. movement, 149-150 Frontal lobe and attention to left and right, 70-73 and control of visual attention, 69 Frontal lobe functioning, uncertainties in current knowledge of, 84-85 Frontal neurons, 69 Frontal patients, deficits in attentional control, 81-84 Frontal response to diverse cognitive demands, 73-77 Frontal systems, role in working memory, 74-75 Gain increase, 272, 275-278 Gating control units, 290 Gating units, 290 Gaze behavior. See Selection Global winner, 287 Grabbing items for short-term memory, 180-182 Grabbing response and grabbing procedure, 178-182 Guided search model, 20 Habituation/dishabituation, 260, 261 Hemodynamics and hemodynamic signals, 2-3 Hierarchical neural networks, 285. See also Winnertake-all (WTA) selection processes, hierarchical Hue discrimination, with ambient vision, 223, 224 Ideal observer, neural implementation of, 266-272 Ideal observer models, 266, 279-280 Information processing. See Processing "Inhibition of return," 292

Inhibitory zone, 287

Integration procedure, 170-171

Interpretive units, 290

Index

Intraparietal regions (IPs), 15, 16 Ipsilesional stimuli and distractors, 60-62 Laminarity, 184, 185 Lateral neglect. See Unilateral neglect Learning. See also Associative learning hypothesis perceptual, 94-95 Location of flashed stimuli, 7, 8 Masking, visual, 147-148, 217, 218 Medial temporal cortex (MT), 7, 15, 26, 37, 133, 265 Memory access to, 209-210 short-term achieving primacy in, 185 grabbing items for, 180-182 working, 74-75 Memory-guided search for stimulus, 131-133 Mid-fusiform gyrus (mFus), 15 Motion aftereffect, 58-59 Motion analysis, standard, 206 Motion discrimination tasks, 26 Motion localizer scans, 13, 14 Motion processing, 58-59 Motion-sensitive areas, 4, 7, 12, 18 Motion (stimulus), 133 attention-driven apparent, 193-196 how attention influences ambiguous, 194-196 task-irrelevant, 58-59 Motion systems, 12, 193 first- vs. second- vs. third-order, 193-198, 202-203, 206, 207 Motor reaction times (MRTs), indirect measures of, 178 - 182Multiplicative scaling, consequences of expanded model of, 111-115 simple model of, 109-111 Negative priming, 52-55 Neural networks, 269-270 attention in, 192 feedforward competitive, 128 hierarchical, 285 Neuroimaging, 2-3. See also specific topics Neuronal firing rates, 41-42 Neuronal representation of behavioral significance of information, 115 Neuronal responses. See also specific topics effects of attention on, 103-104, 115 Neuronal tuning curves, sharpening/enhancing, 272-275 Noise, 266, 269, 276-280 and the decision process, 205 flat vs. proportional, 269-271

Gaussian. 266 Poisson, 272-275, 277 suppression, 7 Object identification, with ambient vision, 224-226 Occipital lobe, spatially directed attention and, 72 Orientation discrimination, 229-231 Orientation tuning/selectivity, attention and, 104-108 Overtraining, and brightness discrimination, 96 Parietal lesions, bilateral, 60 Parietal lobe, attention controlled by lateralized activity of, 72 Passive vs. active viewing/detection tasks, 7-8 Pass zone, 287 Pattern recognition, figure-ground and, 208-209 Perceptual continuity, 91 Perceptual learning and attention, 94-95 Perceptual load, 50, 55 and the aging brain, 62-65 and unilateral neglect, 59-62, 65 Perceptual load model, xvi, 64-65 empirical support for, 50-57 and neural response to distractors, 57-59 "Pop-out" phenomenon, 216 "Pop-out" search, 140-142, 144 Posterior intraparietal regions (pIPs), 17 Postsynaptic potentials (PSPs), 276-279 Prefrontal activity, 148 spatially directed attention and lateral, 72 Preparation enhancement, 244 defined, 244-245 Prime load. See Perceptual load Priming, negative, 52-55 Probability summation, defined, 244 Probe stimuli, 124, 125 Processing, information stages, 287 strategies for modeling biological, 303 Processing capacity limits, 49-50, 65, 121-122 reduced/restricted, 60, 62 Receptive fields, shrinking/shifting, 113-114 Receptive field stimulus, attention to a single, 130 Red advantage, 199 Reference lines, 91, 92 Relevant vs. irrelevant stimuli, focusing on and processing, 49-50 Repetition attended, 53 ignored, 53 Representation of attended stimuli, 115, 272 "Resource limits," 55

Response competition, 50-52, 56, 62, 63 Response conflict, 74 Retrieval cues, 189-190 Saccade execution, 150 Saccade latency, 137, 150 Saccades, 138, 140, 148, 149 production of, 137, 139, 142, 144 Saccadic amplitude distribution (SAD), 165-167 Saccadic eye movements, 137 Saliency/salience (of features) attentional amplification of, 197-200 constraints on top-down control of, 210 contour, 93-94 dynamical systems model of, 201-203 and effect of synchronous sound, 251-253 varying, 197, 199 Saliency/salience maps, 193-197, 205, 207-210 Saliency/salience theories, 207 as central to thinking about attention, xiv-xv Salient event, distracting attention with a, 252-254 Scanning process, covert, 159 Search filter, attentive. See "Attention filter" Search load, 51 Selection (process), visual, 272. See also Orientation tuning/selectivity; Spatial selection; Winnertake-all (WTA) selection processes of ambiguous targets, 147-150 of conspicuous targets, 140, 141 early vs. late, 64 feature, 286 knowledge and, 143-147 multilevel, perceptual consequences, 215-217, 237-239 psychological theories about, 3-5 stages, 142 timing, 142 top-down factors influencing, 137, 143 visual conspicuousness and, 140-143 Selective attention, 8, 49 capacity limits, 49-50, 65 to color, 197-200 Selective modulation of task-relevant pathways, 6-9 Selective tuning model, 285-298, 303-305 Sensory information, degrading, 56-57 Sensory representations, 115, 272 Sensory synchronization, for stream/bounce perception, 258-262 Shape-sensitive areas, 4 Shifting receptive fields, 113-114 Shrinking receptive fields, 113-114 Signal enhancement, 7, 11 Signal enhancement mechanisms, 20-21 Signal enhancement models, 11 Single-unit experiments, 10

Sound, synchronous auditory context and effect of, 244-251 visual distractors and effect of, 251-253 Sound omission, 250 Spatial attention models for (see Multiplicative scaling) used for stream/bounce perception, 258-262 Spatial attention task, effect on activity of visual cortex, 31-36 Spatial filter, 205 Spatial frequency thresholds, 229-231. See also Attention effects, quantitative neural basis, 232 Spatially directed attention regional cerebral activity during, 70-73 Spatially selective effects of attention on area V1, 40 - 41Spatial selection, 286 "Spatial uncertainty" experiment, 36, 40 Spatial vision thresholds, 228-231. See also Attention effects, quantitative computational model of, 232-235 Speed discrimination model, 37-40 Spontaneous activity, 108, 130 Stimulus/stimuli attention filtering out unattended, 126, 127 attention to a single receptive field, 130 cellular response to, 91 competition between, 304 distances between, 166, 167 ipsilesional, 60-62 location of flashed, 7, 8 memory-guided search for, 7, 8 preferred vs. poor, 122-128, 131 processing unattended, xvi-xvii relevant vs. irrelevant, 49-50 (see also Distractors) Stream/bounce perception, 253, 255, 261-262. See also Sound, synchronous; Streaming/bouncing ambiguous motion ambiguous motion display for, 245, 251, 252, 259, 260, 262 development of, 258-262 Streaming/bouncing ambiguous motion, 243–245. See also Sound, synchronous Stream perception, 262 Stroop effect, 74 Superior colliculus (SC), 134 Suppression, cortical, 8 Target detection contribution of chance and attention to, 161-165 probability of, deduced from spatial distribution, 169 - 172spatial distribution of probability of, 165-168

Target lines, 91, 92

Index

Task-independence of attention, 236 Task-relevant vs. task-irrelevant pathways, modulation of. 6-9Template signals. See Expectation signals Temporal attention window, model for engine, 185-187 full model, 186-188, 206-207 Temporal cortex, inferior, neuronal responses in during memory-guided search, 131-133 Temporal recruitment hypothesis, 243-244 Temporal recruitment of motion signals, 262 Texture grabber, 204 Top-down biasing signals, 20-21 Top-down control of salience, 210 Top-down expectation signals, 18-21 Top-down factors influencing selection, 137, 143 Top-down processing, 216 defined. 143 Treisman's feature-integration theory, 228 Tsotsos's model, 20 Unilateral neglect, 59-60 perceptual load and, 59-62 Variance, minimum. See Cramér-Rao bound Ventral intraparietal regions (vIPs), 15 Ventral MT+. 17 Ventral stream, attentional modulation of neuronal responses in, 122-130 Vision, attentive and ambient, 216-226, 238. See also specific topics qualitative difference between, 216, 226-228 quantitative differences between, 216, 228-231 Visual cortex contextual influences in, 89-91 spatial attention and, 31-36 spatially selective effects of attention on, 40-41 Visual expectations. See Expectation signals Visual experience, phenomenal, sources, 238 Visual field, central and peripheral, 139 Visual focal attention, 251 Visual search, 159-160 active, 160 research on, 159 Visual search paradigm, 140 Visual task performance, visual cortex activity, 29-31 Winner-take-all (WTA) circuits/networks, 294, 304 network structure and function, 290-292 neural correlate of, 292-296 Winner-take-all (WTA) selection processes, hierarchical, 286-289, 304 "Winning," 185 Wolfe's guided search model, 20