"Once through the gate, face right. The Deer House, The Camel House, The Giraffe House, The Cattle and Zebra House and The Antelope House will all be found on your left across a canal and a wild ravine. Water Bus rides on the artificial river start at ten. As you face your right you see a path before you. Take it. You pass, on your right, The Owls Aviary and The Pheasantry. All of the pheasants have gone away and you can count up fourteen empty cages, waiting. You can listen to the wind across The Reptile House, The Reptiliary, The Gentlemen's Toilets, The Charles Clore Pavilion for Mammals and Moonlight World. Ahead of you a great fence of wide-mesh wire catches the wind; it is a huge crazy sail that is warped to the ground like a tent and has a door of brushed aluminum. It peaks in twenty places, it bulges at its sides; thick steel pipes at strange angles just like spars and when you walk inside, saying, "You go first. You *come* first, you always came first for me. You know that," the noise that she makes for you by listening in silence, saying nothing, even when you try to smirk your sudden words away, is lost. For you are in The Snowdon Aviary, opened in 1965, the first out-of-doors walk-through aviary in The London Zoo, which houses many birds from a variety of natural habitats. The Aviary was designed by Lord Snowdon in association with Mr. Cedric Price and Mr. Frank Newby. A special leaflet about The Aviary is available from The Zoo Shop (price 1/-). Lost, because the wind is constantly a high sighing human voice inside this cage. The ground slopes sharply and the steep bank is cut by a narrow concrete walk. A wide-barred railing keeps you from falling down, as the waterfall goes down, roaring onto rocks and wet bright vegetation, but you must be cautious at the dangerous rail not to drop like the water down on the rocks and tangled bushes below, very far. There are trees and creepers, everything is twined and seizing and moist and you must take care in the constant wind in which the bellow of her silence is lost.

Shapes and colors move in the transplanted brush, something is moving off the edge of your vision near a pool or in the shadow of a twisted tree or under something green. Over one hundred and forty birds of every color are housed here, and below there are egrets ignoring you, herons and spoonbills; teal and ibises, touracos, kestrel, all were here this morning, will remain tonight, in the breathing wind and faintest rattle, as if chains were shaken, that the fence must always make.

Plans to make The London Zoo the most beautiful and modern Zoo in the world have been moving forward. Moving forward, out the final door, leaving you in The Aviary, she will face a wooden wall and large white sign: UNDER REDEVELOPMENT. Beyond and left she should see The West Bridge. Call her and the wind will crush your words. No birds will rise in fright at the sound of your voice. Move along the rail at which you must take care and leave this unique and justly famous structure."

"Bring Your Friends to the Zoo" by Frederick Busch[1]

birds of a feather: habit, habitat, habitivity

habit

[figure 1] The Northern Aviary (1961-65) in the London Zoo is an amalgamation of biological and architectural experiments in the construction of habitat. It is also one of the few built works orchestrated by the London-based architect Cedric Price. Like most of Price's projects, the aviary is a thoroughly dynamic structure—whether expressed through the triangulation of its structure, the zigzag of its cantilevered bridge, or the diversity of its population. Furthermore, the proposal, similar to the experiments in responsive collectivity building that would constitute Price's oeuvre, was controversial for its audience, starting with the conservative members of the London Zoological Society who voted on architectural commissions and culminating with the critical reception that followed its completion.

While it may seem curious that a design for an aviary met with the same level of criticism usually reserved for human domiciles, given the tradition of groundbreaking work by modern ornithologists, it is not surprising that this level of response would be evoked by a structure designed for birds. Darwin, for example, would claim that the conduct of living (rather than dead) birds described in the proto-ecological accounts of the country clergyman Gilbert White in the eighteenth century inspired him to keep field notebooks of his own sightings, the famous finches of Galapagos notable among them.[2] The biologists Edmund Selous and Henry Eliot Howard spurred further research into living communities of animals at the turn of the twentieth century by studying the courtship habits of birds.[3] It was through these domestic rituals—such as

the points at which male birds paused to sing—that Howard defined the crucial, yet mutable, concept of territory.[4] Julian Huxley, the activist ornithologist, evolutionist and Secretary to the Zoological Society extended the campaign—with his sometime collaborator HG Wells—from birds to the destiny of the human habitat.[5] Further, the Nobel Prize-winning ornithological studies of Konrad Lorenz and Nikolaas Tinbergen led to the establishment of the field of ethology in the 1930s, which combined the disciplines of evolution and ecology to study interactive behavior such as modes of expression and knowledge acquisition. So the connection between the study of community behavior, neighborhood design and domestic ritual was deeply embedded in the study of birds.

Cedric Price had two copies of the naturalist classic that had inspired this ornithological innovation—*The Natural History and Antiquities of Selborne* (1789) by White—in his private library and it was a favorite book.[6] It is no real surprise that an architect fascinated with the globality of cybernetic adaptivity, on the one hand, and the locality of Englishness, on the other, would be particularly taken with a text that had become fundamental for ecologists.[7] On the face of it, *Natural History* was a meticulous survey of the topography, fossils, flora, insects, mammals and, especially, birds of an isolated Hampshire parish centered on the bucolic village of Selborne in the south of England. But the book made a larger case for what White called a "parochial history" recorded by "stationary men" of their ordinary surroundings, rather than the accounts of captive and dead specimens that were the common practice of his day.[8] *Natural History* was thus a log, through the accretion of detail over time, of a living ecosystem in the south of England. White adopted the new—global—taxonomy of Linnaeus in his endeavors, yet he was aware that binomial nomenclature could not account for his own identifications of species via their patterns, such as those of procreation, comportment and communication—elements that are

now classed as ethological. Speech, for example in White's analysis, belonged in an organizational system that accounted for performance as part of the way organisms learn from their environment and from others. White famously wrote of communication amongst birds and his work is strewn with observations such as: "No inhabitants of a yard seem possessed of such a variety of expression and so copious a language as modern poultry."[9]

White has been held in high regard for demonstrating that his cloistered rural hamlet was nonetheless woven into the fabric of nature. Local observations, after all, had made White evermore aware of the effects of distant events on his milieu and of the global circulation of species both as a result of natural tendencies and human commerce. Selborne was but the vehicle by which the concept of habitat as a favored location of a species was broadened to embrace an ecosystem of interdependent animal classes in a physical environment.[10] White, for example, took a particularly keen interest in the yearly cycle of bird migration, which at that time was not fully understood or even accepted.[11] He then supplemented his own observations with travelogues by or through direct correspondence with naturalists in other areas, reflecting the conviction that a multitude of partial observations would more accurately describe the complexity of nature than an overarching hypothesis.[12] Thus in the guise of exquisite Englishness lay the foundation for the call for an interpretation of nature as a dynamically related series of components in which a whole would always be more than the sum of its parts. This too is the narrative of the Snowdon Aviary.

habituate

In White's day there was no scientific institution dedicated to the study of animals, though a Linnaean Society had been formed in 1788 dedicated, as was Linnaeus, primarily to botany. When a Zoological Club was started at the Society in 1822, White's focus on animal

behavior, territory and breeding had inspired others but was by no means mainstream practice. The major boost to the cause of the Zoological Club came when Sir Stamford Raffles, more famously the colonial founder of Singapore, returned from the Far East with a starter crop of specimens brought over with the aim of curating a collection of faunae for the purposes of study by the fellows of a zoological society that he would found in 1826.[13] These animals needed homes and the London Zoological Society, which would eventually be responsible for the commissioning of the Snowdon Aviary, hired the fashionable architect Decimus Burton to prepare the plans and pavilions for a zoological garden to be set within the Picturesque boundaries of John Nash's Regent's Park.[14]

[figure 2] The London Zoological Society and its gardens famously set the bar for the many urban zoos to follow in its use of taxonomic organization principles for the scientific investigation of its exotic and domestic animals, as well as the setting of the collection within the "naturalistic" landscape of a public park.[15] Design and scientific technique were deployed to bring a landscape of the kind that White found at his doorstep into the by now fully industrialized conditions of London for the intimate observation of animals, over time, in a habitat constructed along the lines of shifting naturalist (and, of course, colonial) ideology. Not coincidentally, these two overlapping philosophies of methodology and terrain aptly underscore the inherent contradiction that coerced habitats embody, especially at their points of intersection. On the one hand, there was the escalating scale of environments in which animal groups were studied. On the other, there was the closed system of carefully maintained environmental equilibrium and finite resources, especially as expressed in the inter-related series of sub-climates. Localism was further undermined as the behavior of animals was studied in ever wider ecological, economic, and ideological contexts as the nineteenth century progressed.

One of the difficulties in the maintaining of equilibrium of the London Zoo was the high death rate, especially amongst newly arrived birds and primates. In 1902, an internal report denounced the inappropriate accommodations that harbored infectious diseases such as tuberculosis—also a leading cause of death in humans at the turn of the century and responsible for inspiring a trend for housing reform. Fear of diseases transmissible to humans resulted in the nomination to Secretary of the medically trained Peter Chalmers Mitchell, who had been inspired by research on the affects of fresh air and sunlight on human productivity and the ultra-violet treatment known as "heliotherapy."[16] Chalmers Mitchell, unlike his predecessors, believed that the role of a zoo was to allow animals to live out the course of their natural lives, in circumstances akin to their natural habitats no less.[17] His briefs for the new exhibits undertaken during his tenure reflect this. The first, the rugged, reinforced concrete Mappin Terraces that would be the largest and most prominent of the zoo, best conform to the literalist Hagenbeckian tradition of simulating terrain—in a material less permeable to disease.

His policies for animal upkeep, which emphasized the preventative use of fresh air, light (including ultraviolet), heat and food are best reflected in his commission of the modernist Berthold Lubetkin and his young firm, Tecton, to house two young Congolese gorillas. **[figure 3]** The circular Gorilla House (1932) was also the first truly public work of modern architecture in Britain and the first building by Tecton anywhere.[18] Modern architecture, with its commitment to the health benefits of ventilation and light, had yet to make inroads in human Britain,[19] but Chalmers Mitchell's believed that the displaced anthropoids needed the support of environmental controls to protect their lungs from human borne disease and gave Tecton a brief that required that their habitat provide fresh air in the summer and maintain the environment and visibility of

the gorillas in winter.[20] **[figure 4]** The commission for the Penguin Pool (1934) that followed allowed Tecton to further demonstrate the minimalist concept of modernist housing.

The relationship between modern architects and the Zoological Society was further consolidated in the 1930s by the exile of some members of the Bauhaus community to London. Walter Gropius, Marcel Breuer and Laszlo Moholy-Nagy all resided between 1934 and 1937 at the famous Lawn Road Flats (1934) designed by Wells Coates and shared their views of modern architecture as a form of ecologically advanced housing with influential members of the Society, and especially with two who would both serve as Secretary and therefore be in a position to commission modern architects.[21] The first was Julian Huxley, the evolutionary biologist with a special interest in bird behavior and a modern design enthusiast. The second was the primate specialist, Lord Professor Solly Zuckerman, under whose leadership the Snowdon, or Northern, Aviary would be commissioned. The charismatic and well-connected Zuckerman hired Sir Hugh Casson, the knighted architectural director of the Festival of Britain, to spearhead a site plan for a "New Zoo." Sir Peter Shepheard, another major figure of mid-century British modernism, was hired as landscape consultant. A scheme was presented to the Society in 1958 and work began immediately.

habitat

Anticipating the changes afoot from above, the committee at the zoo dedicated to "Collections Policy" issued a memorandum in 1960 dedicated to the "Future Policy on Bird Collections" to advocate to the administration for its needs.[22] Along with general recommendations to improve specimen visibility, display logic and species diversity, some advice was quite specific.[23] Given the dearth of cliff birds in the collection, for example, a

detailed proposal for a large outdoor birdcage designed to minimize the appearance of captivity was put forward:

> What is wanted is a small artificial cliff, with ledges and holes designed to meet the known requirements of the different species. At the base of this would be fairly deep water (salt?). Under the conditions envisaged, the birds would probably rest on the cliff, even if they could not be induced to breed, and would fly up and down between it and the water. The whole would have to be within a wire enclosure, of which the cliff would form a solid wall on one side; at least the roof should be of tensioned wires in one direction only, but it might unfortunately be necessary to have them set closely enough to exclude sparrows. Spectators should be admitted to a platform within the enclosure and opposite the cliff; there might be two platforms at different levels… The whole might well constitute a major feature of the Gardens, and one that would be unique so far as the writer is aware.[24]

The demographic of this novel space would be geared towards hardy birds in an "assemblage of species and would represent, but not too uniformly, a particular type of environment."[25] In other words, climate affinities would dominate over place or biological resemblance.

In November of 1960, in keeping with Zuckerman's penchant for social connections, the Zoological Society of London invited the celebrity photographer Anthony Armstrong-Jones, who had the year before married Princess Margaret to become the first Earl of Snowdon, to design a new walk-through aviary to replace the Great Aviary of 1888.[26] Snowdon, whose relevant experiences were an undergraduate architectural education at Cambridge and the building of a birdcage at the Palladian Mereworth Castle, brought Cedric Price, a licensed friend from his University days, in as an associate.[27] Price then solicited the collaboration of Frank Newby, the

young structural engineer who had been inspired by modern architecture in 1948 when living in the same Lawn Road Flats that, as it happens, had been commissioned from Coates by the father of a close university friend.[28] Newby had recently taken over the firm of his mentor, Felix Samuely, whose approach to structures as dynamic entities had inspired Price during his diploma years at the Architectural Association. Samuely had supplied engineering services to the Festival of Britain under Casson, including the iconic Skylon whose pretensioned supporting cables Newby had been tasked with keeping taut.[29] **[figure x]** Starting from a brief drawn heavily from the proposal outlined in the policy memorandum—the cliff, the water, the staggered viewing platforms—and a series of preliminary sketches prepared by Price, Newby proposed a tension structure with distinctive peaks using the concept of tensegrity that the two had learned from Buckminster Fuller.[30]

On the 6th of April 1961, the "Working Party of Future Policy on Bird Collections" informed the architect that the zoo had agreed to shift the site from a flat area with large trees to the one he preferred on the steeply sloping north bank of the Regent's Canal which, while devoid of perching and nesting vegetation, would allow for views of the birds from above and below as well as the side.[31] In keeping with the emphasis on large-scale, climate-based affinities, the residents had also been determined to be a "habitat group comprising tropical and subtropical birds appropriate to an environment broadly representative of Africa and India."[32] Price immediately pressed for greater specificity, as well as a decision as to whether any other class of animal, such as the ground squirrels mentioned at an earlier stage, would be included. He would later urge for the same level of detail with regard to the plant species that would populate the landscape. Rather than designing for a display of birds in isolation, Price preferred to conceive of a group of interdependent classes of flora and fauna—in short, a locale, after White's

formulation. The unique challenge presented by the aviary was designing for animals from a large geographical swath, that would not ordinarily establish territory in such proximity, and which were bound tenuously together by the simple fact that they had evolved in a similar climate range. To further complicate matters, these animals would have to dwell amongst vegetation that could thrive in London under unusually acidic conditions. To overcome these obstacles, Price was offered the support of the renowned ethologist, Desmond Morris, who oversaw experimental work with animal housing, feeding devices, lighting techniques and new materials.[33]

[figure 6] The Zoological Society brass responded positively to the preliminary proposal submitted by Snowdon, Price and Newby for "two crystalline end pavilions connected with either a stressed net or a net running over tension cables or a latticed shell, thus enabling a maximum free flight volume with sufficient height together with perching conditions at each end.[34] Criticism of the cage, however, reflected the views held by most Society members for what constituted appropriate exhibit design. Essentially, what was being contested on either side was the effective representation of "nature." The zoological habitat model was akin to an animate version of the meticulous dioramas of the Natural History museum that combined taxidermy with artificial props and elaborately painted backgrounds. Bird groups in particular were focused on in these detailed and realistic settings.[35] Territory in this live case according to the list provided to the architect by the curator of birds required the accommodation of water birds, ground-dwelling birds, cliff-nesting birds, and tree and bush-nesting birds: four categories of breeding behavior in a single spatial vignette.[36] The committee had stated that it was "strongly in favour of providing a naturalistic background for the birds," but given the artificial

demographic there was no version of a non-captive habitat to capture.[37] Rather, they requested features that would symbolize the natural world to the observer.

Mimicry, however, did not interest Price who pushed at every turn for abstraction. There were wrangles over things like the proposed use of artificial trees given the barrenness of the site at the time when the birds were to be first introduced, with some zoo parties resistant to entertaining this option even as a transitional measure.[38] **[figure 7]** The feature that most rankled was the centerpiece: a concrete cliff-face that was to provide nesting, perching and feeding facilities. From the standpoint of the Society this feature was groundbreaking because its goal was to enable birds that had never before reared young in captivity to reproduce and thus the zookeepers had a deep-rooted investment in its appearance. "It was emphasized," the minutes of the meetings between the design team and the zoo insisted again and again as the two sides tussled over the textural treatment of the concrete surface, "that the greatest care must be taken to produce rockwork which would look convincing even to a geologist."[39] The technique of taking moldings made from "natural cliff and rock" was promoted, as was often done when working in the Hagenbeck style. **[figure 8]** Price meanwhile continued to insist on a shuttered grain with vertical projections and recessions to convey the quality of roughness. Emphasis was shifted through the process of abstraction away from the pictorial and its assumption that visitors would gain some of the subjective experience of wildlife encounters to an informational model. The zoo, in turn, protested over what they called "this very formalized treatment of the cliff."[40]

Casson, in his role as master-planner acted as adjudicator between Price and the increasingly exasperated Controller, negotiated a truce whereby the spirit of the proposal prevailed, mediated through a framework in which all the parts of the concrete work would be treated in the same abstract manner, from the face of the cliff to the base of the waterfall.[41] The

entire piece, despite the different natural features it assembled, was also to be uniformly gunnite grey. In other words, abstraction was made tolerable to the realist through a modernist gloss of compositional unity. **[figure 9]** The compromise was underscored by a comparison to the second major addition that was also underway by Casson's own firm: the Elephant and Rhinoceros Pavilion (1962–5). The pavilion was composed of an irregular cluster of pens with wrinkly skin and bulky mass intended to resemble a band of animals drinking from a pool. As with the aviary, the pavilion did not recreate a geographically specific experience, nor did it propose building as a manifestation of landscape. Radiating laminated wood beams disposed in a tree-like fashion, for example, were a gesture at, but not illusion of, things jungle-like. Architecture, rather, functioned by way of "zoomorphic" analogy, bolstered by the undisguised pours and hacked vertical rills that exposed the material process of building. Materiality and truth to mass-produced materials were everywhere emphasized over structure.

With the aviary cliff, Price tried to bypass the processes of analogy. A discussion of the other major landscape feature was had in tandem with the debate over the rockwork and further amplified this aspiration by way of physical contrast. **[figure 10]** The suspended ramp, the human compliment to the grounded cliff, was to be as smooth and dynamic as the other was coarse and solid. **[figure 11]** Because of the twenty-two foot incline, this conceptual landscape was required to create traversable ground for the public.[42] The ramp was the platform from which unfettered views were to be both afforded to enlighten the observer through multilevel views of birds flying, nesting, and drinking from the waterfalls and obscured to allow the birds shelter. The ramp also brought the circulation path of the zoo within the cage and educational signage was strategically dispersed along the route with the aim of preventing bottlenecks in the flow through the pavilion. Casson and Shepheard wanted to keep the paving materials and handrails of the

ramp consistent with those of the master plan and employed landscaping techniques to blend the aviary into its larger context. **[figure 12]** Once within the cage, the pedestrian path of the zoo zigzagged through the rectangular plan of the aviary, crossing through the middle as a dogleg cantilevered bridge. The ramp was a part of the circulation system of the zoo and of the habitat. At the same time it was a structural exercise in its own right, apart from the structure of containment.

[figure 13] The palpable presence of the aluminum members that constituted the cage, especially in comparison with their equivalent in steel, was also a feature that worked against expert opinion. *Avicultural Magazine* published a critique based on interference of the structure with the illusion of the visitor walking amongst free birds.[43] **[figure 14]** Architects too complained that the unusual choice of metal required chunkier structural members than was thought aesthetically ideal.[44] Moreover, manufacture of aluminum parts at this scale necessitated skills from outside of the construction industry and every member also had to be laboriously made.[45] Five different companies had to be contracted to supply the aluminum parts. Yet the case for aluminum and its calculated expense was made based on the request for minimal structural upkeep over an extended duration and found to be justifiable by the Society.[46] Among the significant environmental conditions caused by birds penned in captivity, is the accumulation of acidic feces that corrode material finishes and in large concentrations, guano harbors disease and kills plantings that provide facilities for the birds. The structure of the aviary was therefore a key element in resolving how a closed structure could function as an open framework. It also addressed the specific environmental constrains of its intended population (birds). To complement the durable material, a special pump was installed to provide the water power required to clean the pinnacles of the structure. Various techniques, including air blast devices

used near runways and a sticky "Scarecrow Strip" produced by Rentokil Laboratories, were also investigated by the zoo to keep the birds away from these hard to clean areas.[47] Maintenance, an interaction usually invisible to architectural models, was an intrinsic concern of the design process, on equal footing with other deliberations, and Price repeatedly deflected the demands for an unobtrusive entrance for service personnel.

habitivity

The give and take between the architect and zoo continually focused on the points where the design confronted the interaction of organisms: of the birds with their manufactured habitat, from rockwork to cage to plants; of birds of different species; of birds and their curators; of the plants with their landscape; of structure and maintenance crew; of birds and their visitors; of aviary and zoo. These intersections and the controls installed at them were recurrently pressured by variable circumstances: the configuration of human entry and exit was exhaustively calculated to enable pedestrian flow whilst keeping the birds in, for example, yet that did not anticipate the exclusion of vandals who stripped nests of rare eggs.[48] **[figure 15]** The gaps in the latticework were calculated to be small enough to keep aggressive city birds such as starlings out of the habitat at the same time as they had to be large enough to resist icing. Too late in the process to adapt the weave because a smaller gap would have increased the loading by fifty percent, the working module (6 x 1 1/8") proved to admit foraging sparrows. A patrol of small hooded vultures was proposed to counter that infiltration—in this case to guard who was coming in rather than getting out.[49] Buckminster Fuller also wrote to Newby expressing his concern that resident birds would get caught in and break the mesh in the struggle to get free. "To build the vast tetrahedral," he added, "emphasizing triangular stability, and to wire it with a linking of quadrangular, easily breakable veil is not aesthetically sound, let alone politically safe."[50]

Price, for his part, preferred to treat captivity as a temporary condition. He claimed, "that once the community was established, it would be possible to remove the netting. The skin was a temporary feature: it only needed to be there long enough for the birds to feel at home."[51] In short, it was only needed to achieve the condition of homeostasis. For Price and Newby the structure was part of the dynamic environment, itself the outcome of a design methodology that required the collaboration of many (three designers, one main and one sub contractor, five aluminum suppliers, three others for the cable, the handrails and gates, and the pump, and finally two soft landscaping teams) and adapted like an ecosystem to the many challenging inputs encountered in the proposal, manufacturing and construction process. The intersections of structural conditions with organisms had its architectural equivalent in the intersections of those conditions with material forces. They were, after all, in Fuller's words, engaged in "the hazardous matter of doing experimental structural development in public."[52] And hazards abounded, some intrinsic to the design and some from without. **[figure 16]** One unanticipated problem that took months to solve has how to attach the soft aluminum mesh to the steel cables that carried it in such a way that would allow free rotation so as not to transfer load as would happen with a simple crimped connection. In the end the mesh was connected to edge-stiffeners that were then fixed to the cables by stainless steel links at regular intervals.[53] Fuller, on the other hand, was responding to the apprehension Newby experienced when discovering that the exposed nuts and bolts of the main fixing plates at the base of each tetrahedral were not stainless steel as specified and therefore subject to corrosion. Newby also expressed anxiety to Price over the fractures in and misalignments of the mesh due to which he felt the project would be found wanting.[54] Non-structural elements, such as the insufficiencies of the water pump, regularly postponed the completion date.

The experimental form of this tension cable structure began with the consideration of "crystalline network forms with a minimum number of anti-flutter cable intersections" that would allow for maximum free flight for the birds.[55] An investigation of the possible configurations of cable networks followed that were carried by a supporting framework that by necessity cantilevered from the ground. Because of their special interest in tensegrity, Price and Newby focused on the options where suspended compression members also acted as vertical cantilevers. Physical models were built to finalize the design and then a computer model—far from the norm in 1961—was used to check for unexpected deformations and stresses of the framework.[56] The pair was particularly interested in the deflection of tension cables under load. Price explained: "As the long span cables are attached to a vertical cantilever in the case of the aviary their ends move inwards due to the deflection of the cantilever and in so doing increase the deflection of the cables, so reducing their tension… the whole acts as a spring."[57] As built, pretensioned steel cables sheathed in plastic carried a mesh skin of black, anodized, and welded aluminum netting. The cables supported an unequal pair of tetrahedrons made of aluminum tubes that measure one foot in diameter at either end. Each pair flanked fifty-four-foot, diagonal aluminum shear legs (two feet in diameter) that fixed the skeleton in place. All connections were hinged or pinned to allow for movement. In all, the mesh enclosed an unobstructed volume of 150 by 63 feet in plan that dropped 22 feet across the short axis, with a height of 80 feet at its highest points.

The cage, itself a system of equilibrium, maintained through a variety of controls produced an ecological system within a larger system of controlled environments, the London Zoo, itself being part of a larger urban organism. In this sense, the aviary was a system through which the many independent systems, including architectural technology, biological function,

ecological milieu and zoological criteria, were unified. The aviary was the machine by which all these systems were able to come together. The zoo, albeit unwittingly, had commissioned not an envelope but an environment that aspired to change with and foster engagement. Architecture played a role akin to the one that the natural environment performed for White as a series of influences rather than objects. Ecologies, though, are the products of duration; zoological pavilions do not have that luxury. Instead of time, they have architecture as Price defined it: "that which, through natural distortion of time, place and interval, creates beneficial social conditions that hitherto were considered impossible."[58] Thus architecture was an environmental intervention that allowed for the self-organizing system of the constructed habitat to adapt with the architect as orchestrator of the fields of information that must be synthesized. For Price this role included the cultivation of all levels of information, including those in which the process would register publicly. The aviary, with its figurehead of a playboy married into royalty, insured access to the popular as well as professional media to which Price provided calculated leaks—thus his characteristically extreme reactions to any press that he did not authorize. The composition of the design team also allowed for a blurred stance on authorship, with the emphasis often shifting in relation to the venue in which it was announced. Even the official title, waffling as it did between the Snowdon and Northern Aviary, remained fuzzy. These fluid components suited the form of the object too, which for all its orchestration existed in the mind's eye as components that eluded coherence—a feature that is especially clear when looking at the propositions for the Fun Palace or Potteries Thinkbelt in which the work truly does not have a final form.[59]

The notion of architecture not a set of forms, but as a technological procedure came to Price via a particular interest that he took in the organizational methodology of what became

known as second-order cybernetics—the study of systems that study systems. Cybernetics as a discipline was concerned from the outset with the steering of information in biological, social and mechanical systems. It was a tool that enabled the kind of interdisciplinary discourse Price was after by providing a shared language through which to interpret the constraints imposed by disciplinary models.[60] Price's introduction to cybernetic thinking came to him via lectures delivered at the Architectural Association as did his introduction to dynamic structures and modernism, in this case by the cyberneticist Gordon Pask.

Pask collaborated with Price on the Fun Palace project during the years that the Aviary was underway and was a frequent visitor to Price's office. Unlike many of his colleagues for whom cybernetics was a conduit for the movement of mathematical data, for Pask it was a communications focused discipline that cut "across the entrenched departments of natural science; the sky, the earth, the animals and the plants."[61] Within this encompassing view, Pask was explicit in defining the architect as a mediator of systems.

One of the hallmarks of the work of Pask and his likeminded colleagues was that they sought to define information not as a quantifiable entity, but instead as a kind of energy whose perturbations qualitatively registered in a subject.[62] If first order cyberneticists emphasized the production and observation of adaptive simulacra as a means for understanding adaptive systems, for those who became known as cyberneticists of the second order the observer was also considered a system, whose interactions with cybernetic objects was itself subject to investigation [LA1]. In other words, systems were observing systems. There were no observer-to-object relationships but only system-to-system ones.

Systems, if they are truly self-organizing and able to accommodate complexity, always expand unexpectedly beyond the initial frame of reference. Even the author of the policy

memorandum on bird collections had acknowledged as much, noting that the ledges and holes of the cliff could only "meet the known requirements."[63] In the methodology of Price, observers and their unpredictability always provide the "noisy data," over which the system has no predictive powers. Indeterminacy and enabling, two terms associated in the architectural literature with Price, are also tied to second-order cybernetic theory in which underspecified systems require the engagement of observers to complete them. As Price said when remarking on the aviary in a lecture entitled "Technology is the answer, but what is the question:" "Increasingly architecture must be concerned with mixing unknown emotions and responses, or at least enabling such unknowns to work together happily. It is beyond the art of the behavioural scientist to predict all the reactions of the users, whether they be human or animal, within any particular structure. Therefore architecture must be sufficiently accurate to enable this element of doubt and change to be contained."[64] Habitat for Price was not a replica of place but a site that harbored the interactions of all shades of participant, not just the human patterns of association championed by the Smithsons.[65] As such, Price was essentially unconcerned with aesthetic cohesiveness because meaning for him did not reside in the qualities of an object per se, but was continually constructed through the varied perceptions of those who engage it. The work was left open to be completed by its users. Thus the abstraction of the "natural" features of the habitat was not a formalist gesture but part of a framework which allows interaction to happen. Cliff, ramp, plants and cage represent no particular known or imagined habitat but a habitat waiting to be.

"Gilbert White," wrote Virginia Woolf at the start of her essay, *White's Selborne*, was "talking, of course, about birds."[66] White had been speaking of the "somewhat" through which

genera could be identified at first sight; Woolf was wondering the same with regard to the author. Though she wrote splendidly of the obsession to confirm the migration of tiny swallows from Africa across thousands of miles of ocean from Africa to settle in the eaves of the Selborne houses, as well as of the birdsong magnified in the quiet air of this remote country, what really fascinated Woolf was the unpredictability of "this very fine specimen of the eighteenth century naturalist." White would have appeared an easy target to categorize, this sedentary man in his fixed habitat year after year—and yet by the end of the essay, Woolf concluded, "just as we think to have got him named he moves."[67] White, it would seem, did not even sit still enough for a portrait. "That is why perhaps he escapes identification," Woolf mused. "But his own description fits him best. 'The kestrel,' he says, 'has a peculiar mode of hanging in the air in one place, his wings all the time being briskly agitated."[68] As was the case with the captive kestrels that hovered still in the aviary air over the humans as they migrated through, White kept to the same physical location and yet was never the same twice.

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[1] Frederick Busch, "Bring Your Friends to the Zoo," *The Iowa Review*, vol. 5, no. 1 (Winter, 1974), p. 33.

[2] See, for example, Nora Barlow, ed., *Darwin's Ornithological Notes* (London: Bulletin of the British Museum Historical Series, 1963).

[3] Edmund Selous, *Bird Watching* (London: JM Dent & Co, 1901). The very title of this book, with the emphasis on watching rather than shooting was pointed, though the elaborate and poetic descriptiveness of the daily behaviors of birds was the point. Similar observations can be made about Henry Eliot Howard in *The British Warblers: A History with Problems of Their Lives* (London: RH Porter, 1907-14) or *An Introduction to the Study of Bird Behavior* (Cambridge, UK: Cambridge University Press, 1929).

[4] Henry Eliot Howard, *Territory in Bird Life* (London: John Murray, 1920). Territory ensures, as Howard explains, orders the whole system of community because it is crucial in the pairing of birds for the purposes of reproduction and ensuring all physical needs, such as food.

[5] Huxley's seminal paper was "The Courtship Habits of the Great Crested Grebe," *Proceedings of the Zoological Society*, no. 35 (1914), pp. 95-97.

[6] As catalogued after his demise and before its dispersal by Eleanor Bron and Samantha Hardingham, eds, *Cedric Price Retriever* (London: Institute of International Visual Arts, 2006), p. 49. Price collected many books about diverse aspects of English history, a subject in which he was well versed.

[7] *Natural History* has been positioned as a pioneering text of the ecological movement. For prominent examples, see the leading quote of Charles Elton's classic text on *Animal Ecology* (London: Sidgwick and Jackson, 1927) as well as the first chapter of the classic text by Donald Worster, *Nature's Economy: The Roots of Ecology* (San Francisco: Sierra Club, 1977) pp. 2-55. Also see Rashleigh Holt-White, *The Life and Letters of Gilbert White* (New York: E. P. Dutton & Company, 1901), p. 286.

[8] Gilbert White, *The Natural History and Antiquities of Selborne* (Menston, England: Scolar Press Limited, 1970), pp. iii - v.

[9] White, *Natural History*, pp. 190-91.

[10] Martha Adams Bohrer, "Tales of Locale: The Natural History of Selborne and Castle Rackrent," *Modern Philology*, vol. 100, no. 3 (February, 2003), p. 403.

[11] R.I.C. Spearman, "The Reverend Gilbert White (1720 – 1793) His Contemporaries and Successors," *The Linnean*, volume 19 (2 April 2003), p. 37.

[12] For more on this, see Tobias Menely, "Traveling in Place: Gilbert White's Cosmopolitan Parochialism," *Eighteenth-Century Life*, vol. 28, no. 3 (Fall 2004), pp. 46-65.

[13] As Raffles conceived them, the collections of the London Zoological Gardens were intended scientifically to trump those at the first such institution, the *Jardin des Plantes* in Paris. When the Society was forced for fiscal reasons to open its doors to a paying public in 1847, the institution expanded its educational mission and became popularly known as the London Zoo.

[14] At that time, Regent's Park was at the not-quite-urban outskirts of the city

[15] David Hancocks, *A Different Nature: The Paradoxical World of Zoos and Their Uncertain Future* (Berkeley and Los Angeles: University of California Press, 2001), p. 43.

[16] Chalmers Mitchell had been particularly inspired by the work of Leonard Hill, who published the results of the studies that he had conducted with Argyll Campbell in an accessible form as *Health and Environment*, NY: Longmans, Green & Co; London: Edward Arnold & Co, 1925. For an outline of the origins of heliotherapy with some discussion of its relevance to architecture, see RA Hobday, "Sunlight Therapy and Solar Architecture," *Medical History*, vol. 41, no. 4 (October 1997), pp. 455-472.

[17] Chalmers Mitchell instituted routine pathology reports and had the maintenance staff trained in ventilation, cleaning and disinfection of cages.

[18] Lubetkin had come to hear that the newly arrived gorillas were living in a disused lemur house and pitched the job to the Superintendent, Geoffrey Vevers, who directed the request to Chalmers Mitchell. Through the connections of Godfrey Samuel, Lubetkin met Solly Zuckerman, then a research anatomist at the Zoological Society who would later serve as Secretary (1955-77) who mentioned the situation of the gorillas.

[19] There was a heliotherapy clinic in the *Cité Industrielle* of 1917 by Tony Garnier to which Le Corbusier in his writing on and design for the *Unité d'habitation* is indebted as has been well documented. Heliotherapy and ventilation became part of mainstream attention in Britain as part of the RIBA report on *The Orientation of Buildings* of 1933.

[20] John Allan, *Berthold Lubetkin, Architecture and the Tradition of Progress* (London: RIBA Publications, 1992), p. 204.

[21] Peder Anker, *From Bauhaus to Ecohouse: A History of Ecological Design* (Baton Rouge: Louisiana State University Press, 2010) pp. 9-23.

[22] Sir Landsborough Thomson, Memorandum on "Future Policy on Bird Collections," 22 September 1960, Zoological Society Archives, London.

[23] Visibility of the specimens under the existing conditions was also criticized and it was proposed that the Great Aviary of 1888 be amended, "to allow the public inside the cage" given "the provision of suitable 'locks' for human entrance and egress, plus a central path with low rails." Thomson, "Future Policy on Bird Collections," 22 September 1960.

[24] Appendix to "Future Policy on Bird Collections," 22 September 1960, Zoological Society Archive, London.

[25] Appendix to "Future Policy on Bird Collections," 22 September, 1960.

[26] Snowdon was best known for capturing the spirit of London in the sixties through intimate portraits of artists, writers, actors, and designers. His brother-in-law, the Duke of Edinburgh and the president of the Zoological Society, recommended him for the job.

[27] Coincidentally or not, Price had designed an "aviary in 18th century parkland" as a sketch exercise in 1955 whilst a third-year student at Cambridge. Samantha Hardingham, "Scholar's Choice: Cedric Price's Sketch Design for an Aviary," (2009), www.cca.qc.ca/en/study-centre/830-scholars-choice-cedric-prices-sketch-design-for-an-aviary (accessed 15 September, 2010).

[28] "Engineers and Architects: Newby+Price," *AA Files* no. 27 (Summer 1994), p. 25.

[29] "I liked Samuely's lectures," Price explained, "because he talked about weight, he talked about handling, he talked about movement. He was very much into pre-cast concrete but it didn't matter that it was concrete. He talked about buildings as dynamic structures. It was exciting." ("Engineers and Architects," p. 26) Newby had already collaborated with Konrad Wachsman, Charles Eames, Eero Saarinen and James Stirling. He also participated with Sandy Wilson, Peter Carter and the sculptor Robert Adams in the "This is Tomorrow" exhibition held at the Whitechapel Gallery in 1956.

[30] Price had collaborated with Fuller in the late fifties on a design for an auditorium, which would extend the geodesic radome system to the program of concerts. The design, known as the Claverton Dome, was never built. Newby would also consult with Fuller on details regarding the anchoring of the tie down plates.

[31] Minutes for the "Working Party on Future Policy on Bird Collections," 6 April 1961, Zoological Society Archives, London; Stephen Mullin, "Cedric Price: 1934-2003," *Architectural Research Quarterly*, vol. 7, no. 2 (2003), p. 113.

[32] "Working Party on Future Policy on Bird Collections," 6 April 1961, Zoological Society Archives, London.

[33] Controller Major-General CJG Dalton to Cedric Price, 6 December 1961, Snowdon Aviary Papers, Zoological Society Archive, London.

[34] Cedric Price, "Northern Aviary, London Zoo," *Architectural Design*, volume 35 (September 1965), p. 452.

[35] Jon Charles Coe, "Towards a Co-Evolution of Zoos, Aquariums and Natural History Museums," *AAZPA 1986 Annual Conference Proceedings*, (West Virginia: American Association of Zoological Parks and Aquariums, Wheeling, 1986), pp. 366-376.

[36] Minutes for the "Working Party on Future Policy on Bird Collections," 20 September 1961, Zoological Society Archives, London.

[37] "Working Party on Future Policy on Bird Collections," 6 April 1961

[38] Excerpts from letters and memoranda pertaining to this issue were compiled as a confidential document entitled "Extracts from correspondence, etc. in Zoo files, about Rockwork," 23 September, 1963. The debate continued, as exemplified in a series of letters, including Cedric Price to Sir Solly Zuckerman, November 3 1966; Dalton to Price, 21 March 1966; response of Cedric Price to CJG Dalton, undated; CJG Dalton to Cedric Price, 28 March 1966, Snowdon Aviary Papers, London Zoological Society Archives, London.

[39] "Working Party on Future Policy on Bird Collections," 6 April 1961, London Zoological Society Archives, London.

[40] Controller Major-General CJG Dalton to Price, 5 November 1962, box DR 1995 0185:275 (2/4), Cedric Price Archive, Canadian Centre for Architecture, Montreal.

[41] Sir Hugh Casson to CJD Dalton, 7 January 1963, Snowdon Aviary Papers, London Zoological Society Archive, London.

[42] "Landscaping," the official story of the zoo building related, was "integrated with the circulation system." Peter Guillery, *The Buildings of the London Zoo* (London: Royal Commission on the Historical Monuments of England, 1993) p. 75.

[43] For example: "There has recently been a frightening outburst of bad taste in zoo designing; fantastically shaped and coloured houses, cages, and aviaries are being planned. I was saddened recently at seeing the ugly and inadequate gibbon cage now being built at the London Zoo (on whose Council I served for many years) and still more so by the project of an aviary—a fussy, ridiculously shaped, 'horned' horror which is not only in bad taste, but impracticable and unsuitable. The principle of a 'walk-in' cage is excellent… But its very principle is that the cage itself is not obvious, so that the visitor who is inside has as much as possible the illusion of walking among free birds. The frame of the aviary must not only be simple and inconspicuous, but also made invisible by trees and creepers. Even its approach should be so planted on the outside that one is not aware that there is a cage at all… We show natural objects which

have themselves a great attraction—they do not require outside help to call the visitors attention." Jean Delacour, "Cage and Aviary Design," *The Avicultural Magazine* (May-June), 1961.

[44] Reyner Banham, "Aviary, London Zoological Gardens," in *A Critic Writes: Essays by Reyner Banham*, ed. Mary Banham (Los Angeles: University of California Press, 1996), pp. 119–121. First published in *Architectural Review*, no. 138 (September 1965), p. 186.

[45] See for example the PR for the Lynx machines by British Oxygen to be used for the "Biggest aluminum welding jobs ever undertaken (apart from shipyard work) in the United Kingdom." Draft for "Lynx Joins an Aviary," 29 March, 1963, box DR 1995 0185:275 (2/4), Cedric Price Archive, Canadian Center for Architecture, Montreal. For Newby's recollection of the design process, see "Engineers and Architects: Newby+Price," pp. 28–30.

[46] Confidential Memorandum from CJG Dalton to Zuckerman, 5 September 1962, Snowdon Aviary Papers, London Zoological Society Archives, London.

[47] CJG Dalton to Miles D. Price, Technical Director of Rentokil Laboratories Ltd; MD Price to Dalton, 24 April 1963, Snowdon Aviary Papers, London Zoological Society Archives, London.

[48] "Bird's Nest Robberies Leave Zoo with Egg on its Face," *Tri City Herald*, November 28, 1972.

[49] Minutes of the "Working Party on Future Policy for Bird Collections," 16 December 1964, London Zoological Society, London.

[50] Buckminster Fuller to Frank Newby, box DR 1995 0185:275 (3/4), Cedric Price Archive, Canadian Centre for Architecture, Montreal.

[51] Will Alsop, "Flight of Fancy," *The Guardian*, Saturday, 18 June 2005, www.guardian.co.uk/artanddesign/2005/jun/18/architecture (accessed September 15, 2010).

[52] Fuller to Newby.

[53] "Architects and Engineers: Price+Newby," p. 30

[54] Frank Newby to Price, 24 March 1964, box DR 1995 0185:275 (3/4), Cedric Price Archive, Canadian Center for Architecture, Montreal.

[55] *Architectural Design*, vol. 35 (September 1965), p. 454.

[56] Indeed the computational analysis revealed that two cables would come into some compression and thus need to be pretensioned to carry it.

[57] *Architectural Design*, vol. 35 (September 1965), p. 454.

[58] "Technology is the answer, but what is the question," Pidgeon Audio Visual, World Microfilms distributors, 1979.

[59] Omar Khan and Philip Bessley, *Situated Technologies Pamphlets 4: Responsive Architecture, Performing Instruments*, (New York: Architecture League of New York, 2009), http://www.situatedtechnologies.net/files/presentations/khan_mod.mp4 and http://www.situatedtechnologies.net/?q=node/97 (accessed 15 September, 2010)

[60] For further elaboration, see Bernard Scott, "Second-order Cybernetics: an Historical Introduction," *Kybernetes*, vol. 33, no. 9/10 (2004), pp. 1365-1378.

[61] Gordon Pask, *An Approach to Cybernetics* (London: Hutchinson, 1961), p. 11

[62] Bernard Scott, "Second-order Cybernetics," pp. 1365-1378.

[63] Appendix to the "Future policy on Bird Collections," 22 September 1960.

[64] "Technology is the answer, but what is the question," Pidgeon Audio Visual, World Microfilms distributors, 1979.

[65] By the 9th meeting of CIAM in 1953, institutional modernism under the leadership of Le Corbusier was also making its own version of this shift with the proposal to replace the Charter of Athens with a Charter of Habitat. It was at this meeting that Peter and Alison Smithson engaged the concept of the habitat through the negotiation of identity through scalar levels of social interaction. "The Habitat: Problem of Inter-Relationships" was set as the theme of the tenth and final CIAM under their leadership.[65] The dominance of the Smithsons on the London architectural scene throughout the fifties, reinforced through the curriculum of the Architectural Association, is well known, as is the tale of how the pub that Price designed for his fifth year thesis project so infuriated Peter Smithson that he stormed out of the review.

[66] Virginia Woolf, "White's Selborne," in *The Captain's Death Bed and Other Essays* (London: Hogarth Press, 1950), p. 19.

[67] Woolf, "White's Selborne," p. 23.

[68] Woolf, "White's Selborne," p. 23.