

# Index

## A

- Action-perception couplings
  - cognition, 126
  - cognitive development, 190
  - mirror neurons, 132, 150
  - sandwich metaphor, 106
  - social phenomena, 166
  - vision, 11, 55, 94, 106
- Adaptationist explanation, 25, 270
  - natural drift, 102
- Anecdotal cognitivism, 26
- Artificial intelligence, 5
  - active vision, 94
  - artificial embodied agent, 71
  - Dartmouth conference, 65
  - embodied AI, 63
  - embodied AI as strong AI, 97, 282
  - inception of embodied AI, 83
  - new AI, 83, 274
  - physical embodiment, 65, 282
  - physical situatedness, 65
  - strong embodiment, 98, 279
  - subsumption architecture, 94
  - symbol-grounding problem, 72, 96, 176
  - weak embodiment, 98, 279
- Autopoietic systems, 102, 278
  - metacellulars, 103
  - uni-cellulars, 103

## B

- Behaviorism, 30, 182
  - antimentalism, 32
  - criticism of, 35, 39, 48, 61, 62, 64, 65
  - criticism of equipotentiality, 62
  - equipotentiality, 32
- Biological determinism, 109

Biological reductionism, 4

Bodily mimicry, 117

Bodily movements, 104, 198

body image, 105, 143

body schema, 106, 143

kinesics, 136

language, 135, 137

language metaphors, 138

linguistic meaning, 142

mirror neurons, 134

proxemics, 136

Bodily postures, 57, 118, 120

Bodily states, 122

cognitive states, 149

feeling states, 122

Body, 212

artificial system, 98

body image, 105, 273

body in motion, 104

body in motion in robots, 276

body schema, 273

characterization of, 12

embodied actions as a helping hand in

shaping and sharing thoughts, 152, 211

means and an end in social interaction

and cognition, 211

means and end in social interaction, 150

representational device, 152, 230

role and relevance of, 1, 263

social body in motion, 192, 252

social resonance mechanism, 149, 211

## C

Chinese room argument

strong AI and weak AI, 71, 277

Chumfo, 273

- social chumfo, 274
  - Cognition
    - as activity pattern, 73
    - as biological phenomenon, 99, 101
    - as computationalism, 67
    - as embodied, 81
    - as symbol manipulation, 68
    - body in motion, 104
    - body required, 97, 269
    - computational explanations of, 69
    - cultural cognition, 174
    - cultural differences, 10
    - for action, 101
    - higher level aspects, 12
    - lower level aspects, 12
    - offline cognition is body-based, 94, 130
    - origins of, 137
    - role and relevance of, 1, 263
    - role of gesturing, 142
    - role of the body, 94, 98
    - to guide action, 94
  - Cognitive development, 190
    - as tactile-kinesthetic apprenticeship, 104
    - biological and sociohistorical factors, 51, 278
    - developmental stages, 46, 191
    - elementary mental functions, 49
    - gesture-speech relations, 142
    - higher mental functions, 49
    - in robots, 65, 275
    - phylogenetic development, 56, 269
    - primary level, 192
    - relation to motor development, 107, 279
    - role of gesturing, 196
    - role of movements, 106
    - roles of emotion, 194
    - social body in motion, 193
    - social interactions, 49, 55
    - socially embodied perspectives, 190
    - socio-cultural factors, 47
  - Cognitive map, 62
  - Cognitive neuroscience, 127, 131
    - logically related neurons, 133
  - Cognitive science
    - cognitive revolution, 65
  - Cognitive system
    - unit of analysis, 93, 187
  - Communication
    - bodily mimesis, 145
    - characterization of, 175
    - conversation of gestures, 57
    - conversation of significant gestures, 57
    - metaphors of, 175, 181
    - mirror neuron system, 135
    - protoconversations, 170
    - role of gestures, 145
    - speech and gesture, 136
    - symbolic interaction, 173
    - third-order structural couplings, 103
  - Comparative studies, 269
    - criticism of chimpocentrism, 271
    - dogs, 272
    - enculturated apes, 272
    - parrots, 271
  - Computationalism, 66
    - criticism of, 69, 116
  - Computer metaphor of mind, 65, 175
    - hallmark of computationalism, 66
    - information theory, 67
    - mind-body dualism, 68
    - reaction against, 2, 38
    - representational bottleneck of, 91
    - Turing machine, 64
  - Computer-supported cooperative work, 6, 287
  - Connectionism, 72
    - artificial neural networks, 72
  - Consciousness, 22, 30, 39, 49, 58
    - as animate forms, 104
    - feedback theory, 58
    - intersubjectivity, 169
    - the role of agency, 107
    - verbalization, 43
  - Cybernetics, 63, 136
- D**
- Dance metaphor, 177, 189, 203, 259
    - characterization of, 177
    - criticism of, 180
    - methodological perspectives, 188
  - Dichotomy
    - between individual and social, 108
    - between mind and body, 4, 64, 116
    - between nonverbal and verbal, 136, 177, 265
    - speech and gesture, 135
  - Distributed cognition, 5, 92, 182
    - characterizations of, 187
    - cognitive ethnography, 216
    - neglect of embodiment, 190, 264
  - Dualism, 4, 22, 263
    - attack against, 25, 61
- E**
- Ecological approach

- affordance, 39
  - Egocentric speech, 51
  - Embodied cognition
    - body in motion, 104
    - characterization of, 13, 82, 96
    - epistemological approach, 88
    - metaphysical approach, 88
    - offline cognition, 89, 95, 119, 130, 231, 237
    - online cognition, 89, 95, 119
    - six views of, 89
    - what kind of body, 4, 98, 280
  - Embodied cognitive science, 81, 274
  - Embodied practice, 128, 197, 229, 243
    - narrative practice, 198
  - Embodied re-activation, 222
  - Embodied representations, 118, 122
    - emulator theory, 126
    - offline representations, 130
    - simulations, 125
  - Embodied simulations, 125, 126, 130, 194
    - criticism of, 128
    - gestures, 146
  - Embodiment
    - as cognitive premise, 85
    - body as means and end, 150
    - body as means and end in social interaction, 151
    - characterization of, 12, 81, 84
    - definition of, 99
    - different aspects of, 96
    - ecological perspective of, 87
    - embodied actions as a helping hand in shaping and sharing thoughts, 151, 211
    - endo-organismic embodiment, 165
    - exo-organismic embodiment, 165
    - handicaps, 10
    - levels of, 85, 86
    - means and an end in social interaction and cognition, 211
    - mechanistic embodiment, 97
    - minimal definition of, 99
    - misunderstandings, 8
    - new AI, 83
    - notions of, 97
    - phenomenological embodiment, 97
    - radical embodiment, 4, 87, 146
    - representational device, 152, 211
    - roles in social interaction, 148
    - simple embodiment, 4, 87
    - social dimension of, 108
    - social resonance mechanism, 149, 211
    - strong embodiment, 98
    - weak embodiment, 98, 124
  - Emotional experience, 123
  - Emotions, 178, 191
    - embodiments of, 122
    - mirror neuron system, 134
  - Empirical design
    - case study, 216
    - naturalistic inquiry, 216
    - scientific rigor of empirical work, 267
  - Enactivism, 101, 102, 230, 260
  - Ethology, 33, 186
    - neglect of, 66
  - Evolutionary explanation
    - expressions, 24
    - intersubjectivity, 127
    - language, 135
    - speech-gesture in language, 147
- F**
- Facial expressions, 57, 117, 118, 136, 149, 177, 178, 221, 225, 269
    - emotional, 121
  - Feelings, 196
  - Functionalism, 29, 68, 69
    - disregard of neurological aspects, 72
    - expert systems, 68
- G**
- General law of cultural development, 52, 148, 197
    - robots, 277
  - Genetic epistemology, 43, 180
    - constructivism, 45
    - gestures, 142
  - Genetical epistemology, 193
  - Gestalt school, 38
  - Gesture study
    - characterization of, 11
    - classification of gestures, 140
    - communicative theory of gesture, 143
    - criteria for gesture, 140
    - emblems, 140
    - gesture-speech match, 226, 230, 233
    - gesture-speech mismatch, 142, 224, 230
    - great apes, 270
    - intentional mismatch, 237, 285
    - origins of, 136
    - speech-gesture match, 222
    - symbiotic gesture, 145, 223, 226, 230
  - Gestures, 177
    - bodily mimesis, 145
    - communicative function, 143

- communicative movements, 147
  - conversation of gestures, 57, 172, 183, 252
  - embodied actions, 144
  - expressive movements, 143
  - joint attention, 171
  - Mead's loop, 148, 230
  - mirror neurons, 146
  - motor theories, 127, 147
  - pan-human ability, 140
  - representational, 144, 222
  - significant symbols, 147
  - symbolic meaning, 144, 184
  - synchronized with speech, 140
- H**
- Human ethology, 38
  - Human mind
    - biological aspects, 2
    - cultural aspects, 2
    - embodied cognitive science, 2, 283
    - plasticity embodiment, 273
    - role of social interaction, 57
  - Human-computer interaction, 5, 280, 289
  - Human-robot interaction, 277, 280, 282
- I**
- Imitation, 125, 132, 166, 188
  - Information theory, 65, 136, 175
  - Information transmission metaphor, 175
    - characterization of, 175
    - criticism of, 176
  - Instrumentalism, 54
  - Intelligence
    - embodiment, 70
    - role of embodiment, 71
    - situatedness, 70
    - Turing test, 64, 275, 277
  - Intentionality, 169, 174, 186, 189, 194, 277
    - as action-perception couplings, 187
    - development of, 189, 194
    - in robots, 279, 281
    - robots, 280
    - we intentionality, 249, 250
  - Intentions, 169, 173, 182, 190
    - interactive nature of, 185
    - traditional view of, 185
  - Interaction
    - agent-environment, 4
    - agents-social environments, 5
    - chemical metaphor, 9
    - co-regulated interaction, 177
    - co-regulation, 178
    - co-regulated, 233
    - cross-modal interaction, 148
    - electrical metaphor, 9
    - robot, 64, 279
  - Intersubjectivity, 124, 170
    - characterization of, 168
    - primary intersubjectivity, 169
    - secondary intersubjectivity, 169
    - shared manifold of, 127
    - socially embodied perspective, 197
  - Introspectionism, 29
- J**
- Joint actions, 173, 174, 185, 238, 246, 250, 252, 253, 273
  - Joint attention, 171, 270
- L**
- Language
    - action-sentence compatibility effect, 138
    - action-understanding, 139
    - as symbolic thought, 67
    - Babkin reflex, 137
    - bee dancing, 172
    - bodily mimesis, 145
    - common ground, 185
    - embodied, 136
    - embodied simulations, 138
    - grounded in embodiment, 135, 137
    - indexical hypothesis, 139
    - integrated speech-language-gesture system, 137, 196
    - interaction tool, 173
    - kinesthetic image schema, 138
    - meaning differences in gesture and speech, 141
    - means for social interaction and communication, 172
    - representational nature of, 172
    - sign language, 140, 270
    - significant symbols, 58
    - signing bonobos, 272
    - socially collaborative activity, 172
    - surrogate situatedness, 148
  - Lines of behavioral research
    - anthropomorphical, 26
    - mechanistic, 26
  - Linguistics, 135

**M**

- Manual gestures, 57
- Meaning, 179, 184, 186, 190, 228, 251
  - results of embodied experience, 83, 251
  - shared meaning, 224, 236
- Mechanistic line
  - criticism of, 34, 63
- Mediated act, 49
- Mental models, 66, 129
- Mind
  - as embodied, 9
- Mind-body problem, 5, 54
- Mind-reading, 125, 132, 167, 173
  - mirror neuron system, 134
  - rooted in socially embodied experience, 197
  - theory of mind, 167, 197
- Mirror neuron system
  - Mead's loop, 148
- Mirror neurons, 125, 131, 139, 198
  - gestures, 146
  - relational nature, 147
  - social resonance mechanism, 150

**N**

- Nonverbal behavior, 1, 109, 136
- Nonverbal communication, 1, 136, 177, 198, 265

**P**

- Perceptual symbol systems, 123, 127, 138
- Phenomenology, 42, 243, 250
  - bodily aspects of, 105, 125
- Phylogenetic explanation, 25, 270
- Pointing, 52, 58, 171, 189, 194, 223, 226, 251
  - bodily mimesis, 146
  - declarative pointing, 171
  - imperative pointing, 171
  - in robots, 278
  - Mead's loop, 148
- Primatology, 186, 269
- Psychological tools, 50, 195, 197
  - language, the most significant, 50, 184, 197
  - mediated act, 50

**R**

- Reflex arc
  - as sensory-motor coordination, 30
  - concept in psychology, 55

- misinterpretation of, 29
- notion of, 28
- sandwich metaphor, 106
- sensory-motor coordination, 55, 94
- social act, 58

**Representations**

- action-oriented representations, 94
- corporeal representations, 183
- cued, 172
- detached, 172
- emergent products of social interaction, 182
- external representations, 188
- formal representational languages, 67
- hallmark of computationalism, 66
- in higher-level cognition, 95, 124, 182
- joint representations, 173
- misinterpretation of, 56
- role of, 66

**Robots**

- androids, 274, 280
- behavior-based robots, 84, 274
- humanoids, 274, 277

**S**

- Scaffolding, 2, 3, 87, 91, 93, 279
  - epistemic actions, 91
  - gestures, 223
  - notion of, 93
  - relational, 230
  - social scaffolding, 107, 148, 194, 197, 198
  - socio-cultural situatedness, 277
  - symbolic off-loading, 95, 229
  - via socio-cultural situatedness, 96, 189, 251, 272, 280
- Schema theory, 54
- Schemata, 44
  - accommodation, 45
  - assimilation, 45
  - equilibrium, 45
- Self, 57, 168, 170, 193
  - attitude of the other, 60
  - primitive self, 194
  - self-experienced locomotion, 193
  - socially constructed, 61
  - socially embodied perspective, 198
- Shared attention
  - in robots, 278
- Signalization, 49, 172
- Signification, 50, 51, 147, 172
- Situatedness

- characterization of, 81
    - new AI, 83
  - Social cognition
    - characterization of, 167
    - definition of, 167
    - dimensions of, 128
    - embodied social and cultural phenomena, 168
    - enactment, 134
    - mirror neurons, 131
    - neglect of the body, 109, 116
    - relational, 59, 182, 191, 197
    - research approach, 167
    - role of embodiment, 5, 116, 118, 123, 263
    - social and cultural phenomena, 174
    - socially embodied generalizations, 260
    - theory of mind, 173
  - Social duality, 58
  - Social embodiment, 103, 116
    - attitudes, 120
    - emotions, 121
    - social embodiment effects, 117
    - social perception, 120
  - Social interaction
    - beyond social insects, 165
    - body as means and end, 150
    - body as representational device, 152
    - categorizations of, 169
    - co-ordinations of behaviors, 166
    - dyadic interaction, 170
    - embodied actions as a helping hand in shaping and sharing thoughts, 151
    - embodied perspective, 162
    - embodied simulation, 130
    - first-hand perspective, 148
    - fundamental functions of the body, 148
    - information-processing, 168
    - linguallaxis, 173
    - Mead's loop, 148, 151, 252
    - means and end in relational social interaction, 192
    - metaphors of, 175, 181
    - neglect of the body, 109
    - primary level, 170, 192
    - reflective interaction, 172, 173
    - relational, 59, 182, 190, 191, 197
    - role and relevance of, 1, 63
    - role of embodiment, 5, 263
    - secondary level, 170, 192
    - social insects, 163, 184
    - social resonance mechanism, 149, 192
    - socially embodied generalizations, 260
    - symbolical interaction, 172
    - tertiary level, 172, 195
    - third-hand perspective, 148
    - third-order structural couplings, 162, 269
    - throphallaxis, 163, 172
    - triadic interaction, 170
  - Social learning, 166, 179, 189, 193–195
    - in robots, 275, 281
  - Social-technical gap, 6, 287
  - Socially embodied perspective, 198
  - Socially interactive robotics, 6, 274, 280
  - Socially interactive technology, 6, 274
  - Speech
    - embodied gesticulation, 141
  - Stigmergy, 163, 164
  - Structural couplings, 99, 101, 162
    - in robots, 278
    - second-order, 103
    - third-order, 103, 162
  - Surrogate situatedness, 89, 148, 229, 254
- T**
- Theoretical framework
    - body as a representational device, 211
    - body as means and an end in social interaction and cognition, 211
    - body as social resonance mechanism, 211
    - definition of, 7, 256
    - embodied actions as a helping hand in shaping and sharing thoughts, 211
    - embodied and relational nature of situated interaction and cognition, 206
    - historical perspective, 204
    - illustrations of, 206, 285
    - relationship to empirical work, 255
    - socially embodied aspects of, 255
    - state of the art perspective, 205
    - synthesis with the empirical work, 260, 284
  - Theory of evolution, 23, 54, 101, 270
  - Theory of schema, 55
  - Tool use, 184
    - tooling up others, 184, 253, 273
- U**
- Umwelt, 34
    - effective environments, 91, 272
    - functional circle, 35, 64

**V**

Vitalists, [23](#)

positivism, [266](#)

**W**

Western philosophical tradition, [22](#), [74](#), [272](#)  
embodied point of view, [97](#)

**Z**

Zone of proximal development, [52](#), [180](#), [189](#),  
[197](#)