

Index

Note: Page numbers followed by “f” and “t” and “b” indicate figures and tables and boxes respectively.

A

Air traffic control systems, 75f
Ambiguity, perception, 11, 12f
Amygdala, 156
Apple's i Cloud, 70, 71f
Application-modal pop-ups, 68
Attention, 103
 closure slips, 140
 design guidelines, 126
 external memory aids, 130–131, 131f
 familiar paths, 130
 goals
 brain functions, 130
 change blindness, 127–130, 128f
 inattention blindness, 126, 127f
 human action cycle, 135
 goal-execute-evaluate cycle, 138
 higher-level task, 136
 password strength indicators, 139, 139f
 primary goal, 136
 progress indicators, 138–139, 139f
 subgoal, 137
 sub-subgoal, 137
 information scent
 ATM screen, 133, 133f
 flight reservation, 132
 goal-seeking strategy, 133
 Marriott's reservation cancellation
 confirmation, 133, 134f
 lawn mower, 125–126
 limited capacity, 125
 resources, 140
 short-term memory, 140
Attentional blink, 5, 12
Attention slip, 265, 265f, 268
Authentication methods, 152
Automated teller machines (ATMs), 179
Automatic *vs.* controlled task, 164

B

Background noise, reading disruption, 89, 90f
Basal ganglia, 157

Bias. *See* Biased perception; Decision-making

Biased perception
 current context, 5–8
 design implications
 ambiguity avoidance, 11, 12f
 consistent controls and data
 displays, 11
 experience
 attentional blink, 5
 familiar patterns/frames, 3–4
 habituation, 4–5
 priming, 1–3
 goals, 8–11, 9f–10f
Biometric authentication, 152
Birthdate control, 39, 40f
Bottom-up reading, 83–86
Brain
 new brain, 156–157, 166b
 old brain, 155–156
 responsiveness. *See* Responsiveness
Brain stem, 155–156
Broca's area, 86–87, 86f
Busy indicators, 248–249

C

Captcha, 89
Capture slip, 262, 266–267
Centered text, reading disruption,
 92, 92f–93f
Cerebellum, 156
Cerebral cortex, 156–157
Change blindness, 128f
 researcher-tourist, 127–130
 RoadScholar.org, 129f, 130
 user-interface design guideline,
 130
CharityNavigator.org, 219, 219f
Chernoff faces, 216, 217f
Closure principle, 22, 22f
Closure slip, 263, 268
Cocktail party effect, 9
Cognitive load, 184–186

- Color blindness
 - Google log, 51f
 - Moneydance's graph, 49–51, 50f
 - red-green color-blind, 49, 49f
 - Color display variations, 51
 - Color-opponent channels, 45
 - Color vision
 - color presentation *vs.* discrimination, 49f
 - ambient illumination, 52
 - color display variations, 51
 - color patch size, 46–47
 - daytime/nighttime adjustments and dark mode, 51
 - display angle, 52
 - external factors influencing, 51–52
 - grayscale displays, 51, 52f
 - paleness, 46
 - separation, 47
 - color use guidelines
 - color contrast, 53
 - color pairs avoidance, 53–54
 - colors with cues, 54, 54f
 - distinctive colors, 53, 53f
 - MinneapolisFed.org's graph, 54f, 55
 - opponent colors, 53, 53f
 - edge detection, 45–46, 45f–46f
 - mechanism, 43–45
 - retinal cones, 44
 - retinal rods, 43
 - subtractive processes, 45
 - Command-line user interfaces (CLIs), 147
 - Common Fate principle, 26, 27f–28f
 - Computer security, 220–222
 - Conceptual consistency, 186–188, 186t
 - cognitive load, 187
 - digital system, 186
 - drawing app, 186–187, 186t–187t
 - past conceptual inconsistency, 187–188
 - Cones
 - high frequency, 44
 - low frequency, 44
 - medium frequency, 44
 - sensitivity, 44, 44f
 - Consciousness, 157–158
 - Consistency, 184
 - Context biases perception, 6, 6f
 - Context-free reading, 83–86
 - Continuity principle
 - human vision, 20–21, 20f
 - IBM company logo, 21, 21f
 - slider controls, 21, 21f
 - Corpus callosum, 157
 - Current context, perception bias, 5–8
- D**
- Data
 - compression, 57
 - slip, 262–263, 268
 - specific controls, 39, 39f–40f
 - Decision-making
 - AI-based systems, 213
 - biases
 - anchoring, 206
 - framing effect, 206
 - Ikea effect, 208
 - past behavior, 208
 - stated commitment bias, 208
 - status quo bias, 208
 - sunk cost fallacy, 208
 - vivid imaginations and memories, 207–208
 - word choices, 205–207
 - computer security, 220–222
 - convincing and persuading, 217–219, 218f
 - data visualization
 - automatic processes, 213
 - Chernoff faces, 216, 217f
 - Gapminder application, 215
 - human visual system, 213–214
 - publications and citations, 215, 216f
 - urban subway systems map, 214–215, 214f
 - decision support and persuasive systems, 219–220, 219f–220f
 - emotional response, 209
 - fourfold pattern, 205, 205t
 - irrational, 203–204
 - losses *vs.* gains, 204–205, 205t
 - mind system roles, 203
 - rational, 203–204
 - computers, 209
 - decision support software guidelines, 210–211
 - GoSale.com, 210, 211f
 - mortgage calculator, 209, 210f
 - snowplow routes, 210, 212f
 - Description slip, 262, 267
 - Deuteranopia, 51f
- E**
- Emotional response, decision-making, 209
 - Episodic long-term memory, 106
 - Errors
 - design guidelines
 - risky error-prone operations, 271–273, 272f
 - two-way reversible operations, 269–270
 - undo file operations, 270–271, 271f
 - misrecognition, 273
 - mistakes

Errors (*Continued*)

- avoidance, 266, 267f
- vs.* slips, 259–260, 262f
- slips
 - attention slip, 265
 - capture slip, 262
 - closure slip, 263
 - data-driven, 262–263
 - description, 262
 - loss-of-activation slip, 263
 - mode slip, 265
 - motor slip, 265
 - prevention, design guidelines, 266–269
 - voice-recognition failure, 273
- Evaluation, thought cycle, 136
- Execute, thought cycle, 135–139
- Experience
 - learning
 - casino game, 160
 - evolutionary history, 162
 - limitation, 161
 - overgeneralization, 161
 - perception bias
 - attentional blink, 5
 - familiar patterns/frames, 3–4
 - habituation, 4–5
 - priming, 1–3
- External memory aids, 130–131, 131f

F

- Facial recognition, 144–145, 144f
- Familiar patterns/frames, 3–4
- Feed My Starving Children (FMSC), 220, 220f
- Figure/ground principle, 24–26, 24f–26f
- Fitts' law
 - design implications, 227–228, 228f–230f
 - edge-pointing detail, 226
 - formula, 225
 - pointing time, 225, 226f
 - screen-pointers movement, 226, 227f
 - target size, 226, 227f
- Flinch reflex, 238, 240
- Fonts, reading disruption, 88, 89f
- Fourfold pattern, decision-making, 205, 205t
- Framing effect, 206
- Frequency, learning practice, 179
- Frontal lobe, 156–157

G

- Gains *vs.* losses, decision-making, 204–205, 205t
- Galvanic skin response (GSR), 160

Gestalt theory of perception

- closure principle, 22, 22f
- combination of principles, 28f
- Common Fate principle, 26, 27f–28f
- continuity principle
 - human vision, 20–21, 20f
 - IBM company logo, 21, 21f
 - slider controls, 21, 21f
- figure/ground principle, 24–26, 24f–26f
- proximity
 - Firefox's keyboard text preferences dialogue box, 17, 18f
 - organized objects, 15–16, 16f
 - Outlook's Distribution List Membership dialogue box, 16–17, 17f
 - radio button labels, 17, 18f
- similarity, 19f
 - Gmail, 19f
 - Lyft's smartphone app, 18, 19f
 - Mac OS page setup, 20, 20f
- symmetry principle, 23–24
 - data presentation, 24, 24t
 - human visual system, 23, 23f
 - overlapping rings, 23, 23f
- Graphical user interface (GUI)
 - command-line user interfaces (CLIs), 147
 - design rule, 148f
 - desktop icons, 149f
 - Microsoft PowerPoint and slides, 150f
 - Mozilla Firefox and logos, 150f
 - pictures, 147–148
 - Wordpress.com and symbols, 148f
- Grayscale displays, 51, 52f

H

- Habituation, 4–5, 12, 71
- Hand-eye coordination
 - fake heavyweight computations, 251
- Fitts' law
 - design implications, 227–228, 228f–230f
 - edge-pointing detail, 226
 - formula, 225
 - pointing time, 225, 226f
 - screen-pointers movement, 226, 227f
 - target size, 226, 227f
- steering law
 - design implications, 231–232, 232f–233f
 - formula, 230
 - pointing time, 231f
- Hearing biasing vision, 8
- Highly consistent conceptual model, 187t

Hippocampus, 156
Hypothalamus, 156

I

Ikea effect, 208
Impulsive behavior, 166b
Inattentional blindness, 126, 127f
Inconsistent conceptual model, 186t
Information hierarchy, 35–37, 35f–36f
Irrational decision-making, 203–204

K

Keystroke consistency
 cut and paste keyboard shortcuts, 188
 Google Maps, 190f
 hand-eye coordination activities, 189
 keyboard-shortcut design, 188, 189t
 look-and-feel standards, 189–190
 muscle memory, 188
 physical actions and activities, 188
Keystrokes, 135

L

Learning
 conceptual consistency, 186–188, 186t
 conceptual model
 design, 183
 software applications, 184b, 185f
 task analysis, 183
 users goals and tasks, 183
 consistency, 184
 experience
 casino game, 160
 evolutionary history, 162
 limitation, 161
 overgeneralization, 161
 high-risk system, 198–199
 keystroke consistency, 188–190
 learned actions, 162–163
 low-risk environment, 199
 metaphor, 199
 novel actions
 automatic and controlled task, 164
 car driving, 163
 conscious attention, 164
 music teachers, 164
 practice session
 frequency, 179
 precision, 180
 regularity, 179–180

Learning (*Continued*)
 predictability, 190–191
 problem-solving and calculation
 cerebral cortex, 165
 controlled processing, 166
 environment, 165
 external memory aids, 168
 long-term memory, 167
 modern human brain, 166
 new brain, 166
 short-term memory limits, 167
 technical problems, 169b–171b
 progressive disclosure, 200f, 202
 task analysis, 182
 tools, 180
 tools design, 181
 user-interface design implications,
 171–174
 vocabulary factors
 conceptual model, 196–198
 consistent terminology, 195–196,
 196f–197f
 familiar terminology, 192–193, 193f
 task focused terminology, 191–192, 192f,
 194f–195f
Long-term memory, 103–104
 in brain, 117
 characteristics, 117–119
 error-prone, 118
 human, 117
 long-term memory test, 119b
 old memories, 118
 retroactively alterable, 119
 user-interface design
 authentication, 120
 consistency, 122–123
 NetworkSolutions.com, 122, 122f
 technologies, 120
 United.com's registration, 120–121, 121f
Loss-of-activation slip, 263, 268

M

McGurk effect, 7
Memory
 attention, 109
 long-term memory
 brain, sensory modality-specific
 area, 104
 characteristics, 117–119
 context, 104–105
 episodic, 106
 hippocampus, 106

Memory (Continued)

- memory formation, 105
- neural activity pattern, 105
- procedural, 106
- reactivations, 105
- recognition, 105
- semantic, 106
- user-interface design, 120–123
- short-term memory
 - attention mechanisms, 107
 - perceptual senses, 106
 - warehouse analogy, 107–108, 108f
- short-term *vs.* long-term memory, 103–104, 104f
- working-memory, 107
 - calls to action, 115
 - chunks, 110–111
 - forgetting/losing track, 111
 - Miller's characterization, 110
 - modes, 114
 - navigation depth, 115
 - search results, 114–115
 - Slate.com search results, 115, 116f
 - voice user interfaces (VUIs), 113–114
 - volatility, 111
 - working memory test, 112b, 113f
- Mental model, 183
- Mental priming effect, 2, 2f
- Microblogging, 5
- Mind system
 - characteristics, 159
 - conscious, monitored mind, 157
 - operating system, 159
 - perceptions and judgments, 159
 - perceptual biases, 158–159, 158f
 - unconscious, automatic mind, 157–158
- Misrecognition, 145–146
- Moded user interfaces, 114
- Mode slip, 264f, 265, 268
- Müller-Lyer illusion, 6, 6f
- Muscle memory, 188

N

- Neural memory patterns, 105
- Ninio's extinction illusion, 60, 60f
- Nonmodal pop-ups, 68

O

- Occipital lobe, 156–157
- Old brain, 155–156
- Overgeneralization, 161

P

- Paesslers monitoring tool, 75f
- Parallel processing, 144–145
- Parietal lobe, 156–157
- Password strength indicators, 139, 139f
- Perceptual and cognitive function duration, 238b
- Perceptual filtering, 9–10, 10f
- Perceptual priming, 1–3
- Perifovea, 81
- Peripheral vision
 - computer interface and error message
 - beep sound, 69–70
 - Delta.com, 63, 64f
 - error message visibility, 66
 - invalid login, 65, 65f
 - pop-up message, 68
 - Salesforce.com's mobile site, 67f, 68
 - Taylor & Francis Informaworld website, 63, 64f, 67f
 - user's visual field simulation, 65f, 66
 - wiggling/blinking, 70–71, 71f
 - functions
 - fovea guidance, 61–62
 - low-light conditions, 63
 - motion detection, 62
 - linear visual search
 - bold letter finding, 72, 73f
 - color pops, 72, 73f
 - letter Z finding, 72, 72f
 - neural networks, 72
 - peripheral pops, 74–75, 74f–75f
 - potential targets, 76–77, 76f
 - spatial resolution
 - blind spot, 60–61
 - data compression, 57
 - Ninio's extinction illusion, 60, 60f
 - normal vision, 58
 - peripheral vision, 58–59
 - pixel density, 57, 58f
 - processing resources, 58
 - retinal gap, 60–61, 61f
- Personal identification number (PIN), 120, 120f
- Photoreceptor cell distribution, 58f
- Pop-up message, 68
 - application-modal pop-ups, 68
 - Microsoft Excel and Adobe InDesign, 69f
 - nonmodal pop-ups, 68
 - REI.com's pop-up dialogue box signals, 68, 69f
 - system-modal pop-ups, 68
- Prefrontal cortex, 156–157
- Priming, perception, 1–3
- Procedural long-term memory, 106

Process funnel, 115
 Progress indicators, 249–250
 Progressive disclosure, 200f, 202
 Proximity
 Firefox's keyboard text preferences dialogue box, 17, 18f
 organized objects, 15–16, 16f
 Outlook's Distribution List Membership dialogue box, 16–17, 17f
 radio button labels, 17, 18f

R

Rational decision-making, 203–204
 computers, 209
 decision support software guidelines, 210–211
 GoSale.com, 210, 211f
 mortgage calculator, 209, 210f
 snowplow routes, 212f
 Reactivation, 145
 Reading
 bottom-up reading, 6, 6f
 context-driven, 83
 disruption
 centered text, 92, 92f–93f
 design implications, 92–94
 difficult scripts and typefaces, 88, 89f
 low-contrast text, 90
 noisy background, 89, 90f
 nonpatterned background, 90
 repetition, 91
 tiny fonts, 88, 89f
 unfamiliar vocabulary, 87–88
 feature-driven reading, 83
 foreign script, 80f
 mechanism, 81–83, 82f
 origin, 79
 recognition patterns, 80–81
 skilled and unskilled reading, 86–87, 86f
 software dialog boxes, 94, 95f–96f
 unnecessary text, 95–99, 97f–99f
 Recall, 105
 external and internal recall aids, 147
 method of loci, 147
 reactivation, 146
 vs. recognition, 147–152
 Recognition
 animal prey/predator, 144, 144f
 complex patterns, 146, 146f
 facial recognition, 144–145, 144f
 misrecognition, 145–146
 neural patterns, 143
 parallel processing, 144–145
 Recognition (*Continued*)
 reactivation, 145
 vs. recall, 147–152
 authentication information, 152
 cues, 151
 functionality, 150–151
 thumbnail images, 149–150, 150f
 REL.com's pop-up dialogue box signals, 68, 69f
 Repetition, reading disruption, 91
 Residual perception, 106
 Responsiveness
 busy indicators, 248–249
 camera software, 236
 definition, 236
 fake heavyweight computations, 251
 important information display, 250–251
 interactive systems, 236
 mobile apps, 255
 poor responsiveness, 236–237, 237f
 progress indicators, 249–250
 response delays, 250
 software developers, 255–256
 time compliance, 253
 time constants, human brain
 attentional blink, 242
 automatic processing, 238
 editorial window, 242
 engineering approximations, 243–244
 flinch reflex, 238, 240
 maximum event interval, 241
 neuron-based organs, 237
 perceptual and cognitive function duration, 238b
 perceptual locking threshold, 240–241
 saccadic masking, 241
 sensory systems, 237
 shortest gap silence detection, 239
 subitizing time, 241
 subliminal perception, 239–240
 time lag, 240
 unit tasks, 250
 visual-motor reaction time, 242–243
 time deadlines, human-computer interaction
 guidelines, 244
 0.1 second, 246–247
 0.01 second, 246
 0.001 second, 245–246
 1 second, 247
 10 second, 247–248
 100 second, 248
 timely feedback, 253–255
 unit tasks, 243
 user input process, 253
 work ahead, 251–252

S

Saccadic masking, 241
 Scotopic vision, 63
 Self-awareness, 157–158
 Semantic long-term memory, 106
 Semirandom process, 6
 Sensory-specific residual perception, 106
 Short-term memory, 103–104
 attention, 140
 attention mechanisms, 107
 vs. long-term memory, 103–104, 104f
 perceptual senses, 106
 warehouse analogy, 107–108, 108f
 Similarity principle, 19f
 Gmail, 19f
 Lyft's smartphone app, 18, 19f
 Mac OS page setup, 20, 20f
 Spatial resolution, fovea and peripheral vision
 blind spot, 60–61
 data compression, 57
 Ninio's extinction illusion, 60, 60f
 normal vision, 58
 peripheral vision, 58–59
 pixel density, 57, 58f
 processing resources, 58
 retinal gap, 60–61, 61f
 Special-purpose organizational chart-editing
 application, 181
 SPRINT mobile-phone service, 193, 194f
 Stated commitment bias, 208
 Steering law
 design implications, 231–232, 232f–233f
 formula, 230
 pointing time, 231f
 Stroop effect, 263f
 Structure information
 airline reservation information, 31, 31f
 chunking data, 40
 chunks, 37
 credit card numbers, 38, 38f
 dates and phone numbers, 38, 38f
 data-specific controls, 39, 39f–40f
 driver license renewals, 32, 32f–33f
 HP.com's site search results, 33, 34f
 information hierarchy, 35–37, 35f–36f
 mortgage summary, 33, 34f
 visual hierarchy creation, 35, 35f–36f
 Subliminal perception, 239–240
 Symmetry principle, 23–24
 data presentation, 24, 24t
 human visual system, 23, 23f
 overlapping rings, 23, 23f
 System-modal pop-ups, 68

T

Task analysis, 182
 Telephone voice-response systems, 113
 Telescope's control system, 181
 Temporal lobe, 156–157
 Thalamus, 156
 Thought cycle, 135–139
 Thumbnail images, 149–150, 150f
 Top-down reading, 83–86, 84f

U

Uncle Charlie effect, 207–208
 Unit tasks, 243, 250
 User-interface design
 change blindness, 130
 Fitts' law, 227
 graphical user interface. *See* Graphical user interface (GUI)
 learning, 171–174
 long-term memory, 120–123

V

Ventriloquism, 8
 Visual hierarchy creation, 35, 35f–36f
 Visual-motor reaction time, 242–243
 Visual perception, 6, 6f
 McGurk effect, 7
 Müller-Lyer illusion, 6, 6f
 semirandom process, 6
 ventriloquism, 8
 Vocabulary
 learning
 conceptual model, 196–198
 consistent terminology, 195–196, 196f–197f
 familiar terminology, 192–193, 193f
 task focused terminology, 191–192, 192f, 194f–195f
 reading disruption, 87–88
 Voice user interfaces (VUIs)
 design guideline, 114
 devices, 114
 long instructions, 113–114
 telephone voice-response systems, 113

W

Web Content Accessibility Guidelines, 37
 Wernicke's area, 86–87, 86f
 Working-memory, 107
 calls to action, 115
 chunks, 110–111

Working-memory (*Continued*)

- forgetting/losing track, 111
- Miller's characterization, 110
- modes, 114
- navigation depth, 115
- search results, 114–115

Working-memory (*Continued*)

- Slate.com search results, 115, 116f
- voice user interfaces (VUIs), 113–114
- volatility, 111
- working memory test, 112b, 113f