

CHAPTER SEVEN – LEARNING WITH PEOPLE, PLANTS & ANIMALS in Zoos, Aquariums and Sanctuaries

Introduction. In previous chapters natural landscapes including wildlife, or people themselves, were the heroes to be celebrated, protected, supported, or healed. My growing attraction to and empathy for novel people, places, plants and animals began to expand into the realm of unique animals and plants in human care, in zoos, wildlife sanctuaries and botanical gardens. This peaked briefly with my master’s thesis “Artificial Habitats for Captive Animals”, about zoo design based upon animal behaviour and global biomes described in Chapter Three. However, it would be seven event filled years before I had my first opportunity to design a zoo. These stories cover times I was employed by Jones & Jones, Architects and Landscape architects in Seattle Washington through my partnerships in Coe & Lee, CLRR and CLRdesign, all in Philadelphia and concludes with projects by Jon Coe Design Ltd. in Australia.

Northwest Trek Wildlife Park -1974. Soon after joining Jones & Jones in Seattle we won our first zoo design contract for the planning and design of Northwest Trek Wildlife Park in the Mt. Ranier foothills in Eatonville Washington. This property owned by Dr. David and Ms. Connie Heller already had a private collection of native hoof stock including moose, wapiti (elk), mule deer, mountain goat and later acquired bighorn sheep. Concerned about the continuity of their beautify enterprise, the Hellers donated the land to the Tacoma Park Department which also owned Point Defiance Park Zoo and Aquarium and who became our client.

Grant Jones and I surveyed the 290 ha (720 acre) site of deep evergreen and alder forests, a swamp, marshes, hills, and grasslands, in his vintage Land Rover and on foot, noting where these wildlife species chose to live. We then designed visitor tram roads connecting these animal-favored locations in the most inconspicuous and least damaging way possible. We studied viewsheds and located roads so that visitors in one tram would not be distracted by seeing other trams in their views.



Figure 40. Free-ranging wapiti and lake seen from the tour coach in 2012.

I designed exhibits for smaller animals like beavers, otters, badgers, and wolverines modeled after the innovative naturalistic displays at the Arizona Sonora Desert Museum in Tucson, Arizona I had visited during this work. This innovative outdoor natural history museum was directed by Mr. Merv Larson, a talented designer and builder. In 1976 he left the museum to found the Larson Company the leading zoo design-build firm in the USA in the 1980 and 90's. This company now operates globally as Larson Themed Construction. My beginnings with Merv Larson didn't go well. I had made an appointment to meet him at the Arizona Sonora Desert Museum. I was then beginning my zoo design career and unknown to him. He was busy, kept me waiting, spoke briefly to me and handed me off to his then lieutenant, Mr. Rick Dyson. Rick was friendly, interested in my projects and shared his time and experience freely. During the time we planned Northwest Trek, Rick left the museum to found his own artificial rockwork (mock rock) firm he called Cemrock. We then hired Cemrock to build the small mammal exhibits for us, and later, the exhibits at Woodland Park Zoo and many of my later exhibits. This infuriated Merv Larson.

In hindsight modeling our small mammal exhibits after those at the Arizona Sonora Desert Museum recognized their groundbreaking realism and beauty but was a mistake in terms of exhibit size. Our exhibits turned out to be far too small for such active animals, especially the mustelid family such as otters and wolverines. Much larger areas of natural forest were provided for wolves and bears.

I designed the entry roads and car parks and located many facilities directly in the forest using stakes and strings, rather than designing them on paper in the office. Surveyors then prepared construction drawings from my staked field layouts. I have used this technique many times on future projects. This was often cold field work in drizzling rain and 5C (41F) temperatures. I returned home at night several times to dry my wet field drawings on an ironing board only to find the rain had smeared my pen writing and washed away my pencil notes. The benefits of designing in the field were also memorable. Large Douglas fir trees cleared for road and parking areas were sold for lumber, offsetting much of the construction cost. Overall, Northwest Trek, which opened in 1975, remains one of the finest "safari parks" in the world almost five decades later.

Woodland Park Zoo. In 1974 a master plan for the renovation of Seattle's Woodland Park Zoo by Architect George Bartholick was opposed by citizens not wanting to lose half of Woodland Park to zoo expansion and for being financially unrealistic. Seattle City Council negated this plan, leaving zoo redevelopment funding of USD\$4.5 million (a huge sum in those days) waiting for a new plan. Mr. David Hancocks, an English zoo architect consulting to Bartholick, was retained to pick a new design firm and fortunately we at Jones & Jones were awarded the new planning contract in 1975.

Our team was led by Grant Jones, landscape architect, architect, poet, and Harvard classmate, consulting ecologist Dr. Dennis Paulson and me. Supporting team members included architect Johnpaul Jones (no relation to Grant) and landscape architect John Swanson. David Hancocks was the City's project manager. David, Grant, Dennis, and I

were the principal authors of the resulting 1976 “Woodland Park Zoo Long-Range Plan.” This became a sold-out model for “landscape Immersion” zoo design and is widely considered a classic resource today.

With my zoo thesis background, and all the zoos I had visited, I assumed we would model improvements on the best existing zoos, and the best animal management practices of the day. However, David Hancocks’ firm admonition was “You won’t learn anything from zoos, look to nature as the model!” This suited our team wonderfully, both logically and emotionally. This was in fact the point of my thesis, to use global bioclimatic zoo organization and natural animal behaviour rather than modern zoos to drive our design ideas.

Using Grant’s site analysis overlay system, I spent countless hours studying the existing zoo site. I calculated tree shadow patterns using summer, spring/autumn and winter sun angles for our latitude using existing tree cover maps. This defined our site’s landscape infrastructure and microclimate. If we wanted to create a forest biome for gorillas, it would go in existing tall groves. Open plains exhibit for giraffes would go in existing open lawn areas. I assembled a large folio with dozens of hand drawn overlays. With these we collaborated on organizing the entire property into biomes, even selecting pedestrian circulation systems linking biomes into adjacencies as they are experienced when traveling internationally. For example, tropical deserts are adjacent to tropical grasslands, these connect to savannas or woodlands leading to tropical dry forests then to tropical rainforests along a rainfall gradient. So, we organized our zoo exhibits in a similar sequence, while also fitting them to site vegetation patterns. As Grant Jones liked to say, “We let the site tell us what it wanted to become.”

The most important of our teams’ inventions was what Grant named “landscape immersion”.

“I originally coined the words “landscape immersion” to describe the responsibility of the strategic design to give a wild home place for each animal to adapt to (not an exhibit or landscape painting to peer into from a sidewalk). I wanted to cultivate the responsibility of each visitor to enter the animal’s private domain as a respectful intruder carefully passing through the animal’s habitat in an intimate experience that might, if as a visitor you’re lucky enough, include the animal’s own decision to interact on its own terms with you, or being thus comfortable with you on its own terms to retire off view.”¹

Not only were we copying nature with great realism rather than copying other zoos, but we also intended zoo visitors to walk through, be immersed in the animals’ accurately simulated natural habitat. Only then would they discover the animals (separated by invisible barriers). I overheard a visitors say, “What keeps the gorilla from walking up and tapping us on the shoulder?” The human physiological-behavioural basis for

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landscape immersion design is defined in my 1985 Paper "*Design and Perception, making the zoo experience real*"² This paper has passed thirty thousand "reads" on the "Research Gate" online research site. This approach has three main focuses:

- Animal welfare will be enhanced by recreating the habitat in which the animal evolved as closely and richly as possible. This includes both facility design and design of management procedures, such as allowing gorillas to climb trees and providing and changing naturalistic behavioural enrichment features of interest to individual species. I call this the 'biocentric' philosophy, that nature knows best, as compared to the modernist 'anthrocentric' philosophy that humans and their technologies know what is best for animals. However, we accepted the modernist approach in designing the animal's climate controlled off-display management facilities. The animals seemed to benefit from both approaches.
- Visitors' experiences will benefit from being "transported" from the modern zoo to another time and place, such as the African savanna or the gorilla rainforest. The cognitive mind knows you are visiting the zoo, but the emotional mind "feels like" you are in the rainforest with gorillas. Strong emotional experiences make strong memories and stimulate learning. These visitor experiences were choreographed like theatrical or dance performances by mapping sequential "scenarios" or "storylines" I wrote as if I were walking through the actual scene and describing what already existed. These scenarios documented the specific proposed location, geography, landform, exposed geology or soils, plants, site ecological evolution and the viewer's visual relationship to landscape and animal inhabitants. We wanted these simulations to be of such quality that an expert scientist, geologist, or botanist, experiencing the exhibit, would say, "Yes, that looks right." Sceptics may say, "Why bother. Ordinary visitors can't tell the difference." I would respond, "Why limit the exhibit's teaching potential to a low level? Why not further enlighten, whatever education level the visitor has?" Zoos should lead and not follow popular tastes and styles.
- Reciprocal benefits to both visitors and animals. In both my 1985 paper (footnote 12) and 1984 paper *The Coe Jones Rules*³, I list the "rules" of what has come to be known as "immersion design." One example is that exhibits are designed with the animals positioned above viewers, so that visitors "look up to" (respect) and don't "look down on" (disrespect) the animals. Being above strange humans is likely to make animals less stressed and more in command. Looking up to the animals predisposes visitors to learn from the animals. Thus, both visitors and animal's benefit. Certainly, demonstrating respect for animals, plants, and all of nature is our primary design goal.
- Implied conservation. Mary Akeley, wife of the famous museum taxidermist Carl Akeley, wrote that animals cannot be fully understood when taken out of context. To understand the animal one must see it in its natural habitat. This was

² Coe, Jon C. (1985) *Design and perception, making the zoo experience real*. Zoo Biology vol.4, no. 2, pp197-208.

³ <https://joncoe.net/wp-content/uploads/2021/12/TheCoe-JonesRules-1984.pdf>

demonstrated in Akeley's amazing museum dioramas. We took this idea further, asserting that animals and natural habitat landscapes are inseparable. If we are to save gorillas from extinction, we must save their habitats from destruction. Thus, we hoped that showing gorillas in a realistic simulation of their natural habitats would embed the implied conservation connection in visitor's minds. Visitors would support habitat protection. Looking back today, I do not believe that an implied conservation message is sufficient to evoke positive conservation action by visitors. William Conway's wonderful Congo Exhibit at the Bronx Zoo takes the immersive implied conservation farther with active conservation donation stations and a modest conservation directed admission price.

In addition to using microclimates to organize exhibits and landscape immersion principles, David Hancocks also wanted the design to include a second major concept, "social biology" developed by E. O. Wilson. This meant that social species would always be exhibited in social groups, never alone.

We assembled our overall concept for Woodland Park Zoo into a preliminary report for City Council to assure their support before we went further in development of the master plan. To our astonishment, immediately after our presentation and before any discussion, the chairman called for a vote to approve the Woodland Park Zoo Master Plan! This early draft was approved as the full master plan to release the funds for zoo redevelopment! Rather than continuing the planning work we were instructed to begin design of the first phase projects, the new Gorilla Forest, and African Savanna, Monkey Island and Waterfowl Marsh exhibits. David Hancocks was appointed Zoo Director and the team's work continued. It was only after completing the exhibit designs that we published the 1976 Long Range Plan⁴, which became the "how-to-journal" on naturalistic zoo planning and design. It sold out soon and was reprinted by the Seattle Parks Department. In 2004 while with CLRdesign, I was commissioned to write the updated "Woodland Park Zoo Long Range Physical Plan." This is the version available today.

How do I now see my role in the 1976 Long-Range Plan zoo design breakthrough? Grant Jones, as principal of J&J, rightfully is listed as lead author. David Hancocks and Dennis Paulson put us and kept us on the right paths. I take credit for human behavioural insights and did most of the writing, illustration, and exhibit design in the Long-Range Plan, and the actual exhibits which followed. J&J architect Johnpaul Jones led naturalistic design of architectural features. Landscape architects including John Swanson, Dave Walters, Kai Makami and Peter Harvard transformed my sketches into buildable construction documents, inventing new construction details to achieve these highly naturalistic forms. Artificial rockwork fabricators Rick Dyson of Cemrock working under Jolly Miller contributed to our joint success. The resulting work was highly collaborative. My work would never have been as insightful or innovative without these

⁴ <https://joncoe.net/wp-content/uploads/2022/04/Long-Range-Development-Guidelines-and-Exhibit-Scenarios-WPZ-1976.pdf>

complimentary and interactive team members. For more details on this important period in zoo design history please see these books listed in the footnote below⁵.

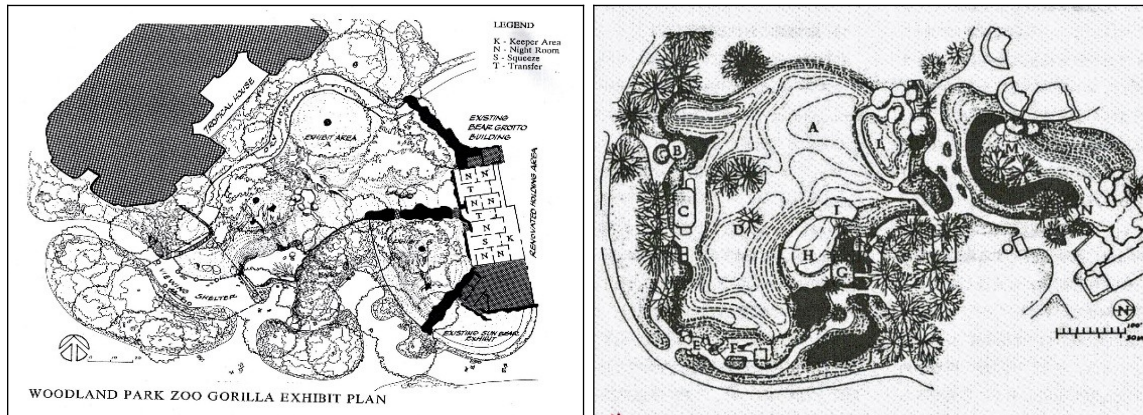


Figure 41. Upper row: drawings I made illustrating my design for the world's first immersion Gorilla and African Savanna exhibits. Note the visitor paths winding through the landscape rather than outside exhibits looking in. Lower images: two gorilla exhibits I photographed at different zoos in 1978 showing our remarkable revolution in gorilla facility design. Left: the old Cheyenne Mountain Zoo. Centre and right: our new exhibit at Woodland Park Zoo. Lower right: Kiki in his tree, where he would quietly watch the people around him and his family for hours. Photo: David Hancocks.

One of my memorable experiences was meeting with my hero the intrepid wildlife research scientist and fine writer Dr. George Schaller on the old Woodland Park Zoo site of the future gorilla exhibit. Director David Hancocks had been assured by “zoo experts” of the day that allowing zoo gorillas to climb trees was a ridiculous and dangerous notion. Tree limbs would break, and gorillas would be injured. Any counter argument that gorillas had evolved to be semi-arboreal was ignored. Dr. Schaller had studied wild mountain gorillas for a year and was the first to do so, spending hours perched on tree limbs himself. He didn't know zoos, but he certainly knew nature. I showed him the existing large maple trees we planned to provide the gorillas with access, mentioning the resistance the idea had received. Should we proceed with our

plans? George Schaller looked at the trees, then looked at me, saying, ‘Someone has to do it.’ You have to do it!’



Figure 42. Upper row: 1977 construction photos. Although our planning took careful account of existing trees, it was necessary to move many very large trees out of proposed biomes where they did not fit to other areas of the zoo where they would enhance future biome exhibit zones. All these trees survived transplanting and have become magnificent. Lower row. Left: landscape immersion’ means being within the themed landscape while seeing the animals in the same habitat separated by hidden barriers as shown here. Lower right photo taken by Brianne Hoppe in 2016 shows how zoo Horticulture Director Sue Maloney Nicol and her staff have maintained the dense habitat landscape for forty years, which our critics had said would be impossible.

Then Zoo Director David Hancocks asked me how long it would take for new plantings to become established before animals could be introduced into the new exhibits. I replied that a full growing season would be required. To our surprise, David delayed exhibit opening for a full year, a highly successful strategy no other zoo I know of has followed. During this plant growing period, I led groups of first grade school children through the areas the gorillas would later inhabit, seeing the world as the gorillas would later see it. I don’t know what other zoo visitors thought of seeing children in a gorilla exhibit.

After the exhibit was opened silverback gorilla Kiki spent hours most days high up in one maple where he had an excellent view of everyone approaching, including his

caregivers. He was never seen damaging the tree. Unfortunately, the tree died during the second year from root damage caused during construction.

Gorilla Kiki's day out.

During spring day in 1977 Zoo Director David Hancocks is in his zoo office when two zoo visitors come in excitedly exclaiming, "Your gorilla has escaped! He's out!" David replies calmly, "Oh no, the exhibit is designed to look that way, to look as if there are no barriers. As the two leave David hears them say, "Amazing just sitting next to the path like that." David sounds the alarm: "Code blue gorilla exhibit!" goes out to the walkie-talkies of all zoo staff. Their first task is to get all visitors safely indoors.

Kiki is sitting under a tall fatsia shrub near the Nocturnal House's service entry. He is trembling slightly, showing anxiety. Zoo Veterinarian Dr Jim Foster approaches calmly, with feigned casualness and encouraging words. He has known Kiki since the gorilla's infancy, but Kiki is an adult now with over 260 kilos (450 pounds) of gorilla strength. Potential danger is very real. Also, gorillas mostly associate veterinarians with uncomfortable experiences and rarely welcome their visits.

Jim calls quietly, "Come on Kiki, let's go." Kiki recognizes Jim and, becoming somewhat calmer, follows Jim back towards the exhibit, then hesitates. The bucket of bananas and sliced apples Jim ordered arrives and, with this incentive, Kiki again follows Jim. They reach the back of the Nocturnal House near the point where Kiki escaped, but the gorilla is still agitated and can bolt away. Calmly and slowly, Jim sits down next to Kiki and shares the fruit. They picnic under spreading magnolias just outside the escape-proof moat barrier. Sharing food has a calming effect on the gorilla, as it usually does with humans.

Jim then leads Kiki to the gorilla moat where an aluminum ladder has been placed across. Jim starts across the ladder, but Kiki won't follow. The ladder is too foreign to him. Then Jim rearranges the ladder so that it descends into the moat and climbs down, inviting Kiki to follow with the promise of more bananas. Kiki has not finished exploring and instead enters the hallway into the Nocturnal House service area. Keepers shut adjoining doors and Jim slips in behind Kiki. The gorilla randomly picks a door and turns the handle. It's locked. Kiki pulls harder, using his prodigious strength and the lock snaps open. Kiki walks into the service kitchen, where the food for the nocturnal animals is laid out in neatly spaced pans on the stainless-steel table. Kiki steps up onto the table and, stepping carefully among the dishes, samples the fare, picking out the papaya pieces and blueberries. He climbs down, quietly inspecting some small potooroos held in temporary cages nearby.

Jim has his tranquilizer gun ready but wants to dart the silverback when Kiki is distracted enough that he won't know where the dart comes from and can't associate the sting of the dart with him. Also, the tranquilizer takes several minutes to take effect, and it would be best to have Kiki in a confined area, so that he won't go too far before he is fully asleep. Kiki starts exploring a corridor towards the toilets. This might be the

chance. Jim tosses a banana ahead and, as Kiki turns to retrieve it, Jim fires his tranquilizer dart - a good shot. Kiki, surprised and recognizing the sting of the dart, turns and charges down the narrow hall at Jim, turns his 1.4m wide shoulders sideways, agilely slipping past Jim at full speed. In the kitchen he backs into a corner and succumbs to sleep. Kiki wakes up in his familiar bed the next day, no harm done.

The next day's Seattle Post-Intelligencer features a large cartoon showing Kiki being escorted around nearby Green Lake by two buxom blonds on roller skates, while Zookeepers with butterfly nets lurk behind bushes.

How did Kiki escape? Several small hawthorn trees, perhaps two meters high, had been planted in the exhibit before it opened. According to then director David Hancock who inspected the scene after Kiki was returned, Kiki had planned his escape. He plucked one of these trees out of the ground roots and all and threw it into the back moat. Then he climbed down after it. The outer 3.65m (12') high wall was far higher than the small sapling tree, but Kiki had very long powerful arms. He only needed a step ladder to reach the wall top and lift himself out. Kiki then headed for the fatsia bush and settled down to watch the zoo visitors. After all, they had been watching him for years. As a post scrip, Jim Foster later became the field veterinarian at the Dian Fossey Karisoke Mountain Gorilla Research Center in Rwanda.

Did our Jones & Jones plus David Hancock's team invent landscape immersion design? We certainly named it and published the design process and rules for achieving it. In 1905 Carl Hagenbeck invented impressive "naturalistic" exhibits using "sightline design", but in most cases visitors were on the outside looking into the themed exhibit area and not immersed within them. Arizona Sonora Desert Museum Director Merv Larson was the first I knew to achieve landscape immersion a few years before us. He wisely borrowed and inserted surrounding Sonoran Desert landscape features and planting, making excellent use of distant "borrowed" desert landscapes. He never attempted to create exotic landscapes as we did, and kept his methods as commercial property, while we published our theories and techniques widely. Later his Larson Company zoo design/build firm created wonderful tropical simulations at the Bronx Zoo's Jungle World working with iconic Director William Conway and outstanding in-house designer John Gwynne at the Bronx Zoo. The skills of artificial tree fabricator Ms. Jonquil LeMaster are much in evidence. Still, John Gwynne didn't consider Jungle World immersive.

Director George Rabb at Brookfield Zoo envisioned highly realistic wilderness recreations for an early small but excellent indoor Predator Ecology exhibit that opened in 1979. Our Woodland Park Zoo work slightly preceded this, but I think Dr. Rabbs vision there was original. Unfortunately, he lacked both the design theory and fabrication team to achieve this grand vision later with his vast Tropic World project.



Figure 43. Award winning J&J designed polar bear exhibit at Point Defiance Park Zoo and Aquarium. My small design contribution showed only the upper portion of the back moat barrier wall as exposed permafrost, giving the impression of a vast area for the bear. By today's standards the actual area of this exhibit is much too small for this species.

Point Defiance Park and Aquarium. After our success with Woodland Park Zoo and Northwest Trek, our J&J team prepared the master plan for the Pt. Defiance Park Zoo and Aquarium in Tacoma Washington. This was led by John Swanson with help from Johnpaul Jones and David Roberts. My input was limited, but it was I who suggested the viewing angles and barrier configuration which helped make their polar bear exhibit innovative and its landscape convincing. Working with ecologist Dennis Paulson we designed many small exhibits in the World of Adaptions using reptiles and insects to demonstrate ecological adaptations such as cryptic coloration. These exhibits were built by Mr. James Peterson, then a friend from Bainbridge Island who later designed exceptional displays at the famous Monterey Bay Aquarium and became a leading aquarium exhibit expert. Jim later formed the design firm Bios with John Nightengale, who earlier helped to design the Seattle Aquarium during the 1970s.

Living Desert State Park, Carlsbad New Mexico. During 1977 Johnpaul Jones and I were invited to redevelop their master plan and design new exhibits by New Mexico Parks Department Project Manager David Johnson. We loved this work because it allowed us, with David Johnson and ecologist Dennis Paulson as guides, to explore the Chihuahuan Desert ecosystem. During weekends, David toured us around the wonderful and historic town of Santa Fe and the ancient Anasazi villages of Aztec, Mesa Verde, and Chaco Canyon⁶ in New Mexico and southern Colorado. David remains a distant friend to this day. Years later, Susan and I visited Chaco Canyon, Canyon de Chelly⁷ and Acoma Pueblo, from which we still have a wonderful small ceramic pot. Later still, our daughter Alyssa attended the University of New Mexico majoring in archaeology. I retain great fondness for this region.

Pittsburgh Zoo. Working for Jones & Jones during 1979-81, we were hired by the Pittsburgh Parks Department to completely redesign the old Pittsburgh Zoo. We

⁶ https://en.wikipedia.org/wiki/Chaco_Culture_National_Historical_Park

⁷ <https://www.nps.gov/cach/index.htm>

coordinated with the city's project manager Todd Meyer and collaborated with Bill Swain and Bob Mullen and project manager Jim Pashek of GWSM Landscape Architects. This was a jolly group to work with. Bill Swain often invited us home for a family supper.

Zoo Director Howard Hays, in contrast, was a stern traditional director who didn't want us there. Perhaps he felt we threatened his knowledge and authority. He told me he had consulted with other zoos; he did not need us and could develop his own new exhibits if given the funding. During our first meeting Howard demonstrated his power by having Jones & Jones founding principal Grant Jones removed from the job. Grant was describing our overall master plan layout based upon bioclimatic zones. Howard didn't care about master planning and asked for specific animal exhibit details. Grant replied calmly he would come to that, but it was important to understand the big picture first. Howard then turned to City project manager Todd Meyer and said clearly, "I want this man off the team. He can leave now!"

Being a designer surrounded by others in this field led me to the false assumption that everyone else could also visualize abstract ideas and understand "big picture" concepts as we did. In Pittsburgh I learned that intelligent people often don't share this capacity. Howard Hayes could only visualize familiar details, but he could gradually arrive at the overall vision as the sum of the practical parts. Once I demonstrated I knew the details, such as what gauge of fence wire was needed to contain a tiger, he began to trust my ideas about organizing exhibits as geographic biomes rather than taxonomic groupings. Eventually we had a very good business relationship resulting in two highly successful stages of designs and constructions.

This was an important life lesson in patience and communication which taught me: 1) Respect people and their knowledge (or lack of it) and opinions even if you don't like them. 2) My job was to communicate my ideas in ways they could understand.

When I first toured the old Pittsburgh Zoo Main Building, opened in 1898, it was the worst animal welfare environment I had ever experienced. I walked past small, bared cages with desolate single animals whose mates had died. There were two of everything. Now there was one of some species. Some cells now were empty. A lone African elephant calf swayed endlessly with no herd contact and barely room to turn around. It had hurt its trunk by investigating a large fan set within its reach in a back corner and afterwards would only use the front half of the small space provided. During one visit I saw a dead manatee lying unattended on a zoo kitchen table awaiting necropsy. An overpowering smell of cleaning solutions and animal wastes permeated the dark oppressing structure, producing the indelible sensation that the old Main Building was filled with the ghosts of zoo animals passed, but not freed by death. I have never experienced this chilling premonition before or since. The hillslope site had been leveled for this long old building. Heartfelt demolition allowed to use this flat area to construction of the African Plains area for antelopes, zebras, elephants, and giraffes to the benefit of all.



Figure 44. National Geographic Magazine photographer Michael ‘Nick’ Nichols took these images of the elephant exhibit we designed on the site of the old Pittsburgh Zoo Main Building. Nick kindly gave me permission to use them. I wrote the concluding essay in his book: *Keepers of the Kingdom, the New American Zoo*⁸

Meeting Dr. Jane Goodall was a high point in my Pittsburgh Zoo experience. The first National Geographic TV specials on her work with African chimpanzees was produced by WQED-TV in Pittsburgh soon after she was introduced in National Geographic Magazine, so the producers decided to have her at the screening at Pittsburgh Zoo. She entered the presentation room after having been toured around the terrible old zoo by director Howard Hayes. She looked pale and ill from this experience as she took her seat in a folding chair next to mine. Early in the broadcast, at the scene where she is shown sitting on a hilltop, miscast as a ponytailed naive young woman, she turned and whispered in my ear, “It wasn’t like that!” More about my work with Dr. Goodall is described later in this memoir.

Toledo Zoo. In 1981 I met Toledo Zoo Director Bill Dennler during a zoo conference and visited Toledo on the way home from one of the Pittsburgh Zoo meetings. Bill and his wife Jeannie were very hospitable. The zoo, while old, was lovely, including an aquarium, a natural history museum and an auditorium. However, fitting all these attractions on a small site resulted in limited space for the animals. Bill was as

⁸ Nichols, Michael (1996) *Keepers of the Kingdom, the New American Zoo*. Thomasson-Grant-Lickle, NY.

welcoming to new ideas as the Pittsburgh Zoo director had initially been closed to them. Both directors, like most people, had difficulty visualizing intangible ideas. Having learned this lesson in Pittsburgh I devised a method to make my ideas more immediately clear. In the Jones & Jones office I designed a tracing table, a rectangular frame on wheels with a heavy plate glass top. It had an adjustable low shelf to hold a slide projector facing a 45-degree slanting mirror. The photo image was projected onto the underside of the tracing paper taped to the top glass surface. Thus, I could quickly trace projected images to show before and after animal exhibit perspectives...all long before the invention of Photoshop and iPad tablets. Using this technique, I produced a dozen or so sketches envisioning the zoo visitor experience moving through a proposed exhibit area. Decades later Bill reminded me of how helpful these sketches were to him.

Once I had developed the overall master plan, we faced the issue of phasing new projects around existing buildings. I printed the overall plans, both existing conditions and proposed changes, sized to fit into the top of a cardboard shoebox lid. Then I overlaid the two plans and cut out the new project areas on both, creating something like a double-layer picture puzzle. Bill could lift out one piece of the existing zoo and replace it with the proposed new area, instantly seeing how the zoo would look and operate at various stages of redevelopment. Today this would be shown using computer animation, but my trick worked very well in 1981.

An especially innovative exhibit J&J designed for Toledo Zoo was the world's first Hippoquarium, with a massive filtration system designed by oceanarium filtration expert Mr. Nestor Ramos to remove the hippo's frequent and considerable poo ejections. While I oversaw this work, architect Johnpaul Jones was the principal designer.



Figure 45. Upper left: my 2012 photo of the Toledo Zoo Big Cat House in the distance, converted to the zoo restaurant at my suggestion during my 1981 master plan. Upper right: my design sketch of the proposed white rhino exhibit and below is my photo of the completed exhibit.

During this general time, I gave a few talks at the University of Washington Landscape Architecture Department then headed by Professor Robert Buchanan. One of the students was Becca Hanson who later joined J&J with her later husband landscape architect, David Roberts. With the additional zoo work to be done, we also hired Charles Mayes and John Swanson' friend Mark Johnson, his then wife Ann Mullen, and several other talented young design professionals. I mention these people because I helped to train them in our zoo design skills, and they later became important designers in this field. Becca, David, and Charles helped to produce the construction drawings and field observation work for phase two of the Pittsburgh Zoo and Toledo Zoo exhibit construction. They also contributed to developing the plans and supervising construction of the Gene Coulon Beach Park mentioned earlier.

J&J partners Grant and Ilze Jones were no longer involved in my zoo projects in the eastern USA and fully trusted my team to properly represent the firm's interests. Suddenly I learned Becca Hanson, David Roberts, Charles Mayes, John Swanson, and several other J&J members had resigned to open their own competing firm, the Portico Group, and convinced our Toledo Zoo client to give them its next design contract. This was a serious blow to our trust in shared professional ethics. Nevertheless, we

continued with our trusting ethos and continued to win our share of new clients. Later Becca Hanson and David Roberts left Portico to open their own firm, Studio Hanson/Roberts. John Swanson opened his own single person firm. Charles Mayes stayed with Portico until his recent retirement. Mark Johnson, never part of the Portico firm, left J&J to open his highly successful firm Urban Initiatives in Colorado and is no longer engaged in zoo design. I've made it a lifelong practice to stay on good terms with everyone and remain friends with all these colleagues to this day.

Pardisan Park, Tehran Iran. Pardisan Park was a proposed public cultural attraction complex covering more than 270 ha (667 acres), in northwest Tehran, Iran. In about 1978 Ian McHarg, then Chairman of the Department of Landscape Architecture at the University of Pennsylvania and his design firm McHarg, Wallace, Roberts, and Todd were selected by Mohammad Reza Pahlavi, then Shah of Iran (the Shah's wife Empress Farah Pahlavi was more directly involved I was told) to design a vast new 'Pardisan' ('paradise' in Farsi). This would include an Iranian cultural centre, science and technology hall, planetarium, aquarium and zoo in the capitol, Tehran. After extensive research Ian's team developed a highly detailed ninety-four-page master plan published in 1975⁹. This plan described bioclimatic zones of Iran relating them to similar zones around the world and proposed recreating everything from tundra to tropical forest in the hot, arid climate zone of Tehran. Ian's plan was to literally transpose a rectangular map of the world, with Iran in the center, onto the sloping and deeply eroded ground. Vast mountains like the Zagros and Alborz Mountains of Iran and even the Alps, Himalayas, Andes, and Rockies would be represented by high concrete-covered earth formations dug up to excavation lakes representing the Caspian Sea and Persian Gulf. Only Ian had seen the actual site. This was an unpromising outwash plain descending from the Elburz Mountains, dissected by both deep and shallow erosion channels including an intermittent stream subject to flash flooding. Water would need to be supplied by deep wells with ground water levels declining. The plan was high on aspiration, zoogeography and bioclimatic theory without consideration for practical considerations such as how to build, plant and operate the grand vision. Ian's vision expressed in his team's exhaustive master plan was inoperable. He paid no attention to how the zoo would be designed in detail, how animals for this vast new zoo would be acquired or cared for or who would provide this essential care.

For detailed zoo design, Ian contacted the Jones & Jones team, including our excellent consulting ecologist Dennis Paulson and Woodland Park Zoo Director David Hancocks as advisers. Ian had not realized the cost of designing such an extensive project, and when he saw Grant Jones' fee proposal he realized he didn't have the funds for us to do the full design. Instead, Ian had J&J prepare the zoo concept plan and hired Mr. Gary Lee, a brilliant recent graduate of his university program, to do the detailed design and

⁹ PLAN FOR AN ENVIRONMENTAL PARK IN TEHRAN

For the Imperial Government of Iran, Department of Environment
The Mandala Collaborative/Wallace, McHarg, Roberts and Todd
1975

construction document preparation work which would normally require four to five experienced zoo designers. Dennis Paulson was funded and toured the diverse biomes and wildlife reserves.

I remember working on the project in Ian's Philadelphia office through the night with Gary Lee, while Grant Jones, David Hancocks, Ian McHarg and his chief assistant Narendra Juneja went out for a leisurely dinner. Ian and Narendra were heavy smokers. Gary and I were happy to work together after they left. This late-night work session is memorable because Gary and I got along so well we later formed a design firm together, Coe & Lee, later to become CLRdesign described in Chapter 9.

Ian liked to produce large drawings for large projects; what we called "bedsheet" graphics. Ian also liked to travel in style. On his final trip to Tehran to present his project to the Royal Family, he booked his flight on the supersonic Concorde airliner. When Ian checked in he was told this slender aircraft had no room for his large drawings. They had to be sent on a later flight. These critical drawings never arrived, and Ian had to present to the Shah and his wife without them. The Shah was deposed in 1979 and the ill-conceived project abandoned. Fortunately for us, architect, and landscape architect Gary Lee, originally from Medford Oregon, came to work for J&J. He will figure strongly in my story going forward.

Oregon Zoo and Beaver-Otter exhibit. We developed the master plan for the Oregon Zoo in Portland in about 1980 and then designed the first stage of their North Cascades zone, the Beaver-otter Exhibit. Gary Lee and I collaborated on the award winning, highly naturalistic aquatic exhibit with trout, waterfowl, beaver, and otter within a natural stream corridor. We worked together very well.

Coe & Lee. In 1984, soon after we settled into our home in Newtown PA to teach at the University of Pennsylvania (Chapter 3.), I was contacted by my old firm Jones & Jones in Seattle about a master planning project at Turtleback Zoo in New Jersey. J&J was not interested in the work but thought I might be. I contacted Gary H. Lee, who had recently left to open his own architectural office in Oregon. Gary agreed to fly out and collaborate on the Turtleback project. This was a small zoo with limited resources, and our plan was not especially noteworthy but for one thing. It led to our founding the firm Coe & Lee Associates in my Newtown homes' garage. Most of the following zoo projects I describe until 2004 were done in close collaboration with Gary.

Bronx Zoo -1984. The New York Zoological Society – Bronx Zoo under legendary director William Conway was and is one of the world's great zoos. Mr. John Gwynne, Director of their Exhibits and Graphics Depart (EGAD), a landscape architect and outstanding exhibit designer (and bird illustrator) and his team were fully occupied in the design and construction of their Jungle World facility. He asked me if we could assist them with other pressing exhibit design projects. Our first work was the redevelopment of the heritage domed "capitol" building at the head of Beaux Arts era Astor Court. Animals to be displayed included Asian elephants, tapirs, and Sumatran rhinoceroses.

Our first meeting included New York architects Goldstone & Hinz and General Curator James Doherty. Mr. Conway, a somewhat intimidating polymath asked, 'Jon, you are most known for highly naturalistic exhibits. How will you deal with this symmetrical, axial setting?'

Assuming Mr. Conway, with his posh manner and English/American accent, would know art history, I recalled some of my own training in this area. I confirmed axial architectural symmetry became popular during the Italian Renaissance as early as the 14th Century, was celebrated in the Greek Revival Period in the mid-17th Century and re-envisioned at the beginning of the 20th Century as the Beau Arts style of Astor Court. However, during the mid-15th century painters Claude Lorrain, Nicolas Poussin and others created Arcadian pastoral landscapes with classical buildings seen from side angles as landscape features rather than architectural subjects. I suggested we could design the new exhibits with all views from side angles as Lorrain had done or bring visitors through dense vegetation obscuring the side of the formal main building and redirect their views outward, away from the building. I believe my display of erudition and practical approach was appreciated. I passed the test. We were hired. Here is another example of applying the appropriate method of communication to each client.



Figure 46. Views of the three exhibits I designed avoiding the architectural symmetry of Astor Court at the Bronx Zoo. The middle photo shows the central domed building more as an Arcadian relic than as the formal architectural terminus of the Beau Arts Astor court.

Bill Conway is also respected for founding the Wildlife Conservation Society, for whom I later did work planning Band-e Amir National Park facilities in Afghanistan. I was in occasional communication with Bill until his death at 91 in 2021. I've remained in infrequent contact with Jim Doherty, and he and his wife Elsie later visited us here in Australia. Sadly, Jim died in January 2024.

Dr. Terry Maple, beginnings of our Zoo Atlanta experience -1981. At the American Zoo & Aquarium Association (then AAZPA) National Convention held in Chicago in about 1981, I attended a lecture by noted animal behavioralist Dr. Terry Maple of Georgia Tech University. I spoke to him afterwards and we spent the remainder of the afternoon in congenial professional conversation. One year later Terry invited me to give

a lecture to his university environmental psychology class. Later we spent an hour or so discussing how exhibits could be designed to feature and support the unique behavioural styles of three great ape species: chimpanzees, gorillas, and orangutans. While Terry left to deliver another lecture or other university business, I developed three sketches illustrating exhibit designs based upon these concepts¹⁰. Terry was so impressed he later included these sketches in several of his scientific papers and a joint publication¹¹. Terry became founding editor of the *Journal of Zoo Biology* in 1982. With Terry's support as editor, I published my first peer-reviewed scientific paper "Design and Perception, making the zoo experience real" in 1985, in *Zoo Biology*¹². Thirty-eight years later, this paper has gained over 11,000 "reads" and 164 citations on ResearchGate at the time I write this. Terry remained a much-appreciated friend and benefactor until his passing in 2023. His mentorship and life-long support has followed and benefited his outstanding students, now professional leaders, including Dr. Kristen Lukas, Dr. Tara Stoinski, Dr. Molly Bloomsmith, and Dr. Jackie Ogden, to only name a few I've worked with.



Figure 47. Left: staged photo of Zoo Atlanta Director Terry Maple in 1984 (photo: Zoo Atlanta). Right: Terry with me during his visit to Australia in 2019.

Zoo Atlanta design and reconstruction 1985-1990. In February 1984 *Parade Magazine*, a popular weekend newspaper supplement, listed the Atlanta Zoo as one of the ten worst zoos in the USA based upon ranking by the Humane Society of the United States. Proud Atlanta community leaders were shocked into action. In June Atlanta Mayor Andrew Young offered Dr. Terry Maple directorship. After hiring new staff in key departments, Terry, remembering our zoo exhibit design brainstorming based upon animal behaviour in 1982, hired CLRR (a later version of Coe & Lee), led by Gary Lee and myself, to develop the master plan for renamed Zoo Atlanta.

Importantly, the zoo now had both public funding and the right to self-management in what came to be called a public-private partnership. This was led by Mr. Robert Holder,

¹⁰ For a variation of this account and the founding of Zoo Atlanta, including Gary Lee's and my roles, see: Maple, T. L. (2016) *Professor in the Zoo. Designing the future for wildlife in human care* p. 50 and elsewhere. Red Leaf Press.

¹¹ Coe, J., Maple, T. (1987) *In search of Eden, a brief history of great ape exhibits*. In *AAZPA Annual Proceedings*.

¹² Coe, J. C. (1985) *Design and Perception, making the zoo experience real*. *Zoo Biology* vol 2, no 4. Pp. 197-208.

who became first chairman of the reorganized zoo society. Seed money from the Cecil B. Day Family paid for our planning. Our master plan concept and graphics, supported by Terry's charisma and community leaders such as Robert Holder and Park Director Carolyn Boyd Hatcher, was soon accepted. We joined local architectural and engineering firms Turner Associates and Robert & Company designing early stages of development, including a new entry and, importantly, a new home for local celebrity silverback gorilla "Willie B." Captured as an infant in West Africa, 'Willie', named after legendary Atlanta Mayor William B. Hartsfield, had lived 27 years in a 6m x 12m (20' x 40') sterile, blue-tiled room, never being out of doors. Terry had negotiated with Yerkes Regional Primate Center Director Fred King to bring thirteen gorillas, three breeding groups, to Zoo Atlanta if our new facilities were the world's best. And Willie B would join them.

In 1986 Ford Motor Company saw the zoo as a magnet for the same young families they marketed their new Ford Taurus station wagon too. They donated \$100,000 as development money, and far more funds later, from their Detroit marketing budget rather than from their much smaller philanthropic fund. Thus, the zoo's new gorilla complex was named the "Ford African Rainforest". Exhibits included "Gorillas of Cameroon", and "Monkeys of Makokou." Ford then asked us to build a larger scale model of the proposed Ford African Rainforest in a Plexiglas case. This was before our actual design was finalized, so an expression of our intent was visualized. This large model, built by staff members Nevin Lash and Larry Dame, made the rounds of Ford dealers in the Atlanta area, being displayed for about one month at each venue. I never heard if this helped sell Ford automobiles, but it must have helped sell the zoo's rebirth. Later Ford helped support our African research tour, provided travel bags, and even paid for us to attend the national premier of the film "Gorillas in the Mist" with Ms. Sigourney Weaver, in New York City. She later became a leading supporter of the Dian Fossey Gorilla Fund administered by Zoo Atlanta.

Rebuilding a major zoo requires much more than designing new facilities. Terry Maple recruited very able staff. While Terry himself was our major contact and the decision maker, I especially recall working with veterinarian Dr. Rita McManamon, General Curator Dietrich Schaaf, brilliant educator Jeff Swanagan, primatologist Dr. Molly Bloomsmith and zoo biologists Gail Bruner and Trish Pfeffer. We enjoyed their collaboration and support.

Gorillas of Cameroon. The concept Gary Lee and I developed was revolutionary, the world's first. Wild gorilla troops move or rotate between areas in their territories, accessing preferred food or other critical resources. The dominant troop gets first choice of its territory, other troops use adjacent territories, sometimes in sight of each other across ravines. Why should gorillas or other zoo species be limited to a single small area? Gary had coined the phrase "Activity-Based Design & Management"¹³, based on

¹³Coe, Jon C., 2000. "Activity-Based Design and Management: New Opportunities for Apes and People" in *The Apes: Challenges for the 21st Century*, C. Sodaro, Ed.

the notion of using then new techniques of positive reinforcement training. I called this “animal rotation” and Gary referred to it as “flex exhibits”.¹⁴ Terry had hired California-based animal training team Active Environments, Mr. Tim Desmond, and Ms. Gail Laule, to help condition Willie B to tolerate the changes being planned for him. Using new reward-based techniques called “desensitization training” they gradually introduced Willie to novel objects in the familiar, non-threatening environment of his old room. Watching Tim and Gail work, I realized their training could be used to teach gorillas how to rotate through a variety of outdoor enclosures mimicking wild behaviour.



Figure 48. Upper left: gorilla troop rotation concept. Note “Research Camp” location. Upper right: view from the darkened, air-conditioned viewing pavilion across three gorilla enclosures with hidden barriers. Lower photos: the simulated Takamenda Research Camp showing tropical plantings and educators discussing gorilla biology on an elevated deck overlooking three gorilla display areas. There also was a large canvas tent, and later, life-sized sculptures of gorillas.

Above is a diagram of the gorilla habitat rotation concept I developed. The service building (gorilla night house) was a renovation and extension of the zoo’s old feline house, entirely stripped and redeveloped. All the indoor gorilla dens connected to three outdoor exhibit areas and to one off-exhibit exercise yard. Our idea was that during the introduction period each troop would go to its accustomed outdoor exhibit area. The smaller central area would be for popular bachelor Willie B. Visitors viewing Willie B would be surrounded by gorillas on three sides. According to our plan, after the troops

¹⁴ <https://joncoe.net/wp-content/uploads/2021/10/ZooAnimalRotation1995.pdf>

were each settled into their “home area”, each troop would gradually be introduced to adjoining yards until they were all comfortable using any of the display areas and rotating from one to another. They would be taking turns in each area, somewhat as they would do in the wild. Each gorilla troop would then have access to much more space and increased behavioural stimulation and opportunities.

Many zoo animal carers seek to keep animals in their care as stress-free as possible. Yet Professor Maple taught that lack of mild stress or achievable challenge resulted in boredom, apathy, and diminished welfare. I later called this deplorable state “welfare dependence,” in which zoo animals habituate to having everything done for them. I’ve more recently written about the need to provide zoo animals achievable challenges, novelty and complexity with concurrent agency and choice to develop physical, behavioural, and social competence to optimize their life experiences.¹⁵ I predicted that allowing the gorilla troops to alternate among different areas would provide more opportunities for increased naturalistic behavioural opportunities and “ideal arousal”.

We designed the three display areas to be separated by hidden dry moat barriers. Each area had a high central point where silverbacks from different troops could display with species-typical short downhill rushes, or they could pass inconspicuously behind the hills to move into their areas. This was the behaviour the gorillas chose. The silverbacks took care that the females in their troop remained hidden from other silverbacks as they entered or left their areas. The gorilla exhibit areas were arrayed under large existing oak trees upslope from zoo visitors, encouraging visitors to “look up to the gorillas” and intending the gorillas to feel more comfortable by “having the high ground”.

I designed an air-conditioned viewing pavilion providing an extended view across three gorilla areas with hidden barriers (photo above). Guests on carpeted, terraced seating in a darkened, air-conditioned space savored this panoramic view, speaking in hushed tones while observing the gorillas. There were museum-style displays explaining gorilla habitat and behaviour. Barbara McGrath, our graphic and interpretive designer, and I planned a special infant and small children’s area in a far corner of this pavilion. Barbara designed carpet materials on floor and walls creating a soft rainforest corner occupied by a life-sized plush Coco gorilla doll. A low, child-height window extended to the floor, providing views out to the adjacent shady slope on which we placed a fallen log often occupied by a silverback gorilla. Silverbacks seemed to enjoy quietly observing human children as much as they enjoyed seeing him. Knowing male gorillas have been observed playfully interacting with young gorillas in their troop, we accommodated this expected silverback gorilla behaviour.

We also developed a themed outdoor viewing and interpretive area; a wooden platform called the Takamenda Research Camp (see photo above). In 1993, this area hosted a research tent, simulated gorilla nest, and other items to replicate a researcher scientist’s

¹⁵ <https://joncoe.net/wp-content/uploads/2021/12/EmbedEnrichmentDesigners2017Wroclaw.pdf>
<https://joncoe.net/wp-content/uploads/2021/10/Choice-Control-and-Computers-2020.pdf>

home in the forest. A theatrical skit was written and performed by Zoo Atlanta staff, teaching the public how to observe gorillas using a timer and clipboard. Later bronze gorilla sculptures were placed there, so visitors could take photos and compare their size with that of a gorilla.

Converting an Atlanta oak tree shaded park landscape into a tropical jungle required special skills. When designing the very successful tropical-looking plantings for the Woodland Park Zoo gorilla exhibit I had developed a list of temperate plant species with tropical appearance. I had worked with their zoo horticulturalists Sue Nichol to develop their novel natural plant maintenance procedures. I had my Cameroon travel records and photos of western lowland gorilla habitat plants. However, Zoo Atlanta had no professional horticulturist to work with. I convinced Terry Maple not only to hire the best zoo horticulturalist he could find but also create the unheard-of zoo position of Curator of Horticulture. This was putting plantings and their care on the same level as zoo animals and educational programs. In 1987 Terry hired Mr. Don Jackson, previously with the Cincinnati Zoo, as Zoo Atlanta's first Curator of Horticulture. Don was a quick learner and good organizer, helping implement the massive plantings while making the remainder of the old zoo attractive.

A special task of mine was supervising the cutting, transportation, and placement of several large dead trees into the exhibits as gorilla climbing structures. I especially remember one very large, spreading elm which had to be removed to build the new zoo café. The contractor hired two of the largest mobile cranes available, huge machines, both to be cabled to this large tree. Crane operators looked to me to show where to make these connections so that the tree would remain in perfect balance when cut and lifted. Then, when the tree was attached and the two lifting cables tensioned, a worker with a long chainsaw approached the tree to saw through the base of the tree trunk. This was extremely hazardous. If not perfectly balanced, the massive trunk could swing and injure the worker. I circled the tree, again judging cable placement from all sides, took a deep breath, and signaled the cutting to begin. The trunk barely moved when cut through. It then rose upward in perfect balance! Both cranes moved in careful unison up to the building site and placed the tree in the prepared excavation while it was secured in place. In hindsight, I never should have taken on such liability, and the great tree only lasted a year or two until rot required its removal. But I'm still proud of this perfect balancing act.

Building the Ford African Rainforest on this steep red clay slope was a challenge. Rain was the problem. Rain and the contractor's consistent failure to divert runoff away from the construction area. Muddy washouts occurred at least twice, flooding construction work with red mud, delaying work unnecessarily. Nevin Lash, CLRR's very able project manager dealt with these and countless other challenges over five years of coordinating local architects, engineers, and builders. Remarkably, the plans we first established emerged into an award-winning reality with very few changes.

On the 13th of May 1988 Willie B, encouraged by his long-time friend and carer Charles Horton and trainer Tim Desmond (and a carefully placed trail of large strawberries), hesitantly let go of the doorway and stepped carefully down into his new habitat. This was his first touch of turf or leaf, his first sensation of sunshine in 27 years. What I recall most vividly was how Willie B changed, not in himself, but in our human eyes. Willie B, the sad and helpless victim, transformed into a majestic, confident silverback gorilla before our eyes. After standing up to touch living tree leaves he strode out into the centre of his area, turned sideways to us in a silverback side display position and proclaimed, in gorilla body language. 'I, Willie B gorilla, claim this land to be mine!' Then, as rain began to fall, Willie hurried back inside. There wasn't a dry eye among those of us blessed to be his witnesses.

After the opening we rewarded the remaining builders with a group photo of them in front of the completed Willie B area with Willie looking on, sending copies to each company.



Figure 49. Left: Willie B in his boring sterile home of 27 years. Photo: Terry Maple. Centre: Willie investigates a living tree moments after stepping outside for the first time in 27 years. Right photo: Willie in his dominant gorilla side display stance. Centre and right photos by Joe Sebo.

After the thirteen Yerkes' gorillas had also settled in, the Ford African Rainforest opened to the public in June 1988. Terry and I walked among visitors observing their responses to the new gorilla exhibits. I especially recall watching an attentive, middle aged African American man and his 12-year-old son approaching Willie B's habitat. I saw them again shortly after and heard the son tell the father: 'You know, dad, I think I like Willie B! Would the son have said this after seeing Willie in his old cage? I think not. Nine months later three baby gorillas were born among the Zoo Atlanta gorilla troops, proof of the "honeymoon effect" of changing environments, but also credit to the quality of facilities and care embodied in the new Zoo Atlanta. Bachelor Willie B not only successfully integrated with several females to form his own troop but sired three offspring. In February 2000 Willie B. died at 41 years old.. Ex-mayor Andrew Young led his memorial service, spontaneously attended by more than 7,000 people mid-week. This is reportedly more people than attended the memorial service for legendary Atlanta Mayor William B, Hartsfield. Willie's ashes are buried in a hidden location nearby. I feel

emotional just recalling this story and how our collaborations and Terry Maple's leadership contributed to the brief but spectacular regeneration of Willie B.

The gorilla rotation concept I devised was never used until one of Terry's star students Dr. Kristen Lukas¹⁶ obtained permission to test it. She studied two troops in adjacent display areas, noting activity levels and other wellbeing indicators. She noted one female gorilla would step outside but never left the doorway area. Next Lukas gradually alternated (rotated) these troops into each other's enclosures so they now had periodic access to two different areas. This stage of the study noted substantial increase in exploitative and other positive troop activity and the timid female freely utilized entire areas of both displays when available to her. To conclude the study Lukas returned the troops to their original enclosures and their behaviour returned to old levels. The timid female again remained on the door sill. Thus, Lukas proved that our built-in rotation capability was indeed enriching. Nevertheless, over the years, the gorilla management team declined to use this behavioural enrichment opportunity we provided through flexible exhibit design. As Terry Maple explained about the revolutionary rotation feature: *"It was just too good too soon."*¹⁷ Thirty-five years later I heard from present Zoo Atlanta Primate Curator Jodi Carrigan.

"Yes, we do rotate habitats regularly...we rotate different groups into different habitats that are acceptable for the groups. We are running 1 bachelor group, 1 geriatric group and 2 family groups at this time. 25 gorillas have been born at Zoo Atlanta."

Lessons learned include 1) provide a variety of enclosures to meet changing needs; 2) plan for eventually having elderly animals, 3) be patient when built-in opportunities are not immediately activated by animal care staff.

The Ford African Rainforest won the AAZPA Significant Exhibit Award in 1988. The Orangutans of Kitambe exhibit was designed and built at the same time as the gorilla facilities. The main feature was the 17m (55') high pine tree trunk we provided for the orangutans to climb for a great zoo-wide view. Soon after being introduced to the area, one young orangutan climbed and stood upright grasping the top of the pine log with his feet while reaching up with both arms into the sky, as if wanting even more height.

¹⁶ Lukas, K.E., M.P. Hoff, and T.L. Maple. 2003. Gorilla behavior in response to systematic alternation between zoo enclosures. *Applied Animal Behavior Science* 81:367–386.

¹⁷ T. M. Maple & B. M. Perdue (1913) *Zoo Animal Welfare* p. 147, Springer.



Figure 50. The Sumatran tiger exhibit and breeding facility was part of the Indonesian area exhibits with the Orangutans of Kitambe but opened a year later.

Masai Mara. The next stage included design and construction of the Masai Mara exhibit, which opened in 1989. This included African elephants, lions, ostriches, and hoofed animals such as antelopes, giraffes, and zebras. The black rhino exhibit was designed at this time but built the following year. My Serengeti and Masai Mara safari experiences in 1982 and 1986 heavily influenced my designs. We wanted to transport visitors emotionally to a different time and place, from Zoo Atlanta to Kenya, using a combination of landscape, graphic and theatrical devices I called “habitat theatre.”

Habitat Theatre. The experience started with a themed gateway like those we had seen in East African game park entries, including a signboard with park rules such as: ‘Wild animals are dangerous. Stay on the paths’, ‘Move quietly, Do not disturb the animals.’ ‘Take only photos, leave only footprints.’ My pathway layout, mimicking crisscrossing animal trails, was intended to disorient and confuse visitors. Suddenly, unexpected views of lions or zebras were revealed. Years later university researcher Dr. Jane Wineman reviewed the exhibit, criticizing the confusing and unclear layout as if it were a public park rather than an African savanna stage set.

I also invented a comic book hero, Game Warden Mr. Zuma. I sketched and wrote the dialogue for two comic book panels, one introducing Mr. Zuma and one illustrating his encounter with a poacher. Our art director Barbara McGrath located a fine professional comic book artist to illustrate the two panels, and they were mounted along the trail. I hoped we could design a weekly or monthly Mr. Zuma comic book series to include in the Zoo Atlanta member publication and to sell in their gift shop, but this didn’t occur.

I scripted the second Mr. Zuma cartoon panel to show Mr. Zuma arresting a rhino poacher. The poacher defended his actions, saying: “My father and grandfather brought food to the table and honor to the family, and now you arrest me for feeding my family!” Mr. Zuma replied: “In your grandfather’s time there were few people and many animals. Now there are many people and few animals. If we don’t protect the animals now, there will be no animals left for you the show to your own grandchildren!” My idea was that this encounter would be performed by costumed actors using the zoo exhibit as an

informal stage set. “Mr. Zuma” would then take the “Poacher” to the “Elder’s Tree Theater” we designed to hold a mock trial to be judged by the zoo audience. My intention was not to make poachers or other local citizens villains, but rather to demonstrate the real-life, complex issues of wildlife conservation.

In 1996 Zoo Atlanta hired Mr. Terry Richardson, a local educator, to play Mr. Zuma. In game warden costume, he greeted zoo visitors along the trails with ‘*Jambo, habari?*’ (Swahili for ‘Hello, how are you?’). He then encountered the poacher’s character and the public trial followed. The staged production lasted about 25 minutes with detailed script written by Gail Bruner and Adriana Warner from the zoo Education Department. Unfortunately, this program was discontinued after one summer because of lack of funding.

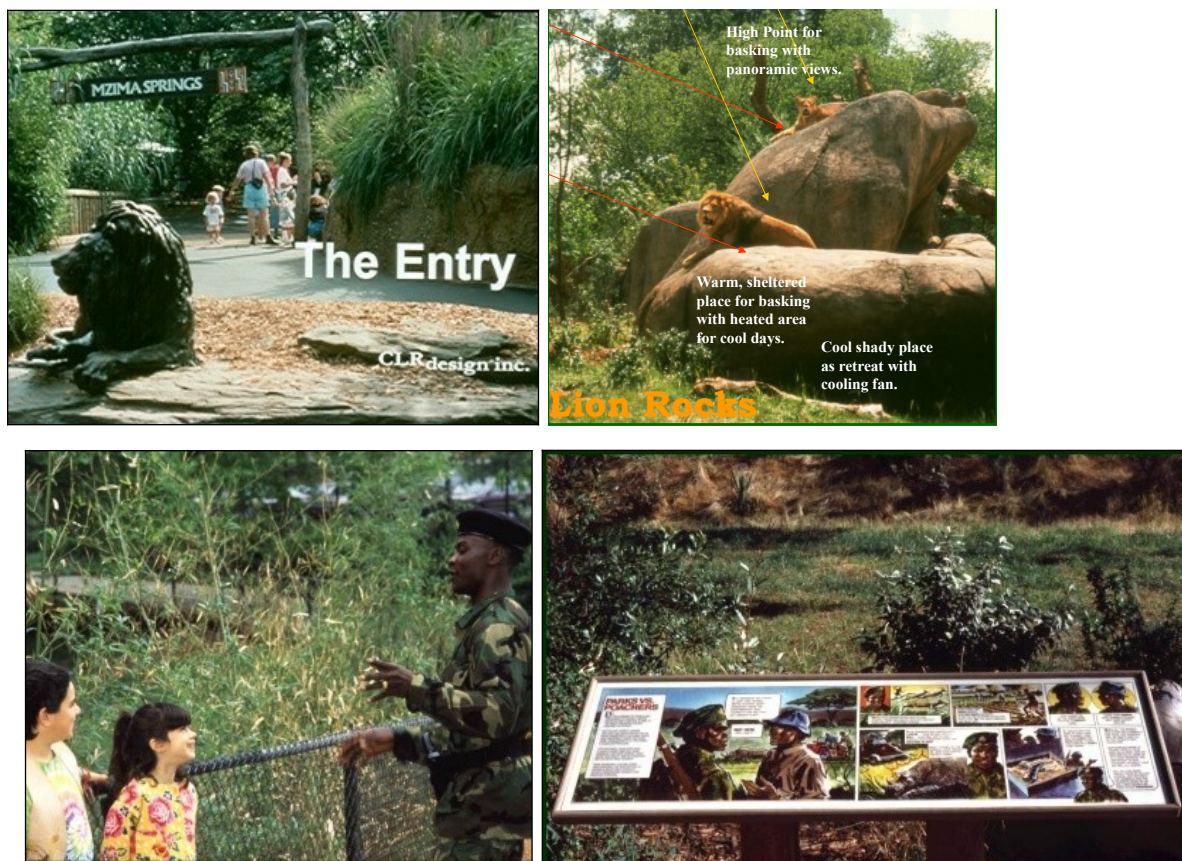


Figure 51. Zoo Atlanta Masai Mara exhibit area photos. Upper left: safari park themed entry way. Upper right: an example of ‘structural enrichment’, artificial lion rocks designed as passive solar furniture considering summer and winter sun angles to provide warm and cool areas for the lions in all seasons. Heating cables are also embedded in the concrete surface for cold weather comfort for the lions. This feature also provided panoramic views of lions and by lions. Lower left: Mr. Zuma actor Terry Richardson costumed as wildlife warden Mr. Zuma greeting children near the black rhino exhibit (photo Terry Maple). Lower right: Mr. Zuma comic strip I designed and wrote, wonderfully illustrated by a professional comic book artist hired by CLRR.

As initial designers we don’t have much control over eventual animal management and novel, changeable enrichment activities after exhibits open. But we are concerned with

what I've termed "built-in" or "structural" enrichment. These are permanent landscape features providing life-long benefits to animal residents and zoo visitors. The Masai Mara lion exhibit provides examples. As shown in the above photo, the artificial lion rocks were designed as passive solar furniture as well as needed lion look-out positions. Other hollow artificial rocks near a viewing window contained evaporative coolers to blow cool moist air down on lions and visitors alike during Atlanta's warm summers. I don't know if these are still in use.

Lessons learned at Zoo Atlanta. Firstly, it is a fortunate design group that can affiliate with a knowledgeable, risk-taking, determined, and charismatic zoo director like Dr. Terry Maple. Secondly, supported by Terry and the Ford Motor Company, our field research visits to Africa and Indonesia provided deep insights into both what was important and what was possible. Thirdly, senior level vision continuity is essential for long term success. At Woodland Park Zoo, the devotion to deep learning through intensive, immersive naturalism in exhibit design lasted for forty-seven years through four zoo directors. Zoo Atlanta's devotion to the highest quality of exhibitory began to ebb soon after Terry Maple moved on and funds for new exhibits became less available. However, their success in breeding great apes and other species continued. Lastly, Zoo Atlanta remains outstanding for its continuing emphasis on empirical research around zoo biology, which peaked during Dr. Maple's tenure. Reviewing the hundreds of academic papers published by zoo staff and university faculty using the zoo for research, I found thirty papers relating to or enabled by things our team had designed.

Many of the dates, names and figures given in this section were confirmed in Terry Maple's books describing this period¹⁸.

New York Aquarium Sea Cliffs -1985. New York Zoological Society designer John Gwynne invited us to design the new Sea Cliffs exhibit at the New York Aquarium in collaboration with aquarium specialist designers Bios, a firm then composed of Mr. James Peterson and Dr. John Nightingale, old friends from Seattle ferry boat rides. New exhibits included habitats for sea otters, walruses, fur seals, and South African penguins.

¹⁸ Terry L. Maple, Erica F. Archibald (1993) *Zoo Man, inside the zoo revolution*. Longstreet Press, Marietta, GA.
Terry L. Maple (2016) *Professor in the Zoo. Designing the future for Wildlife in Human Care*. Red Leaf Press.



Figure 52. The New York Aquarium Sea Cliffs penguin exhibit designed with James Peterson and John Nightingale. The steep grass slopes were my special contribution, as well as the general layout. Photo by rockwork fabricator David Manwarren.

Innovations included a dump bucket wave machine for the penguin exhibit. I designed the shape of the penguin pool to concentrate the force of the wave into a spray near the visitor passage under the cliffs. I was keen to find a way to green the artificial cliff tops with living plants as occurs on natural sea cliffs. I developed a system of stacked soil bags made of long-lasting poly fabric above the artificial rockwork with lines of “leaky pipe” irrigation between bag layers. Then the stacked bags were beaten to form a generally even surface and then seeded with weeping lovegrass. This is an early experiment in my attempts to make permanent living or “green walls”. John Gwynne wisely insisted on building a small test installation to prove functionality. This was successful and final installation proceeded. Recently I heard from Mr. Rob Halpern, past NYZS horticulturalist, that the system later failed, likely because the irrigation system was not properly maintained. This is yet another example of a good idea, successfully tested, failing later because future operating staff were not properly informed of the original design’s intent.

Denver Zoo -1986. Gary and I received an invitation for legendary zoo director Mr. Clayton Freiheit of the Denver Zoo. Clayton was a crafty fellow and said he had been following our work for some time before approaching us to help develop their master plan. As his surname suggests, Clayton maintained the persona of a Prussian aristocrat or traditional German zoo director. He was a large fellow with many rings on his fingers (Gary would tease him with the phrase “You may kiss the ring.”) Clayton could be high handed and fear provoking with his staff but was a master of zoo board management. Gary, masterfully playing the court jester, developed a special relationship with Clayton and Denver Zoo gradually became more Gary’s clients than mine. Gary developed designs for the zoo entry, Predator Ridge (lion, hyena, and hunting dog rotation) and latest, Toyota Elephant Passage, a vast rotation exhibit for Asian elephants, rhinos and tapirs including an elephant overpass. Clayton exclusively called on CLRdesign for some 15 years of continuous redevelopment.



Figure 53. Left photo: gorilla and orangutan dayrooms were identical indoor exhibits for cool weather and 24/7 accommodations for the apes. Note high windows for basking in morning sun on winter days while viewing surrounding activities. Right photo: orangutan spending time in living poplar trees without destroying them.

Among our early projects I designed, the **Primate Panorama** project was especially innovative with several zoo firsts. This may have been the first “soft,” and voluminous indoor space in which great apes could stay day and night as social groups. The old Fisher Great Ape house at Lincoln Park Zoo was wonderfully spacious but had hard steel climbing and resting areas. Unfortunately, it was demolished to make space for their new facilities I will discuss later. Another innovation was an overhead mesh tunnel connecting smaller primates from the main building to their mesh aviary-like structure. This became a model for our later Tree-top Trail at Philadelphia Zoo.

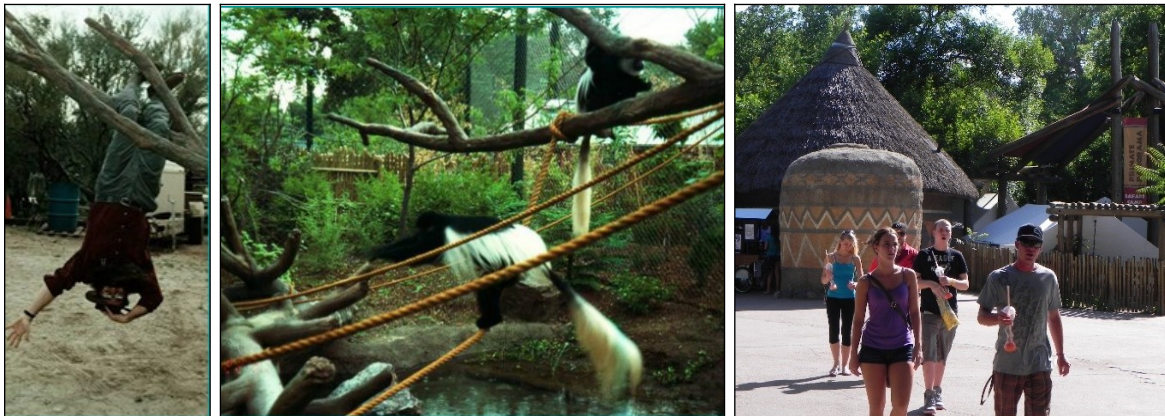


Figure 54. ‘Sway Branches’, my invention to add motion to artificial climbing structures, was first used at the Denver Zoo in about 1987. Left: I hung upside down to test the strength of an artificial branch built by Rick Dyson of Cemrock. It had a steel core and epoxy bark. Middle: the same sway branch after installation being used by colobus monkeys. Sway branches of natural or artificial branches attached to a mast with a flexible or moveable joint are hung from a line. This allows them to be lowered for provisioning and raised into place at various heights. Moveable branches help arboreal animals improve their balance and agility. Right: we gave an African rural theme to this food and gift area in the Primate Panorama complex.

One evening I was walking through this area after hours. I saw a woman standing outside the service gate looking in. She was older, slender, dark skinned, and wearing traditional African prints. As I walked over I saw she was weeping. I asked if I could help her with anything. She said she had immigrated from Ethiopia and was feeling homesick. She had just seen the African themed building in the exhibit area pictured above and it looked just like the buildings in her native village! Recently I read a paper by a university academic declaring in essence that zoos featured themed mud and thatch huts as an unconscious celebration of colonial and present-day racism by featuring African buildings, and thus Africans themselves as backwards and primitive. She could not have been farther off the mark in assessing our design motives. Firstly, such exhibits are intended to emotionally transport zoo visitors to the biomes which both gorillas and people share, not to visit modern African capital cities. Secondly, rather than disrespecting the mud and thatch huts, I celebrated the simplicity, functionality, and beauty of these huts and the rich cultural and sustainably lives practiced by the people who build and live in them. We should learn from them. On later thatched structures we designed at Louisville Zoo we hired African Zulu thatchers to build these, providing both pride and incomes to these skilled workers. I doubt if the elderly Ethiopian woman I met at the Denver Zoo service gate would agree with the academic that we misrepresented Africans.

Oklahoma City Zoo 1991-1992. After our work with the Denver Zoo Primate Panorama project, Director Steve Wylie and Curator Jack Grisham invited us to develop a master plan for Oklahoma City Zoo. I previously met Director Lawrence Curtis at zoo conferences. Curtis was known as one of the great zoo “horse traders”, dominant directors in competition for the most spectacular rare species and for the size and diversity of their collections. Wylie and Grisham were an intermediate generation, developing larger populations and facilities for fewer species, resulting in improved animal welfare. As before, Gary Lee developed a great relationship with Director Steve Wylie while I related more with Curator Jack Grisham.

Their **Great Escape** project with gorillas, orangutans and chimpanzees was their first major project following completion of our master plan. The most innovative work was the design of the great ape complex.

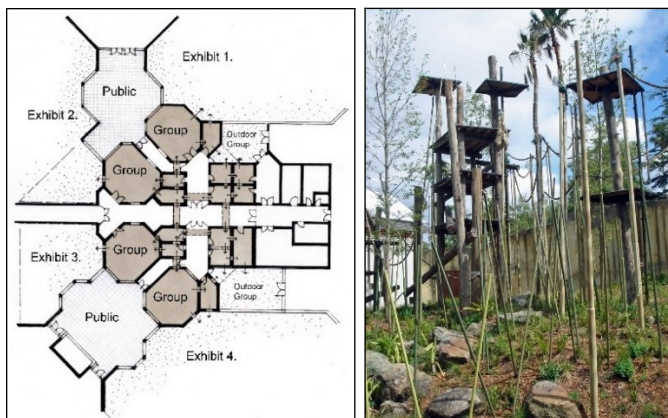


Figure 55. Left: The Great Escape Building Plan. Right: sway poles used at Melbourne Zoo orangutan exhibit in 2006. We invented these for Oklahoma City Zoo about 1991, now they are used worldwide. We tested commercial fiberglass pole vaulting poles, steel pipes and thick stemmed bamboo poles. We had especially good results with them later at Louisville Zoo. Sooner or later the orangutans bend or break them. Sadly, often they are not replaced.

The Great Escape building plan above shows the innovative and practical arrangement of large outdoor animal areas connecting to covered outdoor animal areas near and visible from indoor public galleries, viewing into enriched group rooms (much like the Denver Zoo day rooms shown previously), supported by a system of overhead raceways connecting individual temporary cells and off-display outdoor exercise or quarantine areas. This arrangement provides management flexibility. The sequential arrangement seems ideal for cold climate zoos.

About seven years after completion of the gorilla exhibit we received a call from Oklahoma City Zoo. They were being sued by a visitor for an injury sustained in a fall in a play area we had designed. Assuming this was a design flaw, the zoo was passing on the suit to our firm. After contacting our liability insurers, I researched our files, correspondence, and meeting minutes and then flew to Oklahoma City to learn more about the case. As was normal, we had several mid-sized dead oak trees mounted in the gorilla exhibits as climbing structures for the apes. Meeting notes implied my partner Gary had suggested setting one of the dead oak trees in a public overlook area for kids to climb on mimicking the gorillas, something called "parallel play". The injured man claimed his son had climbed into the tree, was afraid to climb down and the father climbed into the tree to rescue him when a rotted branch broke causing him to fall and injure his back. He was suing for USD\$75,000. Further research showed that 1) the limb was rotted. 2) The man had climbed higher than the boy to reach the limb which broke, and it appeared he could have reached the boy without climbing himself. 3) The man had a history of back problems and had scheduled an operation costing the same amount for which he was suing. This suit seemed suspicious. I further discovered the dead oak trees planted for the gorillas to climb had been found by animal care staff to be weakened by rot and were unsafe for the gorillas. The zoo had removed and replaced these gorilla trees. Why hadn't the zoo replaced the tree in the public area? I contended our design was correct and the trees were sound at the end of our project guarantee period. The zoo was at fault for poor maintenance. When the case went to a local judge for consideration, the judge found that the plaintive knew it was just an old dead tree and should have exercised more caution. The case was dismissed. I am amazed how zoo clients whom we have gone so far to help, and are such good friends, then quickly abandon us when threatened by lawsuits. Similar expensive, undeserved and frivolous lawsuits were filed against our firm two other times by client zoo friends who were themselves responsible for visitor injuries. This is a major problem when working in the litigious American workplace.

National Zoological Park -1988. Most of my innovations described thus far have been intended to benefit both zoo visitors and zoo animals. The following is an example purely in the zoo educational area.

Ms. Judy Mitchell, Education Director of the US Smithsonian National Zoological Park, invited me to collaborate on her pet educational project, a new kid's learning center called '**Rabibat**'. Her twelve-year-old son made up this name from 'rabbit' and 'habitat'. Judy's vision was to take a simple idea about a common animal and "shrink the kids" to enter, the rabbit's world. We proposed to do this by using plants with giant leaves and setting up indoor and outdoor kid-sized mazes as illustrated below.

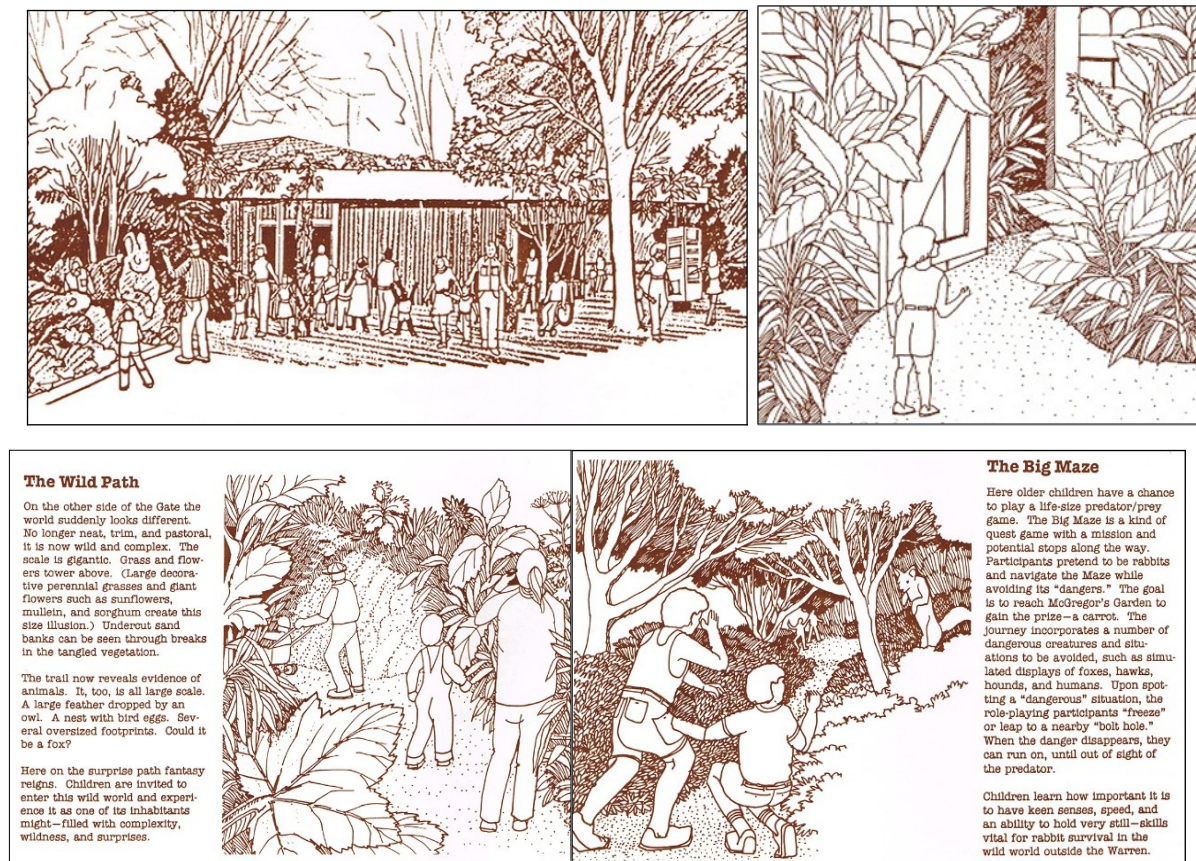


Figure 56. Here are four of my ten sketches from the Rabibat booklet.

Our problem was that director Dr. Michael Robinson had his full attention on building the highly naturalistic Amazonia project and Judy's project was never funded. At the time primatologist Dr. Ben Beck invited me to help him develop the concept for his new 'Think Tank' project. This would have been an amazing opportunity but working for the US National Zoo meant negotiating onerous federal government contracts designed for mega-contractors doing mega-projects. I sadly declined Ben's kind offer. Later Ben developed the world's first extensive overhead line (O-line) for orangutans. I regret that I missed this opportunity and congratulate Ben Beck on his inventiveness and willingness to take risks to advance animal welfare and visitor experience in zoos.

Brookfield Zoo 1988-1989. Dr. George Rabb, a leading zoo director who combined science and bold imagination, hired CLRR in 1988 to master plan their northwest zoo quadrant, an area featuring African hoof stock. George was mentor to his senior staff but sometimes fear inducing as well. Once again Gary Lee brought out George's lighter side by playing court jester, and George had a delightful light side.

It was mid-winter in Chicago, windy and very cold. We were being led through a distant area of the zoo where American bison were kept in a large snow-covered paddock. We needed to cross the paddock to inspect a major water pump location. As we went through the bison barn the staff member instructed us to pick up a rake, broom, shovel, or other tool to fend off the bison if they became too curious. I was last in line, and the only tool left was a rubber toilet plunger. I was also last in line as we made our way through the paddock with a line of Pleistocene bison closely following us, steam arising from their nostrils, as I defended our group with my toilet plunger.

The master plan led to a contract to design **Habitat Africa!**, the renovation of the old giraffe house to recreate the experience of exploring a granitic outcrop or "kopje" in East Africa, combining giraffes, hunting dogs (outdoors), klipspringer, pygmy mongoose, monitor lizards and a variety of birds (indoors).





Figure 57. Upper photos: Brookfield Zoo “Habitat Africa!” outdoor and indoor giraffe display areas. The entire roof over the indoor area was one extensive skylight, providing natural appearing illumination. Middle photos: views of Habitat Africa! kopje entry showing over twenty years of plant maturity. Lower photos: left view from building into hunting dog exhibit. Right: indoor kope exhibit klipspringer enclosure. This project has matured marvelously over the years.

This design was developed using a large-scale model of the building, applying plasticine clay to shape the artificial boulder formations. We worked at night in an empty building on zoo grounds and George Rabb dropped by for informal and productive discussions. George picked up a handful of clay and began working with us once. Many zoo architects rely on specialist rockwork contractors to build scale models demonstrating and later fabricating their plans. But I always built models myself, often with other firm members, as a fundamental 3D design tool. Such large models also allowed clients to understand the designs in detail, when they were not trained to read architectural drawings. After the models were approved they became a legal part of the construction documents. Artificial rockwork contractors based their construction costs on the models rather than on architectural drawings and these models were kept on the construction site as references. Models usually did not survive this necessary but often rough handling. I now recall how Pittsburgh Zoo director Howard Hays taught me the obligation of presenting design ideas in the language clients can understand. Large scale models are just such a language.

Detroit Zoo 1988-1989. Director Steve Graham invited us to design a new chimpanzee facility based upon an earlier concept by Jones & Jones. We would collaborate with noted chimpanzee expert Dr. Franz de Waal. Franz had worked with and studied the groundbreaking chimp exhibit at the Bergers’ Zoo in Apenhuel, Netherlands, the most advanced chimpanzee facility at the time. Steve Graham wanted at least one 0.4 ha (one acre) outdoor area for the chimps and a sizeable indoor group area modeled after the Bergers’ Zoo’s facility to use during Detroit’s long cold winters. We designed the holding building with two indoor group areas and two outdoor yards, one large and one smaller, in case the chimp troop eventually split, as often happens with this species.



Figure 58. Detroit Zoo Chimpanzee exhibit two years after opening. The use of dead trees increases ape opportunities initially, but my experience is that zoos rarely replace them after they decay.

We debated using an expensive concrete dry moat like Zoo Atlanta, which would be safer, or a less expensive clay lined water moat, which would allow construction of the full-sized 4000sm yard Graham requested. Based upon Dr. de Waal's assurance that Berger's Zoo had used a water moat, we designed the exhibit with a water moat. Big mistake. Not long after opening a female chimpanzee, without coercion, tried to leap across the water moat and drowned. Forming new troops of chimps is dangerous. Competition for hierarchy can turn murderous if subordinate apes cannot escape their attackers. Later the first year a male chimp was attacked by the dominant male, had fingers bitten off and sustained other injuries. This ape and perhaps others should have been moved into the second area of enclosures, but Graham had imported gorillas and housed them there. Instead, Graham ordered the injured chimp to be promptly returned to his troop. Upon re-entering their yard, the injured male saw his persecutor, immediately fled to the perimeter water moat, leaped in, and drown. A heroic visitor, seeing the ape's distress, immediately waded into the moat and pulled the unconscious chimp onto the bank on the apes' side of the barrier, then quickly retreated before the other apes could respond. Were these tragedies a design failing or a management failing? Clearly they were both, but there were steps the inexperienced zoo staff should have taken during the animal introduction process to minimize risks. At zoo Atlanta and other ape exhibits, zoo staff placed electrified livestock fencing around the moats until the animals became accustomed to the area. This would have prevented the first drowning. Gorilla introductions by Zoo Atlanta staff were gradual and with great care to reduce aggression. Experienced great ape trainers were brought in to advise during this period. We were not involved in Detroit Zoo's introduction process, but the second drowning was the outcome of a rushed introduction process by the inexperienced director and animal managers. This is another example of the need for close coordination of design and management plans and systems.

Detroit zoo previously had chimps, but no one on their staff during the design and initiation of the chimp facility and management system had ever managed these apes. Primate care staff wanted a mechanical or hydraulic animal gate closing system that

could overpower any chimp trying to open or block the gate. We explained that the chimp had only to place a finger in the gate opening and staff could not close the gate no matter how powerful the mechanics provided. The apes needed to comply with staff requests through reward-based training and not physical force. In the design of the isolation pens and connecting animal gates Larry Dame of our team developed a clever counter-weighted safety locking system to prevent chimps from throwing open gates once they were closed. Staff approved prototypes we tested with them before installation. A few months later I received an emergency call from one of the chimp managers that a safety lock had failed and in securing the gate a staff person had her fingers bitten by a chimp. I hurried to Detroit and met with the staff manager at the gate that had failed. No chimps were present. While she watched I personally operated the gate one hundred times, counting off each time. The gate worked perfectly. Neither of us could explain why the gate or the operator had failed previously. We did not hear of any further problems with these gates.

Riverbanks Zoo 1989-1998. Director Satch Krantz invited me to come over to Riverbanks Zoo in Columbia, South Carolina while working with Zoo Atlanta. He was interested in ideas for a new white rhino exhibit area and a restaurant. These were built from the general sketches I provided during our meeting.

Aquarium/Reptile House. In 1990 we began to develop plans for a new Aquarium/Reptile House and invited aquarium design specialists Bios, James Peterson, and John Nightengale, who we collaborated with in the New York Aquarium Sea Cliffs project, to join us. I recall one evening when Satch, a natural worrier, sat impatiently watching us work on a large piece of brown craft paper, moving around paper blobs representing the approximate areas of the different exhibits he had requested, seeking the best arrangement from storytelling, visitor circulation and servicing standpoints. Satch had never seen designers' work. Collective logic, experience, and intuition were in free play. Finally, Satch ask: "Jon, are we getting anywhere?" I confidently replied: "Yes, Satch, we are nearly there," even though this was purely intuition. Five minutes later we had the jigsaw puzzle solved and presented it to an amazed and delighted zoo director. From this point on Satch had full confidence in our ideas and years later Satch reminded me of this experience.



Figure 59. Aquarium/Reptile House design came out wonderfully, being among the best small reptile displays and aquaria in the country.

During the construction of the coral reef tank the expensive new acrylic windows had been installed, waterproofing completed, and the big tank filled for testing. That evening during the weekend, while I was in Philadelphia, I received an urgent call from Satch. The back of the tank was leaking, and he could not reach anyone to solve this problem. I caught an early flight to South Carolina the next morning. Aquarium tank waterproof is not my specialty, but I could see small amounts of water beading along the back of the tank, leaking through small honeycomb voids in the concrete. There may have been a small leak around one of the windows as well. These problems were not urgent, but Satch, completely new to aquarium work, feared they might represent something serious. Technically, there was nothing I could do until the contractors returned to drain the tank and reapply the waterproofing, a common procedure. But Satch remained grateful that I was the one who dropped everything and responded immediately. Riverbanks Zoo attendance increased from six hundred thousand visitors to 1 million the year after the Aquarium/Reptile House opened.

Later Satch invited us back to design new Asian elephant and tapir displays. Riverbanks Zoo is on a riverbank, on high ground with adjacent lower, periodically flooded forest. I designed the elephant area next to this forest and proposed an additional elephant trail system through the forest which could be alternately used by tapirs. My notion was this would not be damaged by or interfered with occasional floods. Unfortunately, local river managers didn't agree. This may have been my first attempt to create long trails for elephants and other large species.

About this time Satch wanted to build a new botanical garden on the other side of the river, accessed by a new long pedestrian bridge. Years before I had recommended he hire a professional horticulturalist as horticulture Curator, as I had done at Zoo Atlanta. I no longer recall his name, but I collaborated with him on the general layout concepts for the public garden, but detail design was done by this Curator with good results.





Figure 60. Riverbanks Zoo gorilla, penguin, aviary, and elephant displays.

In 1998 Satch Krantz was organizing a development fund and invited us back to prepare a new master plan and design a new zoo entry, aviary, penguin exhibit, lemur island and gorilla display. This time Gary Lee oversaw the design work, though I helped develop initial design concepts. CLR designers Jon Stephensen and Greg Dykstra led the work as I recall. These are small, but beautiful and practical features and have proven extremely popular. Riverbanks Zoo has become one of the best mid-sized zoos in North America.

Nashville Zoo 1990-1991. I met Ms. Connie Cloak while attending a national zoo conference. Connie, an ex-zoo animal manager, led a small group attempting to establish a zoo in Nashville Tennessee. After the conference I flew with her to Nashville to learn more and visit possible future locations. At first we met a group with a zoo location, but the deed required only native animals be displayed, so Connie and her colleagues decided to proceed with plans for a larger zoo with a full range of species. After several false starts the 'Zoo Boosters' were allowed by the Tennessee State Parks Department to consider a large state-owned site next to a large reservoir being developed as a recreation precinct. The site had been suggested as the location of a shooting range in their master plan. I helped Connie and the Zoo Boosters by holding several community zoo master planning workshops. These were open to all, and proceedings were openly circulated in newsletters. Connie formally invited representatives from conservation groups such as the Sierra Club, Audubon Society and Tennessee Trails to participate in the workshops to ensure any objections could be dealt with during planning. All these open workshops were attended by a representative from the Sierra Club and from Tennessee Trails. They sat in the back taking notes and declined to comment on or discuss the ideas being presented. Each meeting I invited them to participate, Each meeting they declined. Zoo Boosters visited all landowners bordering the proposed site, assuring them the zoo would not impact property values or cause nuisances, but would be good neighbors and an asset to the entire community. We submitted our master plan to the Tennessee State Parks Department with supporting community documents, along with a State recreation survey showing having

a zoo was the second highest state recreation desire, following only recreational driving in popular demand.

During this time the two conservation groups went to neighboring landowners, distorting what they had learned during our open workshops, and convincing them the zoo would become a smelly and dangerous neighbor, turning some of them against us. Anti-zoo newspaper articles began appearing. I spoke privately to the Tennessee Trails leader, who was more open to unofficial conversation. He told me that he liked our plan, but by publicly opposing it he had succeeded in increasing his organization's membership considerably. In speaking with a state park department official I was told they never expected the zoo boosters to prepare an entire master plan for their consideration. The implication was they were caught off balance. A simple letter of interest by the Zoo Boosters would have been easier to dismiss.

The Tennessee State Parks Department scheduled a public hearing to discuss our new zoo proposal. I flew to Nashville and, with Connie Cloak, was the second person to sign up as a speaker for the hearing. Advance applications were not allowed. Then we were told that only one speaker for the Zoo Boosters could speak for five minutes and that person must be a state resident. This barred me from being the principal speaker for our side. I would be allowed only three minutes like all other speakers. The hearing began with full press coverage. Connie gave our main presentation and I, having signed up early, expected to be called soon. After thirty minutes the press reporters left. After sixty minutes the convenor asked if anyone else wished to speak. I then spoke to an empty house. It was clear that my name on the speakers list had deliberately been bypassed until the hearing was over. The State denied our application and the Zoo booster organization dissipated permanently. This was very hard on Connie Cloak, though this conservationist ambush was completely beyond her control or mine. We were both under the outdated impression that national conservation organizations were still the 'good guys'. But ever since President Reagan's aggressive conservative Secretary of the Interior James Watt declared war on the conservationists, the warrior casts on both sides took control. Moderates, collaborators, and compromisers like me were obsolete. As a twenty-year Sierra Club member, I wrote my complaints to them. They did not answer, and I tore up my membership card and mailed it back. The other Nashville Zoo I mentioned earlier somehow changed their land donor's requirements and is now a successful mainstream zoo.

Los Angeles Zoo 1990-1998. Growing up in the Los Angeles area, I visited both the old zoo in Griffith Park and the new LA Zoo when it opened in November 1966. Ron Herman, a classmate of mine at UC Berkeley, had worked on the planning and thought highly of it. I did not. The architecture firm specialized in shopping malls and industrial projects and had simplified their zoo work by developing modular exhibits for great apes, big cats, hoofed animals, and aviaries. These were standardized footprints simply repeated all over the site in a modernist "one-size-fits-all" design system. The pathways were interlocking loops, causing visitors to constantly backtrack if they wanted to see

everything. Also, refreshment stands were placed at perimeters of walkway loops where visitation was low, rather than at key pathway intersections everyone would pass. There were many steep hills, difficult for pushing baby strollers or for the elderly or disabled, especially on hot Southern California summer days. Demographic surveys showed many of LA Zoo visitors were of Hispanic descent, arriving in large family groups. They would only walk as far as their elderly family members were comfortable going, not far on steep hills during summer heat.

Master Planning. In 1990 legendary Dr. Warren Thomas, Zoo Director from 1974 to 1991, invited us to update their original master plan. Colleagues Gary Lee and Nevin Lash also developed concepts for new animal health and education centers. Warren was one of the great 'horse traders' of the era, competing with other zoo directors for the rarest or most spectacular species for "his collection". His dealings with the Hunt Brothers, major zoo animal traders, were often rumored in zoo conference backroom gatherings I chanced to attend. Warren was a collector. One evening he invited us to his home for dinner, where he showed us his collection of medieval armor and rare chinaware. Warren treated us well and I enjoyed working with him. He was witty, creative, and combative, always in strife with the Greater Los Angeles Zoo Association (GLAZA), City of Los Angeles, the zoo worker's labor union or sometimes all of them together. He directed his curators, headed by very competent Mr. Michael Dee, and other staff, but rarely consulted with them. Warren's many battles finally got the best of him when the City government fired him. None of the work we began with Warren was ever realized.

Veterinarian Dr. Mark Goldstein, then Director of Franklin Park Zoo in Boston, was recruited to become LA Zoo Director in 1991 and requested us to revise the plan we developed with Warren. Mark was very personable and invited Gary and I to his home for dinner with his remarkable family on all our visits. I am still in occasional touch with him. Mark had a completely different personality and management style. He was welcoming, receptive, and collaborative with his staff. Warren had been self-assured and knew everything. Mark asked questions and invited information. Unfortunately, zoo staff had become combative under Warren, isolated into departmental fortresses. Some took Mark's openness as weakness. When we presented our overall plans to an open meeting of zoo-wide staff, I observed an atmosphere of hostility and resistance, without any particular focus on the plans we suggested. Neither of the two master plans Gary Lee and I developed received serious attention to my knowledge.

Tree of Life. One interesting outcome deserves mention. There is an important pathway intersection near the administration building, children's discovery area and a café forming a small triangular plaza. This was the first opportunity to create a landmark near the zoo entry. There were several medium sized Moreton Bay fig trees growing in the park. These grow into very large, impressive trees. I suggested that three be moved to the center of this area and pruned to make a single impressive living banyan. Life-sized animal sculptures in bronze or terracotta were to be mounted on sloping tree limbs. As

the tree grew it would begin enfolding these sculptures into its form. I called this the “Tree of Life.” It was never built. At the 1994 American Zoo Association (AZA) conference in Toronto, I spent several hours over two days in my hotel room educating the Walt Disney Company’s Head Imagineer Mr. Joe Rhode and his team in zoo design and landscape immersion theory. They had just begun planning the new Disney’s Animal Kingdom (DAK) in Orlando Florida. I described my Los Angeles Zoo living “Tree of Life” concept to them in detail. DAK opened in April 1998 with a massive artificial “Tree of Life” with blended animal sculptures as its centerpiece. Joe Rhode and his team and consultants have done magnificent work designing Disney’s Animal Kingdom.

In 1994 Dr. Mark Goldstein was replaced by new Director Manuel Mollinedo. Mark went on to take a senior position with the Humane Society. Manuel came from a parks and recreation background, I found him to be friendly in a professional sense, quietly guarded, and a strong leader. Manuel projected the image of the confident, unquestioned Spanish Don. Meetings were punctual and productive. There were occasional shared lunches, but no after-hour socializing. LA Zoo suffered from coyote predation, with poorly maintained fencing occasionally damaged by strong growing eucalyptus trees. During his first week Manuel ordered perimeter trees to have a serious haircut and fencing mended. This was not only sensible and overdue but also sent a clear sign to staff that Manuel expected prompt action. Director Manuel was a good fit for this difficult position.

Chimpanzees of the Mahale Mountains. The existing chimp exhibit was a donut-shaped concrete moat with a central concrete island on which a four-generation troop redirected their internal stress against the public, who reciprocated. This seemed a classic case of two territory defending species contesting their common frontier. An animal behavior researcher who had observed the troop for some time agreed with my observation.

Design for positive visitor-animal interaction. This sad situation led me to develop a new design theory I called “**Affiliative Design**”¹⁹. We know that some environments, such as territorial boundaries, where “a line drawn in the sand” or resource poor environments can encourage agonistic behaviours while environments of abundance and shared benefits can encourage affiliative behaviours. Could we reduce aggressive behaviour between chimps and zoo visitors by designing areas of approximately equal amenity: sun, shade, topography, aspect, views, diversity, species-appropriate utility, on both side of the exhibit barriers? What if instead of an obvious boundary with crowds on both sides we devised a complex zig zag frontier suited to encounters of individuals or small groups rather than crowds of each species? Can we devise games people and chimps engage in, people enjoy, and chimps always win? These are examples of intentional affiliative design. I predicted these strategies would decrease or extinguish chimpanzee aggression towards humans. I also predicted this loss of the uniting

¹⁹ Coe, J.C. (1999) Increasing affiliative behavior between zoo animals and zoo visitors. 1999 Annual Conference Convention Proceedings, American Zoo and Aquarium Association, Silver Spring, MD, pp. 216-220.

common enemy, human strangers, would result in aggression being redirected against status rivals within the troop. As a result, the troop would split requiring separate areas for each troop, as happened with the chimps at Detroit Zoo. These behavioural predictions came true soon after the exhibit opened.

Project staging. The new chimp exhibit was the area they were presently in plus an adjacent and equal area previously inhabited by baboons. Each had small underground night cells. Our job was to combine both areas, creating a unified area while the chimps remained in their present area during construction. We developed a three-stage strategy: 1) construction of a new and enlarged ape holding building next to the existing enclosures suitable for managing chimps 24/7. This building would have a penthouse enclosure in which zoo visitors could view the chimpanzees. 2) Move the chimp troop into the new facility, demolish much of the old facilities, but minimize cost by reusing much of the ugly existing concrete barrier walls. 3) Move the chimps into their new 883 sqm (9500 sf) outdoor display area.

Behavioral scientist Dr. Cathleen Cox recorded chimp behavior before construction and during each of these stages. Her report²⁰ concluded that chimp aggression directed toward the public ceased but intragroup aggression increased, just as I predicted. Unfortunately, this social struggle resulted in two chimp deaths before a new group hierarchy was established. Today these chimps are managed in two groups as we had prepared for.

The visitor's experience. We contrived a storyline that the shed structure we would build had been part of a tropical timber mill. When local timber had been exhausted, the mill was converted to an African chimpanzee sanctuary. Ms. Polly McKenna-Cress, our interpretive graphic specialist in this work, designed simple attractive panels setting out our concept. This ecological and cultural framing is important to me, a holdover from the Woodland Park Zoo Long-Range Plan scenarios. I doubt visitors ever understand this story or read about it in Polly's interpretive postings. Perhaps visitors to an opera or concert do not care about the libretto and come only to enjoy the experience. As designers we must aim high, satisfy ourselves as well as our audience and never "dumb-down" our performance or expectations.

Chimpanzee shower concept. We devised a game where people and chimps could choose to play and the apes would always win. During our work on the Detroit Zoo chimpanzee project Gary Lee and I were heading to Philadelphia airport for the flight to Detroit. We planned to discuss ideas for chimpanzee behavioral enrichment in Detroit but had not yet given the subject any thought. At Gary's suggestion we upgraded to first-class seats so we would have room to work together on the flight. We taped a large sheet of paper on the front bulkhead and began brainstorming. Soon many in the first-class section were joining in. I recalled a game chimpanzees and orangutans often play

²⁰ Cox, C.R., Wilcox, S.F. (1999) Effects of exhibit conditions on chimpanzee activities. *American Journal of Primatology* 49,1.

against their caregivers-spitting on them. The apes become masters at hiding water in their mouths and successfully luring humans into position with sweet expressions. What if we gave zoo chimpanzees access to a spray hose? Detroit Zoo staff were not interested in their apes being engaged in such undignified games.

A variation on the game, the ‘chimp shower’ idea occurred to me for the Los Angeles Zoo exhibit. We proposed a sign in the public area stating: “If you want the chimp to give you a shower, stand here.” The chimp then has the choice to climb up, pull a cord and activate a mist sprayer above the visitor. Primate staff objected. Perhaps, like Detroit Zoo staff, they also thought this behavior was too undignified and anthropomorphic. Or perhaps, recalling the visitor-chimpanzee aggression from the old exhibit, they feared the shower game public would encourage the public to misbehave. The chimp shower was installed by zoo volunteers, but staff had it removed after a few weeks, before independent testing could occur. However, the idea was later picked up and redeveloped for the orangutan exhibit at Toledo Zoo where it has proven very enjoyable for both orangutans and visitors. During my 2012 North American zoo tour described later, then Toledo Zoo director Dr. Anne Baker described a female orangutan tricking visitors.

“The female orangutan would place her darling infant next to the viewing glass to attract a group of adoring visitors ignoring the warning signs. When enough people had gathered, she activated the sprinkler on them!” Dr. Ann Baker.

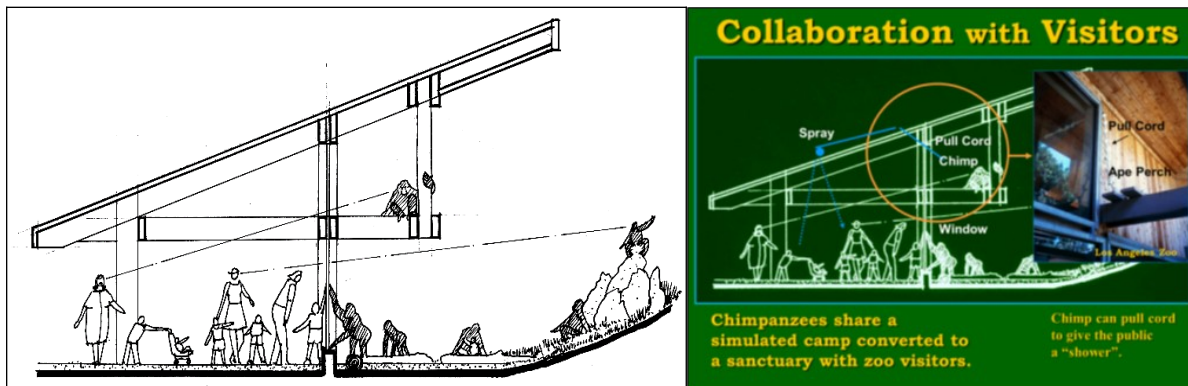


Figure 61. Left: themed as a converted tropical lumber yard shed, the shared shade roof and woodchip surfacing were intended to create a sense of equity to both visitors and chimps. However, the chimps could get above the humans. Right: chimpanzee shower concept. We devised a game where people and chimps could choose to play, and the apes would always win.

Features benefiting the chimpanzees. We designed the chimpanzee night house to be three levels high to accommodate the steep slope it was built against. Staff access was from ground level and midlevel. Indoor night rooms for the apes were on the midlevel with access to existing tunnels into their exhibit areas. A fine mesh-covered penthouse was built on the upper level (see photo below). This penthouse served two purposes, 1) allowing chimps to sleep under the stars when they wish and 2) the multi-male troop split into two groups, as I predicted. The penthouse is used by one group

while the other is in the main display area, another example of animal rotation or alternation.

“Howdy log” and “feeding log” enrichment features encourage positive chimp-visitor experiences. The “howdy log” was a large artificial hollow log made in two sections and mounted so that it seems to penetrate the exhibit window. The window remains the barrier between children crawling into the log from the public side and a young chimpanzee entering from the other side. This was intended to encourage young humans and young chimps to entertain each other. I have seen children using it (see photo below), but no research has been done to evaluate the howdy logs effectiveness that I know of.

The feeding log was another artificial hollow log designed to allow chimps to forage for nuts inside the log using long sticks while visitors could watch closely through the open end that appeared to penetrate the glass. I demonstrated how to train the chimps to use this innovative feature to the caregivers. Unfortunately, this expensive feature was never used because the zookeepers union refused to allow its members to do enrichment work without extra pay, which zoo management refused to provide. About six years later I again demonstrated to new staff how to train the chimps to use the feeder logs. To my knowledge these expensive and inventive enrichment features have never been used. However, during later back-of-house visits, zoo staff confirmed how much they liked the multilevel service building.

I positioned an elevated shady grotto under an overhanging cliff. A small waterfall provided with mist sprayers created a cool ‘throne area’. Here dominant chimps could rest on warm afternoons while overlooking their entire area as well as looking down on throngs of zoo visitors.





Figure 62. Los Angeles Zoo Chimpanzee Exhibit. Upper left: chimp penthouse above night holding building. Upper middle: “feeding log” integrated into the public viewing area. Upper right: overhanging cliff for shade and a small waterfall with a mist spray to create a cool chimpanzee ‘throne area’. Lower left: chimp using one of the artificial “feeder logs” inside the chimp area. Lower right: visitors looking into the chimpanzee’s world while both enjoy abundant summer shade.

“The chimps want to be able to climb, have a social group and plenty of things to occupy their time and their minds... They’ve got a state-of-the-world exhibit.” Dr. Jane Goodall, Renowned Primatologist describing this exhibit (as quoted in the LA Times).

In 1998 I was invited to be keynote speaker at the Jane Goodall Institute Chimpanzee Conference²¹ in Los Angeles. During a tour of the LA Zoo chimp exhibit Dr. Jane and I had an opportunity to sit inside the elevated chimp rooftop penthouse. We sat quietly on log perches, under overhanging shade trees gazing around the zoo and up into the surrounding Griffith Park. We had used fine netting made of woven aircraft cable, nearly transparent, to enclose the space. This elevated position created a feeling of confident relaxation. Jane turned to me and said: “This doesn’t feel like a cage.” The chimps must have felt the same way.

On a later trip I followed a carer up the steps to the penthouse in which four chimps were relaxing. I, a stranger, stood one meter away from three chimps on the other side of the lightweight mesh barrier. One turned his head to look at me and turned back. Two others did not appear to wake up. In any typical zoo enclosure having a stranger in such proximity would cause an uproar among the apes. These experiences convinced me empathetic, informed design can indeed reverse a long history of aggression between chimps and humans, replacing agonistic chimp behaviours with indifference at least, even in challenging situations.

Orangutans of the Red Ape Rainforest. Our next LA Zoo project was a new orangutan exhibit. Gary Lee suggested the design of a donut-shaped cable mesh tent with viewing in the centre. Visitors would be surrounded by the orangutans above them, which could rotate around different sections of the loop. I suggested the entire area be enclosed with a dense hedge of towering timber bamboo. We installed heavy and

²¹ <https://joncoe.net/wp-content/uploads/2021/12/ChimpanzeeChoices1998.pdf>

expensive sway branches which could be lowered for provisioning and then raised to changeable positions with small winches. When I visited 14 years later the carer responded she seldom used this feature because the winch wasn't conveniently reachable. Was this a case of poor design or low staff incentive? Given the staff-management problems I have observed over the years working with this organization I suspect the latter cause.



Figure 63. Orangutans in the round at Los Angeles Zoo. Left: public entry under the mesh torus. Centre: orangutan approaching gateway to the next section of the torus. Right: indoor night facilities with overhead raceways for transferring apes into different rooms; conventional but beautifully detailed. The wheel-operated manual gate control designed by our in-house genius Larry Dame and fabricated by A-thru-Z fabricators has become the international best product in my opinion. Left photo: CLRdesign.

Children's Zoo renewal. Under Director Manuel Mollinedo's direction I designed the redevelopment of the children's zoo area, especially the farm animal area. I ensured animals had "time-out" retreat areas, groups of animals were platooned so no one had to spend too much time being touched and garbed by zealous children. I also provided an organized waiting area for children and their families on crowded days. Rich new colors on the older buildings brightened the atmosphere.

Our final LA Zoo master plan. My major work with Manuel was yet another master plan, our third. We prepared a different master plan for each of the three directors we worked with at LA Zoo. I thought this one was both practical and far sighted. My plan for the new entry included a sweeping curved walkway accessible to all, a concept called "universal design". Senior staff felt it was not imaginative, not "Hollywood" enough. Soon after a San Francisco architecture firm designed a new billboard entry with a long steep stairway reminding me of Fascist Italian or German design. Grandiosity without sympathy for visitors with disabilities or elderly members or pushing children in prams. They were not welcome on the steep main path and had to take narrow inconvenient side routes. We provided the best ideas and best completed work to Los Angeles Zoo over a period of eight years, off and on, serving three directors. But in the end I never felt our work was appreciated the way it was by most of our clients.

Woodland Park Zoo Northern Trail 1990-1994. Northern Trail may be my favorite zoo design project because of the quality of design and implementation, the ways the

animals use it, how well it has matured and the support of co-workers on the zoo's team. I'm proud of other project successes under strong leaders. But the WPZ team at all levels fully understood and supported what I now call "deep landscape immersion." They enhanced our work with thoughtful management, allowing both landscapes and animal behaviours to mature gracefully. Our CLRdesign team of Gary Lee, Nevin Lash, Larry Dame, and I worked closely with the Woodland Park Zoo team headed by Director David Towne (David was Seattle Park Director during my earlier work with Jones & Jones and later joined the J&J staff when I designed Gene Coulon Park). Exhibits Coordinator John Bierlein was a past park naturalist, and lover of both wild nature and art. John was responsible for the whimsical art found around the zoo. Zoo Naturalist Gary Mozel previously worked as a naturalist in Alaska. Project Manager Jim Maxwell, together with John Bierlein, were keepers of the flame, insuring WPZ maintained its commitment to the highest quality of landscape immersion exhibits. Horticulturalist Sue Maloney Nicol worked with us during the first immersion exhibits and supported and managed our landscape-based exhibits for fourteen years before the beginning of this new work. Exhibits supervisor Larry Sammons, with John Bierlein, took wonderful photos of the completed work. Lead Keeper Gregg Thompson managed the mountain goats and had waited a decade and a half for his turn to design ideal facilities for his favored species. His knowledge of their unique behaviors resulted in innovations in the design of their transfer chutes and, with Gary Lee's personal design attention, their extraordinarily beautiful exhibit.



Figure 64. Mr. Kenny Twywana carved this wonderfully realistic artificial columnar basalt geology. Mr. Jolly Miller's company managed the outstanding rockwork construction. Photos: left John Bierlein, centre and right Woodland Park Zoo.

As determined in the 1976 Long-Range Plan, the project area was designated to recreate taiga (boreal forest), tundra and montane landscapes, simulating a visit to Alaska. Animals were to include white wolves, brown bears, wapiti (elk), river otters, mountain goats, fishers, snowy owls, and bald eagles. Recalling my experiences in the Canadian Northwest Territories, on the Kenai Peninsula, and Fairbanks Alaska, I suggested a storyline of ecogenesis for the taiga exhibit. These northern landscapes, and resulting wildlife, are created by the interactions of **fire, frost, and flood**. Evergreen

forest, high and dense where soil drainage is good, stunted, and sparse where permafrost prevents drainage, is the most permanent of these landscape forms. **Frost:** over time the deep shade of large white spruce prevents soil warming during summer allowing permafrost to form and rise. Gradually deep sphagnum mosses form under the tall conifers, insulating the soil still further. Stunted black spruce muskeg becomes dominant. **Fires** consume trees and moss layers, exposing the soil. Permafrost recedes; seedlings renew the forest cycle. Openings are first colonized by birch, aspen, poplar, and willow. These later give way to pine and spruce. **Flooded** rivers change course, undercutting forests, creating gravel and sand bars. These bars are colonized by poplar and other deciduous trees, later replaced by conifers, again beginning the gradual forest transition. To express these events in the exhibit designs Gary and I created a fast-flowing stream crossing a gravel bar and flowing into a pool for the brown bears, suggesting flood renewing the landscape. The wolf area was in a birch grove with charred logs recalling the force of fire in shaping landscapes. Melting permafrost was simulated in the foreground of the snowy owl exhibit with water seeping out of deep bed of sphagnum moss.

Environmental enrichment²², providing exhibit features encouraging natural animal activity and physical fitness, is an essential feature of good zoo design. A challenge is to provide enriching features which also support our ecological story. In the bear's pool I suggested placing a log floating in the pool while tethered to the bank with one end extending onto the land area. The bobbing motion attracted a swimming bear, who would wrestle with the log. This caused the elevated extension of the log to swing and sway, attracting the second bear to grab it. Soon the bears, one in the water and the other on land, would have a tug-of-war using the log. Zoo animals often get tired of such amusements, but the fact that zoo staff have replaced this log over decades of use testifies to the bear's continuing use of this natural enrichment feature. We also worked with zoo staff to design a computerized lazy-Susan device which randomly dropped food items into the water, including live trout hatchlings, for the bears to catch. While the public watches, the bears, heads underwater go fishing. Some trout survive to large size. These are examples of naturalistic enrichment for both zoo animals and zoo visitors.

This exhibit opened in 1994 after construction management by Gary Lee, Nevin Lash, and the zoo's team. Gary Mozel and Sue Nichol traveled to Alaska to purchase many of the plants and arrange shipments to Seattle. Sue and her horticulture team did all planting and maintenance themselves. I helped her with a few special details such as arranging and planting in special soil bags hanging down rock faces simulating an avalanche chute.

²² <https://joncoe.net/zoo-theory/enrichment/>

For more information please see: Bierlein, J. (1917) Woodland: The story of the animals and people of Woodland Park Zoo. p. 136. www.histotylink.org



Figure 65. Above: This accurate model of the central area of the Northern Trail exhibit complex by CLRdesign demonstrates the use of hidden dry moats. These allow panoramic multi-species vistas illustrated in photo below by L. Sammons. The brown bear explores the foreground stream. Mountain goats occupy the high ground beyond. Borrowed landscape forms the backdrop, including trees outside the zoo property.





Figure 66. Upper row: visitors enter the Northern Trail through transplanted Alaskan coastal forest, then see wolves with elk (wapiti) beyond. Second row: first major bear overlook and path to bear cave with the entry to Tundra Center in background. Third row: Bear Cave and view of bear from cave (Photo: S. Chin) and bears finding food in meltwater stream (Photo: L. Sammons). Bottom row: view from within the Taiga Center pavilion looking into bear habitat and bear in pool interacting with visitors. Bottom left note floating enrichment log mentioned earlier. Last image of bear interacting with visitors which I often observed. Photo: Woodland Park Zoo.



Figure 67. John Bierlein arranged for local First Nations sculpture Tony Angel to create these sculptures of raven “Spirit Guides” and wolf puppies across from the wolf exhibit. I collaborated with Tony in developing this storyline and locating these sculptures.

Woodland Park Zoo hosted the 1995 annual conference of the Association of Zoos and Aquariums (AZA). As conference goes experienced the recently opened Northern Trail exhibit I happened to be standing behind legendary Bronx Zoo Director William Conway. I had worked with him and his exhibits team fourteen years before and they now were Woodland Park Zoo’s main competition for the most exhibit awards. I was delighted when I overheard Bill Conway say to his colleague “This exhibit is so good it’s scary!”. That week Northern Trail was AZA’s Exhibit Achievement Award winner.

I last visited the Northern Trail exhibit in 2018, twenty-four years after opening. It had been well cared for and the entire wooden elevated deck section had been replaced. Plantings had matured as the above photos demonstrate. To this day it is considered one of the finest zoo exhibits ever built. In 2023 the present Director changed the name

to the 'Living Northwest Trail' and changed the theme area from southwestern Alaska to northwestern Washington State, which fits the now mature landscape well. He has renovated the indoor Tundra Center (covered over the amazing tundra diorama painting) to a display of endangered local pond turtles the zoo is helping to conserve. He has also stated that the original bioclimatic zone zoo organization will no longer be followed as new exhibits are developed.

Adventures with Dr. Goodall: From LEMSIP to Chimp Haven. In about 1991 I received a phone call from Dr. Jane Goodall, the eminent primatologist, asking if I would help her with an undertaking. Perhaps she remembered me from our brief meeting at the Pittsburgh Zoo during the first showing of her National Geographic film, or perhaps someone had recommended me from my previous design work with great apes. Jane told me about LEMSIP (Laboratory for Experimental Medicine and Surgery in Primates) a chimpanzee breeding and biomedical research facility near the Hudson River in Tuxedo NY. At the time they had some 200 chimpanzees, 'lab chimps' and 200 smaller primates kept and managed in inhumane conditions. Early in 1990, the US Department of Agriculture had charged LIMSEP with 378 violations of the Animal Welfare Act. Jane told me she had offered Director Dr. Jan Moor-Jankowski to design and help fund a major chimp enrichment and exercise area. Jane asked me to design such a facility and assured me that if Dr. Moor-Jankowski refused, she and her colleagues would see that LEMSIP was closed. I drove to LEMSIP and met Vet. Dr. James Mahoney, Jane's ally, and a strong animal welfare advocate. He showed me around and shared horrific examples of routine and casual animal cruelty. All chimps were kept in 1.5m x 1.5m x 1.5m (5' cubed) cages, infant chimps were taken from their mothers and hand raised and of course chimps were inoculated with the many infectious diseases being researched. I then met briefly with Dr. Moor-Jankowski and explained my mission. After returning to our Philadelphia Office, I developed plans for a two-level outdoor steel mesh enclosure to be attached to one end of the lab building and filled with climbing and other behavioural enrichment furnishings and features. I sent a draft set of these plans with an explanatory narrative to Dr. Moor-Jankowski for this review but received no response. I sent a reminder and still received no response, so I contacted Dr. Goodall with this unfortunate negative result. LEMSIP agreed to close in 1995, causing a rush to rehouse around four hundred lab primates before it shut down in 1997. In 1998 Jane Goodall was featured in a National Geographic documentary 'Chimp Rescue' featuring James Mahoney's efforts to relocate approximately one hundred primates to humane sanctuaries. The remaining primates went to other government funded research labs.

Dr. Goodall sent me a thank-you postcard I still have. I first met Jane Goodall at Pittsburgh Zoo in 1979, as I described in that earlier section. In 1994, After helping design the Los Angeles Zoo chimp exhibit and being keynote speaker at her Chimpanzoo conference, I joined her party during four of her lectures in the Los Angeles area (she sent me a thank you postcard then also) and was a speaker with her at the SAGA primate conference in Japan in 2004. I also enjoyed a brief chat with her during

her visit to Melbourne Zoo in 2008. I always found Dr. Goodall to be friendly, approachable, and confident. I've seen her speak with austere Japanese business leaders with the same informal tone, and the same effectiveness she would use talking with a passionate young zoology student. Jane once told me she met so many people on her travels yet had a terrible memory for faces. I was thus doubly pleased that she remembered me. Perhaps my long white beard was easier to recall than my face. Dr. Goodall is certainly one of my and the world's heroes.

In about 1995 I attended a conference intended to decide on future privately managed humane housing for government owned lab chimps. This was a groundbreaking coalition of animal welfare advocates both within and against the lab animal industry convened by the National Institutes of Health, the US government funding agency. It was pointed out during this meeting that maintaining chimps in labs was very expensive and that, when it was discovered that chimps were not biologically suited to testing drugs against AIDS, there was now a major surplus of lab chimps no longer needed for research. If private sanctuaries could be built for these apes, the government would help fund construction and operation and still save money. During this conference and subsequently a decision was reached to proceed with the private sanctuary movement with the requirement that once chimps were relocated no further breeding or invasive research would be allowed. The lab chimp generation would gradually age and go extinct. The CHIMP Act (Chimpanzee Health Improvement Maintenance Protection Act) was passed in 2000. The Federal Sanctuary System was born.

In 1995 I wrote *Giving Laboratory Animals Choices* published in Lab Animal Magazine. That year I was invited to help develop a master plan for Chimp Haven, to provide humane housing for lab chimps on an area of the Eddie D. Jones Nature Park in Keithville, LA. I visited their site with them and recommended an 81 ha (200-ac) parcel of mostly pine forest with the possibility to create several dammed water features and a wide perimeter buffer zone around it. There was a low security prison nearby and I harbored the dream these prisoners could grow crops to feed the chimps and, with proper training, could even work as caregivers at the sanctuary. I doubt this ever happened. I worked with co-directors Ms. Linda Koebner, who had helped rescue some of the LIMSEP chimps, relocating them to Florida's Lion Country Safari, and Dr. Linda Brent, a primate management expert²³. Their goal was that with nurturing care and environment each chimp could advance to self-selected limits of personal development and welfare. This was exactly the goal driving the design of the Red Deer Home in Alberta for severely disabled people I had helped to plan back in 1973. For example, some lab chimps had been so mentally damaged they were afraid to leave their small cages. The door would be left open into a larger enclosure if they chose to leave their refuge. When possible, individuals would be paired with compatible partners and larger compatible groups would be formed with access to very large natural forest areas.

²³ I wrote a chapter on chimp facility design with her in her 2001 book *The Care and Management of Captive Chimpanzees* published by the American Society of Primatologists,

Flexible and efficient facility design was essential to minimize labor costs. In sanctuaries there are far more animals for each caregiver to support than in Zoos.

At this point my colleague Nevin Lash took over for the design stage and the result is a major success with the first chimps arriving in 2005 and there are now 300 chimpanzees living in Chimp Haven. I visited the facility in 2004 during construction and remain a donor.

Lincoln Park Zoo 1991-1993. Then Director Kevin Bell invited our CLRR firm to develop an area master plan followed by design of a major new facility, the 3000 sqm (32,000 sf) Regenstein Small Mammal-Reptile House²⁴. Gary Lee and I developed a very innovative and I believe successful design process. The Zoo provided us with a dedicated work and meeting room. Before each meeting we covered the walls with very large and colorful drawings and models displaying our latest progress. We found these 'bedsheet' sized drawings more 'client-friendly' and more easily understood than smaller black and white prints usually used by architects. We filled large tablets with workshop notes and pinned these up as well. Everything was left on the walls when we departed and remained on display for casual staff visits before our next design meeting. When we returned the process was repeated, with newer drawings covering older ones. Nothing was lost. This process increased understanding and confidence, and thus support, among zoo staff.

The Regenstein Small Mammal-Reptile House displays small mammals, reptiles, amphibians, invertebrates, and birds. The first half of the visitor experience is organized in traditional museum fashion with viewers in a darkened gallery looking into living dioramas organized from very simple (What is a reptile?) to dramatic views of large snakes in simulated habitats. The organized visitor circulation follows the educational pathway, but experienced or impatient visitors can easily proceed to favorite exhibits. This free-flowing design is effective on high visitation days when typical museum galleries become congested. The second experience builds upon the basics demonstrated in the first gallery by immersing visitors in a tropical habitat within a large conservatory shared by many reptiles, mammals, birds, and plants. Long-time friend and colleague Mr. Ray Mendez of Work-As-Play built and provided animals for displays of naked mole rats and leaf-cutter ants. The third major element not seen by visitors is a large 400sm (4,300 sf) animal management and breeding facility.

²⁴ <https://clrdesign.com/project/lincoln-park-zoo-regenstein-small-mammal-reptile-house/>



Figure 68. Upper left: this building designed by CLRR architect Peter Alusitz makes a handsome contribution to the Lincoln Park Zoo campus. Upper centre. the education stations designed by Barbara McGraw roll out to enclose educators in front of iconic super-sized bat-eared foxes and geckos (not shown). Upper right: the gallery displays present animals in their scientific, taxonomic context, rather like a living science book. Curved acrylic windows supporting the free-flowing visitor circulation path. Lower left: the second visitor experience is in a tropical conservatory displaying animals in their ecological context, with free-flying birds and immersive exhibits of reptiles and small mammals within their heavily vegetated habitats. Lower right: the third project element was a large off-display and highly functional animal management centre especially suited to breeding small endangered species.

Traditional curators expected all their cherished collections to be on public display. A study done by Reptile Curator Dr. Dale Marcellini at the Smithsonian National Zoo found that no matter how many species were displayed, visitors only paid attention to about 25 species. Marcellini suggested it is more economical and effective to breed less popular endangered species in flexible off-exhibit areas. Thus, we planned for only twenty-two species to be displayed in the main hall with another 12 species in the naturalistic conservatory setting. Nineteen years later I visited the project (see photos above from 2012) and spoke to management staff who confirmed the entire facility was very successful, including the large off-exhibit animal conservation and breeding area.

Regenstein Small Mammal-Reptile House is our best architectural product, both inside and outside. Peter Alusitz our lead architect from the New York CLRR office managed

by then partner Geoffry Roesch, designed the building's facades to wonderfully harmonize with the traditional Lincoln Park architecture.

New York Botanical Garden Enid Haupt Conservatory 1993. The New York CLRR office headed by Goeff Roesch was awarded the work of redesigning exhibits in all eleven glass houses of the historic Enid Haupt Conservatory. The design work began as the conservatory was emptied of most of its plants and reglazed. The future locations of all plants were up to our planning. The old plantings had been arranged traditionally by taxonomic type by specialist collectors. For example, the giant domed Palm House displayed ferns and palms. Director Gregory Long envisioned bioclimatic organization based upon their wonderful research and collections of South American species, plus changing ornamental displays. I suggested keeping the palms and giant ferns under the palm house dome as an astonishing entry experience, followed by lowland rainforest, cloud forest and desert, with connecting glass houses featuring aquatics, vines and changing exhibits. Gregory Long left it to me to convince the traditional fern Curator who objected to these changes. "This is my collection", he stated "which I built over my career." To my encouragement that ferns distributed among all the bioclimates showed their diversity he responded, "My collection will be lost." He resigned later that week. Traditional curators in zoos, aquariums, botanic gardens, and museums were collectors and often thought of the collections they managed as personal, or at least professional property. It takes a strong leader like Gregory Long to unite them under an institution-wide vision.

Gregory Long organized two international research trips, one to visit and learn from the best conservatories in Europe and one for me to visit NYBG research sites in Ecuador.

On the first trip I joined Gregory, along with Geoffery Roesch and his wife Marcia, to visit Kew Garden, especially the new Prince of Wales Conservatory. We found the low roof created a sense of confinement and the plantings, while attractive and collected from around the world, had 'no science' in their organization. We next visited the Royal Botanic Garden Edinburgh. Their grand old tropical conservatory was arranged scientifically at the time with little attention to creating an aesthetic visitor experience. It seemed haphazard, accretional and clearly human dominated. As we left I asked Gregory "Why must collections be either scientific or ornamental? Why can't we have both? And why must even large conservatories appear so human-dominated? Why can't visitors take a beautiful walk through the wild in a large conservatory?"

In addition to visiting gardens, I also spent an afternoon exploring Edinburgh Castle and the historic road leading up to it. We next visited the grand Palmengarten Frankfurt and again found a beautiful but human-dominated environment with no sense of wildness. On the flight home I was seated next to Gregory and developed sketches and notes illustrating and confirming our findings.

Returning from Europe, I realized I had just visited four continents, North American, South America, Europe, and Australia, in fifteen days. A few days later I again flew to Australia for the Alice Springs Desert Park work.





Figure 69. Upper row: New York Botanical Garden's restored Enid Haupt Conservatory showing the dark pool I designed to reflect the 30m, (100') height of the great dome. Second row left and center: my conceptual sketch of the lowland rainforest artificial 'fallen limb from the forest canopy' covered with bromeliads and my photo of the result. Second row right: my use of a simulated shaman's hut demonstrating medicinal and economically valuable plants placed to unite two separate pavilions withing the lowland rainforest theme. Third row left: connecting gallery displaying aquatic plants and swags of flowering vines. Note the use of local Fordham Gneiss geology for construction. Center: CLRR interpretive design leader Barbara McGraw in the cloud forest dominated with native ferns, bromeliads, and mosses. Right: Overlook to mountain stream with mist system simulating cloud forest conditions and adding atmospheric and acoustic qualities to the cloud forest simulation.

The magnificent dome of the Haupt Conservatory, opened in 1902, is 30m (100') high, with the same diameter at its base. The upper dome is supported by a 15m (50') diameter compression ring clearly visible from inside the Palm House entry. I wanted visitors to appreciate this amazing space and so I placed a dark reflecting pool of the same diameter directly below. Visitors looking down into the pool see the reflection of the high dome above. This is a special example of the use of "sight-line design" I had developed in my zoo work. I also introduced an acoustic dimension by having water from the pool spill out into special drains (third of the Palm House photos above). The overall result proves my assertion that botanical displays can be both scientifically accurate and educational as well as aesthetically pleasing.

New York Botanical Garden Children's Adventure Garden was our second project, again working with partners Geoff Roesch and Gary Lee. We were challenged to make

botany fun and understandable to children. Local researchers had found that some children growing up in the nearby South Bronx neighborhoods did not realize that trees were any more alive than utility poles. Our plan was based on developing discovery areas around natural site resources such as geologic outcroppings, a marsh and lake, and developing discovery trails connecting these play and learning opportunities. Gary also designed a charming and kid-friendly learning center.



Figure 70. Gary Lee's birds eye illustration of the plan and some final developments.

Alice Springs Desert Park Australia -1993. Mr. John Wright, an American landscape architect living in Australia, visited our Philadelphia office in 1992 to learn about zoo design. He was planning a new open-range zoo in Werribee, Victoria, near where I live today. Then in 1993 John and Mr. Tony McCormick from Hassell Architects, a major interdisciplinary Australian firm, invited me to join them in planning a new desert wildlife park in Australia's Red Centre. Our team was joined by noted ecologist and award-winning science writer Dr. Penny Van Oosterzee, whose illustrative book *The Red Centre* was our inspiration. Canadian born local ecologist Dr. Bill Low guided us to iconic outback habitats such as sand and gypsum hills, gibber plains, mulga woodlands, chenopod and spinifex plains, red stone gorges and chasms. Imagine being paid to visit and learn about such amazing landscapes! Our plan was to recreate highly accurate representations of these biomes, placing them at the base of the picturesque MacDonnell Ranges ridgeline.

Our detailed site analysis included an important dimension. This has been the homeland of the Arrernte people for at least 30,000 years and possibly much longer. The area had numerous sacred sites. Cultural communications can be complex and nuanced. Initiated Arrernte men have sacred knowledge not available to outsiders or even to Arrernte women. Women's knowledge is likewise hidden from their men and outsiders. How were we to locate and protect sacred sites when traditional custodians were not allowed to show them to us? I reasoned that since such sacred areas are ancient and timeless, they would be unusual and imperishable geological features such as dramatic rock formations. Such features were common on this picturesque site. Any could be sacred, but which ones were? I arranged a walk through the site with male Arrernte Elders, showing them the locations of proposed constructions. "We were

thinking of building a viewing pavilion connected to this dramatic rock”, I said. “What do you think?” If the Elders had long faces and their body language suggested negativity, I asked “Is this a better location over here?” “Yes”, they answered. “That would be a good place”. We adjusted all building locations to avoid men’s sacred sites. A few days later, a female anthropologist from our group who was known and trusted by the female Arrernte Elders led a similar walk. Thus, we assured that women’s sacred sites were also protected without disclosing specific locations. I believe the Arrernte Elders appreciated our respect for their biophysical and spiritual land and they supported our development plans.

I made three visits to the site as well as attending meetings in Sydney. Our detailed master plan was approved by the Northern Territory Government. Unfortunately, as seems common in international work, development phase design was awarded to a more local firm and several of my best ideas were never realized. Nevertheless, the outcome remains excellent. Respected naturalist Sir David Attenborough, after a visit, is said to have proclaimed Alice Springs Desert Park to be his favorite zoo!

Territory Wildlife Park Australia -1998. I again joined John Wright of Hassell Architects and award-winning science writer and ecologist Penny van Oosterzee for work in Australia’s Northern Territory. This time we developed a master plan for the Territory Wildlife Park in Berry Springs outside the city of Darwin. Mr. David Larson, of the Parks and Wildlife Commission of the Northern Territory, was our client. At 15 degrees south latitude, this is a tropical monsoon climate with distinct wet and dry seasons. As with the Alice Springs Desert Park, we located characteristic biomes on this 400 ha (988 ac) property where examples already existed. Examples include evergreen rainforest, monsoon forest (dry woodland), billabong (a pond left by floodwater surrounded by trees), and open marsh. As with the Alice Springs Project, I was privileged to visit outstanding natural examples in Arnhem Land with ecologist Penny van Oosterzee as my guide. We flew in a light plane to Camp Borrodaile, a remote barramundi fishing camp on Aboriginal land just south of Kakadu National Park. This camp is jointly owned by the local Aboriginal community, whose ancestors arrived there about 60,000 years ago. Mr. Brendin Bainbridge, the camp’s knowledgeable young guide, led us to ancient quartzite (metamorphosed sandstone) cliffs decorated with some of the earliest and best-preserved rock art ever created. We followed Brendin into a grotto where Aboriginal bones, carefully wrapped in paper bark, had be placed on stone ledges. I respectfully asked him if we were permitted there. He answered, “Oh yes, just do not step on anything.” He also showed us two more resent drawings (perhaps only 4,000-8000 years ago) of life-sized Thylacines (Tasmanian tigers) who likely became extinct on the Australian mainland after dingoes arrived.



Figure 71. Upper left: pandanus sketch from Barry Springs.

Another fine memory from this visit was swimming in Barry Springs, near the city of Darwin. Here a substantial flow from natural hot springs cascades over a low waterfall into an extensive marsh. Swimming in the clear warm water with native archer fish, usually seen in tropical aquariums, was a treat. Outflow channels were regularly monitored with crocodile traps. The most recent croc was trapped two days before my visit.

Coimbatore Zoo and the Central Zoo Authority of India -1994. Mr. Chuck Coburn, then Zoo Horticulturalist at San Diego Zoo and I were invited by Ms. Sally Walker, a zoo animal welfare activist in India, to help plan a new private zoo in Coimbatore in the Western Ghats state of Tamil Nadu. British Airways had a program called "In Support of Conservation" and Sally had arranged complimentary airfare on a space-available basis. I could only have carry-on luggage and needed to check in early to be first on the standby list. I was cautioned not to schedule any flights out of India on Sunday nights because these were always overbooked. Our travel agent booked my return flight on a Monday. My flight to London was guaranteed but I was the last to board the flight to Mumbai. The connection south to Coimbatore was paid for by the clients, Mr. and Mrs. Rangaswami. Mr. Rangaswami was a wealthy textile manufacturer and a gracious host, but no match for his wife's quick intelligence. Mrs. Nadini Rangaswami was one of the most intelligent and insightful people I've ever met. Nadini came from an old important family. Her mother ran a girls' school. She was the perfect traditional Indian hostess and during evening conversations in their home, while she was serving drinks, she would ask a seemingly casual question bringing important subjects into perfect focus. On one of the few times I spoke to her alone she confided she had asked her personal astrologer about my coming and had been assured I would be very helpful to her. Therefore, she trusted my judgement completely. I soon learned to trust her judgement as well. She was a beautiful and formidable woman. Of the technical members on their team, I especially recall Mr. Brij K. Gupta, who later became a member of the Central Zoo Authority (CZA) of India and along-time student and colleague of mine and Dr. Vet. N. V. K. Ashraf whose energy and commitment were important to the project.

Sally Walker was an American from North Carolina. She had spent much of her life in India, first as a student of Sanskrit and Yoga in the 1970s, and later in the cause of zoo animal welfare, and conservation. She founded the Zoo Outreach Organization in 1985, whose informative newsletter I still receive. Sally also made the first comprehensive list of zoos in India and was influential in establishing and serving on the Central Zoo Authority. Sally was an outspoken woman and a demanding foreigner in a culture where women were expected to speak through their husbands, if at all. She was very effective.

The Central Zoo Authority is a statutory agency of the National government and controls Indian zoos as a central policing agency. Their initial mission was to close inhumane zoos. This was good. But they had an imbedded distrust of both private zoos and new ideas, feeling that if anything could go wrong, it would go wrong. Most Indian zoos are

operated by State Departments of Environment and Forestry. They felt that these were easier to control than private zoos, which they assumed would always put profits above animal welfare. Restrictive ordinances prohibited public animal demonstrations and restaurants on zoo grounds. At that time, the Central Zoo Authority was dominated by Mr. Pushp Kumar, known as Mr. Zoo Man in India, who designed the large naturalistic exhibits at both the Nehru Zoological Park, Hyderabad, and National Zoological Park in Delhi. Both had large display areas but extremely limited animal night quarters where big cats spent sixteen hours each day while the zoos were closed. He visited our highly naturalistic exhibits at Woodland Park Zoo twenty years earlier and became a supporter of our heavily planted and open moated approach. I met him briefly on a tour of US zoos. I recall he seemed very skeptical, perhaps because I was so much younger than he was at that time. Sally told me Mr. Pushp Kumar had previously been paid by Mr. Rangaswami to design a plan for their site, which she found poorly developed. They had visited his work at other zoos and found it boring, she said. This led to my being invited to do their planning, which Sally believed he resented and therefore opposed. "He didn't want any other zoos better than the ones he himself had designed" she told me.

The Rangaswami's had purchased a 100ha (250 acres) property from the government which had been part of a vast elephant and other wildlife reserve but had been considered unsuitable because it was a treeless goat and sheep pasture used by a village of "Tribals." I learned these Tribals were a low-caste indigenous ethnic group whose pastureland had been taken by the government. Our plan was to employ and train these people from their nearby village to work at the new zoo.

We prepared a master plan for the proposed Coimbatore Zoo which the Rangaswami's submitted to the Central Zoo Authority for approval. It was disapproved because it was to be a private zoo. Also, a solid "proper puka wall" (stone masonry) was required around the entire 100ha property. When we responded that in the remainder of the world most zoos had wire mesh perimeter fencing, they responded the local Tribals would simply steal the mesh fencing. The frustrated Rangaswami's decided to proceed with reforesting the entire property with native plantings, using local Tribals to both plant and weed the new areas. Eventually the project became a botanic garden. To my knowledge, they never opened a zoo, and a quick look online does not show any zoo of the size we planned in the area.

Later the Central Zoo Authority of India invited me to participate in zoo director planning and design training programs in Bhubaneswar (2006), Hyderabad (2011), and New Delhi (2012). They seemed keen to hear about the many zoo innovations we had made in North American zoos, but the "old guard" always responded: "You don't understand, this would never work here in India!" I tried to explain that conditions in American zoos were not so different when I started, but we had advanced and so could Indian Zoos. India is a very creative and competent nation in many areas of science and technology, but it is the distrustful Indian bureaucratic mindset together with ancient cultural limitations on

gender rolls and caste which limit the evolution of Indian Zoos. Things are gradually improving as a newer generation of Central Zoo Authority managers emerges.

I had my travel agent schedule my return flight from Mumbai on Monday and was dismayed to discover she had scheduled it for 2 am Monday morning, which was the departure time for the overbooked Sunday night flight! I checked in three hours early and was told I could wait in the business class lounge, but there was little chance I would have a seat, as Sunday flights were always overbooked. An hour later I again visit the British Airways counter and told the English attendant I was working with Sally Walker and flying courtesy of the BA In Support of Conservation program. She nodded and gave me these instructions: "Stand in plain sight at the back of the room during boarding and watch me. When I give you a nod, board immediately." Boarding became increasingly chaotic as passengers with tickets in hand realized they were being left behind. I finally saw the BA attendant's subtle nod and boarded with the last passengers. I suppose this was an example of neo-colonialism, but I was happy to be on my way.

Louisville Zoo -1995-2003. The senior staff at Louisville Zoo as an especially friendly and open-minded group. Then Director Dr. Jim Foster, DVM, managed overall policy and external affairs with the City and Zoo Board. General Curator (and later director) John Walczak effectively managed internal affairs from animal care to visitor services. Then Mammal Curator Steve Taylor was very supportive of our ideas. Director of Education Marcelle Gianelloni was a leader in zoo education at the US national level. She remains a friend to this day., Curator of Birds Gary Michaels was especially passionate about his charges. Sometimes zoo veterinarians are skeptical of untested ideas, but Dr. Roy Burns, DVM, was very supportive of our work. This group was open to change, and we had visionary ideas. However, it was Animal Training Manager Jane Anne Franklin, with a "can-do" attitude and practical creativity, who devised means to ensure the zoo animals contentedly and reliably complied with our ideas. I list these key participants to underline the value of an integrated, team-based planning and design process (I also highlighted this approach with Woodland Park Zoo) compared to some other projects led by a dominant leader without gaining enduring staff understanding and support.

Master Planning. Louisville Zoo had just received a master plan report completed by another zoo design firm specializing in low-cost planning. This plan was unbuildable. It must have been developed in their office and not on the zoo grounds. An ornamental lake was suggested on a steep hillside, and proposed pathways would be impossibly steep if built as shown on this plan. Unfortunately, this same situation occurred with two previous clients of ours. Yet despite this disappointment, the Louisville Zoo remained positive and excited to proceed.

Architect and Planner John Rogers, Gary Lee's, and my partner at CLRdesign, oversaw the master planning stage. Priority new projects were identified, as well as the overall visitor experience, educational themes, and public and service circulation concepts. All

were based upon a thorough understanding of site topography, aspect, existing tree cover and location of existing buildings and underground utilities. Once the master plan was approved, the first project was a new zoo entry and plaza, these set the scene for improvements to come. My largest design contribution was the Islands Exhibit and, later, the Gorilla Forest.

Islands followed a storyline of an Indonesian village along a small stream such as I had visited in Sumatra. Traditional village buildings (animal viewing stations) were designed by CLRdesign architect John Collins. Visitors passed through tall timber bamboo for outdoor viewing. A cluster of evergreen magnolias was positioned to imitate a banyan tree. Traditional Indonesian art and craft features were imported to decorate the buildings by Education Director Marcelle Gianelloni, who had previously visited Indonesia. Thai Buddhist monks sanctified the spirit house during opening ceremonies.

This was the world's first mixed species rotation exhibit as far as I know. It included three outdoor mesh covered habitats and one indoor exhibit area time-shared by Sumatran orangutans, siamang gibbons, Malayan tapirs, babirusa pigs and Sumatran tigers. There also were a large indoor aviary, classrooms, and support areas.



Figure 72. Upper left: I'm leading a planning workshop with then Director Bill Foster on the near right. Upper centre: plan showing three exhibits and indoor day room with viewing shelters and raceways connecting night holding areas and exhibits. These allow any animal to be transferred to and between all exhibit areas. Upper right: Indonesian style viewing pavilion. Lower left: inside view of Indonesian shelter

with views of Sumatran tiger (photo: Louisville Zoo). Lower centre: view into rotation exhibit with stream, used alternately by tigers, tapirs, and babirusa pigs. Lower right: two-level indoor day room being used by siamang gibbon, but alternately available to all the exhibited species. The window in the upper background allows apes to view people in a meeting room where we later held planning sessions.

In 1997 Gary Lee and I published the concept of **Activity-Based Design and Management** in a paper called “Entertaining Zoo Animals and Zoo visitors, an Integrated Approach”²⁵ supported by the success of this exhibit. The idea was that engaging recent advances in reward-based animal training enabled zoo animals to access and use far more behavioural opportunities. This encourages increased animal activity which in turn improves visitors’ experiences. This is a win for animal welfare and a win for visitor experiences, two realms long considered in opposition and contention.

The first element of this concept is animal rotation through multiple exhibits. We first developed this with the gorillas at Zoo Atlanta, but mixed species rotation was first widely implemented by the Louisville Zoo. The concept was advanced by increasing the number of species and including both predator and prey species. Animal welfare concerns have been expressed that the mere sight of a predator would stress prey animals. Indeed, the Central Zoo Authority of India prohibits their zoos from displaying predator and prey animals in sight of each other. This concern is not supported by observations in nature. Prey species such as zebra and antelope show little fear of a lion obviously passing nearby on its way to a waterhole. Prey species judge the lion’s intentions by its behaviour. In our Islands exhibits animal areas are separated by double fencing several meters apart. Prey species soon learned the tiger couldn’t reach them. I observed a tapir feeding calmly while a tiger in the adjacent exhibit, tail wagging excitedly, focused its full attention on the tapir. As further evidence of the tapir’s adaptation to the tiger, researcher B. C. White et al., during a two-year behavioural analysis, observed the tapir entering the area recently left by the tiger. Undaunted by the tiger’s recent presence, the male tapir placed his own scent mark over the tiger’s previous mark. The tapir was saying, in animal language, “I now claim this area to be mine!”

The White et al. study noted that when an animal enters a space previously occupied by a different species, its first response is to explore the area, seeking olfactory signposts left by the previous occupant. This activity seems undiminished by years of familiarity. For example, on a visit fifteen years after the exhibit opened I observed the tiger wading downstream, apparently following the scent the tapir had left just before.

Animal rotation also adds complexity to facility design. We developed a two-level animal raceway network connecting the night quarters and exhibits. Agile animals like orangutans, gibbons and tigers used the upper level. Tapirs and babirusa pigs used the lower level. The upper-level raceway passed above staff doorways. The lower-level raceway needed to decent under staff doorways and return the ground level. Large, heavy, semi-aquatic animals like Maylan tapirs are not comfortable going down

²⁵ <https://joncoe.net/wp-content/uploads/2022/04/EntertainiZooVisit.pdf>

unfamiliar stairs. Using her knowledge of animal behavior and creative thinking lead animal trainer Jane Anne Franklin understood tapirs would rather swim across than climb down unfamiliar stairs. She simply covered the drain and flooded the stairwell. When the tapirs were comfortable swimming across she lowered the water level a little each day until the tapirs were comfortably using the stairs.

How was the complex rotation movement with multiple animal gates and dangerous species safely managed? Jane Anne Franklin organized the four-person Islands management team with an innovative strategy. Reasoning that accidents most often occur from inattention during routine practices, she made each caregiver “curator for the day.” That is, on Monday, person “A” decided the entire day’s routine, which animals would rotate into which enclosure, when and in what order. How often and when would each move to a different exhibit area? On Tuesday person “B” takes overall responsibility, alternating staff throughout the week. Jane Anne reasoned that when it’s your day to be in charge, you will pay full attention to every detail. As a second precaution, she insisted two people attend each animal transfer, the gate operator, and an observer. While safety was the first concern, Jane Anne also wanted to optimize the randomness of the animal’s experience. While both animals and staff have been shown to favor routines, unpredictability and novelty favor resilience, adaptability, and reduce boredom. At least this is our approach, which the White *et al.* study confirmed to be enriching to the animals, although even this stimulation diminished over time.

Another benefit of Jane Anne’s system was to encourage early professional staff development by giving even junior staff, under supervision, the responsibility normally held by a senior manager or curator.

Visitors also became more engaged, actively seeking animals in unpredictable locations. Animal identification graphics illustrate all species and visitors matched the animals they saw to the identified animals illustrated. This supported the storyline that when looking out the window of a remote Indonesian structure you could see any resident species passing by.

Gorilla Forest. At this time John Walczak was Director of Louisville Zoo, which did not have any gorillas. Lincoln Park Zoo needed somewhere to house their large gorilla colony while they redesigned their own facility, where I also assisted. Louisville Zoo’s new facility could house the Lincoln Park Zoo gorillas during this period.

Our project included a forest trail connecting an African-themed restaurant, village garden (children’s) area, and pygmy hippo exhibit leading to the gorilla conservation centre. Inspired by the gorilla exhibit at the Apenheul zoo in Apeldoorn, Netherlands with their “gorillas in the round” arrangement, we surrounded the indoor central visitor area with two large and two smaller indoor gorilla activity areas from which the gorillas could chose or they could circle the three areas with overpass above the visitors. Long climbing ropes attached to cargo nets extended beyond the animal rooms, crossing

over the public. When a gorilla in one area climbed using this rope, it tensioned the rope across the hall and the cargo net above the visitors was moved.

Soon after construction was completed, a large group of gorillas arrived from Lincoln Park Zoo with their very able Manager Roby Eisner. He and Jane Anne Franklin collaborated in training the new arrivals to use their new facility and settle in.

There is a long, on-going contention among zoo animal welfare advocates over whether highly naturalistic or highly artificial habitats best meet the gorilla's needs. My approach to this project was to provide both opportunities and let the gorillas themselves decide which they preferred at any given time. Louisville has a continental climate, meaning it is cold in winter and warm in summer. The gorillas, enjoying comfort, chose the climate-controlled indoor facility much of the time. I was told by facility manager Roby Eisner that he was once approached by an irate visitor asking why the gorillas were locked inside on such a pleasant day. His response was: "Lady, the gate is open. The gorillas can go out whenever they want to!" This is an early example of designing to provide the animals themselves with more choice and control over their own lives.

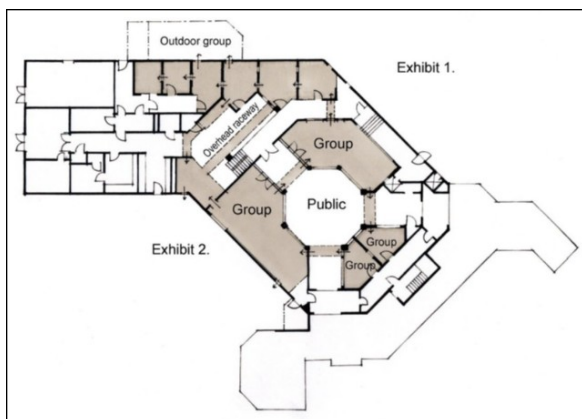




Figure 73. Upper left: pygmy hippo exhibit with a jacuzzi pool integrated into a cascade. I designed the pool to be activated when the animal entered it, but the installation was activated by a timer instead. Upper right: the upper of two large outdoor gorilla habitats. Note that no barriers or buildings are in view. Unfortunately, over time horticultural maintenance crews lost the plot. The manicured lawn and flower bed resembles a garden rather than a rainforest clearing. Middle row left: our floor plan for the Gorilla Forest building showing gorilla activity rooms surrounding the central public space as well as variety of indoor areas available to gorillas' day and night. Middle row right: central public space surrounded by high gorilla activity rooms. Note that the gorilla activity areas are placed well above zoo visitors so the people look up to the gorillas. Lower left: Mammal Curator Jane Anne Franklin training gorillas in the flexibly designed non-public management area. Roby Elsner is shown below. This facility is now considered one of the best in North America. Lower right: the CLR designed zoo café with an African theme. We arranged for the thatch roof to be provided and installed by Zulu thatchers from South Africa. The second and fifth photos are by Louisville Zoo.

Philadelphia Zoo PECO Primate Reserve²⁶ -1996. The terrible 1995 Christmas Eve fire destroyed Philly Zoo's World of Primates, killing a gorilla family of six, three orangutans, four gibbons and 10 lemurs by smoke inhalation. Working with then Director Pete Hoskins, Primate Curator Andy Baker, Animal Program Manager, Karl Kranz, and senior zoo staff, John Rogers, and I, with our CLRdesign team, developed plans for a much larger new facility. It would also house many smaller primate species. We were aware that the Bronx Zoo was planning a far larger gorilla facility (2.6 ha, 6.5 ac) called Congo Forest. It would house around twenty gorillas and other African forest species. These outdoor exhibits would be spectacular, but indoor holding areas were likely to be limited. We only had 1 ha (2.5 acre) and wanted to house and display eleven primate species, providing better year-round amenities for the animals in spacious indoor facilities. Substantial outdoor areas would be provided for gorillas and orangutans to use during summer. But what should such a large building look like and what story should it tell? We needed to invent a completely different direction from the tropical habitat simulation proposed by the Bronx Zoo.

Building upon the storyline we developed for the Los Angeles Zoo chimpanzee exhibit, I suggested theming the building to represent an old tropical lumber mill. The story would be that the "Equator Lumber Company" had exhausted the local timber resources and

²⁶ <https://clrdesign.com/project/peco-primate-reserve/>

its building had been converted to a primate sanctuary while the surrounding forest was restored. It would be known as the PECO Primate Center named for the principal donor, formerly the Philadelphia Electric Company. Our strategy was to advance our activity-based design and management strategy developed earlier at Louisville Zoo. This featured the integration of facility design with behavioral enrichment, animal training, husbandry, and habitat to create a memorable experience for both animals and visitors. Described as: “Better than a behind-the-scenes tour,” visitors are surrounded by the primates in bright, spacious community day rooms. All animal areas were interconnected with gates and raceways. On warm days when the gorillas and orangutans were outdoors, their spacious day rooms could be used by smaller primates to explore novel experiences and increase physical activity.



Figure 74. Upper left: PECO Primate Reserve entry with walk-through ring-tailed lemur exhibit in foreground and “Lumber mill” building beyond. Upper right: colorful, two-level visitor corridor. Lower left: spacious orangutan day room with industrial-themed climbing furnishings. Monkeys perched on overhead gantry rail designed to move lumber through old the old mill. “Howdy crate” designed to encourage positive interaction between children and apes (concept sketch and actual use). Note gorilla behind the window interacting with child.

Our design also incorporated advances in “affiliative design” (described earlier). For example, the “howdy crate” pictured above is a less expensive variation on the “howdy log” built into the Los Angeles Zoo chimpanzee exhibit. The crate is assembled on both sides of the viewing glass and allows children to sit inside or on top of one side while

young gorillas can do the same on their side. One day I observed Demba, a female gorilla, sitting on the crate and playing “paddy cake” through the glass with a child on the other side. Spontaneously, all the parents in the area formed a reception line with their children, patiently waiting for their children to meet Demba and play paddy cake with her. This is the best example I know of demonstrating affiliative visitor/animal interaction specifically supported by design intention.

The PECO Primate Reserve was a success with the primates living there. They multiplied immediately. It was a failure with the zoo’s educators, who chose to ignore the lumber mill storyline and used their very substantial budget on telling stories featuring “Conservation Heroes”. It was a failure with visitors, who bypassed the conservation hero videos, complained exhibits “were not naturalistic” and did not even notice the “lumber mill” storyline. It was also a failure with the animal care department who chose not to use the animal transfer and rotation opportunities. Lessons learned include the need to obtain buy-in from educators and operating staff before proceeding with design innovations. Also, it is dangerous to go against public expectations, including some we ourselves created earlier with highly naturalistic animal summer habitats. I now believe that as zoo sentiment shifts from visitor experience dominance to animal wellbeing emphasis this facility will be recognized as a pioneer.

Philadelphia Zoo Master Plan 2009-2016. Under innovative Philadelphia Zoological Foundation CEO Mr. Vikram Dewan, Philly Zoo launched a new vision for their future. Earlier, in 1996, I worked with General Curator Dr. Andy Baker and my firm CLRdesign to develop a system of interconnected exhibits as an animal rotation strategy for the PECO Primate project. Andy liked this idea but found after the project opened zoo staff were not inclined to use this built-in enrichment opportunity for the primates. Later, CLRdesign adopted an animal exhibit rotation concept for renovation of their old Big Cat House (the final design was done by another firm) which this animal care staff fully embraced. Andy had also seen a short overhead connection for orangutans at Cologne Zoo in Germany and had been thinking along the same lines. To expand upon this exhibit-by-exhibit rotation strategy I had suggested to Andy Baker a zoo-wide overhead animal trail system. I argued that, based upon zoo biologist Heini Hediger’s depiction in 1950, a wild animal’s territorial is not so much a space as a system of habitually used trails connecting critical resources. Could a zoo be designed on this basis? Why must an animal spend all its time in one place? We believe that apartment dwelling pet dogs can have a good life if taken on frequent walks through a park. Could zoo animals in small existing displays also benefit from taking themselves on walks along defined overhead and surface trails through the zoological park? Could these trails be shared with other animals (not at the same time) to access a variety of social, feeding, resting and surveillance areas and opportunities? Importantly, experiencing the environment and human activities seen from the trail can also be enriching to bored zoo animals. Animals, like people, may need rewarding reasons to exercise their bodies and intelligence. Accessing distant benefits can provide such incentives. Finally, the animal

trails (we called these “trailways”) themselves become linear exhibits from the public’s perspective.

Earlier I had proposed a sanctuary-wide rotation system to the Center for Great Apes in Wauchula Florida. At my suggestion, Andy visited Ms. Patti Ragan, Center for Great Apes founder, and observed her railway system in action. The Great Apes in Florida sanctuary now have 2.4km (1.5 miles) of aerial trailways connecting twelve night houses and nineteen outdoor enclosures, as well as their clinic and quarantine area. This visit convinced Andy that a zoo-wide animal trail and rotation scheme was manageable and he saw firsthand how much the great apes enjoyed moving around their park along these elevated trails. Andy then convinced CEO Vikram Dewan this startling departure from traditional zoo design was both feasible and desirable. Thus, the innovative concept of a zoo-wide animal trail system became the basis for the Philadelphia Zoo’s 2009 Master Plan by CLRdesign. Their new marketing slogan emerged: “Zoo 360 – As you move through the zoo, the zoo moves around you!” CLRdesign not only developed the master plan but, with the help of their structural engineering subcontractors, designed the trail structures in detail following my initial sketches.

Philadelphia Zoo is surrounded on three sides by railway lines with a busy road and freeway forming the other side. It cannot expand beyond its present 17 Ha (42 acre) area. However, overhead animal trails passing over their beautiful park areas expanded the animal’s opportunities for exploration and exercise without enlarging the zoo. Visitors were surprised and delighted to see zoo animals passing overhead.

This was a revolutionary concept. For a century and a half people have visited parks called zoological gardens to see exotic animals. In the 1820’s London Zoo and Garden des Plants in Paris became the first ‘scientific zoos’, organizing animals according to their taxonomic families and species for scientific research and later opening to the public. 1905 Carl Hagenbeck created the first “barless zoo” in Germany, organized geographically by the continents with stylized landscapes representing their habitats, a concept called zoogeographic zoo organization. In late 1970 with Jones & Jones I helped introduce zoo visitors to natural biome habitat and landscape immersion exhibits. Today most visitors expect these types of zoo exhibits. Philadelphia Zoo, “America’s first Zoo” now presented a simpler story advancing our concept of “Activity-Based Design:” “These animals live under our care, and this is how we give them more opportunities to live their lives more fully.”

At this time, I had my own Australian firm when Philly Zoo hired me to collaborate with CLRdesign on both a Zoo 360 master plan and concepts for all the trail systems developed. I greatly enjoyed returning Philadelphia and collaborating with my old firm. Mark Beauchamp, Jeff Sawyer, and Larry Dame where the principle CLR contributors.



Figure 75. Upper left: the circular trail around the historic Impala Fountain Court was the first of the “tree top trails” used by over fifteen species of small to medium-sized primates in the Rare Mammal House. Note the activity pod built around the adjacent tree on left edge of this photo. Upper right: Storm the mangabey was the bold explorer assessing the tree top trails. Middle left: this photo of a tiger crossing the Big Cat Bridge went viral. Right: six species of big cat use the Big Cat Trail, of which the overpass is only a small section. Lower left: interesting encounters; a gorilla in the Great Ape Trail encounters a tiger in the Big Cat trail. Lower right. ‘Kids Zoo U’ (designed by others) with overhead trails for children and domestic goats and sheep. Shown here during bare winter, it is much more attractive in summer when most people visit.

Tree Top Trail (upper photos): The first project scheduled for renovation in the new plan was the old modernist Rare Mammal House and their staff also requested rotation opportunities such as the big cats enjoyed. This trail circled the adjacent Impala Fountain Court near the main zoo entry, becoming the first zoo feature encountered by visitors. It connected all existing indoor display areas, making the trail available to all fifteen existing species of small to medium-sized primates. Five, 5m (16') diameter activity pods with food dispensers were built around large existing trees near the trail so animals could use them while other species passed by on the trail. Tree top trail was extended through several construction stages to a total length of 500m (1640') connecting to the PECO Primate building where we initiated this rotation concept with Philadelphia Zoo. This made it available to many more primate species. Image being a family of tiny pigmy marmosets exploring a kilometer-long roundtrip journey.

Big Cat Trail (middle row left): this photo went viral, being republished in newspapers and online globally. Soon zoos in China copied this idea. While visitors flocked to see this sight for themselves, many were disappointed because the big cats often passed quickly over the bridge and down the 78m (255') long Big Cat Trail (partly elevated and partly on the ground) to the elevated lakeside overlook at the far end. Six species of big cat take turns using this enrichment feature.

Great Ape Trail: this 106m (350') elevated trail is used alternately by gorillas, orangutans, and gibbons. The photo above showing the gorilla looking down at the tiger is misunderstood by some people accustomed to seeing zoo exhibits arranged by continental or biological habitats. Seeing species from different areas of the world together seems "unnatural." The intended message is not about biogeography but rather to display ways animals in zoos can have varied and interesting experiences in a beautiful park landscape.

Ungulate Trail: Working with CLR, we also suggested a long terrestrial trail of the zoo's large, hoofed animals including white rhino, giraffe, zebra, antelope, and hippo. But this was determined to be too expensive for the time.

Kids Zoo U: Philly Zoo designed this innovative children's facility using other designers while integrating the mixed species trail concepts for domestic species such as ponies, sheep, goats, and children, as well as many small species.

Philly Zoo completed about one-half of the total animal trails shown on their master plan between 2009 and 2016 with staged funding and construction every few years. A total of 613m (about 2000') of trailways have been opened. This innovation was a popular success, with increased visitation and city cultural status. Elevated animal trailways have now been built by zoos and primate sanctuaries all over the world. This approach has won praise from animal behaviour scientists like Dr. Robert John Young:

"I really like this concept, as an animal behaviorist it totally makes sense, and I am sure it must be very good for the psychological wellbeing of the animals. Not to mention that the zoo is no longer a static place - it is dynamic like the wild and the public will need to

seek out the animals. Great to see that you keep pushing the boundaries on enclosure design and modification.”

And zoo managers like Ms. Wendy Husband:

“I find this so interesting and innovative and see enormous opportunities for zoos of all sizes - the animals display such confidence and comfort and I especially LOVE when we get to see the animal totally engaged its own activity. Bravo...I'm sure this will inspire many new trails in zoos around the world.”

Philadelphia Zoo holds their annual fundraising Gala in November every year. In 2016 they flew me round-trip all the way from Melbourne Australia to present a brief inspirational speech (one of only three, seven minutes each) for their Gala. Zoological Foundation CEO Vikram Dewan was pleased with my talk and with the funding level achieved that evening. We are both retired now and remain in occasional contact. Andy Baker, who has retired now, became Chief Operating Officer and managed zoo staff with both vision and patience. He offered innovative opportunities but did not implementing them until he was himself confident of the details and front-line operating staff were in support. Vik Dewan's leadership was also exemplary, leaving in-house management to Andy Baker and managing his Board and city officials expertly.

Taronga Zoo Wild Asia Elephant & Coastal Precinct²⁷ -1999. Mr. Tony McCormic, landscape architect and my friend at Hassell Architects in Australia, invited me to join their team in tendering for the design of new Asian elephant and marine mammal facilities at the famous Taronga Zoo in Sydney, Australia. This required me to participate in the interview with zoo officials by telephone at one-thirty in the morning from my home office outside Philadelphia.

In those times most zoos still used punitive ‘full contact’ elephant training systems in which trainers asserted their dominance over the elephants beginning at a young age. “Protected contact” was a training system developed by colleagues Tim Desmond and Gail Laule with elephant expert Alan Roocroft, then at San Diego Zoo. In the protected contact system, trainers used reward-based training. They remained out of elephant reach and emphasized elephant welfare and independence without human dominance. This was a far superior system. Its use was then becoming more common in the USA, although it was still resisted by traditional elephant trainers around the world, including in Australia. I was asked during the interview if I would design a facility under the old full contact management system. I answered I would be willing to design a facility which could be operated under either system, allowing them to transition to the protected contact management system in the future. We were selected and I was delighted to discover they had also hired elephant management expert Alan Roocroft as our specialist advisor.

²⁷ <https://zoolex.org/gallery/show/1186/>

The Hassell team was headed by Tony McCormick, the most professionally thoughtful and thorough design and planning professional I have had the pleasure to work with, often challenging clients and designers alike with essential hard questions. During the required project briefing for all competing design firms few offered any questions to the client. Tony had over thirty questions, exposing weaknesses and inconsistencies in the client's tendering materials.

I think of Taronga Zoo as the 'view with a zoo'. The vistas from the zoo across the harbor to the famous Sydney Opera House and city skyline are world class. But they come at the expense of a very steep site with plentiful exposed Devonian sandstone outcrops. Access both for construction machinery and later for animals and visitors is expensive to build and difficult to use. We also experienced early resistance from the Zoo's elephant care staff headed by Mr. Joe Haddock. We were immediately asked: "Why have you questioned our plans?" "You weren't listening". We patiently explained our brief was to produce the best outcome not only for animal care staff but also for elephants and visitors, using the world's best practice as well as their own experiences and priorities.

The area designated for the new exhibit was very small, only about one hectare (about 2 ½ acres). How could the elephants get enough exercise in such a small area? I recalled how people and horses are exercised in pools; a process called aquatic aerobic exercise. Such exercise should also be beneficial for older elephants with painful foot and joint problems from being kept on hard surfaces. Most elephant exhibits have circular pools providing little incentive for vigorous exercise. Instead, I designed the elephant pool to be more like a river oxbow meander. I made it 60m (about 200') long, 3m (10' deep) and 3m wide, with gradual slopes for elephants to enter and exit at both ends and in the middle. It was too deep for elephants to stand in, so swimming, or at least lunging up and down would be required. What would motivate the elephants to exercise vigorously in their river? There was a shallow verge along the outside where a trainer using a long "target pole" would train elephants to follow in exchange for frequent favored food rewards. I hoped this would encourage lap swimming by the elephants if animal care staff were willing to undertake parallel exercise themselves. Also, we designed a lower elephant paddock accessible by boulder lined slope which would also provide exercise. In presenting this scheme to our clients I emphasized the elephant exhibit would only be of an acceptable size in the future if the management program continuously provided abundant aquatic aerobic exercise.

Following the riverfront storyline, we designed a riverside Thai village with some buildings on stilts to avoid floods on one side and with the elephants on the sandy river flats on the other side of the river. This explained why the elephant area was paved with sand, which benefited the elephants. One stilted structure extends across the river into the elephant area. This provides shade for the elephants and VIP viewing for selected guests.

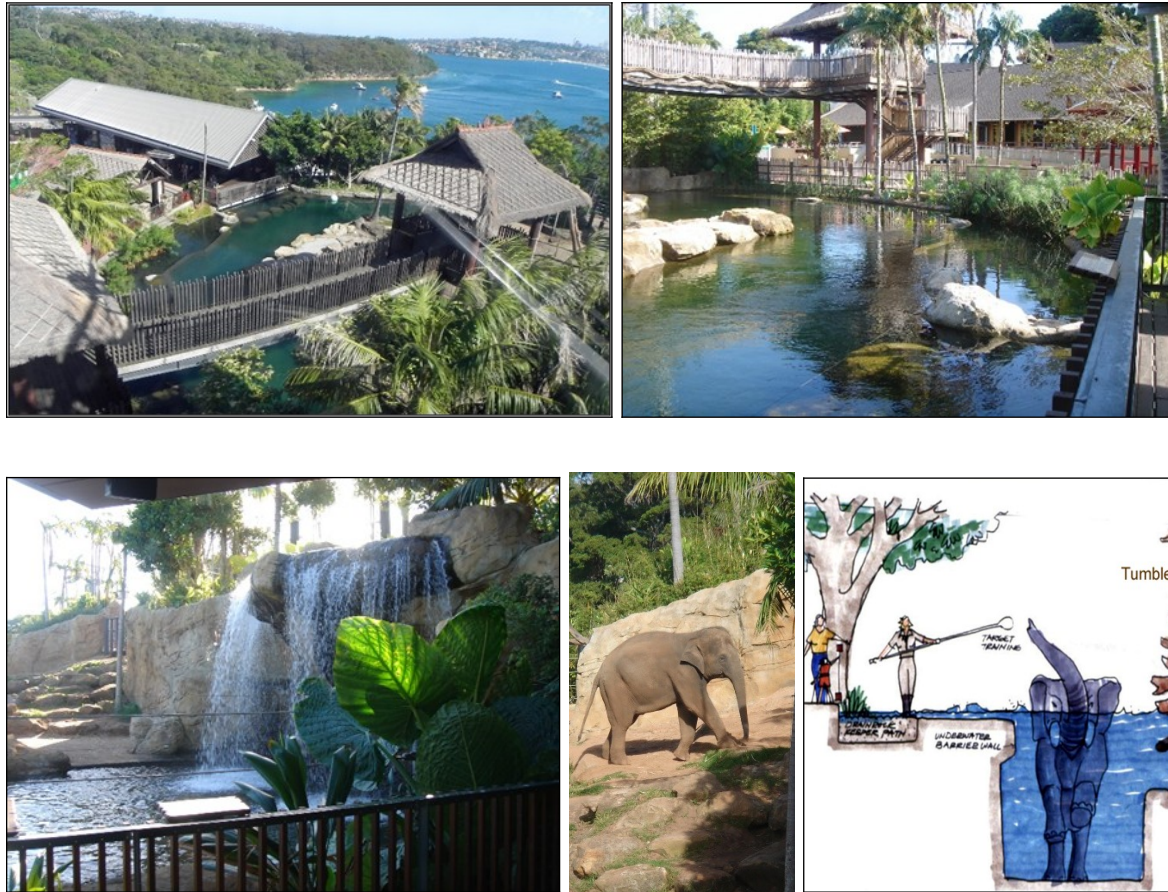


Figure 76. Upper left: view from Taronga Zoo's aerial tram of elephant exhibit 'river meander' with visitor bridge to VIP overlook, which is also a shade structure and area to hang enrichment features for the elephants. Upper right: visitor overlook of river and VIP bridge. Lower left: lower elephant yard with waterfall for elephants to bathe under. Lower middle: boulder-paved slope to the upper yard. Lower right: my diagram showing elephants lunging through 3m (10') deep water following trainer's target pole to encourage aquatic aerobic exercise and develop elephants' physical fitness.

The Hassell team, guided by Tony McCormick, developed the final detailed plans, which were excellent. After our final presentation we received applause from Joe Haddock and the originally recalcitrant zoo elephant staff.

Coastal Precinct Exhibit (now the Seal Show) for fur seals was also part of the Hassell brief, with assistance from aquarium specialist architect Cam Crossley, and life-support system expert Cris Warner. Working with Cam, we developed an accessible pathway connecting surface and underwater viewing as well as a rather small demonstration pool and seating area. The results came out well considering natural site limitations. Hassell architects also designed a large Thai-themed café and restaurant forming a major element in the riverside village we designed.

People-mover concept. The Seal Show complex was proposed on the same two levels as the elephant exhibit. I noted most visitors entered the zoo from the upper end (many by the overhead gondola from the ferry terminal far below) and experienced their visit

walking downhill on the steep zoo site. This suggested many visitors to the elephant exhibit would need to backtrack uphill to also see the Seal Show complex, restaurants, and other exhibits on this level. Working with our Hassell colleagues, I suggested the zoo install two escalator/elevator (people-mover) facilities to provide convenient visitor access to all attractions in the multilevel visitor hub area. This feature, not a part of our original project brief, has proven to be very successful.

Unfortunately, Taronga Zoo then hired less expensive local firms to complete construction documents with no further work from our teams. The 4500 sqm (48438 sf), elephant exhibit opened in 2005 with only minor departures from our plans. A 2000 sqm (21,528 sf) bull elephant outdoor facility, including a 500 sm (5,382 sf) exercise yard, was added in 2008.

I visited this exhibit three years later with elephant staff member Joe Haddock, who was very pleased with the results. I asked Joe if he could get the young elephants to go swimming so I could make a video. He complied by first spraying two elephants with a hose, which they clearly enjoyed. The young elephants then entered their mud wallow for group mud wrestling and progressed to the river to swim. Joe explained this was their daily routine. For the next 30 minutes the two youngsters vigorously wrestled underwater. Finally exhausted, they climbed out, strolled to a hill of loose sand and fell asleep. For these young elephants our aquatic aerobic exercise strategy was clearly successful. I am not aware of any studies of how well this feature was used by the elephants as they matured. The strategy of using target training to encourage elephant lap swimming was never utilized.

As a consultant driven to advance and integrate both the physical design of environments (hardware) and the ways they are used and managed (software) I often find myself and designer colleagues in the unfortunate situation that once things we design are built our project influence ends. We have no authority to ensure our intended long-term management systems are followed. I accepted the small site for the Taronga elephant facility based upon the hope elephants would receive as much or more exercise as a large site would provide through the regular scheduled use of aquatic-aerobic and land trail exercise. These advances were championed by international elephant expert Alan Roocroft during our first design meetings, and I had hoped he would find a continuing advisory role. He told me later he had never heard from Taronga Zoo after the first meeting. Alan and I both advocated for a “protected contact” elephant training system. In 2012 elephant trainer Ms. Lucy Melo was needlessly crushed and nearly killed by a young male elephant during a traditional training session. Our protected contact system was then installed, too late for Ms. Melo.

Our vigorous exercise regimen was never followed and two decades later the zoo acknowledged the facility was too small to provide sufficient exercise for the elephants. The elephants were moved to join a larger herd at the expansive Western Plains Zoo in Dubbo New South Whales. The exhibit we designed is now used by Indian greater one-horned rhinos, for which it is better suited.

California Science Center, Los Angeles, California 2000-2004. Mr. Howard Litwack, a noted science educator and project manager, invited me to join a consultant team to work on a new project, the World of Ecology, at the California Science Center (CSC) in Los Angeles. This was my first opportunity to expand my design ideas with a major science museum. CSC had been an important museum of science and technology and wanted to expand into the biological sciences. I thought I could help build that bridge. I was joined by Jim Peterson, a specialist in marine exhibits with his then company Bios. We collaborated on the design of the Riverbanks Zoo Aquarium-Reptile Exhibit and the New York Aquarium Sea Cliffs Exhibit. Jim's Bios Partner, Scott Horner would develop the hands-on exhibit features. Dr. Paul Martin an educator from the Science Museum of Minnesota was also part of the team, which was headed by Architect Ed Rubin of EHDD Architects in San Francisco. Director Jeff Rudolph, Project Manager Barbara Punt, Deputy Director Operations Tony Budrovich, and Ecologist Dr. Chuck Kopczak headed CSC. Jeff and his staff were very welcoming and actively seeking innovative ideas, which the design team supplied in abundance. Unfortunately, they seemed to enjoy the creative frenzy more than the decision making. I spent more time on transcontinental flights and in meetings during this four-year period than for any other client. I designed an indoor California desert exhibit with insects supplied by Ray Mendez, and we took the planned outdoor rainforest exhibit through design and construction documents. The intended results were meager. While the small desert exhibit was completed, the areas designated for outdoor tropical forest exhibits, including two large fig trees, were eventually used to display the retired Space Shuttle Endeavour. However, several side projects turned out very well indeed.

The California Science Center shares a campus the Los Angeles County Natural History Museum (a favorite destination when I was a child), the California African American History Museum, and the heritage listed Los Angeles Memorial Coliseum. Opened in 1921, it hosted both the 1932 and 1984 Olympic Games. Architectural heritage considerations limited possible developments on the site. CSC required greatly enlarged parking capacity but was not allowed to increase land area for parking. Thus, they planned a sunken three-level parking structure with each level the same dimensions as the existing parking area. I was asked to design the landscape around this large structure. To save the cost of retaining walls and improve natural ventilation, I suggested the area around the sunken structure be sloped with pathways leading up through my recreated Southern California native plantings resembling the original landscape of the site. I developed general grading, pathway and planting plans. Final plans and native plantings were then designed and installed by a local landscape architect and contractor. This work turned out very well and the plantings have matured nicely.

Director Jeff Rudolph asked what planting I suggested for the upper level of the parking structure. This would be a very difficult artificial environment for living plants, so I suggest shading the car park with photovoltaic solar power cells mounted as large leaves on a structure resembling a grape arbor. This was a decade before rooftop solar

became popular and the sort of technology the CSC should demonstrate. Jeff enthusiastically took this idea to the Los Angeles Department of Water and Power, who liked the idea so well they offered to design and install it themselves as a test model. Unfortunately, the Cultural Heritage Commission would not allow this innovation in their heritage-listed district.

The vast Memorial Coliseum campus is nearly flat and had no overall drainage system, a big problem in a region prone to flash flooding. Hoping to build on the success of the native California landscape restoration around the buried parking structure, I developed a regrading plan for the entire museum campus suggesting recreation of the natural intermittent surface stream system with riparian replanting which had originally flowed through the area according to soil profiles and old maps I researched. This could have been an early example of “rewilding” projects which over twenty years later have taken hold in Southern California. This concept too was blocked by the Cultural Heritage Commission.

Director Jeff Rudolph also invited me to select the display location of their full-sized SR 71 Blackbird hypersonic aircraft. This was a retired example of the aircraft which still holds global speed (3,540 km/hour, 2200 miles/hour) and altitude records. I located the plane elevated above the newly planted canyon as if were about to soar over the car park. In this position it can be admired both from below and from eye level.

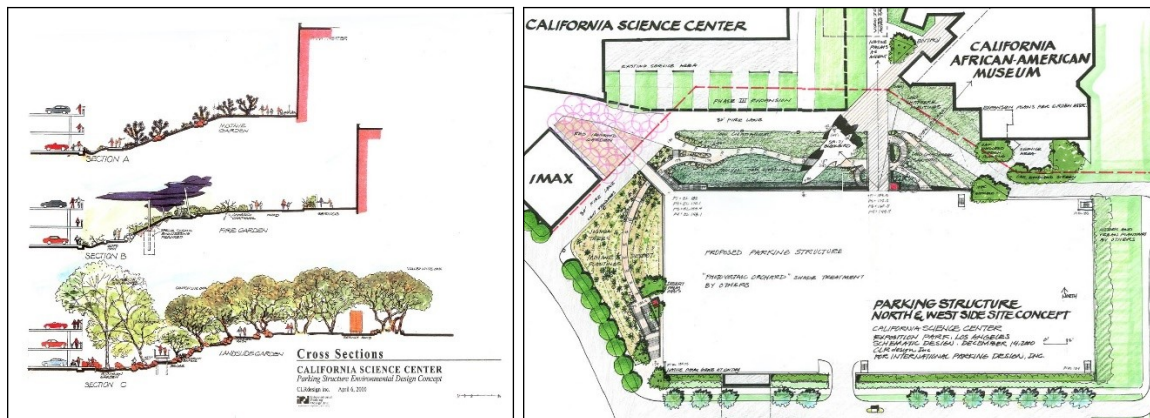




Figure 77. Upper row: my cross sections and plan for the sunken parking structure with SR 71 Blackbird hypersonic aircraft placement and surrounding Southern California native garden. Lower left: photo of the Blackbird with the California Science Center beyond. Lower center and right: photos of the completed installation and established plantings along the pathways leading up from the sunken car park levels and resembling the native hillsides I had explored as a child in Southern California.

Looking back, my work with the California Science Center leaves me with mixed feelings. I enjoyed the people very much and have stayed in touch with several. The opportunity to investigate the wider field of science exhibits was certainly welcomed. Projects like the interior desert exhibit, sunken car park landscape rewilding and placement of the hypersonic aircraft, not part of my original brief, turned out very well. The advanced ideas for the overall museum campus rewilding, sustainable stormwater management and solar parking cover, had they been realized, could have put Los Angeles a decade or two ahead in its present climate change adaptations. Moreover, the major work, World of Ecology, was never realized. I wonder if all those hours of work and meetings and travel could have been more productive in other endeavors. I will never know.

Brookfield Zoo Wolf Woods 2002-2004. Dr. Tim Sullivan, animal training specialist and project manager at Chicago Zoological Park-Brookfield Zoo, contacted me about designing a new wolf exhibit. He was supported by animal behavioralist and curator Dr. Joan Daniels. Dr George Rabb, legendary Brookfield Zoo Director, had studied wolves in the previous large enclosure with his wife Mary Rabb decades before. I and the zoo

wanted to do a new facility to honor them and to support the international Mexican Wolf Recovery Program²⁸ of the U.S. Fish and Wildlife Service. By 2021, 387 Mexican wolves were managed in approximately 61 facilities in the United States and Mexico.

Their program was to breed this endangered species using methods minimizing habituation to humans and maintaining natural wild behaviours. The offspring of these zoo wolves would be introduced to very large natural enclosures in New Mexico and their offspring would be released into the wild as hopefully self-sustaining packs. This required two 0.4 ha (1 acre) enclosures, one for visitor viewing and one as a retreat area. Therefore, our design should minimize the impact of visitors on wolves and optimize the wolves' positive impact on visitors, seemingly contradictory requirements. To solve this challenge, I suggested designing an enclosed public viewing pavilion using mirror glass (on-way glass). This would allow the wolves to approach the visitors without seeing them and visitors to have close views of the wolves. There was also provision for food release from the building to encourage the wolves into the viewing area. We provided a simulated wolf den in the building for children to crawl into with views into the exhibit. This heated and air-conditioned building also supports year-round public viewing and after-hour research observation of wolf activities. I wanted to integrate this building into the site. Jon Stefansson and the CLRdesign team used geo-textile fabrics to support plantings banked against side walls, as well as some roof-top plantings.



²⁸ <https://www.fws.gov/sites/default/files/documents/Mexican-Wolf-2021-Progress-Report-Final.pdf>



Figure 78. Upper left: entry to Wolf Woods viewing pavilion with planted sides. Upper right: viewing exhibit through mirror glass, suggesting wolves are not aware of proximity to humans (photo: J. Schultz - Chicago Zoological Society). Lower left: public view from pavilion through mirror glass with no animal barriers in sight. Lower second image: wolf's view of viewing pavilion mirror glass obscuring visitors within. Lower third image: outdoor viewing area with wolf den in the distance. Lower fourth image: view of wolf den hill from visitor overlook. Bottom right: close photo of Mexican wolves in wolf den hill.

Recently I received this update from Dr. Joan Daniels Tantillo, Senior Director of Hooved Mammal Care and Conservation

“We have exhibited over 40 different individual wolves with varying responses to the glass. Overall, most wolves ignore their reflection in the glass and after acclimating to seeing it, they readily approach the area and are comfortable. Some have even taken to sleeping up against the glass when it is not noisy in the visitor building. A few wolves have aggressed towards their reflection. We are using food chutes on either side of the viewing window which draws the wolves up to the glass in a positive way – I feel this has increased their comfort and acceptance of the area significantly.”

Phipps Conservatory²⁹ - 2002. Since 1994, Richard Piacentini, President, and CEO had guided Phipps Conservatory and Botanical Gardens in Pittsburgh Pennsylvania from public to private management and was keen to transform its facilities and operations, to become both a profitable attraction and a deeply sustainable facility. Mr.

²⁹ <https://www.phipps.conservatory.org/green-innovation/at-hipps/tropical-forest-conservatory>

Jim Taylor, from IKM Architects invited us to join their design team for the new Tropical Forest Conservatory as an addition to the existing historic conservatory.

Although I was hired as a landscape architect and botanical exhibit designer, my initial design influence was as a sustainable architecture advisor. Recalling ideas from my conceptual design of the domed town in northern Alberta thirty years earlier, I developed a building shape with a high south facing glass wall arching east and west to track the sun's path. The roof sloped to the north at the winter noon sun angle so that all winter light came through the front glass and the roof glazing could be insulated in winter. Summer sun hit this roof at an acute angle and most infrared light bounced off rather than entering the building. The building was placed on a south-facing slope, and the gardens inside were terraced with masonry walls which absorbed heat during the day and reradiated warmth to the plants at night. As the design phase advanced the architects used computer simulations to refine the sun angles I developed. They also added important features such as double glazing and automated insulation blankets for winter and vent openings for summer.

They followed my suggestion and installed six long, large diameter tubes buried 4.5m (15 feet) below ground where the temperature remained constant at 13C (55F) degrees. These open onto the slope below the building. Make-up air was cooled as it was drawn through these tubes into the building by hot air rising to the roof vents. Insulated concrete western and northern walls and paving below the south windows provide thermal mass, collecting heat and releasing it at night. After opening, this 18m (60') high, 1,115 square meter (12,000 square foot) conservatory functioned wonderfully year around without artificial heating and cooling. It was the first major greenhouse in the USA to be awarded a LEED Platinum EBOM Certification.

I recently contacted Director Richard Piacentini to confirm the information above. He disputed my role in anything but the exhibit design, crediting others for the architectural and climate design features. Nevertheless, what I report above reflects my clear memory of this work.

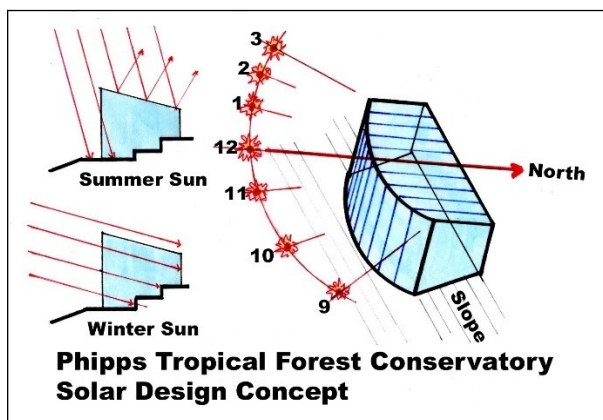




Figure 79. Upper left: diagram of my early concepts setting the building into the south facing slope, arching the building front to follow the sun's path, and pitching the roof at the winter sun angle to optimize solar gain and light penetration during winter. Upper right: photo of the completed building Photo by Denmarsh Photography, Inc. Second row: interior photos showing the 18m (60') high south facing glass wall seen from lowest level and view of sun plaza and pool. Lower left: my sketch of the proposed cliff and cascade on the west end of the conservatory and photo of the finished work. Lower third image: hidden vent introducing cooled air from deeply buried tubes I had recommended.

Lincoln Park Zoo Regenstein Center for African Apes - 2003. In 2000 I attended a workshop on facility design for bachelor gorillas with respected gorilla experts Dr. Kristen Lukas (previously at Zoo Atlanta), Dr. Dwight Scott from Oklahoma City Zoo (a facility I had helped to design) and Dr. Steve Ross from Lincoln Park Zoo's pioneering but now old Fisher Great Ape Center. One result was that in 2006 I was lead author with Lukas and Scott on a paper on this subject.³⁰ A second result was that I was invited by Lincoln Park Zoo in Chicago to help them design a new trend-setting great ape facility, collaborating with Steve Ross and Kristin Lukas. The new facility would house many of the gorillas which had been on loan to the successful facility we designed at Louisville Zoo.

While highly functional, the Fisher Great Ape facility was entirely underground. It had soaring, ape accessible height and adequate skylights, but no outdoor areas for the

³⁰ Coe, J., Scott, D. and Lukas, K., (2009). Facility Design for Bachelor Gorillas. *Zoo Biology* 128:144-162.

apes. Dennis Pate, then curator and project lead for the zoo, wanted to demolish this old facility to make room for the new. But highly respected Dr. Les Fisher, past Zoo Director who had designed the old building, pleaded with me to find some way to save his still pioneering and still functional facility. I agreed, for it is usually more sustainable to adapt and reuse than to demolish and build again. I suggested the existing facility be kept as a public back-of-house area, with new outdoor exhibits designed around it. The apes were certainly capable of making vertical connections.

Unfortunately, this approach was dismissed out of hand by Dennis Pate. He envisioned an indoor tropical environment for the apes in winter magically converting to open outdoor habitat during summer. Somehow, using some mechanical technology, the roof and walls would disappear and then be reassembled on a seasonal basis. The Zoo had hired a top Chicago architectural firm for this work. They agreed with me that even if such a facility were possible, construction costs would far exceed the project budget.

I continued to work with Steve Ross and Kriston Lukas on the best possible arrangement of the functional areas they proposed until we arrived at an ideal overall concept plan. At this point I received a letter from Dennis Pate informing me that my services had been terminated because I lacked the creativity to fulfill the Client's project requirements! This was the first and only time I have ever been fired by a client. Not long afterward I heard that Pate himself had left Lincoln Park Zoo to become a zoo director elsewhere. The Chicago architects completed the 2,694 sm (29,000 sf) project in 2004. In 2006 the Regenstein Center for African Apes was awarded the AZA Significant Achievement Honor Exhibit of the Year. I was toured through the project in 2012 by Steve Ross who told me: "Much of Jon Coe remains in this building".

Woodland Park Zoo Long-Range Physical Plan – 2003. I was honored to be invited to update the pioneering 1976 Woodland Park Zoo Long-Range Plan twenty-eight years after I had drafted most of this plan with Jones & Jones. This was a physical plan update and contained all the overall guidelines and biomes from the original plan. No other clients had followed their master plans as ardently or as long. Staff had mastered detailed naturalism in exhibits (I called these "hardware") but had not kept pace on other major zoo trends such as animal behavioural enrichment, reward-based training, or animal rotation ("software") to increase the effectiveness of the exhibits. They would also benefit from visitor accommodation improvements and innovations I suggested. These advances could be integrated within their exhibit design style but would require changes to their animal management systems. The new plan also showed extending Northern Trail exhibits I helped to design with CLRdesign as a cul-de-sac, to become a complimentary loop through my proposed Asian Highland Trail. This would add exhibits specified in the 1976 plan for Amur tigers, takin, red panda, and other species of this biome.

This new plan was accepted and officially replaced the earlier plan. However, lack of public parking limited the Zoo's earned revenue growth and resulted in loss of public support. Major new exhibits like my proposed Asian Highland Trail were not fundable.

An excellent new entry was added as recommended. Some remaining exhibits from the old plan were added. I didn't find them to have the quality of the earlier exhibits, perhaps because of limited funding. My greater disappointment was the Zoo's seeming disinclination to take on the "software" opportunities we had found so successful at Zoo Atlanta and Louisville Zoo.

Mandalay Bay Las Vegas Casino - 2003. Mr. Mike Ensign called inviting me to visit the casino he was managing in Jean Navada, just past the California border. He wondered if having exotic animals around his East Indian style casino would provide interest and amenity for the families of guests staying there. When I visited this casino I immediately liked Mike's sincerity, completely opposite of what I expected from a casino manager. I quickly drew some sketches based upon ancient Mughal garden traditions which he liked. About a year later Mike called me again. This time he was Director of Circus Circus, one of the older but still dominant casinos on the Los Vegas Strip. The story was that Mike had been Executive Director, but in a previous Board of Directors insurgency he had been deposed and sent into exile in their remote Jean Navada casino. Now he was back in power and wanted to build a state-of-the-art casino and hotel with over 3,200 rooms on the Los Vegas Strip next to their Luxor casino and hotel property and opposite two other 2000 room hotel-casinos. This was a different world! Mike explained their twin objectives: 1). Lift their public offerings to a very high level of quality in concept, construction, and operation, and 2). Introduce something not seen on the Strip before. He explained that casinos and hotel rooms were all the same. It was novelty which drove attendance and thus profits, at least for the first years. Could a high-quality living animal attraction work on the Strip?

I was skeptical. I also considered the opportunities to positively influence even a small percentage of the vast expected crowds. There were then two animal attractions on the Strip, the dolphin feature and tiger show at the Mirage. The dolphin facility had evolved into one of the world's best, with frequent successful births and reward-based training as exercise for the dolphins rather than scheduled shows. The tiger show was not to my taste, though the tigers were well cared for, albeit in very restricted spaces. I was also encouraged by Mike's repeated insistence that the facility and guest experience must, to use his words, be pristine. Therefore, it would be immaculate, intact, and natural, his proud legacy.

We developed a two-level plan with a large underground aquarium and restaurant and above it a domed habitat for animals I believed would not be concerned with large crowds, such as grizzly bears, desert big horned sheep, ravens and other easily trained species which would have lived in the area in ancient times. I explained American Zoo and Aquarium Association accreditation would be essential. This may require that every animal acquired by the casino be provided with a life-long endowment. If the casino decided to close the facility, the care of every animal would be funded wherever it was rehomed. Mike Ensign quickly agreed to these conditions.

Working with local architects we developed convincing models, illustrations, and cost estimates. Finally, during the deciding board meeting other board members, unfamiliar with managing wildlife, voted to proceed only with the aquarium project. I passed the work on to long-time friends and aquarium experts Jim Peterson and John Nightingale to complete. The result was the Mandala Bay Seascape Restaurant and the Shark Reef Aquarium with 6,056,650-liter (1.6 million gal) tanks.

I was relieved with this result. Mike Ensign would soon be retiring, and I had no confidence his replacement would have the same vision and goodwill he expressed. Also, I learned the accelerated construction schedule common in Los Vegas would require me and several of our staff to move there and forsake all other work to meet their deadlines. None of us were willing to do this. However, as another example of my cross-over career, ranging from West African national park planning to science centers and Los Vegas attractions, I am happy to have had this unusual experience.

Dubai Zoo Planning - 2003. CLRdesign was contacted by the British architectural and engineering firm WS Atkins to work with their office in the United Arab Emirates on planning a major new zoo in Dubai. Our application was awarded and CLR principals Greg Dykstra, and I flew to Dubai several times. We were joined on one trip by Mark Beauchamp and by Rick Biddle, our zoo strategic planning advisor. I had worked in several deserts but was not prepared for a region with both 40C-45C (104F-113F) temperatures and 90% humidity. To compensate, we followed the locals taking advantage of slightly cooler evening temperatures (30C, 80F) to walk through the old gold and spice souks and bazaar, to Old Town, the wonderful, unassuming restored original city. This had been only a fishing village and the local centre for pearl diving as recently as when I was in university before the local discovery of oil.

A previous zoo master plan had been rejected because it didn't provide sufficient shelter from the heat. The Atkins firm, headed by Mr. Andrew Thomas, were congenial, but we soon found that we were doing all the work. The Dubai Municipality client team headed by the Director of Parks were professional and expected the same behaviour from us. We got off to a poor start because, travelling with the Atkins team, we were late to every meeting. Dubai traffic is slow, but being late was both unprofessional and disrespectful. During our first week I asked Andrew Thomas when we would schedule a social dinner with our Arab clients. His response: 'Why would you want to have dinner with them?' shocked me. This was the first and only time I encountered such neocolonial prejudice in an international prime consultant. Contractually, all communication to the clients was to go through the Atkins firm. But when I learned their attitude, I arranged to visit the Dubai Park Director on my own in his office. He welcomed my visit and told me they previously had poor experience with the Atkins firm but had decided to give them another chance. Now they were disappointed, but they were pleased with CLR's work thus far. I also visited the sad old 2ha (4.9ac) Dubai Zoo built in 1968 (considered an embarrassment by city officials) to meet the director and learn about his aspirations and possible management abilities for a next-generation zoo,

Their large, proposed site had been planted as an irrigated forestry project on a sandy hill by the Forestry Department. They were proud of their accomplishment and preferred to keep it as a nature park rather than converting it into a zoo. Water for irrigation was supplied from petrol burning desalinization plants which were both financially and environmentally expensive. Extensive irrigation also resulted in the trees being planted in rows. These were not suitable for the creation of highly naturalistic landscapes, although large trees could be relocated using heavy equipment. I gradually learned through observation that Arab governments spoke forcefully about supporting conservation, but to them conservation didn't mean habitat preservation as it did to us, but rather greening, turning deserts to irrigated, managed woodlands.

We advanced our plans during our several visits, resulting in what we thought was a beautiful vision showing how different vernacular cultures had adapted to living sustainably with local wildlife. My designs were beautifully illustrated with John Collin's excellent sketches.

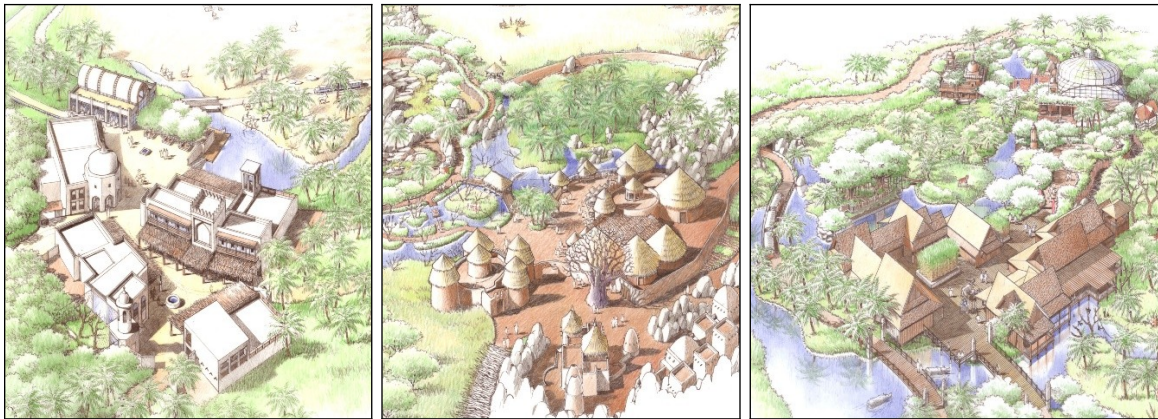


Figure 80. For Dubai Zoo we proposed vernacular villages illustrated here by CLRdesign architect John Collins. Left: Arabian village. Centre: African village. Right: Thai village. These were intended as hubs for visitor amenities leading to wildlife discovery trails (images: CLRdesign).

On our final meeting we entered the room to find our Emirati clients in a notably displeased mood. During the previous meeting they challenged us to develop something unique with high impact on visitors. We had assured them our plans were unique, but our emphasis had been on living sustainability with nature. Other consultants had announced plans to develop a domed and climate-controlled snow skiing facility in Dubai. Why hadn't we thought of something this original? I didn't know how to answer. The amount of energy required, and greenhouse gases produced for long-term chilling such a dome in this climate would be, to us, an inconceivable and irresponsible recommendation. Yet it would have been disrespectful to the Emirates to openly question their values in their country. I had previously advised them that to create the natural and cultural landscape we would need to relocate sixty of the over 1000 existing trees. This did not please them and increased the Forestry Department's resistance to using their site for a major development like a zoo.

Not surprisingly, our master plan was not accepted. We were the second master planners for the project. At least four further master plans by other international consultants, some on other sites, were also rejected. It wasn't until December 2017, fourteen years later, that Dubai Safari Park was opened on a larger site outside the city and is operated as a private business.

One exciting memory from this project was a four-wheel-drive expedition up Wadi Bih led by Jeremy Trotman, a young Atkins engineer. Wadi Bih is a dry riverbed and at times a dramatic steep-sided canyon through the Al Hajar Mountains to Oman for about 72 km (45 mi). The round trip back to Dubai took most of a summer day. This was a real desert.

SAGA Primate Symposium, Tama Zoo, Tokyo - 2003. I was invited to speak at this conference along with distinguished primatologists Dr. Jane Goodall, Dr. Ian Redmond who had worked with mountain gorillas with Dr. Dian Fossey and was noted for his work in gorilla conservation, Dr. Tetsuro Matsuzawa chimpanzee behaviour expert from the Primate Research Institute of Kyoto University, Dr. Roberto Delgado, orangutan conservationist, Ms. Debby Cox, founder of the Tchimpounga Chimpanzee Rehabilitation Center in the Republic of the Congo, and other distinguished speakers.

I had the opportunity to chat with Dr. Jane, who I first met in 1979 and helped with her initiative to close the inhumane treatment of lab chimpanzees at LEMSEP in 1991. I had been keynote speaker at her Chimpanzoo conference in Los Angeles in 1998. I recall that Jane said the growing demand for her international speaking tours had exhausted her. Today, twenty years and millions of travel miles later, 89-year-old Jane Goodall is still actively speaking, traveling approximately 300 days a year, for her nonprofit organization, the Jane Goodall Institute (JGI), and JGI's youth program, Roots & Shoots.

After the conference I took the amazing bullet train from suburban Tokyo to Osaka escorted by Dr. Masato Takeda, the veterinarian at Osaka's Tennoji Zoo. We transferred between six different trains, over four travel hours, yet we never waited more than ten minutes between trains which were all exactly on time. My hotel was opposite the famous Osaka Castle, a wonderful example of stone wall construction, the best I had seen since visiting Cusco, Peru. I was taken on a tour of Osaka's Tennoji Zoo by an old friend, Dr. Kenji Wako. I enjoyed seeing the elephant and African Savanna exhibits Kenji had designed. These were by far the most beautiful, yet functional zoo exhibits I had seen in Japan. Kenji had collaborated with Professor Masahiro Yoshida, an old master of Japanese landscape architecture. With Kenji translating, Professor Yoshida remarked on how similar my zoo design theories, particularly design of sightlines, and circulation experiences, resembled traditional Japanese garden design theory. I responded that I had learned about these traditional Japanese methods and philosophy while a landscape architecture student and integrated many into my zoo design practices. I also delivered a lecture to Kenji's students. Kenji is a very gracious host, paying for my meals and local transportation himself.

Mr. Yoshida guided me around three iconic Japanese gardens in historic Kyoto, including Katsura Palace, a small, austere Zen garden in a Buddhist temple and the expansive Shunga Kuin Palace with distant forested hills resplendent with autumn color, used as “borrowed landscape” in the garden’s composition. It was informative to see these classical gardens through the vision of a modern master like Mr. Yoshida and hear what he liked and disliked about their original designs and present maintenance. We had wonderful Japanese dinners together on several evenings after our tours. The next day Kenji and I took the local train to nearby Inuyama District and met Dr. Yoshikazu (Yoshi) Ueno a behavioural researcher at the Primate Research Institute (PRI) of Kyoto University who I had met at the SAGA Symposium. Yoshi kindly became my guide. PRI had developed a highly artificial chimpanzee enclosure featuring three 15m (50') high steel towers connected by large ropes. Vegetation between the towers included many plant species known to be toxic to humans. Yoshi explained that researchers assumed the primates could identify potentially toxic plants by taste and used them for nest building. There had not been any incidents of apes suffering from plant toxicity. This approach was opposite to my experience in Western Zoos, where veterinarians refused to take any risks with potentially toxic plants in animal enclosures.





Figure 81. Upper left: Katsura Palace Garden. Upper Right: Shunga Kuin Palace Garden. Middle left: Tennoji Zoo, Osaka. I am on the left, Dr Kenji Wako in centre and Professor Masahiro Yoshida, far right. Middle right, my lecture to Dr. Kenji Wako's landscape architecture students in Osaka University. Lower photos: 15m (50') high chimpanzee climbing towers at the Primate Research Institute of Kyoto University. Lower right: plantings at base of tower including species listed as toxic such as *Robinia pseudoacacia* planted among the towers.

Later we observed noted primate behaviour expert Dr. Tetsuro Matsuzawa demonstrated chimpanzee self-awareness by placing a white mark on a young chimp's forehead as they played together and then providing the chimp with a mirror. The ape immediately saw the white mark and touched his forehead, proving he recognized his own reflection. This test has now been widely applied to great apes, elephants and dolphins; the only non-human animals known to be self-aware. I later had lunch with Dr. Matsuzawa, Yoshi and Dr. Kim Hathaway, an American primate researcher. Dr. Matsuzawa told me he had been trying to get me invited to speak in Japan for four years, so he was the influential source of my SAGA speaking invitation. He said they had many of my academic papers in their library.

A few days later I had to again navigate the Japanese train system back to Tokyo Narita Airport for my flight home, this time without a guide. Everything went well until arriving at the four-level Tokyo Central Station. I arrived by bullet train on the top level, descended the seemingly endless escalator and by chance saw a hand-written note in English taped to a column informing foreigners that the airport train departed from the lowest level.

Woodland Park Zoo Greater One-horned Rhino Exhibit - 2004. Ironically, my first Jon Coe Design (JCD) work was back at the Woodland Park Zoo in Seattle where my zoo design career began thirty years earlier. I happily collaborated with my old firm CLRdesign. The zoo wanted to add an Indian rhino exhibit in their Jones & Jones designed and now wonderfully mature Asian forest area. Old friend and CLRdesign colleague Larry Dame very ably assisted me. The assigned area was not large enough and we recommended they convert one of their elephant yards to a rotation area which elephants and rhinos could alternately inhabit. After I made two international visits, and we completed quite detailed drawings the zoo decided to abandon the project. They

correctly decided there was not enough space for both species. They were also concerned the Seattle climate would be too cold for tropical Indian rhinos. Almost eighteen years later their elephants were relocated to a large elephant sanctuary and Indian rhinos now occupy the entire old elephant area. Although I hate to do uncompleted work, this was the best outcome. I also learned a good deal about this interesting species.

Adelaide Zoo, Australia - 2006-2018. My friend John Wright with Hassell Architects invited me to join their team to design new Sumatran tiger and orangutan facilities, working with enthusiastic Director Mark Craig. Adelaide Zoo is an attractive, small city zoo and didn't really have sufficient space for both exhibits, but Mark was confident the orangutans could use O-lines to access air space above the tigers. Mark also wanted the tiger night holding building connected to the service area behind the exhibit. I warned Mark this may cause the tigers to stay near the back of the exhibit waiting to be fed and thus well away from visitors. To remedy this, I designed the tiger exhibit with a long, hidden raceway connecting their night dens to the exhibit front area. My idea was they would wait near the front of the exhibit. This strategy had worked well in the Zoo Atlanta lion exhibit I had designed a decade earlier. These were unfortunate examples of designing physical features requiring changed animal management methods not embraced by animal care staff. Mark Craig moved on to work at Sydney Wildlife World and wasn't present to change management procedure. Orangutans were never allowed to enter the O-lines over the tiger area; staff said the apes were terrified to go there. Thus, the orangutan area was too small. One timid and fearful Sumatran tiger refused to turn a right-angle corner in the raceway and never went into the exhibit. Staff blamed me for a design flaw that I see as a training flaw.

Giant Panda Exhibit - 2009. I again teamed with Hassell, John Wright and Sharon McKay, to design the blockbuster Giant Panda Forest. Then General Curator Kevin Evans was an active member of our design team. Based upon my experience with several giant panda exhibits in the USA I admonished the zoo not to fall into this costly trap. Chinese authorities then charged USD\$ 1 million per year for ten years to rent their pandas. They always kept their best breeding stock at home and sent incompatible pairs. New facilities were very expensive to build and maintain. Zoos opening such new attractions experienced "boom and bust" attendance and all eventually lost money unless cubs were born, which very rarely occurred. Adelaide Zoo senior management at that time ignored this advice, saying they had a special deal through the Australian government to acquire the pandas. Although the giant panda lease agreement was favorable, the zoo went heavily into debt for construction expenses and eventually the zoo nearly became bankrupt. A significant part of this expense was the fine new entry location and building, gift shop, cafe and administration building by the Hassell Adelaide office opened in 2009 which won awards for 'Green Architecture'.

In 2012 Ms. Elaine Bensted, a banker, was wisely hired as the new CEO. Elaine led Adelaide Zoo out of debt and, after some difficult years, into a renaissance.

Master Planning - 2017. Elaine was a successful team builder, delegated, and oversaw the sensible staging of new work. An area next to the new entry was developed as a two-level Nature's Play area designed locally, which opened in 2015. Elaine Bensted and Zoo Horticulture Director and later Operations Director Jeff Lugg invited me to guide their in-house master planning initiative in 2017. I participated in two planning workshops with zoo staff and advised local planning consultant Ms. Vicky Jo Russell, who shared workshop management and developed the actual plan.

The next new attraction linked in the development sequence was the Variety Children's Zoo Farm in 2019. I was again invited to join early brainstorming and update zoo staff on the latest ideas in children's domestic animal areas in zoos. My major contribution was to suggest that domestic goats and children be positioned on two levels connecting to the successful Nature's Plan construction. Adelaide Zoo was an early adaptor of my ideas for elevated animal trails. Jeff Lugg and zoo staff designed and constructed an overhead trail system for golden lion tamarins as a test of concept for larger, longer and more complex colobus trail systems that opened in 2020. I mention these dates to demonstrate a sensible development schedule for a small zoo, recovering from the cost of a blockbuster panda and entry projects and then opening a planned new attraction every few years to hold and increase attendance. This was a part of my original advice Elaine Bensted took to heart and executed very well.



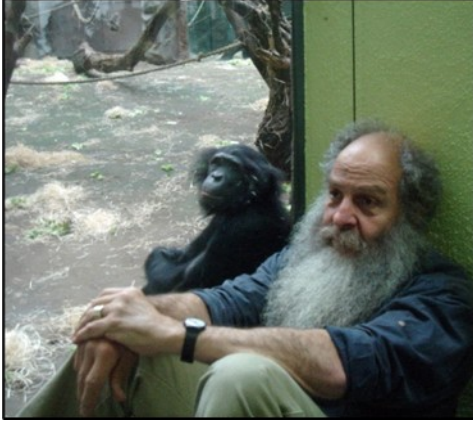
Figure 82. Upper left: giant panda demonstrating their noted rest-and-digest behaviour in the garden I helped to design with Kevin Evens and John Wright. Upper right: we develop this mechanically chilled “cool rock” rest area for warm days which can be enjoyed by both pandas and visitors on opposite sides of the glass barrier. I hoped this would bring the animals closer to the visitors, but no research has tested this notion. Lower left: planning workshop session with “break-out groups”. CEO Elaine Bensted is in the centre of the photo. Lower right: the overhead trail I suggested, and Jeff Lugg and zoo staff designed and constructed for golden lion tamarins in 2015 (Photo: Zoos South Australia). They have expanded it several times since then. I’m told the tamarins spend most of their days on the trails rather than in their old outdoor enclosures.

Zoos Victoria, Australia 2008-2018. Zoos Victoria (ZV) includes Melbourne Zoo, Werribee Open Range Zoo, Kyabram Fauna Park and the nearby Healesville Sanctuary. Most recently I completed the master plan for Kyabram Fauna Park just before they joined the Zoos Victoria family. My work with ZV, like work with Sydney’s Taronga Zoo, consisted of developing alternative conceptual plans with illustrative sketches.

My Zoos Victoria work was done under five ZV executive directors and several park directors. Projects included Melbourne Zoo Vision Plan with then Director John Wills 2008, Orangutan Island & Tiger Trails concept with then General Curator Dan Maloney 2008, Lemur Exhibit 2011, Predator Precinct Concept 2011, Growing Wild 2013, Predator One & Two 2014- 2018. Healesville Sanctuary concept design included Koala Exhibit with Director Glenn Holland 2015. Werribee Open Range Zoo began planning their entry area with then Director Jenny Gray 2008, followed by Werribee Elephant Design Survey, Gorilla Shelter and Savanna Shade Studies under Glenn Holland 2022.

Once a direction I developed was approved and a construction budget established, larger design firms develop final designs and construction documents, completing the work. While I enjoyed these challenges, the completed work was usually very different than I had envisioned. When we settled in Healesville I thought of developing a very long-term relationship with Healesville Sanctuary, which is only four kilometers from our home. But soon I was working on different continents and across Australia and never got around to promoting my services to the sanctuary.

Frankfurt Zoo, Germany - 2009. Ms. Monika Fibi, an Austrian landscape architect approached me in 1991 for advice on becoming a zoo designer. I suggested she return to university to do her thesis on improving zoo design through scientific evaluation and increased knowledge of zoo biology and visitor studies. In 2000, after completing her excellent thesis and degree, she and her husband Hanz opened the non-profit ZooLex Zoo Design Organization. Their Vienna-based consulting firm also publishes the ZooLex Gallery, an in-depth reference to zoo exhibits built around the world. I am pleased to be one of their editors and have enjoyed regular communication with Monika ever since.



In 2009 Monika invited me to collaborate with her in master planning Frankfurt Zoo in Germany, collaborating with Curator Carston Knott. Carston understood the need for a master plan, which the zoo director ignored, preferring to put resources into conservation projects in Viet Nam. Carson cleverly talked him into a compromise in which Monika and I would be hired to provide workshops in training zoo staff in planning. The result would be a conceptual master plan.

Figure: 83. Tired after long hours of workshops and late nights drawing our results, I rested next to a sympathetic zoo bonobo on the other side of the glass at Frankfurt Zoo. Photo: M. Fibi

We arrived at the zoo to find a new bear exhibit under construction designed by architects who had never done a zoo project before but had won a City managed architectural competition. Such competitions favor academic architects with exciting ideas, little experience and no knowledge of zoo biology. Monika said this is how city zoos were managed in Germany. Carston told us zoo management had no role in architectural selection and very little input into the design. This was one reason he was keen to use us to help develop a staff-driven master plan. Monika and I developed a decent plan and enjoyed working with the keen staff members, but I don't know if anything came from our collective plans.

Kabul Zoo Master Plan, Afghanistan - 2011. While in Kabul I developed an interest in the renewal of the war-torn Kabul Zoo resulting in my pro bono 2010 Kabul Zoo Vision Plan, which proposed a high quality yet small and sustainable zoo and a large flood plain central park for Kabul. In 2011 I was hired by KCI-Tetra Tech, a US planning firm under the direction of Mr. Bradley Baxter, to develop an official master plan for Kabul Zoo. Funding was from USAID, the US foreign aid agency. This plan included zoo operational Standards and Norms as well as development plans, cross sections and staging, recommendations for parking, entry, food and beverage, education, visitor circulation, animal displays and support areas, conservation, and administrative offices, and veterinary centre. This planning was done in close coordination with Mr. Aziz, the zoo's young Director.



Figure 84. I planned the Zabol Zoo to remain small and affordable for the city to operate well, while demonstrating ambitious standards of animal welfare and rewarding visitor experiences. I then went on to develop plans for a suggested Kabul Central Eco-Park for the adjacent Kabul River Flood plain. This would have been an amazing contribution to the city.

During the month of my work in Kabul, Bradley and I attended weekly open meetings in the mayor's office but were never called on to present our work. We met twice with the Assistant Mayor who liked our work but had little power. We were finally awarded an audience with the mayor requiring me to extend my visit for a week. His Honor did not like my work and lectured me on proper zoo design. His vision was to build a mega-zoo with the flood-prone Kabul River flowing through it and extending to the already populated steep hills beyond. His zoo would have massive ornamental wrought iron gates like the Berlin Zoo of the 1930s. I knew US aid to Kabul was already drying up. Existing programs were being cut back. The mayor's plan had no chance for funding and would be far beyond the city's capacity to either build or operate. My plan went into the bin. Lesson learned: challenging, visionary yet sustainable plan explorations like this are worthwhile in the same way post-graduate design studios are, for the enjoyment of the search and the experience gained. Take pleasure in work well done regardless of the outcome.

North American Past Project Evaluation Tour - 2012. For some time, I had been wondering what could be learned from projects I had helped to design in previous years

and decades in North America, some over 35 years earlier. I had my favorites, and many had been award-winning. But how did their operators evaluate them over time? Very few zoos and botanical gardens undertake, much less publish, scientific evaluation of projects after they open. Informal information is in the minds of zoo managers and the only practical way to learn from them is to tour their facilities with them. Also, I wanted to learn how North American zoos were preparing for climate change and sustainable 'green' operation. So, as a self-education initiative I organized my own tour of twenty-two zoos in the USA and Canada where I felt my colleagues and I had done our best work. Many of these projects have been described earlier in this narrative. However, I included visits to places I admired but had not done work with, including Disney's Animal Kingdom, Sea World Tampa, and Cincinnati Zoo. My travel route was complicated by fitting into the schedules of the facilities I wanted to visit. Also, my wife Susan had planned her dog show schedule for late in my travels, so we arranged to combine one section of our trip. I had arranged with Mr. Michael Noonan from the Anthrozoös Program at Canisus Collage to join him and his students in an animal welfare tour of six zoos on the US Upper Midwest. I fitted this into the last part of my trip. The resulting schedule required me to cross the USA four times.



Figure 85. Travel map illustrating my 2012 evaluation tour of facilities I had designed in North American zoos and other projects.

Lessons learned from North American zoo project tour:

1. User satisfaction. Gratifyingly, all the people I interviewed, from directors to curators and frontline animal caregivers, some third generation of operators, remained

very satisfied with the functionality, popularity, and animal suitability of the projects we had designed. Several remarked they wished they had more such projects.

2. Preparation for climate change. I questioned senior zoo staff about their plans and actions for resilient responses to climate change. I framed this in terms of sustainability in energy, water, food, animal availability, wildlife conservation and civil security. Very few of the zoos I visited had made any preparations at all. Several zoos have done outstanding work in one of these areas, but not the others. Toledo and Cincinnati Zoos had built large solar panel shaded car parks supplementing their energy supply and Cincinnati Zoo had done a thorough water and energy audit, greatly reducing waste. Disney's Animal Kingdom had secured local sources for food for both animals and visitors.

3. Animal welfare perceptions. Several of the exhibits we visited have been designed to provide enrichment opportunities for the species living there. The Toledo Zoo had built their elephant exhibit (by other designers) around the concept of varied feeding opportunities for the elephants. The result functioned well for the elephants, but the hard, industrial appearance of heavy steel cables and I-beam barriers caused the animal welfare students I accompanied to react negatively. This reminded me of our design of the PECO Primate Center at Philly Zoo. It also was designed around the animals functional year around needs, but its intentional industrial look was not popular. Perhaps this supports our original concept that, from the human perspective, zoo exhibits need to look natural to satisfy visitors or at least be immersed in nature as the Philadelphia Zoo's Tree Top Trails were.

Zoo Guadalajara Mexico - 2012. Earlier in the year Dr. Michael Noonan from Canisius University in Buffalo NY organized a landmark conference on "The Future of Zoos". I was a featured speaker. Later in the year Vet. Dr. Luis Soto Rendón of Zoo Guadalajara held a Mexican version, *El futuro de los zoológicos*, inviting me, Michael Noonan, and Ron Kagan (former CEO of Detroit Zoo), along with Mexican zoo speakers. I delivered two lectures, *El Pasado Y El Futuro De Los Zoológicos —Una Perspectiva Internacional Integrada* and *El Futuro de Los Zoológicos en Epocas Cambiantes, los próximos 50, 75 y 100 años*. I presented the talks with the help of simultaneous translation but translated the Power Point slides into Spanish myself. There were about one hundred attendees from countries including Mexico, Central America, Colombia, Peru, Chile, Argentina, USA, and Qatar.

During our tour of Zoo Guadalajara, I suggested the idea of overhead primate trailways and orangutan lines (O-lines) to Luis and in the following days developed an overall concept plan for improving their zoo. During the next several years Luis implemented their elevated trailways system, 60m long (200') Senderos Aereas (Aerial Trails). He also developed a 200m (656') long, up to 25m (82') high O-line for their orangutans, both based upon conceptual sketches I had sent, and they developed.

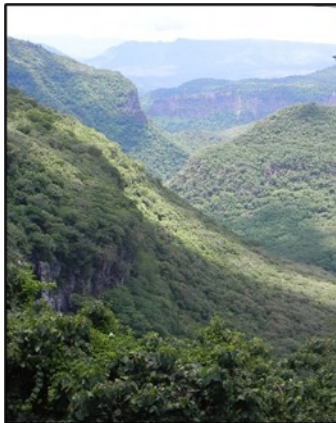


Figure 86. Upper photo of mother and young orangutan 25m high above Zoo Guadalajara (Photo: L. S. Rendón). Middle row left: another view of an orangutan on their O-line. Right: intersection control gates for the Senderos Aereas. This was a practical arrangement but should have been controlled from the ground. This trailway formed a loop, a better arrangement than the up-and-back system we designed at Philly Zoo. Bottom left: view from the north edge of the zoo looking into the Rio Grande de Santiago Valley and Barranca de Huentitan National Park. Bottom right: on my 2018 visit I sketched ideas for overnight accommodation on property they owned just below the cliff forming the north edge of the zoo. These facilities would have this view.

I made my second visit to Guadalajara in 2018 and was amazed at Luis's progress. I also developed some ideas for cliff-side overnight accommodation and a river ride

exhibition. Neither has gone ahead to my knowledge. I have stayed in touch with my friend Dr. Luis Soto Rendón, who is now Zoo Director.

Thrissur Zoo India 2012- present. I mentioned previously contributing to training programs for Indian zoo directors sponsored by the Central Zoo Authority of India (CZA) in Bhubaneswar (2006), Hyderabad (2011), and New Delhi (2012). After the New Delhi training I was recommended by CZA as a paid consultant to assist the Thrissur Zoological Park in Kerala, South India with the planning their new zoo. My friend Dr. Brij K. Gupta, who I met collaborating on the Coimbatore Zoo design, was with the CZA at the time and may have been influential in assigning me this work.

I was concerned about the vast Indian bureaucracy and being limited by the tradition-shackled CZA of the time. Yet, I realized the only way real progressive change could come to the CZA and Indian Zoos was through creation of a successful new example in India. Once a model new zoo was built would they recruit and train zoo staff in the Western style of zoo management where front-line staff are skilled and trusted by senior management and female staff are welcomed at all levels. Could this project lead to a new generation of zoo design and operation in the vast Central Asian subcontinent? It was worth a good try.

I contacted Mr. Adit Pal, a long-time friend and previous CLRdesign employee who taught landscape architecture at the University of New Delhi. Adit strongly recommended Idea Design in Cochin, near the project site. Idea Design is an architectural and landscape design partnership headed by Mr. Biley Menon, his wife Ms. Chitra Biley, and American expat Mr. Michael Little. Adit said Biley and Chitra were among his best students and had later worked with David Hancocks (from my Woodland Park Zoo experiences in the late 1970's) on later planning for the Coimbatore Zoo I had initiated with zoo activist Sally Walker in 1994. I was delighted when Idea Design agreed to enter a joint venture agreement with me for this major work. I developed the overall zoo design. Idea Design managed the contractual and legal complexities of work in India and transformed my free-hand drawings into standardized computer documents. I have never been happier with a collaboration! Idea Design are world-class environmental designers, architects and landscape architects specializing in site and culturally sensitive sustainable design. Their environmental and business ethics are admirable, and they are wonderful hosts, cultural guides, and companions.

Biley and Chitra introduced me to Old Kochi, an important spice trading port since Greco-Roman times and home to Jews and Christians fleeing Jerusalem during the Roman occupation. St. Thomas is said to have established Christian churches there in AD 52. An old church still stands next to an ancient synagogue and a mosque. Marco Polo visited in 1292, and Vasco de Gama arrived in 1498, beginning the European colonial period which later passed to the Dutch and finally to the British before Indian independence. The second highlight was our houseboat tour of a vast above ground canal and lake system created by the Dutch to connect Kochi Port to the Indian interior and now a major tourist attraction.



Figure 87. Biley and Chitra took me to see a large series of elevated canals and lakes created during the Dutch colonial occupation. We toured these waterways in old commercial barges locally converted to travelling tourist accommodations with wonderful meals of local seafood.

The existing Thrissur Zoo, established in 1885, was a small substandard menagerie attached to the State Museum focused on local art and natural history. Poor conditions for the animals resulted in public complaints and inspired the idea of building a new world-class zoo. The State Forestry Department identified the new zoo location in the Sholayar Forest Reserve near the town of Puthur partially developed as a bamboo plantation for an unsuccessful paper making initiative. This was an aesthetically spectacular and physically demanding site comprised of three steep hilltops with abundant exposed granite-gneiss bedrock outcrops and small tors. Expensive and disruptive rock blasting was required for installing underground utilities and roads. The steep central hill and a lower saddle area together comprising 50 ha (124 ac) were selected for the new zoo site. The remaining area, too steep for future zoo expansion, was designated a Conservation Zone.

Our client was Mr. C.S. Yalacki, Additional Assistant Chief Conservator of Forests, Government of Kerala, based in the state capital of Thiruvananthapuram. I learned to be wary of projects where I was not in direct contact with the senior client, especially of government work in bureaucratic India. However, I was immediately impressed with the genuine interest and integrity of Mr. Yalacki when I met him, and we explored the project

site together. He was a forester and knew his field. He was not informed about the design business and the work required to design a major new zoo. According to his approval letter, he had already prepared his own master plan. He agreed to hire me to review his plan and prepare, in only seven days, the following:

1. Master layout plan indicating the visitor flow, individual enclosures for zoo animals and birds, infrastructure for zoo offices, veterinary health care, quarantine, waste treatment, offsite captive breeding and research facilities, water, and electric supply layouts etc.
2. Detailed design drawings for every individual enclosure for all animals and birds proposed for display in the zoological park.

Mr. Yalakki was supportive of our early plans, and he was a pleasure to work with. Unfortunately, his departmental workload doubled when he received a second major assignment and later his health began to fail, and he retired. There followed a succession of State project directors and managers with no deep understanding of the project or of our work.

During my first visit I met Dr. P.O. Nameer, Head of the Centre for Wildlife Studies, College of Forestry, Kerala Agricultural University, Thrissur. Nameer (in India people usually go by their last names in informal communications), a friend of zoo activist Sally Walker, was keen to collaborate with us.

In a November 2015 visit to the USA, I met with Ms. Pat Simmons, then Director of the North Carolina State Zoo (NCZ). She was willing to support an intern training program for Indian zoo care givers at her facility and to send some of her staff to India for training programs at the Kerala Agricultural University under Dr. Nameer. In return, Pat was planning a new Asian section for her zoo and hoped this relationship would help them locate and import animals from Indian Zoos. Being a state operated zoo, NCZ was an ideal “sister facility” to collaborate with Thrissur (State) Zoo. I then suggested this opportunity to Dr. Nameer. His university wildlife program seemed an ideal venue for organizing a zoo animal care certificate program in collaboration with an American Zoo. No such program existed in India at the time. Nameer was keen to collaborate, but all this would need approval and funding from our client, the State Department of Forestry. Our zoo training recommendation disappeared into the State bureaucracy and was never seen again.

Another concern I raised was for the State to hire the zoo’s new director or at least curator, so we designers would have a leader and project champion to collaborate with during zoo planning. I was informed no manager would be hired when there was not yet any facility to operate. I feared a 21st Century zoo, operated by what I considered to be India’s 19th Century top-down management system, would not meet my expectations or be a successful proof-of-concept. The CZA, expecting corruption during long

directorship tenures, distrusted career zoo directors. It mandated all state-operated zoos (most zoos) be operated by Forestry Department foresters or wildlife zoologists seconded for a maximum five-year period. Private zoos were discouraged, as my friends at the unsuccessful Coimbatore Zoo discovered.

Curators and veterinarians manage internal zoo operations. In India, animals were cared for by uneducated laborers. CZA required animal holding buildings to have a locked room for tool storage because they expected laborers to steal equipment (perhaps because they were so poorly paid). There was no tradition of professional animal care personnel, male or female, as there is in the West. And this sad condition is codified in State labor statutes. State run facilities have low established salaries for unskilled laborers (who take care of animals) and higher pay levels for trained professionals, such as curators and veterinarians. There was no intermediate pay level for professional daily animal care staff. I was told It would require a change of state employment standards to establish an intermediate pay scale. Even if we could have organized an exotic animal care certificate program at the local university, graduates could not afford to work at the existing pay level.. Establishing a bottom-up transition for animal management skills, as I had observed in North American Zoos over the past fifty years, could be done with private zoos, but would be difficult with this State client.

Our first visits to the site were exhausting in the tropical heat, but areas of the land suggested themselves as ideal locations for needed features such as the arrival, parking and entry area, a giant aviary, and areas for alpine species. After the first week, with the help of Biley, Chitra and Michael, we had an exciting overall layout plan to present to Yalakki and Nameer which was well received.





Figure 88. Upper left: photo with the entire Idea Design staff taken by Biley Menon with partners Chitra Biley and Michael Little on the left. The office was on the ground floor. Biley, Chitra and their family lived upstairs in a wonderfully climate-adapted building they had designed. Upper right: on-site work session with C.S. Yalakki on right and Chitra Biley in pink cap. Middle left: with P.O. Nameer. Middle right: with Biley Menon in front row. Lower left and centre: Michael Little and Biley Menon demonstrate large granite-gneiss outcrops, the site's deep geologic bones. Lower right: my photo with the local mayor. She was a strong project supporter with the prospect of local job creation during construction and later operation. Sorry, I did not note her name.

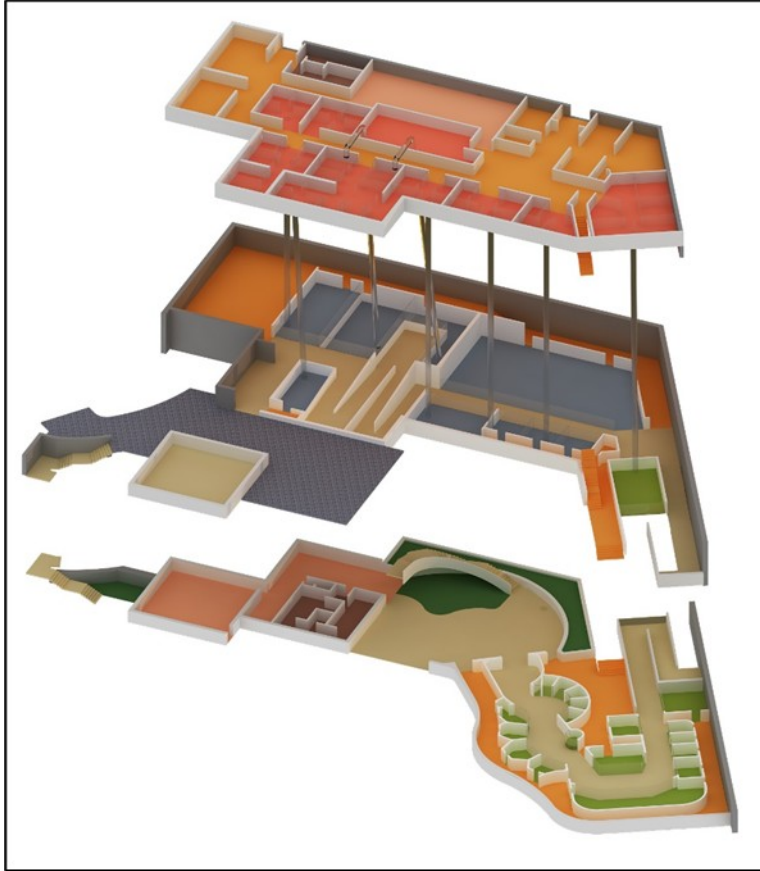


Figure 89. Idea Design's depiction of the three-level Conservation Centre building I designed to step up the existing hillside minimizing bedrock excavation. Lower level has a central banyan tree courtyard entry with toilets on the left and reptile exhibits on the right. Ramping up to the second level visitors experience nocturnal animal displays, existing onto an elevated terrace and café. The third level provides considerable non-public space for breeding endangered species. Public facing exterior walls would become "living green walls" based upon Michael Little's designs.

We completed our Master Layout Plan in record time. Perhaps the physical constraints of the site, its steepness and abundant bedrock, made the best design choices obvious. We used existing solar aspect, orientation and microclimates to locate exhibits from similar climate zones. The level African savanna exhibit was in the only large level area available. Circulation would be a complete loop "around the mountain," about 4km (2.5 miles) to see everything. This distance in a warm climate requires a tram service and separate tram road, also used for service vehicles.

CZA provided their mandated animal management Standards and Norms, which had some obsolete provisions in my view. For example, these provided only two areas for the animals, small individual feeding cages to prevent strife during feeding, and generously sized exhibit areas. Carnivores such as lions, tigers and bears were required to be locked up at night, spending sixteen hours in twenty-four, their most active times and two-thirds of their lives, in these cramped cages. We added spacious

off exhibit sheltered outdoor exercise pens where animals could spend their hours when the zoo was closed.

Our master plan was sensibly divided into two construction stages, but the client insisted on building everything during a single extended construction period which continues today (thirteen years after our plan was approved at this time of writing). In India it is common for political parties to alternate in power. Project progress was deferred when the supporting government was out of power. Thrissur Zoo is now scheduled to fully open early in 2026.

For the best outcome, zoo design teams need to participate during construction as art directors and inspectors, insuring that important less tangible aspect of the initial design are properly executed. In this case, once Idea Design submitted CZA approved final drawings our work has finished, The Forestry Department used their own engineers and designers (with no zoo design experience) to supervise construction. One initial result was that Idea Design was flooded with requests for additional information without additional pay for their service. Based upon on-line photos, I expect the outcome to be sound, well organized, practical to operate, with larger areas available for the animals. I will be disappointed with some final finishes, poor quality artificial rockwork and sightlines. Salvation depends upon final plantings, and plants grow very quickly there!

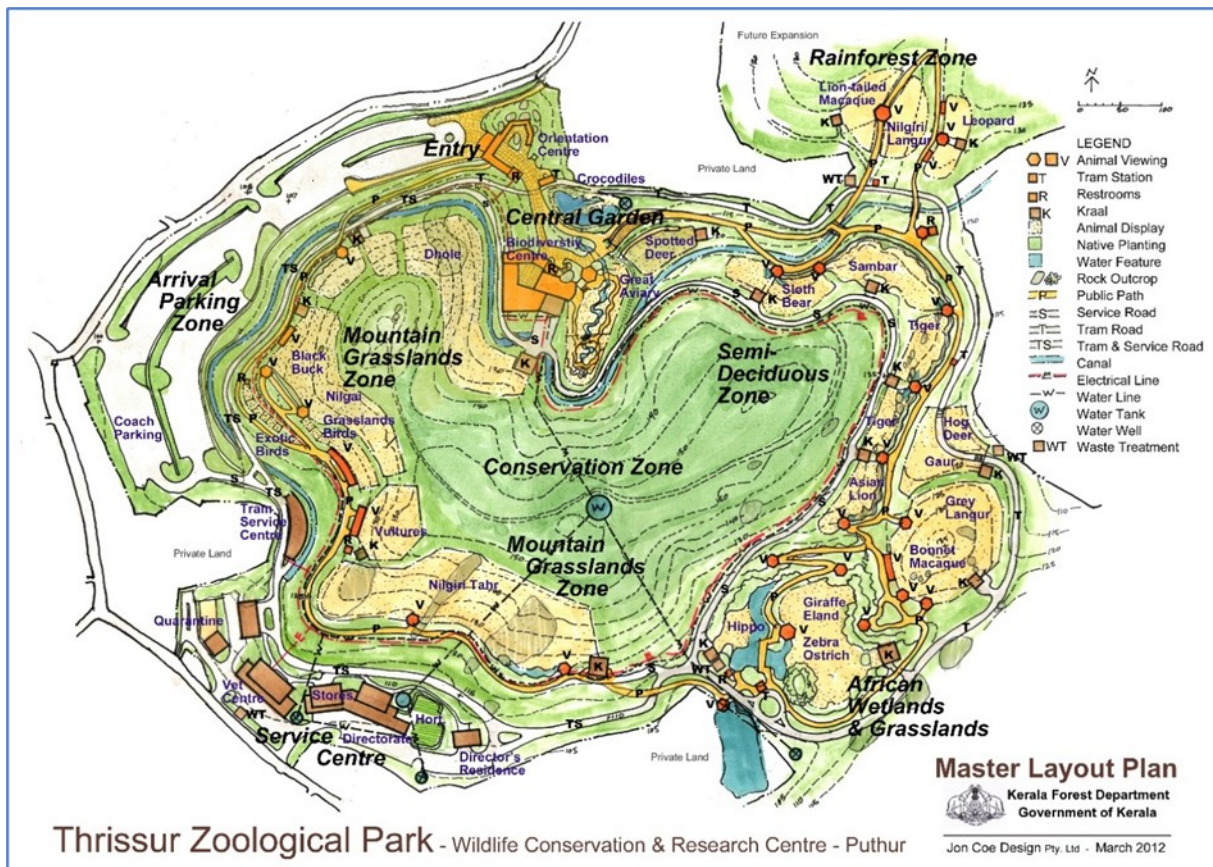




Figure 90. Above: our final 2012 approved Master Layout Plan. Below: Google Earth photos of construction achieved by 2022. Below right: zoo entry, garden, gift shop, and education complex are on the lower left. Three-level Conservation Centre (grey concrete construction) is the only major building. The Great Aviary is shown on the upper right with blue-roofed bird holding pens around the outside.

Final thoughts on Thrissur Zoo. Collaboration with Idea Design was a singular success. Together we produced a good plan on a difficult site in a short time. Idea Design's high quality construction documents ably guided constantly changing construction managers for well over a decade. My focus for the last three decades has been the integration of advanced physical design features with advanced operational and management design programs. When this was possible, as was the case with the Louisville and Philadelphia Zoo animal rotation and trailway programs, outcomes have benefited all stakeholders. On the Thrissur Zoo project, as with many other projects, I had no influence over animal management programs or staff requirements and training. Thus, I expect great zoo popularity but limited initial success in achieving its full potential. We built-in opportunities for greater advancement, such as animal rotation and environmental enrichment. When Indian State zoos advance their staff entry and mid-level hiring and training programs and especially when female staff finally are encouraged to make professional contributions as they have in Western zoos, we will see major improvements in all areas. There is recent good news on this front. The Forestry Department hired a woman as their first Director. Ms. R. Keerthi was likely a student of our original colleague Dr. P.O. Nameer, Head of the Centre for Wildlife Studies, College of Forestry, Kerala Agricultural University. They also hired five female zookeepers. There is now much media attention to the proposed opening, often referring to it as a "designer zoo." This is a quote from *The New Indian Express* from November 8, 2025:

Designed by international artist Jon Coe, the facility, officially the Thrissur Zoological Park, Wildlife Conservation and Research Centre, is a dream project of the state. Zoo director R Keerthi says the zoo will follow the landscape immersion model as advised by Coe, which will offer tourists a memorable experience. "We are trying our best to make the spaces, housing the animals, as natural and beautiful as possible, so that people feel like they are watching the animals in their natural habitat," says Keerthi.

Perth Zoo Planning - 2018. The 17-hectare (41-acre) Perth Zoo was founded in 1897 as a botanical garden and is now managed by the State of Western Australia, which also manages their amazing King's Park. I made two visits to Perth Zoo, 2006 and 2010, unsuccessfully pursuing design opportunities when I was contacted by Vet. Dr. Katja Geschke, Manager of Strategic Projects. She was interested in planning a new veterinary centre and realized a new master plan was needed first. Soon after Ms. Wendy Attenborough was appointed Executive Director. Together with Operations Manager Brad Horan, who I had worked with on a project at Royal Botanic Garden Sydney and John Lemon who managed exhibit design projects, we undertook development of a new vision plan. Together we developed an overall concept integrating an overhead railway system for lemurs and gibbons around their historic central green and an animal rotation system for their large African hoofed mammals. Our Vision Plan was approved by the Perth Zoological Authority Board and later the State funded a "proper master plan" by the Perth office of my old colleagues Hassell Architects and Landscape Architects. I participated in this planning as a zoo advisor, along with my old friend John Wright from the Hassell office in Brisbane. Local creative architect Finn Pedersen joined the Perth team to help with smaller projects.

During master planning the zoo continued improvements such as naturalizing the edges of their park lake and later building a new restaurant and visitor hub. They are now working on the first stage of an overhead primate trial around their central green.

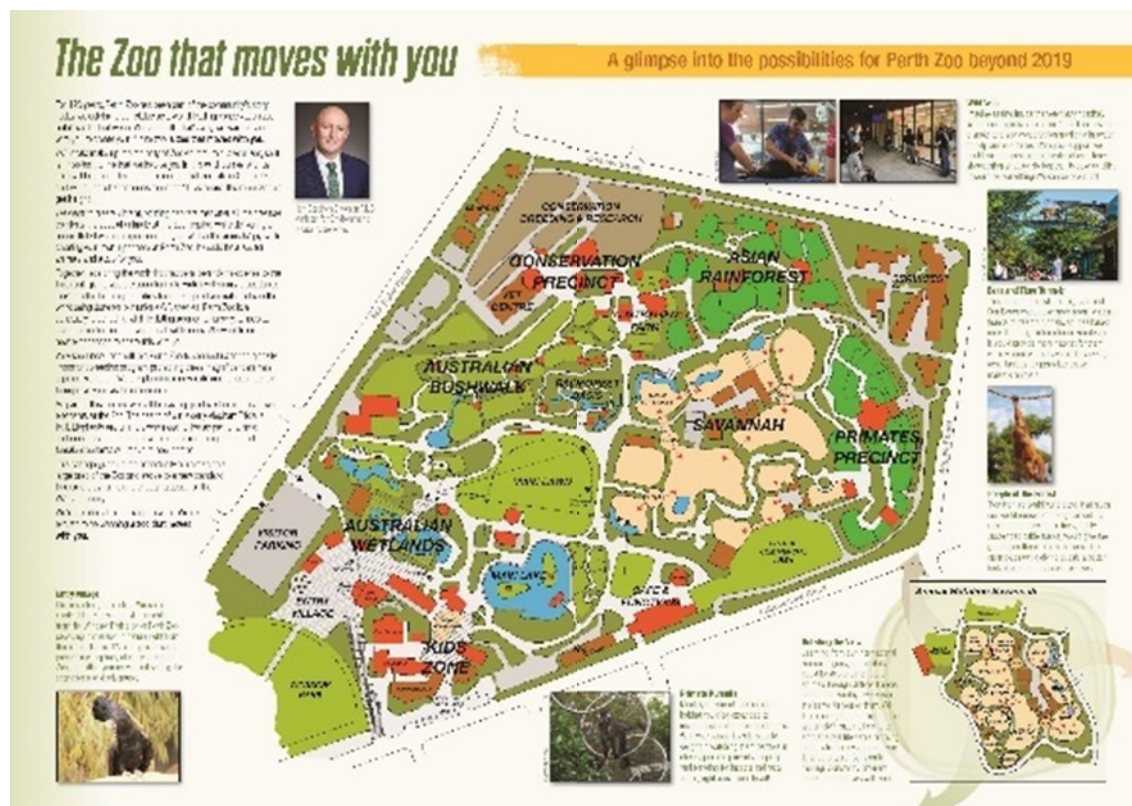


Figure 91. My free-hand drawings were developed into this poster by then intern Ms. Danae Belson, providing an excellent public summary of our innovative ideas.

Two of my favorite projects yet to be realized are the redevelopment of the old Homestead Children’s farm into a tree house and multi-level goat area built around large existing fig trees and the new veterinary, conservation hub and endangered species breeding centre. There has been an unfortunate divide among zoo animal welfare advocates who tend to focus on the wellbeing of individual zoo animals and the wildlife conservationists who primarily address the welfare of endangered animals at the species level with breeding programs and field research. They compete for funding within zoo operations and perhaps in external fundraising. These partisans do not realize they represent different sections of the same spectrum; a rainbow of concern and action aimed at improving the lives of both individual animals and species of wildlife in zoos and globally. Perth zoo could physically represent this relationship by arranging spaces and activities in their proposed Animal Health and Conservation Centre (Figure 92 lower right). Veterinary care represents the ultimate in individual animal health, both acute and chronic, followed by zoo nutrition, positive animal staff relationships, enriching enclosures and management programs, zoo and field research and zoo-based and in-situ wildlife conservation facilities. I suggested these subcenters be organized in an arc around the visitor centre I called the Zoo Animal Wellness Centre with direct visitors’ views into the different activities when appropriate. The term and concept of having a zoo “wellness Centre” was first developed by my colleague and client Dr. Terry Maple. I really liked this idea, but the Perth Zoo master plan team didn’t take it up.

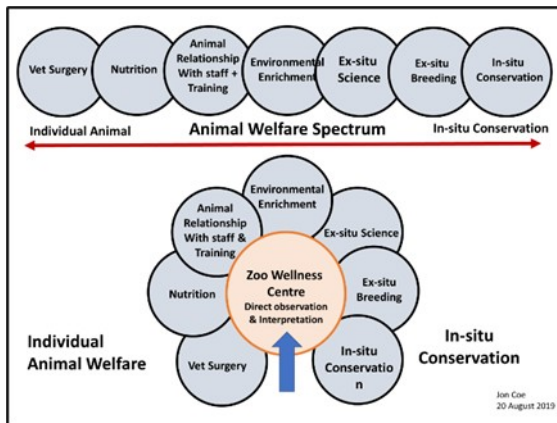
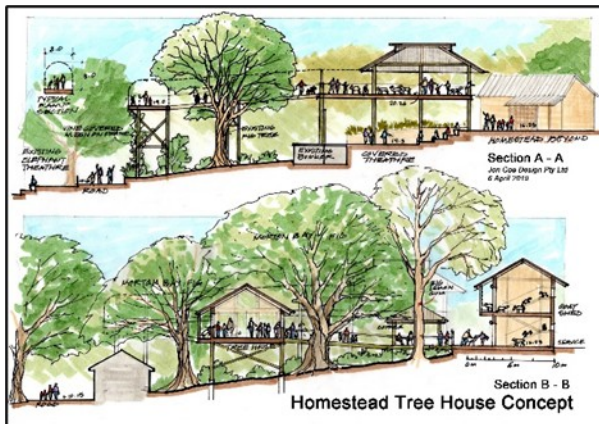


Figure 92. My concept for the Homestead Tree House Kid's Centre with elevated walkways and platforms for both families and dairy goats built around and through existing trees. Lower right: diagrammatic representation for organizing zoo veterinary, animal welfare, management, and conservation activities around a proposed central Perth Zoo Wellness Centre.

The Perth Team was one of my favorite groups to work with throughout and I remain in contact with Katja and her family who generously lodged me on nearly all my visits.

