

Index

- Aalto, Alvar, 123
Abstract human nature, 66, 67
Action research, 160
Activity cycles, 144–146
ADD, *see* Attention Deficit Disorder
Additive effect variables (preschool play areas), 163
ADHD, *see* Attention Deficit Hyperactivity Disorder
Adolph Coors Company, 302
Advanced Green Builder Demonstration (AGBD), 309
See also color Figure 19-3
Aesthetic(s):
 and architecture as visual art, 314, 315
 attachment to water, 44–45
 derived from connection to nature, *see* Environmental aesthetic
 epigenetic rules of, 22–24
 genetically-influenced “aesthetic programs,” 232
 natural, 228–235
 and needs of children, 174
 sensory, *see* Sensory aesthetics
 and water as life force, 51
Aesthetic judgment, epigenetic rules of, 23
Aesthetic response, neurological basis for, 61–63
Affection for natural world, as design attribute, 14
After-school program professionals, 170
AGBD (Advanced Green Builder Demonstration), 309
See also color Figure 19-3
Age, as design attribute, 9–10
ALA Journal of Architecture, 300
Air:
 as design attribute, 7
 natural ventilation, 123–125
Air pollution, ix, 218, 220
Aizenberg, Joanna, 35
AKT Development, 210
Albany, California, 191
Alberts, Anton, 342
Aldersey-Williams, Hugh, 33
Alexander, Christopher, 71, 73, 75, 76, 80, 336, 344
Alhambra, Court of Lions, 266
Alienation from nature, ix
Alleys, converted, 192–193
See also color Figure 10-55
American Electric Power, 218
American Planning Association, 290
American Sports Data, 207
Analog, natural, 340
Angina treatment, 108–109
Animals:
 in children’s play areas, 175
 and child- vs. wildlife-friendly green spaces, 191–192
 as design attribute, 7
 human-animal interactions, 71–73
 loss of wildlife, 215
 resilient relationships among, 233
 sharing homes with, 289
 variation and similarity in, 232
 zoo habitats for, 69
Animal motifs, as design attribute, 8
Anita B. Gorman Discovery Center, Kansas City, Missouri, 348
Appalachia, coal mining in, 217–220
Appleton, J., 234, 235, 265, 266, 269, 338
Arcata, California, community forest, 286
Arches, as design attribute, 8
Arch Coal, 217
Archer, Mike, 289
Architectural transcendence, 74–76
Architecture. *See also* Living architecture
 biophilic strategies/priorities for, 329–330
 processes of building vs. design in, 59–60
 reason for existence of, 244
 survival-advantageous characteristics of, 263–275
 unworkable approaches to, 317
Arkadien Asperg Housing Estate, Stuttgart, Germany, *see* color Figure 4-19
Arlington Row, Bibury, Gloucestershire, United Kingdom, 265
Arnheim, Rudolph, 236, 239–240
Art:
 in healthcare settings, 96–97, 103, 340
 living architecture as, 314, 315
 sacred, 315, 320–321
 water as, 52, 53
Artificial intelligence, 72
Association of Children’s Museums, 172
Atlanta Summer Olympic Games asthma rates, 157
Attachment:
 as design attribute, 14
 and real vs. artificial settings, 222
 to universe and beliefs, 74
 values/constructs of, 44–45
Attention, 158, 231
Attention Deficit Disorder (ADD), 157–158, 209, 328
Attention Deficit Hyperactivity Disorder (ADHD), 157–158, 328
Attention restoration theory, 136–137
Attraction to nature, as design attribute, 14
Atwater Commons, Middlebury College, Vermont, 245, 249–251
Audubon Nature Preschool, Edwin Way Teale Learning Center, 165
Augustine, St., 108
Austin, Texas, bats in, 292–293
Australia:
 biophilic spirit in, 293–295
 children’s mobility study in, 174
 children’s use of school play areas in, 209
 ecosystem mimicry campaign in, 38
 green school projects, 284
Automotive traffic, danger of, 156–157
Autotype, 35
Awe, as design attribute, 14
Backyard Habitat Program (NWF), 220
BAE, 39
Balance, 232, 352–353

- Ballard branch, Seattle Library, Seattle, Washington, 278, 279
- Bank of America Tower, New York City, 349–350, 354–355
See also color Figure 23-5
- Bank of Astoria, Manzanita, Oregon, *see* color Figure 21-2
- Barcelona, Spain, 48
- Barnes, Marni, 208
- Bastille viaduct, Paris, France, 18
- Bat Conservation International, 292
- Bateson, Gregory, 308
- Baubiologie, 314
- Beale, Bob, 289
- Beatley, Timothy, 210–211, 298
- Beauty. *See also* Aesthetic(s)
as design attribute, 14
good design as element of, 27–28
human preference for, 23
importance of, 244
in LEED system, 244
in living architecture, 315
in sacred art, 315
- Beddington Zero-Energy Development project, 286
- Behavioral genetics, 22
- Behnisch, Behnisch, and Partner, 17
- Bell Labs, 34, 35
- Bender, Tom, *see* color Figure 21-2
- Ben-Joseph, E., 194
- Benyus, Janine, 7
- Berry, Wendell, 6, 36
- Beverly Minster, Yorkshire, United Kingdom, 264
- Bicycles, infrastructure for, 156–157
- BIDS, *see* Building Investment Decision Support
- Biocultural restoration, 140, 141
- Biological anthropology, 22
- Biological human nature, 68–73
environmental complexity/stimulation for children, 69
human-animal interactions, 71–73
human-machine interactions, 71–73
pattern recognition, 70–71
physiological operation in built environment, 68–69
- Biological sciences, 22, 24
- Biological wastewater treatment, 55, 56
- Biologists, in biomimetic design, 40
- Biolytix, 38
- Biomimetic innovation credits, 40
- Biomimicry, 27–41
as architectural principle, 28–29
bio-inspiration gardens, 38–39
to bring working ecosystems inside, 37–38
and buildings as chimeras, 30
for buildings with benevolent presences, 39–40
colors, 36–37
daylighting, 34–35
defined, 28
as design attribute, 9
design elements inspired by nature, 30–32
as design process, 29
focus on function in, 29
human comfort with, 40–41
in landscape design, 38
organic forms and structures, 32–34
sounds, 36
ventilation, 35–36
- Biomorphy, as design attribute, 9
- Biophilia, 325–326
benefits of, 326–328, 331
biomimicry in, 28
defined, 3, 221
different interpretations of, 221–222
and human well-being, 3–4
nine typologies, 44
as “weak” biological tendency, 4
- Biophilic design, 3–18, 325–333
as arising from human nature, 65–66
assumption of positive experiences from, 146
attributes of, 6–15
benefits of, 326–328, 331
branches of, 65
defined, ix, 3
dimensions of, 5–6
elements of, 6–18
environmental features in, 6–8, 15, 16
evidence supporting, 107–116
evolved human-nature relationships in, 13–15, 18
as expression of inherent need to affiliate with nature, x
focus of, 206–207
fundamental questions of, ix
and genetic dependence on environment, 61–63
justifying costs of, 331–332
light and space in, 11, 15, 17
merging of artificial and natural in, 63–64
natural patterns and processes in, 9–11, 15, 17
natural shapes and forms in, 8–9, 15, 16
and need to affiliate with natural systems/processes, 3–4
and neurological basis for aesthetic response, 61–63
and neurological nourishment, 62–65
next steps for, 332–333
objectives of, x, 3
organic or naturalistic dimension of, 5–6
and other green design priorities, 331
place-based or vernacular dimension of, 6, 15, 18
place-based relationships in, 12–13
positive effects of, 61
in restorative environmental design, 5, 140
and sensory/emotional connection to built environment, 61
steps supporting, 77–80
strategies and priorities in, 329–330
in sustainable design, x, 5
- Blackberry Creek, Thousand Oaks School, Berkeley, California, 175
- Blanchie Carter Discovery Park, Southern Pines Primary School, 159, 168–170
See also color Figures 10-20, 10-21
- Blankenship, Donald, 219
- Bloomer, Kent, 16
- Body, Memory, and Architecture* (Kent Bloomer and Charles Moore), 255
- “Bogeyman syndrome,” 289
- Bold Park, Perth, Australia, 293
- Bone chair, 33, 34
- Boston Schoolyards Initiative, 168
- Botanical motifs, as design attribute, 8
- Botta, Mario, 266, 270
- “Bottleneck, environmental,” 222
- Boundaries:
psychological, around human body, 255
sensory awareness and lack of, 234
- Bounded spaces, as design attribute, 10
- Brain. *See also* Neurological science
“natural,” 207
neocortex, 308–312
patterns causing arousal of, 23

- Brevard Zoo, Melbourne, Florida, 172
 Brisbane, Australia, 286, 294
 British New Towns, 184
 Britton Courts, San Francisco, California, 182–183
 Bronchoscopy pain control, 110
 Bronson Methodist Hospital, Kalamazoo, Michigan, 327
 Brooks, Rodney, 72
 Buddha, 113
 Buffalo Bayou Partnership, 293
 “Buffer effect,” 159
 Buildings:
 biomimetic, 39–40
 biophilic, 240–241, 339–341
 intermediate fractal patterning in, 233
 sensory aesthetics in, 236–237
 urban design at level of, 278
Building for Life (Stephen Kellert), 206
 Building form, landscape features defining, 12
 Building Investment Decision Support (BIDS), 125, 337
 Building practices:
 to enhance human and natural environments, 339–341
 modern examples of, 341–343
 for productive environments, 336–339
 transformation to biophilic design, 344–345
 “Building with Nature” newsletter, 314
 Built environment:
 as barrier to children’s experience of nature, 155
 dominant paradigm for, ix–x
 extinction of natural experience in, *see* Extinction of natural experience
 as facilitating/impeding contact with nature, 4
 human nature in response to, 59
 informational template for, 63
 intermediate fractal patterning in, 233
 natural environment
 degraded/depleted by, 5
 need to affiliate with nature in, x
 physiological operation in, 68–69
 prospect and refuge in, 235
 rejuvenating spaces in, *see* color Figure 13–3
 resilience in, 233–234
 restorative/protective/instorative value of, 135
 return to balance in, 352–353
 sense of place and behavior toward, 6
 sensory aesthetics in, 235–236
 sensory/emotional connection to, 61
 Burbank Housing Development Corporation, 188
 Burch, William, 221
 Bushcare groups (Australia), 293, 294
 Bush Wardens program, Australia, 284
 Butterfield, Deborah, 336
 Bystrom, Arne, 270

 Calatrava, Santiago, 340
 Calthorpe, Peter, 302
 Campbell, Craig, 44
 Canada, children’s use of school play areas in, 209
 Carbon, 220, 223
Caring Spaces, Learning Places, (Jim Greenman), 162
 Carnegie Mellon University, 126, 337
 Cascades, water, 51, 52
 Cascadia Region chapter, U.S. Green Building Council, 351
 Case-control studies, 111–112
 Cathedral of St. Louis, St. Louis, Missouri, 268
 Cave Temples of Ellora, India, 321
 CDC (Centers for Disease Control and Prevention), 207
 Center for Building Performance and Diagnostics, Carnegie Mellon University, 338
 See also color Figure 23–2
 Centers for Disease Control and Prevention (CDC), 207
 Center for the Built Environment, University of California–Berkeley, 328
 Center for Well-Being, Ross Institute, East Hampton, New York, 348
 Central focal points, as design attribute, 10
 Chains, as design attribute, 10
 Change, as design attribute, 9–10, 13
 Changefulness, spectacle of, 260
 Chawla, Louise, 211
 Cherry Hill, Petaluma, California, 188–189
 Chicago, birds in, 277
 Chicago Landscape Ordinance, 290
 Child development centers, 162–164
 Childhood spaces, 153–196, 205–212
 action-research design strategy for, 160
 biophilic design for, 209–212
 and biophilic forms of residential neighborhoods, 176–177
 changes in, 214, 215
 clustered housing and shared outdoor space, 177–183
 community nature destinations, 172
 converted back alleys, 192–193
 See also color Figure 10–55
 cul-de-sacs and greenways, 183–192
 and cultural reality of institutionalized childhood, 161
 for early childhood, 162–166
 and ecocommunity concept, 205–206
 and exocommunity concept, 206
 and health of children, 156–161, 163–166, 208–209
 home zones, 194
 LEED Neighborhood Development system, 194–195
 need for biophilic design of, 154–156
 neighborhood parks, 170–171
 for play activities, 174–176
 in residential environments, 173–174
 and restorative environmental design/biophilic design, 206–207
 schoolgrounds as neighborhood parks, 169–170
 school sites, 166–169
 social/cultural obstacles to good design, 207–208
 wild vs. manicured, 221
 woonerf (residential precincts), 193–194
 Children:
 art preferences of, 96–97
 contact with nature and development of, 4
 creativity of, 328
 enticement to outdoors, 284–285, 289
 environmental complexity/stimulation for, 69
 lifestyles of, 153, 156–160
 play activities preferred by, 174–176
 school performance of, 328
 Children and Nature Design Certification, 211
 China, urbanization in, 352
 CHRISTUS St. Michael Health Care Center, Texarkana, Texas, 327
 Churchill, Winston, 205

- CII-Godrej Green Building Center, Hyderabad, India, 351–352
- Circadian rhythms, 99, 122
- Cité de Refuge, Paris, France, 244
- Cities:
- biophilic, *see* Urban design and complexity theory, 300
 - growth of, 297–298, 352
 - sensory aesthetics in, 238–240
- City parks, 173
- Civano, Tucson, Arizona, 281
- Clarke, Peter, 294
- Class of 1945 Library, Phillips Exeter Academy, 353–354
- Claus, Elvis, 294
- Climate change, ix, 216, 222, 298
- Clinical epidemiology, 108–110
- Clodagh, 341
- Clubhouse, Huntington Lakes, Delray Beach, Florida, *see* color Figure 4-5
- Clustered housing and shared outdoor space, 177–183
- advantages of, 178
 - examples of, 178–182
 - See also* color Figures 10-35, 10-37, 10-39
 - resistance to shared space, 182–183
- Coalfields, environmental damage from, 217–220
- Cobb, Edith, 328
- Cognition, as design attribute, 14
- Cognitive development, sedentary lifestyle and, 157
- Cognitive neuroscience, 22, 70
- Cognitive psychology, 22
- Coherence, 21. *See also* Consilience
- Cohousing, 180, 181
- Color(s):
- biomimicry of, 36–37
 - as design attribute, 7
- Columbia Forest Products, 31
- Columnar supports, as design attribute, 8
- Commonwealth Scientific & Industrial Research Organization building, 29
- Community gardens, 291
- Community Greens: Shared Parks in Urban Blocks, 181
- Community nature destinations, 172
- Community-supported agriculture (CSA), 287
- Complementary contrasts, as design attribute, 10
- Complexity:
- connection to, 63
 - as design attribute, 13
 - for intellectual satisfaction/cognitive prowess, 14
 - for neurological nourishment, 64
 - in retirement home case study, 274–275
 - as survival-advantageous, 264–265
- Concrete, 78–79
- Congress for New Urbanism, 194
- Connecticut, 46, 47
- Consilience, 21–22, 24–25
- Construction process, human factors in, 79. *See also* Building practices
- Contrasts:
- as design attribute, 10
 - of light and shadow, 11
- Control over nature, as design attribute, 13–14
- Converted back alleys, 192–193
- See also* color Figure 10-55
- Cook+Fox Architects, 353
- See also* color Figure 23-8
- Cooling, natural, 127
- Coombes School, Reading, United Kingdom, 168
- Cooper Marcus, Clare, 208
- Copenhagen, Denmark, 279
- Coping, 134, 135
- Corbett, Christopher, 186, 187
- Corbett, Judy, 184, 205
- Corbett, Lisa, 205
- Corbett, Michael, 184, 205–206
- Council House 2, Melbourne, Australia, 343
- See also* color Figure 22-10
- Cowles, Macon, 345
- Creating Defensible Space* (Oscar Newman), 129
- Creativity, access to nature and, 328
- Crystal Palace, London, 30
- CSA (community-supported agriculture), 287
- Cul-de-sacs and greenways, 183–192
- benefits of greenways, 190–191
 - citywide greenway networks, 187–190
 - conflicts between child- and wildlife-friendly areas, 191
 - English Garden City movement, 174
 - possible negative unintended consequence of, 191
 - urban promenades, 192
 - Village Homes, 184–187
- Cultural change, living architecture and forces of, 317–320
- Cultural connection to place, as design attribute, 12
- Cultural evolution, genetic evolution and, 24
- Cultural patterns, vulnerability of, 318
- Culture, integration of ecology and, 12–13
- Curiosity, as design attribute, 13
- Cutler-Girdler house, Medina, Washington, 268
- Cyberknife Radiosurgery Center of Iowa, Des Moines, Iowa, *see* color Figure 21-1
- Dagara tribe, 320
- Daimler-Chrysler, 33
- Danger (peril):
- thrill of/sensitivity to, 269–271
 - from traffic, 156–157, 174
- Davenport, Hume, 218
- David and Joyce Dinkins Gardens, Harlem, New York City, 301–302
- Davis, Alexander Jackson, 257
- Day, Chris, 314
- Daylighting, 34–35, 127. *See also* Natural light
- DC Ranch, Phoenix, Arizona, 187
- Debussy, Claude, 46
- Demosthenes, 107
- Denmark, 164, 175
- Density, urban, 298
- Denver Business Journal*, 299–300
- Denver Urban Renewal Authority (DURA), 303, 304
- Depression, effects of daylight on, 99–100
- Deramus Education Pavilion, Kansas City Zoo, Missouri, 350–351
- See also* color Figures 23-6, 23-7
- Desealing, 286
- Design with Nature* (Ian McHarg), 217
- Detroit airport, 48
- Diaphanous buildings, 127
- Diffused light, as design attribute, 11
- Direct experience with nature, 5
- Discovery of natural processes, as design attribute, 14
- Disney Hall, Los Angeles, California, 129
- See also* color Figure 8-6

- Distraction theory, 93–95, 326
 Diurnal changes in nature, 230
 Diversity, 11, 220
 Doembecher Children's Hospital,
 Portland, Oregon, 93
 Domes, as design attribute, 8
 Dominionistic attachment to water, 44
 Dreiseitl, Herbert, 284, 342
 Dubos, René, 6, 14
Dune (Frank Herbert), 46
 DURA, *see* Denver Urban Renewal
 Authority
 Dye-sensitized solar cells, 29, 34
 Dynamic balance and tension, as design
 attribute, 10
 Dynamic entanglement or competition,
 260

 Eastgate office complex, Harare,
 Zimbabwe, 35–36
 See also color Figures 3-15
 Eble, Joachim, 342
 E&B (environment and behavior)
 research, 160
 Ecocommunity concept, 205–206
 Ecological connection to place, as design
 attribute, 12
 Ecological restoration, 140, 141
 Ecological rooftops, 278
 Ecology/ecological processes, ix–x, 12–13
The Ecology of Imagination in Childhood
 (Edith Cobb), 328
 Eco-machines, 38
 Ecosystems:
 as design attribute, 8
 indoor, 37–38, 51, 63
 See also color Figure 4-5
 Eden Center, 30
 Edible opportunities, 284
 Edible Schoolyard, 167
 Edwin Cheney house, Oak Park, Illinois,
 266
 Efflorescence, as design attribute, 10
 Efrati, Amir, 189
 Egg forms, as design attribute, 8
 Eiffel Tower, 30, 269
 Einstein, Albert, 350
 Elderly:
 gardens for, 98
 use of shared space by, 178
 ELIZA program, 72
 Elk Rock Gardens at Bishop's Close,
 Portland, Oregon, 336

 Embassy Suites, 343
 Emotional connections, 61, 73–74
 Energetic dimensions of place, *see* Living
 architecture
 Energy consumption, ix–x, 298
 Energy efficiency, 337, 338
 Energy life cycle, 309
 English Garden City movement, 184
 Engwicht, David, 173
 Entelechy II, Sea Island, Georgia, 52
 Enterprise, 301
 Enticement:
 as design attribute, 13
 in retirement home case study, 274
 as survival-advantageous, 267–269
 in urban design, 284–285
 Environment:
 current “bottleneck” in, 222
 genetic dependence on, 61–63
 humane, 227
 mimicking nature, 62
 need for connection to, 59
 and physiological well-being, 62
 for zoo animals, 69
 Environmental aesthetic, 243–251
 beauty in, 244
 groundwork for, 244
 integration in, 245–252
 language for, 245
 and reason for separation of man from
 nature, 244–245
 Environmental features (as design
 element), 6–8, 15, 16
 Environmental psychology, 69, 145
 Environmental sciences, 22
 Environmental stress, 134
 Environment and behavior (E&B)
 research, 160
 Epcot Center, 31
 Epigenetic rules, 22–24
 Erotic aesthetics, 23
 Estrogen replacement, 108
 Europe:
 gathering spaces, 234, 235
 green neighborhoods, 280
 regional ecological networks,
 279
 whole-community approach,
 210–211
 Eva-Lanxmeer, Culumberg, Netherlands,
 280
 Evans, Ianto, 314
 Evergreen Foundation, 168

 Evolution, ix
 attunement to light, 90–91
 epigenetic rules in, 22–24
 increasing complexity in, 62–63
 and need for contact with nature, 3–4
 physiological restoration, 89–91
 preference for environments
 mimicking, 23
 Evolution biology, 22
 Evolved human-nature relationships,
 13–15, 18
 Exocommunity concept, 206
The Experience of Landscape (J. Appleton),
 235
 Expert knowledge, 70–71
 Exploration of natural processes, as
 design attribute, 14
The Extended Organism (J. Scott Turner),
 35
 Extinction of natural experience, 213–223
 antidotes to, 217
 and biophilia, 221–223
 and changes in childhood
 environments, 214, 215, 217
 and climate change, 218
 and creation of sacrifice zones, 222
 defined, 213, 215
 and destruction of environment for
 energy resources, 217–220
 and diversity within radius of reach,
 215–216
 factors in, 214
 and mastery of nature as political, 214
 and New Orleans hurricane damage,
 218
 results of, 216
 strategies for green spaces
 optimization, 220–221

 Façade greening, as design attribute, 7
 Façade paint, *see* color Figure 3-8a
 Fallingwater, 18, 235
 False Creek, Vancouver, British
 Columbia, 182
 “Family-Friendly Courtyard Housing,”
 Portland, Oregon, 181–182
 Farnsworth House, 245, 248
 Fathy, Hassan, 75
 Fauna, 50, 289
 Fear of nature, as design attribute, 14
 Fentress, Curtis W., 300
 Fiber optics, 34, 35
 Filtered light, as design attribute, 11

- Filters, aesthetic, 245
- Finland, cul-de-sac and greenway design
in, 184
- Fire, as design attribute, 8
- Fisk, Pliny, 314
- Flora, 50, 289
- Flowing shapes, as design attribute,
8–9
- Focal points, as design attribute, 10
- Food production, 283, 314–315
- Forest Kindergarten Isarauen, Munich,
Germany, *see* color Figure 10-14
- Forest kindergartens, 164–166
- Forest Service, 114
- Forms, *see* Natural shapes and forms
- Forman, Richard, 191, 328, 331
- Foster, Norman, 30
- Fountains, 51–52
- Four Seasons Kindergarten, Ringe,
Denmark, 165
- Fractals:
as basis of positive responses, 332
defined, 332
as design attribute, 10
and human well-being, 62
intermediate, preference for, 233
in natural environment, 232–233
in Paris, 240
- Francis, Mark, 173
- Freeness, sense of, 234
- Freiburg, Germany, 175
- Frei Otto (Munich Olympics), 30
- Freshwater, *see* Water
- Freud, Sigmund, 23
- Freudian theory of incest avoidance, 23
- Fuller, Buckminster, 30–32, 351, 356
- Function, in biomimicry, 29
- Functional site surveys, 40
- Gaia, revenge of, 220
- Garden Cities of Tomorrow* (Ebenezer
Howard), 298
- Gardens:
bio-inspiration, 38–39
choice of plants for, 220
health benefits of, 326
in healthcare facilities, 97–98, 102–103,
208
Japanese, 231
New York City community gardens,
291
roof, 50
urban, 287
water, 51
Zen, 299
- Gardens:
indoor, *see* color Figures 4-5, 22-6
- Gardner, Howard, 208
- Gastric freezing, 108
- Gate control theory, 93, 95
- Gaudí, Antoni, 78
- Gehl, Jan, 154
- Gehry, Frank, 129
- Gender, restorative design and, 146
- Genetic dependence on environment,
61–63
- Genetic evolution, cultural evolution
and, 24
- Genetic heritage:
epigenetic rules as, 22–24
transcendence of, ix
- Genzyme Building, Cambridge,
Massachusetts, 17
- Geodesic domes, 31
- Geographic connection to place, as
design attribute, 12
- Geological features, as design attribute, 8
- Geometric qualities:
and human interaction with nature, 80
of native plants growing wild, 79–80
for neurological nourishment, 64–65
preferred by humans, 76
sacred geometry, 28
- Geomorphology, as design attribute, 9
- Geothermal springs, 46
- Gerbner, George, 207
- Germany, 164–165, 279–280
- Gewerbehof Prisma, Nuremberg,
Germany, 342
- Gibson, J. J., 255
- Gibson, Larry, 218–219
- Gilliam, Frank, 207
- Glass, 254. *See also* Viewing nature
through glass
- Global warming, 222
- Going Native* (Mike Archer and Bob
Beale), 289
- Good to Grow initiative, 172
- Gratzel cells, 34
- Green Builder Program, Austin, Texas,
309
- Green building movement, 338
- Green Communities Program, 301
- Green design:
focus of, 206
for schools and school grounds, 167
success strategies for, 220–221
for urban areas, *see* Urban design
- Green design movement, x
- Green exercise, 111
- Greening the Building and the Bottom Line*
(RMI), 337
- Greenman, Jim, 162
- Green neighborhoods, 279
- Green roofs, 50, 278, 353
- Greenspaces, 113, 285–287
See also color Figure 10-37
- Green Street program, Portland, Oregon,
175
- Green streets, 282–283
- Green urbanism, 210–211, 278–280,
297–305
David and Joyce Dinkins Gardens,
301–302
Highlands' Garden Village, 302–304
and importance of connection to
nature, 299
intrinsic implications for, 298
origin of, 298
Via Verde, 304
- Green Urbanism* (Timothy Beatley),
210–211
- Greenways, *see* Cul-de-sacs and
greenways
- Greenwich Millennium Village, London,
United Kingdom, 281
- Griffin, Corey, 338–339
- Grimshaw, Sir Nicholas, 304
- Group Zo, 192
- Grover, Karan, 351–352
- Growing Up in Cities project, 195
- Growing Vine Street, Seattle,
Washington, 282–283
- Growth and development, as design
attribute, 10
- Guenther, Robin, 331–332
- Habitats, as design attribute, 8
- Hagen Town Hall, Germany, *see* color
Figure 4-14
- Hall, Sir James, 245
- Halprin, Lawrence, 178
- Hammarby Sjöstad, Stockholm, Sweden,
279, 280
- Hammill Family Play Zoo, Brookfield,
Illinois, 161, 172
- Hannover Green Ring, Hannover,
Germany, 279–280
- Haptic system, 255

- Harkness Tower, Yale University, 17
- Harlem Congregations for Community Improvement (HCCI), 301
- Harman, Jay, 36
- Harmonic relationships, sensitivity to, 232
- Harmony, spatial, 11
- Hartig, Terry, 111, 208
- Hattersheim Town Hall, Germany, 284
- Havel, Václav, 39
- Haworth showroom, Chicago, Illinois, *see* color Figure 4-3
- Hawthorne effect, 337–339
- Hazards, creating illusion of, 235
- HCCI (Harlem Congregations for Community Improvement), 301
- Healing spas, 46
- Health:
 - and access to daylight, 121–123
 - and access to fresh air, 123–124
 - and access to natural environment, 126
 - benefits from contact with nature, 107–116, 208–209
 - biophilic urges related to, 4
 - childhood lifestyle threats to, 156–160
 - coal mining's effects on, 220
 - design of childhood spaces for, 163–166
 - direct link of nature experiences and, 208–209
 - diseases of the spirit, 316
 - evidence supporting beliefs about, 109
 - impact of low environmental impact design on, 5
 - and indoor plants, 128
 - and proximity to windows, 120
 - and socioeconomic position, 147
- Healthcare design, 87–103
 - art's effects on health outcomes, 96–97, 340
 - biophilic design recommendations for, 102–103
 - daylight exposure, 98–100
 - environments mimicking nature in, 62, 208
 - gardens in, 97–98, 208
 - and health outcomes, 88, 138, 299
 - See also* color Figure 8-8
 - for pain reduction, 93–96, 326, 327
 - and stress as problem in healthcare, 88–89
 - for stress reduction, 89–94, 326–328
 - windows in, 130
- Health outcomes, 88, 138
- Heating, natural, 126–127
- Heerwagen, Judith, 69, 267, 325–326, 338, 344
- Height, human preference for, 23
- Helsinki, Finland, 279
- Heraclitean movement, 231
- Heraclitus, 45
- Herbert, Frank, 46
- Herman Miller, 338
- Heschong, Lisa, 338
- Heschong Mahone Group, 120, 328
- Het Groene Dak, Netherlands, 211
- Hicks, Edward, 246
- Hierarchically organized ratios and scales, as design attribute, 10–11
- Highlands' Garden Village, Denver, Colorado, 302–304
 - See also* color Figure 18-3
- High Line Canal, Denver, Colorado, 215
- High Point, Seattle, Washington, 175
- Hildebrand, Grant, 238, 244, 341
- Historic connection to place, as design attribute, 12
- Holl, Steven, 354
- Holocene, 221
- “Home,” human need for, 6
- “Home range,” 290
- Home zones, 194
- Hopkins Architects, 16
- Horizon, in imagery of prospect, 235
- “Houses That Sing,” 314
- Houston, Texas, bats in, 293
- Howard, Ebenezer, 298
- How the Mind Works* (Steven Pinker), 228
- Hudson River School, 46
- Human-animal interactions, 71–73
- Humane human environment, 227
- Humanistic attachment to water, 44
- Humanities/humanistic social sciences, 22–25
- Human-machine interactions, 71–73
- Human nature, 21–25
 - as abstract/mechanistic, 67
 - and basis of aesthetic judgment, 23–24
 - as biological, 68–73
 - biophilic tendencies in, 23
 - conceptions/levels of, 66–67
 - consilient definition of, 22–23
 - in constructing buildings and cities, 59–60
 - in relationship/response to built environment, 59
 - and sensory/emotional connection to built environment, 61
 - and theories of incest avoidance, 22–23
 - as transcendent, 73–74
- Hume, David, 107
- Humphrey, Nicholas, 229, 232
- Humphries, Susan, 168
- Hundertwasser, Friedrich, 79
- HVAC systems, 123–125, 127–128
- Hyatt Hotels, 343
- Hydromimicry, 54
- Hydrotherapy, 46
- Ice carnivals, 56
- Illich, Ivan, 48
- Imaginary elements, 259
- Immanuel, Kerry, 216
- Immune system health, 159
- Implementing biophilic design, 347–356
 - by aiming higher, 348–350
 - conceptual framework for, 66
 - by rebalancing the modern environment, 352–353
 - by recognizing new ethic for excellence, 353–355
 - by returning to buildings that support life, 350–352
- Inca architecture, 315
- Indigenous materials, as design attribute, 12
- Indirect experience with nature, 5–6
- Indoor plumbing, 50
- Industrial waste, 48
- Information:
 - as design attribute, 14
 - and human-machine interactions, 71–73
- Informational fields, 75
- Information richness, as design attribute, 9
- Infrastructure, in urban design, 282–285
- Inha University Hospital, Korea, 122
- Innovation for Conservation program, 40
- Inside-outside spaces, as design attribute, 11
- Institute of Traffic Engineers, 194
- Institutionalized childhood, 161
- Instorative environmental design, 135
- Integration:
 - of culture and ecology, 12–13
 - of parts to wholes, 10
 - of water and earth, 53

- Interconnectedness, 21. *See also*
Consilience
- Intergovernmental Panel on Climate
Change, 216
- Interior design, biophilic
strategies/priorities for, 330
- International Netherlands Group bank,
Amsterdam, Netherlands, 342–343
- Iridescent color, 37
- Isamu Noguchi Sculpture Court, Bloch
Building, Nelson-Atkins Museum of
Art, *see* color Figures 23-10, 23-11
- Ise Shrines, Japan, 321
- IslandWood, Bainbridge Island,
Washington, *see* color Figures 13-5,
13-7
- Ivy, Robert, 236
- Jacobson, Max, 341
- Japan, decrease in play activities in,
207–208
- Japanese gardens, 231
- Jenkins, Janet, 293
- John Amos coal plant, 218
- Johns Hopkins University, 110
- Johnson, Nathanael, 243
- Johnston, Lindsay, 343
- John Todd Ecological Designs, Inc.,
37–38
- Jonathan Rose Companies, 301
- Jones, E. Fay, 236, 237, 355, 356
- Joye, Yannick, 62
- Jubilee Campus, University of
Nottingham, United Kingdom, 16
- Jukkasjarvi, Sweden, 56
- Kahn, Louis I., 229, 237, 353–354
- Kaiser Family Foundation, 207
- Kaplan, Rachel, 208, 338
- Kaplan, Stephen, 208, 267, 338
- Katcher, Aaron, 230–231
- Keeney, Brad, 321
- Kellert, Stephen, 32, 44, 133–134, 136,
206, 209–210, 244, 325
- Kelley, Sun Ray, 314
- Kelly, Ellsworth, 247, 248
- Keskuspuisto park, Helsinki, Finland, 279
- Kids Together Park, Cary, North
Carolina, 171
- Kieran Timberlake Associates, 245–246
- Kinetic sculpture, 53
- Kings Park, Perth, Western Australia,
293
- Kitazawagawa River Nature Path, Tokyo,
Japan, 192
- Kitchen, outdoor, *see* color Figure 19-1
- Kohler, 50
- Konarka, 29, 34
- Kronsberg, Hannover, Germany, 280
- Kulikauskas, Andrius, 70–71
- Kuo, Frances, 110
- Ku-ring-gai Council, 294–295
- Kurswell, Ray, 308
- Laarman, Joris, 33, 34
- Landscape design, 38, 329
- Landscape ecology, as design attribute, 12
- Landscape features defining building
form, as design attribute, 12
- Landscape orientation, as design
attribute, 12
- Landscape Park, Duisberg-Nord,
Germany, 286–287
- Language, aesthetic, 245
- Last Child in the Woods* (Richard Louv),
153, 217
- Las Vegas water entertainment, 48
- Lawn, 63
- Leadership in Energy and Environmental
Design (LEED), x, 5, 211
- beauty ignored in, 244
- biomimetic innovation credits in, 40
- for Neighborhood Development,
194
- rewards for biophilia in, 333, 344
- school sites, 166
- Learning Landscapes Alliance, 168
- Le Corbusier, 244, 298, 353
- Lee, John, 343
- LEED, *see* Leadership in Energy and
Environmental Design
- Legacy Health, Glacier Creek,
Washington, 100
- Legacy Health, Portland, Oregon, 97
- Leonardo da Vinci, 45, 46
- Lerner, Kelly, 314
- “Letter from Iowa” (Nathanael Johnson),
243
- Lewis, C. S., 214
- LID (low-impact development), 282
- “Life style centers” (shopping), 232
- Light, 11, 90–91. *See also* Natural light
(daylight/sunlight)
- Light, Andrew, 294
- Light and space (as design element), 11,
15, 17
- Lighting Research Center, Rensselaer
Polytechnic Institute, 121–122
- Light pools, as design attribute, 11
- Linked series, as design attribute, 10
- Linz, Austria, 278
- Living architecture, 74–76, 313–322
- characteristics of, 313–314
- and current architectural approaches,
317
- deeper essence of beauty in, 315
- drivers toward, 353
- and forces of cultural change, 317–320
- for healing diseases of the spirit, 316
- historical examples of, 315–316
- role and focus of, 314–315
- sacred in, 320–322
- as visual art, 314, 315
- Living Building Challenge, 351
- Lobell, John, 237
- Loblolly House, Taylor’s Island,
Maryland, 245, 247–248
- See also* color Figures 14-10, 14-11
- Loftness, Vivian, 209, 332
- Loos, Adolph, 266
- Los Angeles River, 47, 190–191
- Lotus leaves, *see* color Figure 3-8c
- Louv, Richard, 153, 217, 222, 289, 326,
328, 350
- Love, 73
- Lovelock, James, 216, 220
- Lovett, Wendell, 266, 268
- Low environmental impact design, x, 5
- in restorative environmental design,
139–140
- technologies for, 134
- Low-impact development (LID), 282
- Lucent Technologies, 34
- Lyndhurst, Tarrytown, New York, 257
- See also* color Figure 15-6
- Lyons, Mohawk Owen, 40
- McHarg, Ian, 217
- Machu Picchu, 315
- McLaren Technology Centre Research
Centre, London, United
Kingdom, 53
- McMaster University, 109
- Maeger, Leonard, 326
- Malmö, Sweden, green rooftops, 287
- MARAG film, 35
- Marine sponges, *see* color Figure 3-6b
- Market research, 344–345
- Marquis, Robert, 178

- Marrin, West, 45, 46
- Martin Luther King Jr. High School, Berkeley, 167
- Mason-Wolf Associates, 283
- Massey Energy Inc., 217, 219
- Massing, sculptured, 269
- Master Gardener Program study, 112–113
- Mastery over nature:
 - as design attribute, 13–14
 - as political, 214
- Materials:
 - for biophilic design, 78
 - as design attribute, 7, 12
 - indigenous, 12
 - See also* color Figure 20-7
 - natural, 7
 - See also* color Figures 20-8, 21-2
 - off-the-shelf, 79
- Material event figure, 310
- Mattheck, Claus, 33
- The Meadows, Berkeley, California, 180–181
 - See also* color Figure 10-39
- “Mean world syndrome,” 207
- Mechanistic human nature, 66, 67
- La Mer* (Debussy), 46
- Mercedes-Benz, 33
- Metamorphosis, as design attribute, 13
- Metrovesca, 342
- Micro-restorative experiences, 138
- Middlebury College, Vermont, 245, 249–251
 - See also* color Figures 14-17, 14-18
- Mies van der Rohe, Ludwig, 245
- Migration corridors, 38
- Mind, physical basis of, 24
- Mineral springs, 46
- Minigreenways, 190, 191
- Mining, coal, 217–220
- Mirrors, 314
- Mithen, Steve, 46
- Mithun office building, Seattle, Washington, *see* color Figure 13-13
- Mixed-use development, 18
 - See also* color Figure 18-3
- Mobility, children’s opportunities for, 174
- Mogavero Notestine and Associates, 179
- Mole Hill, Vancouver, British Columbia, 283
- Monet, Claude, 46
- Montefiore Hospital, Pittsburgh, Pennsylvania, 122
- Montgomery Park, Boston, Massachusetts, 181
- Mont-Saint-Michel, France, 18
- Moore, Charles, 255, 256
- Moore, Ernest, 111
- Moore, Robin, 169, 207
- Moralistic attachment to water, 45
- Morra Park, Drachten, Netherlands, 210–211
- Moswieniam, 353
- Movement, 230–231
 - of people in activity cycles, 144–145
 - sense of freedom and options for, 234
 - of water, 46, 50
- Mud bricks, Egyptian use of, 315
- Musée d’Orsay, Paris, France, 265
- Music, 46
- Mystery:
 - preference for, in natural scenes, 267
 - theological concept of, 74, 75
- National Institute of Environmental Health Sciences, 114
- National Institutes of Health (NIH), 114, 332
- National Museum of the American Indian, Washington, DC, 51, 52
- National Science Foundation (NSF), 332
- National Scientific Council on the Developing Child, 208
- National Sporting Goods Association (NSGA), 207
- National Wildlife Federation (NWF), 220, 331
- Natural analogs, 340
- Natural Building Colloquia, 314
- Natural cooling, 127
- Natural heating, 126–127
- Natural heritage, transcendence of, ix
- Naturalistic attachment to water, 44
- Naturalistic dimension of biophilic design, 5–6
- Naturalist intelligence, 208
- Natural Learning Initiative (NLI), 162, 163, 165
- Natural light (daylight/sunlight):
 - benefits of, 121–123
 - as design attribute, 7, 11
 - in healthcare design, 98–100, 102
 - human attunement to, 90–91
 - and school performance, 328
 - and Seasonal Affective Disorder, 230
 - variability in, 122
 - water interaction with, 50
- Natural materials:
 - as design attribute, 7
 - interaction of water and, 50
 - reuse of, 78, 249
- Natural patterns and processes, as design element, 9–11, 15, 17
- Natural Resources Defense Council, 194
- “Natural rights,” 223
- Natural sciences:
 - borderland disciplines in, 22
 - common sequence in, 24
 - humanities/humanistic social sciences vs., 22–25
- Natural shapes and forms, as design element, 8–9, 15, 16
- Natural springs, 46
- Natural ventilation, 123–125
- Nature-deficit disorder, 208, 217, 222, 328
- Nature/natural environment:
 - adult environmental stewardship and childhood experience of, 155
 - basic need for access to, 227
 - and childhood health problems, 156–160
 - and climate change, 222
 - consequences of designing in adversarial relation to, x
 - degradation/depletion of, 5
 - evolved human-nature relationships, 13–15, 18
 - health benefits of contact with, 107–116, 208–209
 - See also* color Figure 8-8
 - human need for contact with, 3–4
 - humans’ preferred elements in, 23
 - liked and disliked features of, 139
 - organizing urban life around, 287–289
 - real vs. simulated, 332
 - sensory richness/variety in, 228–235
 - values/constructs of our attachment to, 44–45
- \Nature Preschool, Schlitz Audubon Nature Center, 165
- Nature preschools, 164–166
- Negativistic attachment to water, 44
- Neighborhoods, green, 279
- Neighborhood parks, 169–171

- Nelson-Atkins Museum, Kansas City, Missouri, 354
See also color Figures 23-10, 23-11
- Neocortex, 308–312
- Netherlands:
 children's mobility study, 174
 urban green spaces networks, 279
woonerf (residential precincts), 188
- Neurological science:
 basis for aesthetic response, 61–63
 basis for design, 308–312
 children's brain architecture, 208
 cognitive, 22, 70
 monitoring of brain arousal, 23
 nourishment, neurological, 62–65, 233
 pattern recognition, 70–71
- New Housing New York, 304
See also color Figure 18-6
- Newland Communities, 210
- Newman, Oscar, 129
- New Orleans, Louisiana, hurricane damage, 216
- New York City, New York, 48, 277
See also color Figure 23-12
- New York City green spaces, 291
- Nightingale, Florence, 326
- NIH, *see* National Institutes of Health
- NLI, *see* Natural Learning Initiative
- Noise pollution, 36, 221
- Noodland Greenway, Stockholm Sweden, 184
- North Carolina State University, 162
- Northern Life Tower, Seattle, Washington, 269, 270
- Northpark, Irvine Ranch, California, 189
- Northwestern University, 109
- Nourishment, neurological, 62–65, 233
- NSF (National Science Foundation), 332
- NSGA (National Sporting Goods Association), 207
- Nurse logs, *see* color Figure 20-7
- NWF, *see* National Wildlife Federation
- Oakey, David, 37
- Oakland, California, 173
- Obesity, 156, 173
- Occupation, restorative design and, 147
- Oil depletion, 318
- Olmstead, Frederick Law, 211
- On Adam's House in Paradise* (Joseph Rykwert), 244
- On Growth and Form* (D'Arcy Wentworth Thompson), 32
- On Human Nature* (Edward Wilson), 65
- Ontario Place, Toronto, Ontario, 56
- Open spaces:
 barbering/manicuring of, 221
 high-density development vs., 331
 human preference for, 23
- Order, as design attribute, 13
- Organic dimension of biophilic design, 5–6
- Organic forms and structures, mimicking, 32–34
- Orians, Gordon, 267, 338
- Orientation to landscape, 12
- The Origins of Architectural Pleasure* (Grant Hildebrand), 341
- Ornamentation:
 classic function of, 256
 interior, 258–260
 as natural analog, 340
 for neurological nourishment, 64
 of picture windows, 256–258
See also color Figures 15-6, 15-8, 15-9, 15-16
 serendipity in, 231
- Orr, David, ix–x
- Ortiz, Iñigo, 342
- Ortiz Leon Architects, 342
- Outdoor kitchen/breezeway, *see* color Figure 19-1
- Outdoor nursery schools, 164–166
- Oval forms, as design attribute, 8
- Ove Arup & Partners, 35
- Paimio Sanatorium, 123
- Pain reduction, healthcare design for, 93–96, 100, 326, 327
- Pallasmaa, J., 229
- Paris, France, 238–240
- Parks:
 city, 173
 neighborhood, 171
 pocket, 191
 school grounds as, 169–170
 urban, standards for, 290
- Paseo del Rio River, 48
- Passive survivability, 127–128
- Pathways to buildings, biophilic features for, 145
See also color Figure 10-48
- Patina of time, as design attribute, 9–10
- Pattern(s), 80–81
 brain-arousing, 23
 and complexity theory, 300
 as design element, 9–11, 15, 17
 fractals, 10, 62
 genetic sense of, 232
 in human-machine interactions, 72
 preferred, 338
 from sensory experience, 70–71
 similarities in, 232–233
 spatial, 341
- Patterned wholes, as design attribute, 10
- Patterning, rhythmic, 257–258
- A Pattern Language* (Christopher Alexander), 71, 80, 336, 337
- Patterns of Home* (Jacobson, Silverstein, and Winslow), 341
- Patterson Park neighborhood, Baltimore, Maryland, 192, 193
See also color Figure 10-55
- Pavilion and Reflecting Pool, Toronto, Ontario, *see* color Figure 4-6
- PAX Scientific, 36
- Peaceable Kingdom, 246, 247
- Pearce, Mick, 35, 36, 343
- Pebble Project, Center for Health Design, 130
- Pedestrian spaces, 80
- Peggy Notebaert Center, Chicago, IL, 54
- Performance:
 and access to daylight, 121–122, 328
 and positive experience of nature, x
 and views of nature, 338
- Peril, as survival-advantageous, 269–271
- Perry Rose, 302
- Peterhouse College, Cambridge, 247
- Philadelphia, ants in, 277
- Philadelphia Water Department, 191
- Philip Merrill Environmental Center, Annapolis, Maryland, 328
- Phipps Houses, 304
- Photosynthesis, mimicking of, 29
- Physical sciences, changes in, 318
- Physicians' Health Study, 109
- Physiological restoration, 91
- Piazza del Duomo, approach to, 268
- Picture windows, ornamentation of, 256–258
See also color Figures 15-6, 15-8, 15-9, 15-16
- Pike Place Market, Seattle, Washington, 231
- Pinker, Steven, 228
- Place-based dimension of biophilic design, 6

- Place-based relationships, as design element, 12–13
- Placelessness, ix, 6, 13
- Place of residence, restorative design and, 146–147
- Planning and Urban Design Standards* (APA), 290
- Plants:
- accessibility of, 80
 - as design attribute, 7
 - human connection with, 64
 - in children's play areas, *see* color Figures 10-5, 10-10
 - and sick building syndrome, 128, 129
 - variation and similarity in, 232
- Play activities. *See also* Childhood spaces
- adult recollections of, 176
 - children's views of, 174–176
 - decrease in, 207–208
 - UK children's informal play study, 183–184
 - at Village Homes, 186–187
- Pliny the Elder, 46
- Pocket parks, 191
- Pollution:
- air, ix, 218, 220
 - noise, 221
 - water, ix, 38, 48, 219
- Pools of light, 11
- Pools of water, 50–51
- Portland, Oregon, ecoroof bonus, 290
- Potsdamer Platz, Berlin, Germany, 55, 56
- Powerlink, 286
- Prisma, Nuremberg, Germany, 54
- Productivity:
- and access to nature, 126, 328
 - biophilic urges related to, 4
 - as driver of green building movement, 338
 - and efficiency of design, 337, 338
 - and Hawthorne effect, 337–339
 - and low environmental impact design, 5
 - measurement of, 337
 - with window views, 120, 121
- Project PLAE, 170
- Promenade Plantée, Paris, France, 18
- Proportions, natural, 28, 300
- Prospect, 234–235, 341
- as design attribute, 13
 - human preference for, 23
 - in retirement home case study, 272–274
 - as survival-advantageous, 265–267
- Protection, as design attribute, 13
- Protective environmental design, 134–135
- Providence, Rhode Island, 48
- Providence St. Vincent Hospital, Portland, Oregon, 130
- Psychoevolutionary theory, 137
- Psychological boundary around bodies, 255
- Psychological disorders, benefits of sunlight for, 122
- Psychological health, outdoor experiences and, 158
- Psychological restoration, 140, 141
- Pyle, Robert Michael, 212, 286, 290
- Qi energy, 318–319
- Quantum nonlocality, 318
- Randomized controlled trials, 108–110, 113
- Rationality, wholeness vs., 319–320
- Ratios:
- hierarchical, 10–11
 - mimicking natural proportions, 28
- Recycled materials, *see* color Figure 13-11
- Rede Lecture (C. P. Snow), 22
- Reflected light, as design attribute, 11
- Refuge, 234–235, 341
- as design attribute, 13
 - human preference for, 23
 - in retirement home case study, 272
 - as survival-advantageous, 265–267
- Regional-level urban design, 279–280
- Reid Dennis house, Sun Valley, Idaho, 269–270
- REI Denver, *see* color Figure 13-11
- REI Seattle, *see* color Figure 13-9
- Releasers, 24
- Religious architecture, 75–76, 318–319.
- See also* Sacred spaces
- Religious concept of mystery, 74, 75
- Religious uses of water, 46
- Relph, Edward, 6
- Remington, Charles, 214
- Repetition, 259
- See also* color Figure 13-9
- Research on benefits of nature contact:
- evidence for benefits, 110–113
 - funding for, 114
 - limits to claims, 115–116
 - need for building evidence base, 113–115
- Residential environments:
- biophilic forms of, 176–177
 - children's play areas in, 174
 - clustered housing and shared outdoor space, 177–183
 - converted back alleys, 192–193
 - See also* color Figure 10-55
 - cul-de-sacs and greenways, 183–192
 - providing for children's needs in, 173–174
 - street design for, 156, 157
 - woonerf* (residential precincts), 193–194
- Resilience, 233–234
- See also* color Figure 13-11
- Resource consumption, ix–x
- Reston, Virginia, 187
- Restoration theory, 90
- Restorative environmental design, x, 5, 133–149
- benefits of, 142
 - biophilic design in, 5
 - characteristics of, 139–142
 - and experiences of people in built environment, 145–148
 - intrinsic implications of, 298
 - low-impact, environmentally sensitive technologies in, 134
 - prospects and challenges for, 148–149
 - protective environmental design vs., 135
 - protective functions of, 139
 - restoration perspective in, 134–136
 - tandem processes in, 139–141
 - theory/empirical research on, 136–139
 - time and place matters in, 142–145
- Retirement home case study, 271–275
- Reuse of materials, 78, 249
- Reverence, as design attribute, 14
- Rhyming (variation), 232
- Rhythm:
- appreciation of, 232
 - in window walls, 257–258
- Rhythmization, 260
- Richard Dattner Architects, 304
- Richness, sensory, 228–230
- Rivanna River Greenway, Charlottesville, Virginia, 285
- Rivers, 47
- RMI, *see* Rocky Mountain Institute
- Roberts, Joan, 122
- Robert Taylor Homes, Chicago, 110–111
- Robots, 72–73, 79
- Rock Hill, South Carolina, 190

- Rocky Mountain Ditch, 302
 Rocky Mountain Institute (RMI Headquarters), Snowmass, Colorado, 336, 337, 338
 Ronald Reagan Airport terminal, 16
 Roof gardens, 50. *See also* Green roofs
See also color Figure 18-6
 Rose Kennedy Greenway, Boston, Massachusetts, 192
 Rose SmartGrowth Fund, 345
 Ruskin, John, 7, 238
 Rusk Institute of Rehabilitation Medicine, New York City, New York, 97
 Rykwert, Joseph, 244, 245
 Ryoanji shrine, Kyoto, Japan, 267, 268
- Saarinen, Eero, 7, 340
 Sacramento Municipal Utility District Call Center, 120, 121
 Sacred geometry, 28
 Sacred sites, 64–65
 Sacred spaces, 75, 320–322
See also color Figure 20-6
 Sacrifice zones, 217, 222
 SAD (Seasonal Affective Disorder), 230
 St. Francis Square, San Francisco, California, 178–179, 182, 195
See also color Figure 10-35
 Sainte Chapelle, Paris, 236
 Saint-Exupéry, Antoine de, 43
 Salk Institute, La Jolla, California, 237–238
 Salt water, 44
 Samara House, West Lafayette, Indiana, 41
See also color Figures 3-20
 San Antonio, Texas, 48
 San Antonio River, 48
 San Diego Regional Canyonlands Park, 211
 San Francisco Museum of Modern Art, 270
 Sanitas Corporation headquarters, Madrid, Spain, 341–342
See also color Figure 22-6
 San Raffaele Hospital, Milan Italy, 122
 Saratoga Springs, New York, 46
 Satisfaction, access to nature and, 328
 SBS, *see* Sick building syndrome
 Scales:
 for biophilic design, 77–79
 hierarchical, 10–11, 77
 for incorporating water, 49
 of urban design, 278, 279
 Scandinavia, urban green spaces networks in, 279
 Schools, 166–169. *See also specific schools*
 green design for, 284
 urban design for, 285
 School grounds:
 as educational resources, 168
 See also color Figure 10-19
 green design for, 167
 as neighborhood parks, 169–170
 Schoolyard Habitats program (NWF), 331
 Scientific attachment to water, 45
 SC Johnson Administration Building, 340
See also color Figure 22-3
 Scully, Vincent, x
 Sculpture, water, 52, 53
 Sculptured massing, 269
 SEA program, *see* Street Edge Alternatives program
 Searles, Harold, 4
 Seasonal Affective Disorder (SAD), 230
 Seasonal changes, 230
 Seattle Library, Ballard branch, 278, 279
 Seattle Street Edge Alternatives program, 282–283
 Security:
 as design attribute, 13
 and sense of freeness, 234
 Semper, Gottfried, 245
 Sense of freeness, 234
 Sense of place, 6
 Sensory aesthetics, 227–241
 in biophilic buildings, 240–241
 in buildings, 236–237
 in cities, 238–240
 in human built environment, 235–326
 movement, 230–231
 prospect and refuge, 234–235
 resilience, 233–234
 sense of freeness, 234
 and sensory richness/variety in nature, 228–235
 serendipity, 231–232
 similarities in patterns, 232–233
 in spaces, 237–238
 Sensory connection, to built environment, 61
 Sensory experience:
 of built environment, 68–70
 patterns from, 70–71
 Sensory variability, as design attribute, 9
 SERA Architects, Inc., *see* color Figure 21-2
 Serendipity, 231–232, 240
 Setagaya Ward, Tokyo, Japan, 192
 Seven Sisters Oak, 33, 34
 Sexual attraction, 23
 Shadow, as design attribute, 11
 Shapes, 11. *See also* Natural shapes and forms
 Shared outdoor space, *see* Clustered housing and shared outdoor space
 Shaw, William, 293
 Shayer, Michael, 157, 162
 Shells, as design attribute, 8
 Shepherd, Benjamin, 338–339
 Shonkoff, Jack, 208
 Shopping behaviors, 232
 Sick building syndrome, 120, 128, 129
 Sick building syndrome (SBS), 123–124
 Sidwell Friends Middle School, Washington, DC, 54–55, 245–249
See also color Figures 4-16, 14-4, 14-5, 14-6, 14-7
 Silverstein, Murray, 341
 Simonds, John Ormsbee, 44
 Simulation of natural features, as design attribute, 9
 Skin, building, 7, 247
See also color Figure 14-5
 SkyCeilings, 327–328, 331
See also color Figure 21-1
 Sky Factory, 327
 Skylights, bio-inspired, 34–35
 Snelson, Kenneth, 32
 Snow, C. P., 22
 Sobel, David, 191
 Social ecology of stress and restoration, 143–144
 Social health, outdoor experiences and, 158
Social Life of Small Urban Spaces (William Whyte), 231
 Socially Responsible Investment (SRI), 345
 Social sciences, 22, 24
 Socioeconomic position, restorative design and, 147
 Soil salinization, 38
 Solar cells, photosynthesis-mimicking, 29, 34
 Somé, Malidoma, 320
 Sonoran Desert Conservation Plan, 293

- Soules, Jim, 181
- Sounds, 36
 complexly ordered, 265
 of nature, 230
 of water, 46, 51
- Southside Park, Sacramento, California, 179–180
See also color Figure 10-37
- South Street Seaport Historic District, New York City, New York, 355
- Space(s):
 as design attribute, 10, 11
 as design element, 11, 15, 17
 perception of time and size of, 309
 prospect and refuge in, 234–235
 sense of freeness in, 234
 sensory aesthetics in, 237–238
 as shape and form, 11
- Spaciousness, as design attribute, 11
- Spadaro, Jack, 217–218
- Spatial harmony, as design attribute, 11
- Spatial variability, as design attribute, 11
- Spirals, 8, 36
- Spirit of place, 6. *See also* Living architecture
 in biomimetic buildings, 40
 as design attribute, 13
 revealed by windows, 130
- “Spirit of Place” conferences, 314
- Spirituality, 14, 75
- SRI (Socially Responsible Investment), 345
- Staircases, *see* color Figure 15-14
- State Prison of Southern Michigan, 111
- Steen, Athena, 314
- Steiner, Rudolph, 314, 342
- Steiner Schools, 314
- Stepner, Mike, 211–212
- Stepwell at Chand Baori, Abhaneri, India, 53
- Stevens, Wallace, 10
- Stoller, Claude, 178
- Stormwater management, 54–55, 175, 246
See also color Figures 4-16, 4-19
- Straw bale buildings, 314
- Strawberry Creek, Berkeley, California, 283
- Streets:
 green urban design for, 282–283
 traffic danger and design of, 156–157
- Street Edge Alternatives (SEA) program, 282–283
- Stress:
 environmental, 134
 healthcare design for reduction of, 89–94, 326–328
 as problem in healthcare, 88–89
 social ecology of, 143–144
- Structural color, 37
- Structures:
 “going against,” 258–259
 organic, 32–34
- Suburban life, contact with nature in, 298
- “The Suburbs Under Siege” (Amir Efrati), 189
- Sullivan, Louis, 75, 257
- Sullivan, William, 110
- Sun exposure (for children), 166
- Sun Life Plaza, Vancouver, British Columbia, 52
- Sunlight, *see* Natural light
- Survival-advantageous architectural characteristics, 263–275
 complex order, 264–265
 enticement, 267–269
 peril, 269–271
 prospect and refuge, 265–267
 retirement home case study, 271–275
- Sustainable design, x
 biophilic design in, x
 focus of, 206
 and healthy child development, 160–161
 limitation of concept, 206
 with low environmental impact design, 5
 as new standard practice, 349
- Swan, Jim, 314
- Sweden:
 children’s use of school play areas in, 209
 cul-de-sac and greenway design in, 184
- Swiss Re building, 30
- Swiss Re London Headquarters, *see* color Figure 3-6a
- Sydney, 16
- Symbolic attachment to water, 45
- Symbolic experience with nature, 6
- Symmetry, 62, 77–78
- Tapiola, Helsinki, Finland, 184
- Television, impact of, 207
- Temple of Hathor, Dendera, Egypt, 315
- Tensegrity, 32–33
- TERMES project, 36
See also color Figure 3-15
- Texas Parks and Wildlife Department, 293
- Thomas, Derek, 210
- Thompson, D’Arcy Wentworth, 32
- Thorncrown Chapel, Eureka Springs, AR, 236, 237, 355–356
- Thornton, L. Camille, 299
- Thornton, Troy, 299
- The Thunder Tree* (Robert Michael Pyle), 215, 216
- Tidwell, Mike, 216
- Time, scales and perceptions of, 308–309
- Todd, John, 37–38
- Tombs, 259–260
- Toronto District School Board, 166
- Touch, system of, 255
- A Tour Through France* (John Ruskin), 238
- Toxins, plant, 221
- Traffic danger, 156–157, 174
- Trance-dancing, 321
- Transcendent architecture, 74–76
- Transcendent human nature, 67, 73–74
- Transitional spaces, as design attribute, 10
- Trees, 8, 115, 277
- TropWorld Casino, Atlantic City, New Jersey, 53
- Trudesland, Denmark, 280
- Tsakopoulos, Angelo, 210
- Tsakopoulos-Kounalakis, Eleni, 210
- Tsui, Eugene, 30
- Tubular forms, as design attribute, 8
- Turing, Alan, 72
- Turing Test, 72
- Turner, J. Scott, 35
- Twombly, R. C., 238
- Uexküll, Ole von, 338–339
- Ulrich, Roger, 7, 68–69, 111, 120, 208, 265, 299, 326, 328, 340
- Understenshøjden, Stockholm, Sweden, 280–281
- Unhealthy indoor environment, ix
- United Kingdom:
 child-nature gap, 207
 children’s informal play study, 183–184
 children’s mobility study, 174
 cognitive and conceptual development, 157
 cul-de-sac and greenway design, 184
 healthcare facilities, 87
 home zones, 194

- U.S. Green Building Council, x, 194, 344, 348, 351
- United States:
- children's use of school play areas, 209
 - elimination of school recess, 166
 - healthcare spending, 87
 - and home zone model, 194
 - increased population and building, 335
 - nature center preschools, 165
 - New Towns and master-planned communities, 187–188
 - obesity, 156
 - urban green neighborhoods, 281
- Unity of knowledge, *see* Consilience
- University of California-Santa Barbara, 34
- University of Michigan law quadrangle, 16
- Urban areas:
- canyons in, 211–212
 - children's environments in, 172–174. *See also* Childhood spaces
 - child- vs. wildlife-friendly areas in, 191
 - parking in, 182
 - return to balance in, 352–353
 - serendipitous experience in, 232
 - stressors in, 147
 - sustainability in, 146, 147
 - water handling, 55
 - water pollution from, 48
 - watersheds in, 38
- Urban design, 277–295
- “activity friendliness” for children, 155
 - biophilic elements, 278
 - at building level, 278
 - distribution of units/uses, 80
 - to entice people outside, 284–285
 - food production, 283
 - green features, 278
 - green neighborhoods, 280–281
 - greenspaces, 285–287
 - green urbanism, 297–305
 - infrastructure, 282–285
 - to organize urban life around nature, 287–289
 - and reform of urban planning systems, 290–292
 - at regional level, 279–280
 - scales of, 278, 279
 - schools, 285
 - streets, 282–283
 - vision for biophilic cities, 292–295
 - water, 282–284
- Urbanisme* (Le Corbusier), 298
- Urban planning systems, reform of, 289–292
- Urban promenade model, 192
- Utilitarian attachment to water, 45
- Utopian movements, 298
- Utzon, Jörn, 7, 16, 266
- UV transparency (of glass), 122
- Vacant lots, 221
- Valley Quest, 191
- Variation in nature, 228–230
- Vauban, Freiburg, Germany, 280
- Vaults, as design attribute, 8
- Vegetative façades, as design attribute, 7
- Vehicle exhaust, 157
- Venice, Italy, 47
- Venolia, Carol, 314
- Ventilation, 7, 123–125
See also color Figures 3–6a, 3–15
- Vernacular dimension of biophilic design, 6
- Vetter, Johanna, 343
- Via Verde, New York, 304
- Vicarious experience with nature, 6
- Vienne, Italy, 297
- Views. *See also* Prospect; Windows
- as design attribute, 7
 - in healthcare facilities, 102
 - scale of, 7
 - through glass, *see* Viewing nature through glass
- Viewing nature through glass, 253–260.
See also Windows
- enhancing positive phenomenon of, 254
 - and interior ornamentation, 258–260
See also color Figure 15-10
 - lack of touching with, 255, 256
 - ornamented picture windows, 256–258
 - as passive and only quasi-sensual, 265–266
 - and psychological boundary around bodies, 255
- Viikki, Helsinki, Finland, 280, 283
- Village Homes, Davis, California, 173, 184–187, 190, 205–206, 209
See also color Figure 10-48
- Village of Woodsong, Shallotte, North Carolina, 178
- VirtualWindows, 327
- Vistas, as design attribute, 7
- “Vitamin G,” 113
- Volme River, Germany, *see* color Figure 4-14
- Wageningen, Netherlands, 177
- Wales, play activities in, 174–175
- Walking School Bus program, 173
- Walls, ornamentation on, 258–260
- Warm light, as design attribute, 11
- Washington Environmental Yard, California, 167, 169–170
- Waste generation, ix, 48
- Wastewater treatment, biological, 55, 56
See also color Figures 19-2, 19-3
- Water, 43–56
- adjacent to architecture, *see* color Figure 4-14
 - animistic traits of, 45
 - biophilic aspects of, 44–47
 - in children's play areas, 175
See also color Figure 10-15
 - in contemporary Western civilization, 47–49
 - as design attribute, 7
 - economic value of, 48
 - human preference for, 23
 - in indoor ecosystem, *see* color Figure 4-5
 - in interior reflecting pool, *see* color Figure 4-3
 - opportunities to enhance built environment with, 49–56
 - religious uses of, 46
 - in urban design, 282–284
- Water Crater, Westphalen, Germany, 53
- Water cycle, 309–310
See also color Figure 19-2
- Waterfalls, 51, 52
- Water gardens, 51
See also color Figure 4-6
- Water pollution, ix, 38, 48, 219
- Waters, Alice, 167
- Waterscapes, 53
- Weintraub, Lee, 304
- Weizenbaum, Joseph, 72
- Well-being:
- and biophilia, 3–4
 - contact with nature for, 4
 - environmental factors in, 62
 - and low environmental impact design, 5
 - and neurological nourishment, 69
 - and positive experience of nature, x
- Wells, Malcolm, 314

- West Edmonton, Alberta, 48
 Westermarck, Edward, 22
 Westermarck effect, 22–23
 Western Electric, Hawthorne plant, 337
 Western Harbor project, Malmö, Sweden, 281, 288, 290–291
 Westin Hotel, Kansas City, Missouri, 339
 West Philadelphia Landscape Project, 191
 Whewell, William, 21
 Wholeness:
 as design approach, 317
 rationality vs., 319–320
 Whyte, William, 231
 Wilson, Alex, 127–128
 Wilson, Edward O., x, 28, 63, 65, 76, 206, 222, 244, 325
 Windows, 119–130. *See also* Viewing
 nature through glass
 for access to views, 119–121
 benefits of light from, 121–123
 bio-inspired, 34–35
 energy, health, and productivity
 benefits from, 125–126
 fresh air and natural ventilation from, 123–125
 in healthcare facilities, 102
 for natural conditioning, 126–128
 openable, 124–125
 ornamentation of, 256–258
 for passive survivability, 127–128
 and spirit of place, 130
 for transparency, 129–130
 virtual, 327
 Windsor, California, 183
 Wines, James, 244, 335
 Winslow, Barbara, 341
 Wise, James, 332, 338
 Witherspoon, Bill, 327
 Wolch, Jennifer, 211
Woonerf (residential precincts), 188, 193–194
 See also color Figure 10-56
 Workplace, restorative experiences in, 138, 147
 Wright, Frank Lloyd:
 on biomimicry of function, 29
 Fallingwater, 18, 235
 on inspiration from nature, 229
 Jones' work with, 236
 letting outside in principle of, 355
 materials used by, 78, 236–237
 mystical perspective of, 75
 patterns used by, 341
 Prairie-style architecture, 8
 refuge and prospect in houses of, 266
 Samara House, 41
 SC Johnson Administration Building, 340
 wall ornamentation placement, 248
 window design, 248
 See also color Figures 15-8, 15-9, 15-10
 The Wright Space (Grant Hildebrand), 341
 Yale University Ingalls hockey rink, 7
 Yao, Marissa, 339
 Yoga Promenade, Tokyo, Japan, 192, 193
 Zen gardens, 299
Zoomorphic (Hugh Aldersey-Williams), 33
 Zoos, 69, 161, 172