

Index

A

Absolute limits, 26–28
Across the Secular Abyss, 156–157
Adaptation in Natural and Artificial Systems, 98
Adaptive help systems, 227
Adaptive interfaces, 227
Addiction, 128, 131–133
Administrative science, 190
Adolescent behavior, 156
Aerospace industry, 211, 213
Affective computing, 121
Age of Spiritual Machines, 45, 122
Agency for Healthcare Research and Quality, 68
Aggression, 165
Agriculture, 92–95, 176, 196
Agrifood, 10–11
Alcohol and alcoholism, 128
Alivisatos, Paul, 58
All-Story Weekly, 29
Alpert, Richard, 129
Alzheimer's disease, 126, 133
Amazon.com, 2
AMD, 55
ångström, 2
ANNE (Analogies in Natural Emotion), 224–225
Antarctica, 219
Anthropic theory, 151, 154
Anthropology, 113–114
Apollo, 35–36, 207
Armstrong, Neil, 207
Armstrong, Robert, 66
Art, 183–186
Artificial intelligence (AI), 21
 and cognitive technology, 113–117
 grand challenges, 72–73
 neural networks, 115–117, 126–127
 personality transfer, 223, 227
 and religion, 125–127
 structural–computational theory, 114–117

Artificial social intelligence, 75
Asian societies, 125
Asimov, Isaac, 30–31, 219
Asimov's Three Laws of Robotics, 31
Assemblers, 40–43
Astronauts, 220–222
Astronomy, 69, 75, 207, 216
Athletes, 106, 132
Atkins Report, 76
Atlantis (spacecraft), 213
Atom bomb, 5, 38
Atoms, 2–3, 7, 68–69, 152
Attentive user interface, 227
Augmented cognition, 227
Avatar, 227

B

Bainbridge, William Seaman, 87
Bartlett, Rodney, 66
Bassani, John, 66
Battlestar Galactica, 219
Bear, Greg, 32, 34
Beck, Thomas, 67
Behavioral social science, 158–161, 163–167
Bell, Daniel, 197
Bell, Gordon, 222
Bell Telephone Laboratories, 118
Bellah, Robert N., 160
Benevolence, 157–158
Beyond Therapy, 131–132
Big Down, The, 176–178
Big Five (personality dimensions), 223
Binary arithmetic, 62
Binnig, Gerd, 6
Bio–nano convergence, 81
Biochemicals, 128
Biochemistry, 58, 147
Bioethics, 105, 131

Bioinformatics, 16, 67, 92, 105
 Biology, 81–82, 147
 Bioprocessors, 16
 Biosensors, 16, 58–60, 85, 134
 Biotechnology, 81, 128
 agriculture, 92–95
 cancer, 87–89
 computing and culture, 95–102
 human performance, 103–106
 nano-bio convergence, 83–87
 nano-bio innovation, 89–92
 Birds Can't Fly to the Moon (parable), 26–28
 Blair Magnet Program, 147–149
 Blindness, 104, 131, 135
 Blish, James, 30
 Block, Steven, 84
Blood Music, 32
 Bloom, Paul, 125
 Bohr, Niels, 30
 Bonadio, Jeffrey, 105
 Boyd, Stephen, 30
 Brain function, 128
 Brain research, 2, 15, 85–86, 102, 122–123
 Braun, Wernher von, 37, 218
Brave New World, 187
Buck Rogers, 39, 217
 Buckminsterfullerenes, 6–7
 Buckyballs, 6–7
 Buddhism, 125
 Burroughs, Edgar Rice, 39, 177
 Bush, Vannevar, 189–190

C

C60, 7
 Caesar, Porter Dean, 144
 Caffeine, 128
 California Nanosystems Institute, 85, 89–90
 Cancer, 42–43, 85, 87–89, 215
 Capabilities, 198
 Čapek, Karel, 179
 Capitalism, 186–188
Captain Video, 217
 Carbon nanotubes, 7, 18, 54–56, 66, 95, 212
 Castaneda, Carlos, 129
 Castells, Manuel, 12
 Cathode ray tube, 6
 Cavalli-Sforza, Luigi Luca, 100–101
 Cell biology, 91
 Center for Cognitive Liberty and Ethics, 132
 Center for Nanotechnology in Society (ASU), 10
 Center for Nanotechnology in Society (UCSB), 10

Center for Telematics and Information
 Technology, 90
 Central Intelligence Agency, 182
 Challenger (spacecraft), 36, 38, 208
 Channell, David, 155
Chemical and Engineering News, 43
 Chemical attacks, 59
 Chemical warfare, 59–60
 Chen, Hingda, 94
 Childe, V. Gordon, 103
 Chomsky, Noam, 114
 Christianity, 125–126
 Chunking, 114–115, 119
 Clarke, Arthur C., 31, 38
 on Bainbridge, 37
 Climate change, 71, 188–189
 Clinton, Bill, 64
 CNN (cellular neural/nonlinear network), 123
 Cogniceuticals, 131
 Cognition, 150, 155–156
 Cognitive convergence, 117–124
 Cognitive liberty, 132
 Cognitive neuroscience, 122
 Cognitive science, 1, 12, 65, 72, 103, 113, 155
Cognitive Science (journal), 113
 Cognitive Science Society, 113
 Cognitive technology, 113–117
 cognitive convergence, 117–124
 The Communicator, 133–137
 neurotechnology, 128–133
 prehistory, 124–128
 Cold Equations, The, 29
 Cold Facts (parable), 28–29
 Cold War, 36, 190, 194–195
 Collaboration, 72–73, 145–146
 Collaboratory, 69
 Columbia Hill, 220
 Columbia (spacecraft), 36, 208, 220
*Communications of the Association for
 Computing Machinery*, 198, 222
 Communicator, The, 133–137
 Complementarity, 152
 Composites, 70, 95
 Computational neuroscience, 66
 Computer chips, 52–57
 Computer cooling methods, 54–55
 Computer science
 CNN (cellular neural/nonlinear network), 123
 Moore's law, 18, 51, 56
 neural nets, 115, 117
 quantum computing, 60–63
 Computing industry, 19
 Configuration, 150, 152–153

Confucianism, 125
 Connectionism, 117
 Connolly, Patricia, 105
Conquest of Space, 218
 Consciousness, 119
 Conservation, 188–189
 Consilience, 13, 100, 185
Consilience (book), 127
 Controversial issues, 231
 Convergence, 1, 9, 66, 185
 Convergence cube, 150
 Convergence principles, 150–151
 Convergors, 143–149
Converging Technologies, 66, 123
 Converging Technologies conferences, 15, 19
Converging Technologies for Improving Human Performance, 180
 Cooler (invention), 28–29
 Copyrights, 184–185
 Corinthians 13:11, 232
 Cornell University, 90
 Coser, Lewis, 161
 Cosmic rays, 215
 Cosmonauts, 214
 Crabbe, Buster, 217
 Cray, Seymour, 54–55
 Cray-2 supercomputer, 54–55
 Crichton, Michael, 31–32, 45
 Crime rates, 150–151, 156, 184, 187, 191
 Crossover, 98–99
 Cryonics, 38–39, 43
 Cryptographic communications, 61
 Culler, David, 59
 Cultural analysis, 101–102
 Cultural capital, 195
 Cultural genetics, 100–101
Cultural Transmission and Evolution, 100–101
 Culture, 183–186
 Cummings, Ray, 29–30
 Curl, Robert F., 6–7
 Cyberinfrastructure, 74–76

D

Darwin, Charles, 143
 Data transmission theory, 155
 Davis, Kingsley, 163
 Dawkins, Richard, 100
 Defense Advanced Research Projects Agency,
 68, 75
 Dementia, 126, 133
 Democratization, 190–194

Demographics, 182–183
 Dendrimers, 95
 Dennett, Daniel C., 31, 154
 Department of Commerce, 11
 Department of Energy Office of Science, 68
Destination Moon, 218
 Dialog systems, 227
Diamond Age, The, 32–34
 Dick, Steven J., 223
 DigiMorph, 75
 Digital immortality, 222
 Digital libraries, 190
 Digital Library Initiative (DLI), 4, 75
 Digital technology, 53, 72
 Disabilities, 13, 16, 72, 104–105, 227
 Disney, Walt, 218–219
 Divorce rates, 181
 DNA, 66, 67, 95–98
 DNA computing, 63
 Dr. Nano, 26
 Drexler, K. Eric, 20, 35–44
 Foresight Institute, 39, 42
 Wikipedia biography, 41
 Drug use, 128–130, 132–133
 Durkheim, Emile, 160

E

Eastern religion, 124–125
 Economic progress, 16, 68, 186, 191
 Economics of scale, 199–200
Economist, 41
 Edison, Thomas Alva, 29, 51
 Education, 68, 145, 147, 195
 and cognitive science, 21, 113
 computer simulations, 73
 scientific, 17, 185
 Egypt, 124–125
 Eidetic memory, 120
 Electron beam, 6
 Electron microscopes, 6
 Electron orbits, 29–30
 Electronic paper, 33
 Electronics hobbyists, 52–53
Electrons and Holes in Semiconductors, 152
 Emergence, 153
 Emoticeuticals, 131
 Emotion, and personality transfer, 223–225
 Energy (solar), 36
Engines of Creation, 39
 ENIAC, 74
 Entropy, 155

242 Index

Environmental issues, 13, 68, 92–95, 188–189
Environmental Protection Agency (EPA), 68,
90, 94–95
Enzymes, 44
Eschenbach, Andrew von, 88–89
Estrin, Deborah, 59
ETC Group, 176–177
Ethics, 12, 105–106, 125, 156–159
and agrifood, 10–11
extraterrestrial raw materials, 37
and medicine, 131–132
Ettinger, Robert C.W., 39
European Commission (EC) report, 15
European Union, 187, 194
demographics, 182
fertility, 182
population, 182
Evolution, 95–102, 127, 150, 154–155
worldwide acceptance, 95–102
Evolutionary computing, 98, 101–102
Expert systems, 226–227
Exploration of Space, The, 38

F

FAA (Federal Aviation Administration), 68
Fab labs, 67
Facial expressions, 121–122
Fall of civilizations, 27
Family, 181–184
Fantastic Voyage, 30
Farms, 92–95, 188–189
FDA (Food and Drug Administration), 122
Feldman, Marcus W., 100–101
Fertility rates, 182–183
Feynman, Richard, 38–39
Finke, Roger, 127
Flash Gordon, 217
Fonash, Stephen J., 145
Food supply, 176, 188–189
homeland security, 94
See also Agriculture
Foresight Institute, 39, 42
Forest, M. Gregory, 145
Foundation, 219
Free association, 117–118
Free markets, 186–188, 190–192
Freund, Jonathan, 66
Frustration, 165
Fuller, Buckminster, 6–7
Fullerenes, 6–7, 42
Functional MRI, 122
Furst, Eric, 85

G

Gas diffusion barrier, 4–6
Gases (military weapons), 59
Gasoline, 69
Gazzaniga, Michael, 122
Gene sequencing, 96
Gene therapy, 105
General Conference on Weights and Measures, 2
General semantics, 144
Genes, Mind, and Culture, 100
Genetic algorithms, 98
Genetic engineering, 45, 103
Genomics, 16
Geodesic domes, 6–7
Geographic information system (GIS), 93
Geographic space, and blindness, 135
Georgia Institute of Technology, 90
Gerhardt, Greg, 85
Germanium, 8
Ghoniem, Nasr, 66
Giant leap, 207–211
Global capitalism, 178, 186
Global positioning system (GPS), 92–93, 135
Globalization, 175–176, 198
GMOs (genetically modified organisms), 177–178
Gödel, Kurt, 152
Godwin, Tom, 29
Golledge, Reginald G., 135
Goode, Erich, 130
Google, 97
Goonan, Kathleen Ann, 34
Gordon, Robert A., 133
Gore, Albert, 44
Gorman, Michael E., 146
Grand Challenges Task Force, 68–74
Gravity, simulating, 214
Gray, Jim, 222
Gray goo scenario, 45, 177–178
Greece, 27
Green goo scenario, 177
Green Man of Graypec, The, 30

H

Hanlon, Michael, 220
Harvard University
and NNIN, 90
Pareto Circle, 159
and Psychedelic Movement, 129
Social Relations Department, 159, 167–168
and social science, 159, 163
Hayakawa, S.I., 144

- Hayes Report, 75
- Health, 82, 104–105, 188
 and bioethics, 132
 cryonics, 38–39
 dangers to, 177–178
 and food supply, 214
 Grand Challenges Task Force reports, 68–74
 Human Genome Project, 96
 and human performance, 103
 and lifestyle, 88
 medical progress, 16
 nanorobots, 43
 and neurotechnology, 130
 sensors, 13, 58
See also Cancer; Disabilities; Mental health
- Heinlein, Robert A., 218
- Heisenberg's uncertainty principle, 152
- Heller, Michael J., 105
- Henderson, Lawrence Joseph, 159
- Henson, Carolyn, 35
- Henson, Keith, 35, 37
- High-confidence infrastructure, 69
- High-Performance Computing and
 Communications (HPCC), 4, 16, 190
- Hinduism, 125
- History and Technology*, 44
- Hitler, Adolf, 38
- Hobbes, Thomas, 160
- Holland, John M., 98
- Holocaust survivors, 148
- Homans, George Caspar, 116, 159–166
- Homeland security, 11, 16–17, 68
 food supply, 94, 176
 grants, 90
 sensors, 59
- Homicide, 156
- Horgan, John, 8–9, 42
- Horn, Robert E., 102
- Howard University, 90
- Hughes, James, 199–200
- Human behavior, 151, 157–158
- Human capabilities, 198
- Human capital, 190
- Human Capital workshops, 195
- Human Cognome Initiative, 102
- Human emotions, 121
- Human enhancement, 14, 131–132
- Human genetic diversity, 190
- Human Genome Project, 89, 96
- Human performance, 15, 103–106, 131–132, 222, 228
- Hydrogen, 59, 212
- I**
- Iapetus, 215
- If* (magazine), 39
- Iijima, Sumio, 7
- Immortality, 124, 126, 222, 226–229
- Indecision, 150–152
- Indeterminacy, 152
- Industrial Revolution, 69, 104, 175, 196
- Information (convergence principle), 150, 155
- Information filtering, 227
- Information overload, 72
- Information society, 12, 101
- Information Technology (IT), 198, 213
 and agriculture, 92
 The Communicator, 133
 Grand Challenges, 68–74
 Human Genome Project, 96
 medical research, 105
 Moore's law, 18, 51–58
 NBIC, 1, 11–12, 103
 quantum computing, 60–63
 sensors, 58–60
 socioeconomic implications, 65
 and U.S. prosperity, 18
- Information Technology Research Initiative,
 The, 63–68
- Information theory, 155
- Innovation, 8–9
- Institute for Biomedical Technology, 90
- Institute for the Theory of Advanced Materials
 in Information Technology, 67
- Integers, 60–62
- Integrated circuits, 52–56
- Intel Corporation, 18, 52–55
- Intellectual property rights, 184
- Interaction agents, 147
- Interaction (convergence principle), 150, 153
- Interagency Working Group, 68
- Intercontinental nuclear missile (ICBM), 37–38
- International Space Station, 208
- Internet, 53, 75
- Internet Archive, 42, 176
- Interplanetary travel, 211–215
- J**
- Johnson, Peter C., 105, 125
- Johnston, Barry V., 168
- Jones, Neil R., 39
- Journal of Nanoparticle Research, The*, 2
- Joy, Bill, 45

244 Index

Joyce, James, 154
Judeo-Christian-Islamic, 125
Jumbotron lamp, 7–8
Jung, Carl G., 117–118
Jupiter, 209, 214–215
Jurassic Park, 31
Justice systems, 193

K

Kaliouby, Rana el, 121
Kennedy, Robert F., 37–38
Kevrekidis, Yannis, 66
Khrushchev, Nikita, 37–38
Kieliszewski, Marcia, 84
Kilby, Jack, 52
Knoll, Max, 6
Knowledge, access to, 134–135
Knowledge and Distributed Intelligence (KDI)
 program, 63–66
Kono, Junichiro, 66
Korolyev, Sergei, 37–38
Korzybski, Alfred, 144
Kroto, Harold W., 6–7
Kurzweil, Ray, 45, 122, 223

L

L-5 Society, 35–38
Lagrange 5 point, 35
Laing, R.D., 130
Language, 96–97, 134, 144, 147, 153–154
Language generation, 227
Language in Thought and Action, 144
Latency of response, 118
Launch vehicle, 211–213
League for Spiritual Discovery, 129
Leary, Timothy, 129–130, 132
Lebeck, Alvin, 66
Legitimacy, 193
Leukemia, 58
Leviathan, 160
Lexicographers, 115
Ley, Willy, 218
Librarians, 115
Library of Congress, 75
Life expectancy, 88, 105, 189
Lifestyle and health, 88
Lifetime tutor, 73–74
Limits, 27–28
Linguistics, 113–114

Literature, 183–186
Livestock, 92–95
Llinás, Rodolfo, 123
Loomis, Alfred Lee, 4–5
Loomis, Jack M., 136
Los Alamos National Laboratory, 62
Love, J. Christopher, 145
LSD (lysergic acid diethylamide), 129
Luddites, 176, 200
Lumsden, Charles, 100
Lynch, Zack, 130–132

M

MacGowan, Roger A., 223
Magic mushrooms, 129
Magical thinking, 125, 156
Makarov, Valeri, 123
Man into Superman, 39
Man Makes Himself, 103
Manhattan Project, 5
Manufacturing (industry), 196
Marburger, John H., 81
Market transition, 193
Maroudas, Dimitrios, 66
Mars, 213, 215–222
Martians, 45, 218
Marxism, 176, 179
Mass production, 198
Massachusetts Institute of Technology (MIT),
 10, 121
 Center for Bits and Atoms, 67
 Initiative on Technology and Self, 136
 L-5 Society, 35–38
 Media Lab, 41
 Radiation Laboratory, 5
Mathematics, 60–63, 145, 185
McAuliffe, William E., 133
McCray, W. Patrick, 44
McLuhan, Troy, 7
Medical research, 16, 105, 121–122
Medvedev, Roy, 130
Medvedev, Zhores, 130
Memantine, 133
Meme, 100
Memetics, 101–102
Memory boxes, 119–120
Memory (human), 118–120, 126–127, 133
Mental health, 13, 129
 and poverty, 185–186
 research, 82
Mersenne prime, 61

Meteoroids, 213–214
 Miah, Andy, 106
 Michigan State University, 10
 Microelectronics, 39, 54–55
 Microscopes, 6
 Microtechnology, 38–39
 Microtubules, 83
 Military applications, 16–17
 ENIAC, 74–75
 neural net research, 116
 sensors, 58–59
 Military weapons, 38
 Miller, George A., 119–120
 Mind children, 223
 Minnesota, University of, 90
 Minsky, Marvin, 114, 116–117
 Mir (space station), 214
 Miu, Carol, 198
 Modernity, 175–176
 Molecular assemblers, 40–43
 Molecular technology, 39
 Montemagno, Carlo, 56–57, 63
 Montgomery Blair High School, 147–149
 Moon landing (1969), 207
 Moore, Gordon, 18
 Moore, Wilbert, 163
 Moore's law, 18, 51–58
 Moral imagination, 147
 Morovec, Hans, 223
 Moskowitz, Sam, 31
 MRI (magnetic resonance imaging), 122
 Multiagent systems, 75
 Music, 183–186
 Myers-Briggs Type Indicator, 228

N

n-grams, 97
 Nano, 2–3
 Nano-bio convergence, 81, 83, 89–92
 Nano Sensors Group, 58
 NanoBank (database), 10
Nanobiotechnology, 81–82
 Nanocomputing, 66
 Nanocrystals, 58, 67
 Nanoelectronics, 54–56, 58, 66–67, 90
 Nanograph, 26
 Nanometer, 2, 39
 Nanonewton, 84
 Nanopanic, 44–46
 Nanoscale, 1–2
 Nanoscale bioinformatics, 67
 Nanoscale Science, Engineering, and
 Technology (NSET), 9–10, 103
 Nanoscale wires, 58, 67, 123
Nanosystems, 40–41
 Nanotech Facts, 7
 Nanotech Quartet, 34
 Nanotechnology
 Drexler on, 39
 term first used, 2
*Nanotechnology: A Gentle Introduction to the
 Next Big Idea*, 44
 Nanotechnology Center (University of South
 Carolina), 10
Nanotechnology White Paper, 95
 Nanotube, 7, 18, 54–56, 66, 95, 212
 NASA (National Aeronautics and Space
 Administration), 36, 75, 207
 Ames Research Center, 214
 Jet Propulsion Laboratory, 214–215
 and NNI, 209
 and U.S. Dept. of Defense, 213
 NASA-NSF research competition, 37
 National Aero-Space Plane, 213
 National Cancer Institute (NCI), 88–89
 National Coordination Office for Information
 Technology Research and Development, 68
 National Endowment for the Humanities, 75
 National Geographic Society (NGS), 45–46, 180
 National Institute of Standards and Technology, 68
 National Institutes of Health (NIH), 20, 68,
 81–82, 91, 148, 209
 National Library of Medicine, 75
 National Nanotechnology Infrastructure
 Network, 90
 National Nanotechnology Initiative (NNI), 3, 5,
 7, 44, 82, 209
 National Oceanic and Atmospheric
 Administration, 68
 National Research Council, 11, 213
 National Science and Technology Council
 (NSTC), 9–10, 68
 National Science Foundation (NSF), 9–12, 216, 222
 Directorate for Biological Sciences, 82–83
 Directorate for Computer and Information
 Science and Engineering, 222
 Directorate for Engineering, 4, 9
 Directorate for Mathematical and Physical
 Science (MPS), 9
 funding, 190
 Grant Proposal Guide, 82
 grants, 83, 96
 Human Capital, 195
 Information Technology (ITR) initiative, 63–66

National Science Foundation (NSF) *continued*
 Interagency Working Group, 68
 NASA-NSF research competition, 37
 Social, Behavioral, and Economic Sciences, 4
 supercomputer centers, 75
 workshops, 75, 192–195
 National Security Agency, 68
 National Virtual Observatory, 75
 Natural disasters, 59, 69, 70, 73
 Natural language processing (NLP), 73, 97
 Natural selection, 27, 95, 98–99, 154–155
 NBIC, 1, 11–12, 103
 conferences, 13–15, 57, 178
 ethics, 105
 Progress in Convergence, 106
 Neolithic Revolution, 103
 Network for Computational Nanotechnology, 90
 Networking and Information Technology
 Research and Development, 63
 Neural networks, 115–117, 126–127
 Neurobiology, 125
 Neurodevices, 130
 Neurodiagnostics, 131
 NeuroInsights, 130
 Neurons, 122–123
 Neuropharmaceuticals, 130
 Neuroscience, 113–114
 Neurotechnology, 128–133
 Neurotransmitters, 85
 New Renaissance, 19
 Newell, Allen, 114
 News media, 45
 Newton, Sir Isaac, 30–31, 84, 86
 Nexialist, 143–144, 146
 Nicotine, 128
Nineteen Eighty-Four, 187
 NOAA (National Oceanic and Atmospheric
 Administration), 68
 Nobel Prize, 6, 7, 42
 Non-spatial government, 199–200
 Normal curve, 153
 Normal distribution, 153
 North Carolina State University, 90
 Nuclear power plant explosion (dramatized), 45
 Nuclear rockets, 212
 Nutrition, 104

O

Oak Ridge National Laboratory, 26
 Oard, Douglas, 148

Office of the Deputy Undersecretary of Defense
 for Science and Technology, 68
 O’Grady, Richard, 85
 O’Neill, Gerard K., 35–37, 47
 Online prediction questionnaire, 45–46, 180–189
 Optical tweezers, 84
 Ordway, Frederick I., 223
 Oscilloscopes, 6
 Oxygen, 59, 212

P

Pal, George, 218
 Panic, 44–46
 Papert, Seymour, 116–117
 Pareto, Vilfredo, 159
 Pareto Circle, 159
 Parsons, Talcott, 159–163, 166
 Partnerships for Advanced Computational
 Infrastructure (PACI), 75
 Patient safety, 70
 Pattern variables, 162
 Peace, 16, 92, 201
 Pennsylvania State University, 90
Perceptrons, 116–117
 Performance overhang, 19
 Peripheral nerve stimulation, 122
 Perseid (meteors), 214
 Perseus Project, 75
 Personality capture, 223–225
 Personality research, 129
 Personality transfer, 222–228
 Personality types, 185
 Peterson, Christine, 40
Pew Internet and American Life Project, 184
 Philosophy, 113–114
 Photographic memory, 120
 Photolithography, 52–54
 Physics first policy, 147
 Picard, Rosalind, 121
 Piconewton, 84–86
 Planck length, 30
 Pollack, Jordan, 99
 Pollution, 69, 71, 73, 93–94, 188–189
 sensors, 13
 Population rates, 182–183
 Porod, Wolfgang, 123
 Postindustrial society, 42, 197
 Poverty, 185–186, 191, 195
 Practical limits, 26–28
 Pragnell, Festus, 30

Precision agriculture, 92–93
 Prehistory, cognitive technologies, 124–128
 President's Information Technology Advisory
 Committee (PITAC), 63–65
 Preskill, John, 67
Prey (novel), 31–32, 45
 Prime numbers, 60–62
 Principles for convergence, 149–156
 Privacy, 46
 Private enterprise, 186–188
Problem of Cancer, The, 87–89
Progress in Convergence, 106
 Prohibition (of alcohol), 128, 133
 Propanolol, 133
 Propulsion, 212–213, 221
Prospect of Immortality, The, 39
 Prospective analysis, 10
 Prosthetics, 91
 Protein databases, 75
 Proteomics, 16, 18, 82, 88, 96
 Protestantism, 125, 128, 160–161
 Protoavis, 26–28
 Psychedelic drugs, 128–130, 132
 Psychedelic Movement, 128–130
 Psychiatry, 126, 185–186
 Psychoanalysis, 125
 Psychology, 113–114, 125, 127
 Public attitudes, 45, 103
 Public key cryptography, 61

Q

Quantum, 30
 Quantum computing, 60–63
 Quantum dots, 67, 95, 123
*Quantum Information Science and Technology
 Roadmap*, 62
 Quantum nanotechnology, 67
 Quantum tunneling, 6
 Qubits, 62

R

Radiation, and space travel, 214–215
 Radiation Laboratory at MIT, 5
 Radio-frequency identification (RFID), 93
 Rapid prototyping, 33
 Ratner, Daniel, 44
 Ratner, Mark, 44
 Rawls, John, 157

Real Mars, The, 220
 Rebellion, of students, 163
 Recommender and reputation systems, 227
 Reddy, Raj, 96, 97
 Reductionists, 164
 Relative power, 18
 Religion, 124–128, 156–159, 165–167, 193, 226
 cognitive theory, 127
 and science, 126–127
 Religious cults, 101
 Remediation (environmental), 94–95
 Renaissance, 19
 Renewable energy, 186–189
 Reproduction, 181–183
 Research, 113–114
 agricultural, 93
 design, 148
 funding, 190
 human memory, 118–120, 133
 internships, 148
 medical, 89, 105
 opportunities, 82
 predictions, 188–189
 retina, 123–124
 Research Triangle Park, 190
 Rhea, 215
 Ribosomes, 44
 Riecken, Doug, 198
 Robinett, Warren, 222
 Robots, 136, 179, 221, 223
 space probes, 209
 and space travel, 213–215
 Robots (medical), 43
 Robots (Pollack's), 99–100
 Rockets, 27, 37–38, 209, 211–213, 218
 Roco, Mihail (Mike) C., 2–4, 9, 11, 185
 Dr. Nano nanograph, 26
 Rohrer, Heinrich, 6
 Rome, 27
 Rome, Leonard, 84–85
 Rubin, Philip, 133–134
 Rural Advancement Foundation International
 (RAFI), 176
 Ruska, Ernst, 6
 Rust, Roland, 198
 Rutherford, Ernest, 29

S

Saturn, 209, 213–215
 Scanning tunneling microscopes, 6

- Scheff, Thomas, 130
 Schism, 101
 Schnapp, Bruce, 83
 Science, 185
 goals of, 149–150
 and religion, 126–127
Science: the Endless Frontier, 189–190
 Science fiction, 8, 29–35, 39, 216–219
Science (journal), 39
Scientific American, 8–9, 42
 Scott, Norman, 94
 Second Life, 7
Selfish Gene, The, 100
 Semiconductor industry, 18
 Sensoceuticals, 131
 Sensor networks, 58–59
 Sensors, 13, 58–60
 Sensory replacement, 136, 227–228
 Sententia, Wrye, 131–133
 September 11, 2001, 66
 Serebrov, Alexander, 214
 Service industries, 196
 Services science, 198
 Sewell, William H., 168
 Sham, Lu, 66
 Shannon, Claude E., 155
 Shelley, Toby, 178–180
 Shils, Edward, 161, 163
 Shockley, William, 152
 Short-term memory, 118–120
 Simon, Herbert A., 114, 155
 SimUniverse, 73
 Skinner, B.F., 116, 163–165
 Skylab, 35–36
 Slots (AI), 114
 Small Business Innovation Development Act, 90
 Small Business Innovation Research (SBIR)
 grants, 90–91
Small Wonders, Endless Frontiers, 11
 Smalley, Richard E., 6–7, 42–44
 Smart homes, 227
 Smith, Corey, 84
 Smith, Edward Elmer, 216
Snow Crash, 32–34
 Sociable technologies, 136
Social Behavior, 164–165
 Social capital, 195
 Social classes, 163
 Social relations, 159–163
 Social Relations Department (Harvard), 159,
 167–168
 Social sciences, 4, 156, 163–165, 185, 190–192,
 198
 and biology, 100–101
 birth rate, 181–183
 and KDI, 63
 memetics, 101
 NanoBank, 10
 Societal implications, 4, 178
 conferences, 9–11, 15
 education, 145
 ethics, 156–159
 NSET, 9–11, 103
*Societal Implications of Nanoscience and
 Nanotechnology*, 2, 9–11
Sociobiology: The New Synthesis, 100
 Socioeconomic implications, 65, 199–200
 Sociology, 155, 167
 Soils, 93
 Solar energy, 36, 187, 213
 Solar flares, 215
 Solar satellites, 36–37
 Solar system, 215–222
 Soviet Union, 190, 191
 Space Age, 207
Space Cadet, 218
 Space exploration, 207
 the giant leap, 207–211
 interplanetary travel, 211–215
 personality transfer, 222–228
 solar system, 215–222
 space debris, 213–214
Space Patrol, 217–218
 Space shuttle, 36, 38, 207–208, 212–213
Spaceflight Revolution, The, 36–37, 207
 Speech recognition, 227
 Speech simulation, 134
 Speech synthesis, 227
 Spielberg, Steven, 148
 Spintronics, 66–67
 Spiritual magic, 125–126
 Spohrer, James C., 155, 196, 198
 Sporulation, 101
 Srivastava, Mani, 59
 Stalin, Joseph, 38
Stanford Encyclopedia of Philosophy, The,
 113–114
 Stanford University, 90
 Stanton, Christopher, 66
Star Wars, 217, 219
Stargate, 219
 Stark, Rodney, 127, 165

Statistical science, 153–154
 Stephenson, Neal, 32–34
 Sternberg, Saul, 118–120
 Strategic limits, 26–28
 Strategic planning, 71
 Strategic research, 190
 Stratification system, 163
 Structural functionalism, 160–163
 Structural–computational theory, 114–117
 Structure, 153
Structure of Social Action, The, 161
 Suicide, 157, 160
 Sun, Lizhi, 66
 Supercomputing, 54, 65, 71, 74–75
 Supersonic ram jet, 212–213
 “Surface Tension,” 30
Survey2000, 180–189
Survey2001, 45–46
 Swaine, Michael, 117
 Swihart, Mark, 66
 Szasz, Thomas, 130

T

Taniguchi, Norio, 2, 39
 Taxonomies, 72, 102
 Teaching methods, 185
 Technological convergence, 9–15
 Technological religions, 125
 Telecommunications, 11
 Telepresence, 228
 Telescopes, 216
 Television programming, 217–219
 Temperance, 128
 Terraforming, of Mars, 220
 Terrorist attacks, 61, 66, 69
 Tesla, 122
 Texas Instruments, 52
 Thagard, Paul, 113–114
 Theory of evolution, 95
Theory of Religion, A, 127, 165–166
 Thermodynamics, 155
Thing, The, 39
Time (magazine), 37
 Tissue Informatics Corporation, 105
 Titan, 213, 215
Tom Corbett, Space Cadet, 217
 Tonn, Bruce, 199
 Transforming tools, 17
 Transistors, 18, 52–54, 152

Translation, 227
 Transportation system, 70
 Trends, 180–189
 Tsibliyev, Vasili, 214
 Tsiolkovsky, Konstantin, 232
 Tunneling, 6
 Turkle, Sherry, 136
 Tuxedo Park, 4–5

U

Ulysses, 154
Unbounding the Future: The Nanotechnology Revolution, 39–40
 Undecidability, 152
 Unemployment, 176, 179, 186
 Unification of science

- behavioral social science, 163–167
- convergers, 143–149
- ethical principles, 156–159
- principles for convergence, 149–156
- social relations, 159–163
- and technology, 1, 10, 19–20, 127

 Universal access interfaces, 227
 University of California, Los Angeles, 10, 85, 90
 University of California, San Diego, 75
 University of California, Santa Barbara, 10, 90
 University of Michigan, 90
 University of New Mexico, 90
 University of South Carolina, 10
 University of Texas, Austin, 90
 University of Texas at Martin, 61
 University of Twente, 90
 University of Washington, 90
 Uranium, 5
 U.S. Centers for Disease Control and Prevention (CDC), 88
 U.S. Department of Agriculture (USDA), 92–94
 U.S. Department of Defense, 213
 U.S. Office of Science and Technology Policy, 81
 User modeling, 227

V

Vacancy chains, 153
 van Vogt, A.E., 143–144
 Variation, 150, 153–154
 Vaults (cell vesicles), 85
 Venneri, Samuel, 209

250 Index

Venus, 209, 213, 215
Vesicles, 57, 63, 83–85
Virtual environments, 105
Vision, 35
Voxel, 122
Voyage of the Space Beagle, 143

W

Walters, Paul A., 129
Wang, Wayne, 58
War of the Worlds, 218
Water delivery, 93
Water quality, 69, 94, 214
Wayback Machine of the Internet Archive, 42, 176
Wearable sensors, 13
Weber, Max, 125, 160
Weil, Andrew, 130
Weil, Vivian, 157
Welch, Raquel, 30
Western religion, 124–127
Wet nanotechnology, 81
Wheeler, John Archibald, 155
When Worlds Collide, 218
White, Harrison C., 152, 197
Whitesides, George, 145
Will, George, 126
Wilson, Edward O., 13, 100, 127, 158, 185
Winnicott, D.W., 129
Wired, 45
Witte, James, 45

Wolbring, Gregor, 105
Working memory, 119
World Factbook, 182
World governments, 187–188
World systems theory, 179
World War II, 5, 190
World Wide Web, 53, 228

X

X-33 (launch vehicle), 213
XOR (exclusive-or) problem, 117

Y

Yale University, 86–87
Yeates, Todd, 84
Yellow Book, 161–163
Young Lady's Illustrated Primer, A, 33–34
Yugoslavia, 193–194

Z

Zero gravity, 214
Ziegler, Alan, 158
Zimmerman, Robert, 214
Zipf, George Kingsley, 153–154
Zipf distribution, 153–154
Zubrin, Robert, 213