

Author index

- Abelson, Harold, 74, 102
 Agre, Philip E., 63, 110, 143, 218, 225, 239,
 259, 263, 272–273, 310–312, 317, 321, 323,
 326, 327, 328, 332, 333
 Ajjanagadde, Venkat, 79
 Allen, James, 326
 Almasi, George S., 68
 Alterman, Richard, 317
 Anderson, John R., 18, 317, 323, 324
 Anderson, John S., 152, 327
 Arbib, Michael A., 37, 39, 308–309, 318, 333
 Aristotle, 29, 318
 Ashby, William Ross, 53
 Athanasiou, Tom, 316
 Atkinson, J. Maxwell, 245
- Bachnik, Jane M., 321
 Bajcsy, Ruzena, 333
 Ballard, Dana H., 333
 Bartlett, Frederic C., 108
 Barwise, Jon, 29, 230, 232–233
 Batali, John, 111
 Baxandall, Michael, 333
 Becker, Howard S., 322
 Becker, Joseph D., 333
 Beer, Randall D., 309
 Berggren, Douglas, 319
 Berkeley, Edmund C., 86
 Berlin, Isaiah, 28
 Berman, Bruce, 50, 316
 Berwick, Robert C., 63
 Billig, Michael, 329
 Birkhoff, Garrett, 131
 Black, Max, 35, 318–320
 Blake, Andrew, 333
 Bloomfield, Brian P., 316, 318–319
 Bloor, David, 36
 Bobrow, Daniel G., 229
 Boden, Margaret A., 235, 316, 331
 Bolter, J. David, 4, 89, 102, 320, 323
 Bono, James J., 36–37
 Boole, George, 86, 89–90, 96
- Bordo, Susan, 323
 Borgida, Alexander, 331
 Boulding, Kenneth E., 226
 Bourdieu, Pierre, 259, 320, 324
 Boyd, Richard, 35–38, 320–321
 Brachman, Ronald J., 229–230
 Bratman, Michael E., 328
 Brentano, Franz, 235
 Brooks, Rodney A., 63, 308, 330, 333
 Brown, John Seely, 259
 Brown, Peter, 323
 Brown, Roger Langham, 29
 Bruner, Jerome S., 317, 322
 Buckland, Michael K., 312
 Burge, Tyler, 228, 231, 332
 Burt, Edwin, 29
 Button, Graham, 14
- Cantor, Paul, 320
 Carbonell, Jaime G., 325
 Cartwright, Nancy, 320
 Chalmers, David, 322
 Chang, C. C., 228
 Chapman, David, 10, 79–80, 155, 263, 273,
 317, 325–327, 332–333
 Chatila, Raja, 330
 Chien, R. T., 147
 Chomsky, Noam, 28, 80–83, 329
 Churchland, Patricia S., 84
 Churchland, Paul M., 316
 Clark, Andy, 85
 Clements, Alan, 89
 Cole, Michael, 63, 258
 Collins, Harry M., 21, 52
 Comaroff, John L., 259
 Copeland, Jack, 316
 Coulter, Jeff, 14, 96, 316, 328
 Coyne, Richard, 320
 Craik, Kenneth J. W., 223–225, 331
 Crevier, Daniel, 316
 Culler, Jonathan, 42
 Cummins, Robert, 235

362 *Author index*

- Davis, Philip J., 50
 de Kleer, Johan, 124, 140, 325, 330
 De Mey, Marc, 321
 Dennett, Daniel C., 242, 316, 332
 Denning, Peter J., 68
 Derrida, Jacques, 39–43, 95, 118–119, 320–321
 Descartes, René, xi, 2–3, 9, 29, 49, 83, 87, 103, 154, 235–236, 316, 323, 327
 Devisch, Renaat, 321
 Devitt, Michael, 318
 Dewey, John, 322
 Dietrich, Eric, 331
 Dixon, Michael, 255
 Dodds, E. R., 49
 Donald, Bruce R., 327, 329
 Donnellan, Keith S., 232
 Doyle, Jon, 124, 140, 167, 174, 325, 329, 330
 Drescher, Gary L., 254
 Dreyfus, Hubert L., xi, xiii, 9, 18, 21–22, 52, 78, 107, 235, 239, 242, 265, 316, 320–332
 Durfee, Edmund H., 329
- Edelman, Shimon, 51
 Edwards, Paul N., xiv, 15, 31–32, 37, 50, 53, 86, 96, 316–317, 321, 326
 Elias, Norbert, 321
 Engeström, Yrjö, 63, 317
 Evans, Gareth, 232
- Fahlman, Scott E., 169
 Feenberg, Andrew, 45
 Feigenbaum, Edward A., 18
 Feldman, Jerome A., 18, 84, 123, 229
 Fikes, Richard E., 144–147, 150–155, 160, 162, 326
 Firby, R. James, 327
 Fleck, James, 316n5
 Fodor, Jerry A., 17, 85, 126, 175, 235, 257, 328–329
 Forbes, David L., 317
 Forbus, Kenneth D., 325
 Ford, Kenneth M., 226, 316
 Forgy, Charles L., 128
 Forsythe, Diana E., 33, 316, 321
 Foucault, Michel, 30–32
 Fox, Mark S., 327
 Franklin, Stan, 316
 Frege, Gottlob, 227–228, 231–232, 331
 Friedman, Sarah L., 317
- Gadlin, Howard, 322
 Gallistel, C. R., 2
 Gardner, Howard, 316
 Gardner, Karen M., 50, 316
- Garfinkel, Harold, 5, 157, 233, 316, 322, 329
 Garvey, Thomas D., 333
 Gasser, Les, 324
 Genesereth, Michael R., 84
 Geoghegan, William, 317
 Georgeff, Michael P., 326–327
 Ghallab, Malik, 147
 Gibson, James J., 255, 322
 Gilbert, G. Nigel, 316
 Gilbreth, Frank B., 150
 Ginsberg, Matthew, 327
 Giralt, Georges, 147
 Glaser, Barney G., 322
 Goldberg, David E., 309
 Goldstein, Larry Joel, 75
 Goody, Jack, 63, 259
 Greeno, James, 317
 Grossberg, Stephen, 333
 Grosz, Barbara J., 317
 Gupta, Naresh, 330
 Güzeldere, Güven, 4
- Habermas, Jürgen, 319
 Hammond, Kristian J., 63, 311
 Hampden-Turner, Charles, 50
 Hanks, Steve, 326
 Hanks, William F., 233
 Harré, Rom, 63, 319
 Haugeland, John, 2, 67, 316, 332
 Hayes, Patrick J., 226, 229, 252, 316, 330, 332
 Hayes, Philip J., 325
 Hayes-Roth, Barbara, 148–149, 317, 326–327
 Hayles, N. Katherine, 53, 320
 Hegel, Georg W. F., 318, 320, 329
 Heidegger, Martin, xi, xii, 2, 5, 8–9, 21, 107, 236–239, 242, 244, 314, 316, 319, 320–332
 Heims, Steve J., 53
 Hendler, James, 163, 326–327
 Hennessy, John L., 70
 Heritage, John, 245, 301, 316
 Hesse, Mary B., 37, 39, 318, 320
 Hill, Jane H., 318
 Hill, William C., 111
 Hillis, W. Daniel, 68
 Hobbes, Thomas, 2
 Hoc, Jean-Michel, 56, 325
 Hodges, Andrew, 323
 Holland, John H., 309
 Holmes, Walter G., 150
 Holmqvist, Berit, 317
 Hoos, Ida R., 319
 Hopcroft, John E., 226
 Horn, Berthold Klaus Paul, 225
 Horswill, Ian D., 63, 259, 272, 310, 328, 333
 Humboldt, Wilhelm von, 28

Author index

363

- Hurlbert, Anya, 51
 Husserl, Edmund, 39–41, 52, 235–236, 238–239, 319
 Hutchins, Edwin, 63
 Ilyenkov, E. V., 320
 Jaynes, Julian, 327
 Jirotko, Marina, 14
 John–Steiner, Vera, 259
 Johnson, Mark, 49–50, 321
 Johnson, Michael P., 333
 Johnson–Laird, Philip N., 126
 Jordan, Michael I., 325
 Jordanova, Ludmilla J., 319
 Joseph, Mathai, 102
 Kaelbling, Leslie Pack, 286, 309–310, 327
 Kaplan, David, 232
 Keller, Evelyn Fox, 11
 Kempton, Willett, 249
 Kirsh, David, 63, 308
 Kitano, Hiroaki, 68
 Klein, Jacob, 74
 Klein, Raymond, 284
 Knoblock, Craig A., 327
 Knoespel, Kenneth J., 41
 Knuth, Donald, 73, 327
 Koch, Christof, 284
 Kolodner, Janet L., 325
 Kopytoff, Igor, 247
 Kowalski, Robert A., 96, 130
 Kraft, Philip, 15
 Kripke, Saul, 229, 232
 Kronfeld, Amichai, 233
 Kuhn, Thomas S., xiv, 23, 36
 Laird, John E., 174, 217
 Lakoff, George, 49–50, 316
 Lange, Trent E., 79
 Lansky, Amy L., 63, 327, 329
 Larkin, Jill, 333
 Lashley, Karl S., 80, 142–143, 325, 329
 Latour, Bruno, 40, 63, 259
 Lave, Jean, 6, 63, 157, 258, 322, 324, 327–328
 Layton, Edwin T., 315
 Leary, David E., 50
 Leder, Drew, 238
 Leith, Philip, 96, 316
 Leont'ev, A. N., 259, 316–317, 322
 Lèspérance, Yves, 332
 Lighthill, James, 316
 Lilienfeld, Robert, 319
 Lucy, John, 318
 Lugowski, Marek W., 50
 Lynch, Michael, 40, 259
 Lyons, Damian M., 309
 Mackenzie, Ann Wilbur, 327
 Macs, Pattie, 307, 333
 Mahoney, James V., 333
 Mahoney, Michael S., 322, 323
 March, James G., 108
 Markley, Robert, 29
 Markus, Gyorgy, 319
 Marr, David, 19–20, 69, 123, 175, 225
 Martin, Emily, 34
 Martin, Janet, 319
 Maturana, Humberto R., 57, 322
 Maunsell, John H. R., 323
 McAllester, David, 325, 327
 McCarthy, John, 80, 84, 252, 316, 330
 McClamrock, Ron, 63, 238
 McCorduck, Pamela, 316
 McCulloch, Gregory, 223
 McCulloch, Warren S., 96
 McDermott, Drew, 15, 147, 325–326, 329
 McReynolds, Paul, 36
 Mead, George Herbert, 322
 Mel, Bartlett W., 333
 Merleau-Ponty, Maurice, xi, 4, 238, 242, 244, 256
 Meyer, Jean-Arcady, 307
 Miller, George A., 1, 5, 50, 80, 143–144, 146–150, 226, 271, 315, 316, 317, 321, 325–326
 Miller, Jonathan, 316
 Minsky, Marvin, 81, 83–84, 172, 229, 254, 305, 325
 Mirowski, Philip, 34
 Moerman, Michael, 245
 Montgomery, David, 150
 Montgomery, Scott L., 319
 Munson, John H., 147, 326
 Nardi, Bonnie A., 317
 Neches, Robert, 324
 Neisser, Ulric, 316
 Newell, Allen, 18, 54–56, 74, 77, 80–84, 96, 128, 142–143, 146, 149, 157, 174, 217–218, 225, 305, 316, 322–323, 325–326
 Newman, Denis, 258
 Nietzsche, Friedrich, 320
 Nilsson, Nils J., 84, 144–147, 150–155, 160, 162, 326
 Noble, David F., 315
 Norman, Donald A., 63, 79
 Nye, Andrea, 96, 232
 Olafson, Frederick A., 331

364 *Author index*

- Ong, Walter J., 96
 Onians, Richard Broxton, 49
 Ortner, Sherry B., 324
- Pea, Roy D., 324
 Pepper, Stephan C., 319
 Perelman, Chaim, 329
 Perry, John, 29, 228, 230, 232–233
 Pervin, Lawrence A., 322
 Piaget, Jean, 254
 Pickering, Andrew, 40
 Pinker, Steven, 85
 Pollack, Martha E., 317
 Popper, Karl R., 322
 Preston, Elizabeth F., 237, 316
 Provan, Gregory, 325
 Putnam, Hilary, 232, 316
 Pylyshyn, Zenon W., 85, 226, 257
- Quillian, M. Ross, 229–230
- Radin, George, 70
 Raibert, Marc H., 63
 Rescher, Nicholas, 329
 Richards, I. A., 320
 Ricoeur, Paul, 319
 Rodis-Lewis, Geneviève, 327
 Rogoff, Barbara, 258
 Rorty, Richard, 2, 223, 321
 Rosenbloom, Paul S., 174, 217
 Rosenschein, Stanley J., 309–311
 Roszak, Theodore, 316
 Rumelhart, David E., 79, 229, 333
 Russell, Bertrand, 228
- Sahlins, Marshall, 320
 Sanborn, James C., 327
 Sandewall, Erik, 252
 Sapir, Edward, 32–33
 Sartre, Jean-Paul, 161
 Schank, Roger C., 63, 254, 324–325, 327, 333
 Scher, Bob, 327
 Schiller, Dan, 312
 Schön, Donald A., 10, 34, 50, 319–320
 Schopman, Joop, 323
 Schoppers, Marcel J., 271, 327
 Searle, John R., 323, 331–332
 Sengers, Phoebe, 318
 Shore, John, 327
 Silverstein, Michael, 33, 233
 Simmons, Reid G., 177
 Simon, Herbert A., 11, 18–19, 54–56, 80–83, 128, 142–143, 146, 149, 157, 322, 325, 333
 Simson, Graeme C., 331
 Singer, Dorothy G., 254
- Singley, Mark K., 324
 Smith, Brian C., 42, 76, 95, 232, 241, 317, 331
 Smolensky, Paul, 79, 333
 Spinosa, Charles, 320
 Stallman, Richard M., 325
 Staudenmaier, John M., xiv
 Steels, Luc, 307
 Stefik, Mark, 19
 Sternberg, Robert J., 321
 Subramanian, Devika, 251
 Suchman, Lucy A., 6, 8, 30, 157–159, 316, 327
 Sudnow, David, 327
 Sullivan, Harry Stack, 322
 Sun, Ron, 79, 323
 Sussman, Gerald Jay, 74, 102, 124, 140, 169, 317, 325, 330
- Tambe, Milind, 218
 Tanz, Christine, 254
 Tarjan, Robert, 64
 Tarski, Alfred, 228
 Tate, Austin, 326
 Taylor, Charles, 316
 Taylor, Frederick, 150
 Tenenbaum, Jay M., 333
 Thorndike, E. L., 324
 Toth, Jozsef A., 226
 Toulmin, Stephen E., 323
 Touretzky, David S., 79
 Truesdell, Clifford A., 316
 Turbayne, Colin Murray, 50, 319
 Turing, Alan M., 11, 20, 64, 103, 139, 323
 Turkle, Sherry, 86
- Ullman, Shimon, 275, 279–280, 282, 284–285
- van Caneghem, Michel, 130
 van Gelder, Tim, 79, 85
 VanLehn, Kurt, 111
 Varela, Francisco J., 57, 307, 322
 Vico, Giambattista, 28
 Vygotsky, L. S., 5, 258–259, 316, 322, 328
- Warren, Scott, 328
 Webber, Bonnie, 317
 Weizenbaum, Joseph, 20
 Weld, Daniel S., 326–327
 Wertsch, James W., 258–259, 316
 West, David M., 50, 52
 Wheelwright, Philip Ellis, 320
 Whitehead, Steven D., 333
 Whorf, Benjamin Lee, 29–32, 318
 Wiener, Norbert, 53

Author index 365

Wilensky, Robert, 56, 327	Woolard, Katherine, 33
Wilkins, David E., 147	Woolgar, Steve, 17, 40, 316–317, 328
Winnicott, Donald W., 306	
Winograd, Terry, xi, 21–22, 229, 232, 316	Young, Robert M., 34
Winston, Patrick H., 169, 255	
Wittgenstein, Ludwig, 21, 157, 228, 239	Zimmerman, Michael E., 319
Woods, William A., 229	

Subject index

- abstraction, xv, 39, 41, 169
 - digital, 2, 66, 70, 87, 90–91, 100
 - vs. implementation, 12, 66–71, 73, 75–77, 79–87, 91, 93–94, 96, 98, 100–104, 229, 303, 322
- action(s)
 - serially ordered, 18, 58, 98, 111–112, 144, 147, 151–155, 157, 169–173, 179, 181, 183, 185, 194, 210, 226, 270, 273, 275, 293, 301, 310, 325
 - as topic of research, xi–xii, xv, 3–5, 7, 28, 31, 41, 83, 107, 111, 113, 142–143, 145–147, 150–151, 153, 155, 157, 161, 163–164, 167, 222, 244, 253, 256–257, 271, 323–324, 327–329, 331
- activity, 20, 51, 63–64, 95, 141, 295, 328–329
 - AI theories of, 5–6, 55–56, 143, 146, 148–149, 156–159
 - vs. cognition, 4, 27, 53
 - in dependency networks, 163, 185, 187, 189, 191–192, 200, 204, 210
 - disciplinary, 12, 30–31, 40
 - emergent organization of, 7, 58, 59–61, 106–107, 109–110, 113, 164, 246–247, 261–262, 271
 - intentionality in, 235–239, 242–244, 253
 - modeling of, 18, 125, 162, 176–177, 215, 220–221, 264–266, 268, 278, 297–301
 - representation in, 28, 222, 227–229, 231–232, 258–259, 311
 - vision in, 256–258
- activity theory, 317
- algorithms, 19, 21, 63–64, 75, 123, 132–133, 135–136, 163, 181, 217
- Amord, 124
- anthropology, 6, 10, 29–30, 32, 62, 259, 318, 321
- architectural theories, 83–85, 229–230, 254
- architecture
 - of buildings, 10, 42
 - of computers, 68, 70, 75, 77–78, 81, 83, 91
 - of models, 79, 84, 105, 129–130, 174–175, 217–220, 225, 257, 265, 268, 278, 283, 295–297, 307–308, 310–311, 317
- artificial intelligence, xi–xii, xiv–xv, 3–5, 27, 57–58, 67, 80, 89, 106, 156, 169, 256, 271, 297, 317, 321, 329
 - design practice of, 95, 160, 216, 246–247, 249, 255
 - discourse of, 51–52, 142, 145–146, 163, 177, 223, 321
 - history of, 3, 31–32, 96, 316, 323
 - infrastructure of, 78
 - interactionist, 53–54, 61–62, 104, 307, 310–311
 - mentalist, 52, 56, 86–87, 223, 306
 - methodology of, 10–17, 30, 64–65, 220
 - phenomenological critique of, 8–9, 20–23, 107, 235, 239, 330
 - theory of action in, 6, 325–326
 - theory of representation in, 222, 242, 250, 253–254, 261
- artificial life, 307
- automata, 307–309
- autonomous agents, 307
- behavior, 49, 85, 142–144, 148, 163, 210, 271, 321
- behaviorism, 1, 5, 49–50, 80–81, 83, 85, 108, 142, 156
- biology, 6, 30, 34, 54, 61–62, 321, 333
- bits, xv, 71–72, 75, 100, 135, 275–276, 280, 282–283, 286
- blocks world, 168–170, 172, 175, 183, 215–216, 220, 264, 330
- body, 2, 20, 52, 87–88, 103, 154, 159, 189, 219, 232, 234, 238, 256, 295–296, 314, 321
- C, 75
- Cartesianism, 2, 4, 22–23, 61, 63, 86, 88, 103, 154, 158–159, 161, 163, 236, 312
- center, 42–45, 52, 156, 232, 304
- central system, 175, 210, 219, 265–269, 273–277, 279–281, 284–287, 298, 329

Subject index

367

- chaining
 - backward, 130, 140–141, 330
 - forward, 124, 130, 180, 330
- chunking, 174, 217–218
- clocks
 - computer, xv, 98–100, 102, 130–131, 171, 177, 180, 183, 214, 265, 273, 276–277, 280, 285, 309
 - mechanical, 7, 36, 55, 122, 154, 320
- cognition, 4, 7, 27, 31, 52–53, 56, 63, 77–79, 81, 84–86, 178, 323
- cognitive penetrability, 257
- cognitive science, 17, 38, 48–49, 66, 77, 174
- cognitivism, 36, 49–50, 80–81, 85–86, 96, 142, 150, 156, 315, 317, 328, 331
- compilers, 67, 70, 74–77, 178, 310, 323
- computer programs, 2, 6, 8, 10, 14–15, 17–18, 21, 55–56, 67, 73–76, 81, 101–102, 112, 123–124, 126, 130–131, 136, 141, 144, 146, 151, 174, 179, 217, 221, 247, 260, 263, 273, 275, 294, 309, 311, 313–314, 321–322, 326–328, 330
- computers, 1–2, 6, 10, 12–15, 18, 20–22, 38, 41–42, 45, 50–51, 54, 66–67, 70–71, 75, 81, 83, 86, 89, 96, 100, 102, 106–107, 146, 229, 247–248, 250, 263, 274, 301, 313–314, 316, 320–321, 328
- connectionism, 22, 78–80, 84–85, 229, 333
- consciousness
 - phenomenological, 235, 237, 239, 242, 257, 331
 - practical, xi–xiii, xv, 32–33, 44, 47, 105, 108, 302, 316, 319
- control theory, 34
- conversation
 - disciplinary, 10, 13, 15, 22, 61
 - as topic, 96, 164, 222, 237, 306, 324
- correspondence
 - between computations and their realization, 68–70, 73, 75–76
 - of representations to reality, 43–44, 228, 248, 261, 303
- critical technical practice, xii–xiii, 3, 14, 22–24, 27, 56, 104–106, 260, 302, 312–313
- culture, xii, xiv, 3, 5, 7, 9, 14, 20, 22, 28–29, 31–34, 36, 39–40, 61, 63–64, 86, 107, 146, 157, 164–165, 233, 236, 238–239, 242, 244, 246, 248, 250, 256, 258, 262, 303, 306–307, 316
- cybernetics, 53, 81, 326
- deconstruction, 16, 39, 42, 47, 53, 234, 314
- dependency maintenance, 113–120, 122–125, 128, 130–131, 135–136, 139, 141, 162, 166–168, 170–172, 174–175, 177, 180–181, 185, 189, 191–192, 194, 197, 200, 210, 214–215, 217, 219, 265, 311, 325, 330
- design, xv, 10–11, 17, 19–20, 62–64, 66–69, 78, 83, 94–95, 97, 104–105, 108, 113, 150, 155, 164, 180, 239, 241–242, 246–247, 249–250, 255, 257, 261, 263, 275, 278, 282, 286, 311–312, 314–315
- designers, 67–70, 89, 93, 95, 99–100, 105, 151, 172, 246, 252, 255, 279
- difference reduction, 272–273
- discourse, xii–xiv, 14–15, 21, 23, 27, 30–34, 36–38, 43–48, 51–54, 58, 78, 86, 104, 142, 146, 223, 239, 302, 304–305, 307, 312, 315, 317, 321, 331
- displacement, 39, 44, 304, 313
- dynamical systems theory, 309
- dynamics
 - disciplinary, 2, 35, 38, 47
 - vs. machinery, 28, 57–65, 105–108, 160, 162–166, 187, 198, 215, 246, 249–250, 254, 257–258, 261–262, 265–266, 271–273, 277, 295–299, 308–310, 312
- economics, xiv, 34
- education, 259
- effacement, 39–42, 217
- efficiency
 - indexical, 230, 232, 245, 253, 262
 - technical, 67–68, 70–71, 73, 76, 117, 130, 139, 159, 229–230, 242, 317
- embodiment, 4–5, 21, 40, 56, 87–88, 96, 104, 149, 218, 230, 238–239, 242–246, 256, 261, 295–296, 310, 321, 324
- engineering, 12–13, 15–17, 20, 22–23, 45, 56–57, 61–62, 66–67, 70, 83–84, 146, 150, 158, 161, 172, 214, 220, 230, 242, 244, 246, 257, 262, 283, 303, 314–315
- entities, deictic, 243, 251–253, 257, 266–267, 297, 310
- execution
 - of instructions to computers, 68, 76–77, 101, 333
 - of instructions to people, 18, 111
 - of plans, 5–7, 56, 143–156, 158–160, 164, 177–179, 261, 265, 303, 325–328
- execution monitoring, 147, 271–272
- executor, 145, 147, 151, 154, 162, 176, 183, 233, 268, 271–272
- expert systems, 50
- expressive power, 155, 223, 229, 327
- feedback, 1, 53, 81, 185, 326
- FIXPOINT, 311
- focus, 218–219, 244, 257, 280, 284, 295–298

368 *Subject index*

- Fortran, 67, 322
 frame problem, 226
 frames, 254, 332
- Galois theory, 74
 gates, xv, 91–93, 97, 118, 120–121, 123, 128–129, 134, 170–171, 176, 180, 191–192, 218, 265, 274, 286
 General Problem Solver (GPS), 18, 55, 81, 142, 326
 generative theories, 82–85, 96
 geometry, 39–41, 70, 226, 264, 268
 goals, 18, 58, 145–146, 152, 155, 174, 177, 183, 185, 187, 189, 194, 200, 214–216, 258, 263–266, 297, 301, 310, 327, 330
- hermeneutics, xv, 24, 44, 314
 hierarchical oppositions, 42–45, 232, 304
 hierarchy, 5–6, 50, 56, 67, 72, 143, 147–149, 214, 277, 309
 history, xiv, 9, 11, 15, 23, 30–33, 39, 49, 52, 67, 74, 96, 102–103, 142, 145, 233, 235, 241, 246, 250, 303, 314–316, 320–321, 323, 333
- implementation, 19, 68, 114, 130, 136, 151, 239, 265
 vs. abstraction, 12, 66, 68–71, 73, 75–77, 80–85, 87–88, 90, 93, 96, 98–100, 102–104, 229, 254–255, 283, 290, 303
- improvisation
 in everyday life, 7–8, 28, 53, 63, 109–113, 156–157, 161–162, 176–177, 258, 261, 263–264, 272, 299, 327–328
 technical, 11, 15, 32
- indexicality, 218, 222, 230–234, 241, 243, 245, 248, 251, 255–256, 267, 332
- information theory, 1–2, 33–34
- intentionality, 6, 11, 87, 104, 222, 230, 234–236, 238–239, 242–243, 246, 261
 deictic, 244–245, 248, 250, 255, 262, 331–332
 objective, 244, 250, 332
 representational, 235, 237
- interactionism, 53–54, 60–62, 64, 79, 87–88, 104–105, 157, 159, 161, 234, 260–261, 271, 304–307, 310–311, 313–314, 322
- introspectionism, 80
- inverse optics, 51, 225, 257
- KL-ONE, 229
- knowledge
 disciplinary, 10, 27, 29, 32, 44, 319
 as topic, 3, 17, 22, 42, 48, 50, 74, 84, 108–109, 126, 142, 164, 170, 173, 197, 220, 223, 228–229, 235, 247–249, 251, 253, 255, 262, 272–273, 303, 311, 332
- KRL, 229
- language
 assembly, 75–76
 disciplinary, 4, 6, 14–15, 28–35, 39, 41–43, 47–49, 54–55, 104, 177, 242, 302, 304, 312, 319–321
 formal, 81, 86
 machine, 75
 natural, xi, 21–22, 41, 52, 82, 84, 176, 232–234, 237, 251–252, 258, 273, 332
 programming, 67, 73, 75, 78, 86, 116, 124, 139, 167, 254, 271, 286, 325
 representational, 229
- latches, 91, 98–100, 310, 323
- lattice theory, 131–136
- learning
 disciplinary, 14, 29
 as topic, 41, 63, 84, 106, 111, 141, 145, 169, 177, 191, 215–217, 220, 253, 258, 265, 269, 324
- Life, 124–125, 128, 130, 136, 139, 141, 180, 329–330
- linguistic ideology, 33
- linguistics, 28, 30, 82, 230, 318, 324, 332
- Lisp, 73, 75, 116, 126, 271, 286
- logic
 Boolean, 89–90, 96, 114, 139
 combinational, 98–100, 103, 106, 120, 130, 175–177, 180–181, 185, 261–262, 265–266, 271, 276, 285, 299
 digital, 89–91, 96, 118, 275, 280, 286, 292, 320
 first-order, 116, 118, 229, 251, 333
 formal, 11, 39, 74, 77–79, 84, 86, 96, 113, 117, 167, 223, 228, 252, 316, 320
 mathematical, 19, 309
 modal, 229
 nonmonotonic, 120
 philosophical, 29–30, 52, 228
 practical, xiv, 3, 32, 38–39, 44–45, 47–48, 50, 56, 66–67, 78–80, 143, 150, 158, 160–161, 223, 302–303, 305, 320
- logic programming, 130, 167
- Logic Theorist, 81
- machinery, 1–3, 19, 21, 30, 50, 67, 69, 75, 78, 104, 114, 125, 130, 261, 317
 vs. dynamics, 20, 28, 57–58, 60–65, 78, 105–106, 108, 164, 217, 219, 246, 256–258, 261–262, 271–273, 277, 283–284, 296, 308, 312, 315
- machinery parsimony, 62–63, 246, 249, 265, 272, 277–279, 283, 298, 307, 310

Subject index

369

- margins, 11–12, 39, 43–47, 52, 64, 95, 156, 232, 234, 304–305, 314
- mathematics, xiii, 1–3, 11, 13–14, 17, 27, 29–30, 33, 38–41, 45–46, 52–53, 55, 64, 66, 74–76, 81–82, 86, 91, 93–96, 102, 151, 155, 229–230, 251, 269, 308–310, 316, 321
- memory
 - in computer architecture, 15, 70–72, 91, 100, 135, 252, 323
 - as topic, 85, 143, 176, 265, 312, 325
- mentalism, 49–54, 56, 60, 64, 77, 80, 85–87, 96–97, 102–104, 143, 151, 154–156, 163, 222–223, 225–228, 234, 260–261, 265, 302–307, 314, 329
- metaphor, 1–2, 4, 9, 15, 20, 27–28, 30, 32–39, 44–47, 49–50, 52–53, 64, 85–86, 89, 97, 100, 102–104, 155–156, 163, 166, 223, 260, 262, 287, 300, 302–305, 307, 312–313, 315–317, 319–320
 - generative, 34–35, 38–39, 44, 46–47, 49, 52–53, 302–304, 306, 313, 319
 - root, 319
 - surface, 50, 304
- microworld, 155, 226
- mind, 2–3, 5, 27, 49–50, 52, 54, 86–88, 100, 102–103, 143, 223, 234, 244, 306–307, 318, 321
- model theory, 223, 228–229, 232–233, 241, 261, 310
- modeling, xi–xii, xiv–xv, 9–12, 14, 17, 31, 38–39, 45–47, 52, 57, 65, 77–80, 82, 95, 113, 143, 149–150, 155, 169, 175–176, 179, 265–266
- modularity, 69, 158–159, 175, 177, 273, 308, 329
- motor control, 97, 114, 161, 171, 175–176, 265, 274, 286
- narration, 2, 9, 14–15, 42, 50, 55, 78, 95–96, 101, 106, 149, 317
- neurophysiology, 69, 79, 81, 83–84, 96
- nonspecificity, 75, 77–78, 253–254, 262
- ontology
 - deictic, 243–244, 251, 332
 - objective, 218–219, 237, 243, 245, 247–248, 251, 254–256, 262, 266–267, 310
- OPS5, 125
- parallel computing, 68, 84, 97, 130, 132, 230, 274–275, 294
- Pascal, 67
- pattern matching, 77, 126, 130, 180, 191, 217–218, 221, 265, 267
- Pengi, 263, 265–273, 275–280, 283–301, 310, 313
- Pengo, 263–266, 268, 271–273, 283–285, 288, 295, 297–300
- perception, xv, 3, 28, 30–31, 39, 41, 176, 210, 216–217, 219, 225, 245, 247, 252, 255–256, 266, 295, 303, 310, 312, 330
- phenomenology, 5, 9, 28, 54, 62, 234–239, 243–244, 307
- philosophy, xi–xiii, 3–5, 9, 11, 14, 21–23, 28–30, 36, 39–45, 49, 67, 71, 86–87, 103, 107, 113, 117, 123, 166, 228, 230, 232, 236–237, 239–240, 242, 260, 262, 313–315, 319, 321, 329, 332
- physics, 2, 12, 34, 66–67, 90–91, 95, 103, 183, 249, 331
- physiology, 3, 34
- PLANEX, 145, 150–154, 158–159
- planning, 6–9, 17, 48, 85, 142, 144–146, 148–150, 154–155, 158–164, 177, 216–217, 223, 226, 233, 250, 265, 268, 271–272, 301, 303, 313, 326, 328–329
 - interleaved, 147, 154
- Plans, 5, 143–144, 147–148, 150, 226, 325–326
- plans, 85, 145–164, 176–179, 181, 183, 194, 216, 226, 261, 311, 327–330
 - in activity, 8, 63, 157–158, 161, 328
 - AI theories of, 56, 317
 - definition of, 142, 145–146, 327
 - vs. dynamics, 58
 - and Pengi, 264–266, 268, 270–273, 297
 - and planning view, 7
 - vs. routines, 108, 111
 - and STRIPS, 144–145, 150–155, 158–160, 162, 326
- Platonism, 49, 51–52, 96, 227, 230, 232–233
- pointers, 71, 73–74, 80, 229, 265
- practical reality, 11–13, 15–16, 28, 46, 62, 305
- precision, 13, 18, 35, 80, 228, 230, 312, 321
- presence, 39, 44
- problem solving, 54, 64, 81, 143–145, 157, 174, 177, 272, 317, 326
- problems
 - in everyday life, 7–9, 51, 54–55, 261
 - technical, xiii, 11, 13, 17, 19, 54, 64, 163, 303–304, 316
- production systems, 77, 79, 128–130, 217–218, 330
- Prolog, 76, 167
- proprioception, 185, 189, 191, 194
- psychologism, 52, 96
- psychology, 1–3, 16–18, 20, 27, 36–37, 49–51, 56–57, 60, 71, 78, 80, 82, 86, 89, 96, 106, 141, 146, 150, 164, 227, 236, 244,

370 *Subject index*

- psychology (*cont.*)
 252, 257–258, 262, 307, 314–315, 322, 329
- psychophysics, 278–279, 285
- quantification, 74, 77, 118, 253–254, 318, 330
- RA, 174, 177, 179–181, 197, 214–215, 217, 219–220, 287, 313, 326
- race condition, 98–99
- real time, 101–102, 180, 214, 218
- reasoner, 113–115, 117–118, 124, 130, 162
- reasoning
 disciplinary, 108
 nonmonotonic, 170, 218
 as topic, xv, 11, 17, 31, 48, 51, 84, 86, 89, 98, 121, 145, 151, 153–154, 157, 159, 174–175, 177, 179–181, 183, 185, 191, 198, 200, 210, 214, 220, 253–255, 327
- recursion theory, 81
- reference
 indirect, 72–73, 76
 linguistic, 35–36, 222, 232–233, 235, 251
 logical, 75, 77, 227
 representational, 230, 239, 241, 247, 262
- reflexive level of analysis, xiv, 27, 46–47, 105, 260, 307
- register-transfer model, 71–72, 75, 77–79, 87, 333
- repair theory, 111
- representation, xi, 4, 28–29, 40–41, 46, 56, 63, 106, 218, 246, 250–254, 261–262, 268, 296, 300–301, 324, 330–331
 of action, 7, 146–147, 273, 324, 329
 AI theories of, 19, 22, 63, 74, 78–79, 216–217, 220, 222–223, 225–227, 229–230, 239, 241–242, 246, 249–250, 253, 313, 317–318, 322, 327, 330, 333
 deictic, 251–255, 258, 262–263, 266–267, 297, 333
 objective, 251, 253–254, 266–267, 297
 philosophical theories of, 39–41, 227–228, 232, 234–235, 243, 331
 in RA, 169, 194, 219
 sociological theories of, 157, 259
 visual, 20, 275, 298
- reversal, 39, 43–44, 53, 64, 156, 232, 304
- Rex, 286
- routines, 108–112, 272, 289, 324, 328
 visual, 269, 275, 290, 295, 298, 333
- rules, xi, 18, 21–22, 55, 77, 82–83, 89, 123–139, 141, 167–175, 177, 180–181, 183, 185, 187, 189, 191–192, 194, 197–198, 200, 204, 210, 214–217, 228, 239, 262, 330
- running arguments, 161–162, 166, 169, 172, 176–177, 179, 265, 330
- science, xiv, 5, 9, 11, 16–17, 23, 29–30, 34–37, 39–41, 45–46, 57, 60, 62, 80, 86, 161, 237, 303, 314–316, 319
- scripts, 254, 324, 333
- search, 143–144, 174, 218, 250, 272–273, 311
- semantic networks, 229, 331
- semantics
 compositional, 228, 232
 machine language, 67, 126, 130, 167, 198, 330, 332
 natural language, 14, 29–30, 37, 39, 228, 233
 representational, 79, 84, 94, 229, 241, 252, 254
- sense, 227–228, 232, 241
- seriality, xv
 action, 142, 163, 280, 295–296
 computer architecture, 68–69, 71–73, 75–77, 81, 83, 100
- servomechanisms, 1–2, 6, 36
- simulation
 computer, 54, 125, 138, 155, 159, 162, 168–169, 250, 271, 274, 278, 286, 329
 mental 51, 63, 86, 145, 149, 164, 272, 298
- situated automata, 309
- situation semantics, 29, 252
- SOAR, 174, 217–218, 330
- social sciences, xi–xii, 4, 156
- socialization, 5, 159, 164, 238, 242, 252, 256, 258, 261
- sociology, 34, 36, 230, 246, 249, 321
- soul, 49, 87, 103, 154, 318
- stabilization, 311
- stack, 76
- state machines, 100, 104
- stimulus chaining, 108, 142
- STRIPS, 145, 151–154, 158–159, 326
- substantive level of analysis, xi, xiv, 27, 105–106, 160, 239, 260, 262
- subsumption, 308
- supplement, 95
- symbols, 11, 28, 52, 74–75, 78, 80, 85, 113, 132, 144–145, 151, 175, 218, 247, 251, 254, 258–259, 272
 constant, 77, 79, 253–254, 286, 310
- technical level of analysis, xiv, 28, 106, 160, 261–262
- technical schemata, 15, 21, 34, 38, 53, 78–79, 234
- temporality, 91, 101–102

Subject index 371

- trade-offs, 56, 67–68, 71, 76, 79, 90, 100, 155–156, 159, 164, 226–227, 253, 261, 283–284, 286, 312, 327–328
- transfer, 60, 181, 191–192, 194, 197–198, 204, 210, 215–217, 253, 324
 - backward, 112
- triangle table, 152–154
- Turing machines, 11, 139
- uncertainty, 147, 154, 156, 163
- universal subgoal, 174
- variables, xv, 71, 74–79, 85, 118, 126–133, 139–141, 170, 180, 197, 217–219, 253–254, 262, 266–267, 287–288, 292, 297
- virtual machine, 75
- vision, 69, 84, 169, 219, 222–223, 225, 254, 256–257, 265, 274, 277, 333
- visual markers, 270, 278, 280–284, 286–292, 294–297
- visual operations, 269–270, 275–280, 283–291, 294–296, 298, 300, 333
- visual system, 20, 51, 69, 84, 121, 175, 225, 256–258, 263, 269–270, 273–275, 278–280, 283, 285–286, 296–297, 300, 323, 333
- wires, xv, 69–70, 91–92, 94–95, 97–100, 104, 114, 265, 274, 277, 280, 286–287, 312, 333
- world model, 51, 56, 74, 155, 164, 219–221, 223, 225–226, 248, 256–257, 261, 265–266, 269, 298, 303, 321, 330