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architecture

A gorilla and chimpanzee exhibit at the University of Ibadan Zoo

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In 1967 I was faced with the problem of providing new accommodation for our pair of young Lowland gorillas and trio of chimpanzees. Up to that time the animals had been kept in old, medium-sized cages attached to a building scheduled for demolition, but they were now growing rapidly and it was imperative to provide larger, more hygienic housing as soon as possible. The main problem lay in the design of the outside accommodation. I wanted to provide as large an area as possible for each group of apes in order to maintain the animals in satisfactory physical and mental health.

The first possibility was to produce traditional barred, completely enclosed cages but I quickly rejected this idea because, when costed, it became clear that such structures would be comparatively expensive in relation to the ground area covered. In any case cages of this kind appear most unsightly and greatly reduce the display value of the animals.

Another possibility was some form of high, unclimbable wall, either built from ground level or sunk into the ground in the form of a dry moat. I came to the conclusion, however, that in the West African climate the amount of heat and light reflected from such large areas of bare concrete and stone would be unbearable, both to the apes and to the visitors. It might have been possible to reduce this reflection by erecting a high roof of some kind or by planting shade-giving trees outside the compounds; however, the roof would have been too expensive and, with regard to trees, extensive shade could be provided only by tall trees with overhanging branches. The danger of these falling across the wall or moat in one of the violent storms of the rainy season would have been too great.

Somewhat reluctantly I came to the conclusion that the answer to the problem was a water-filled moat. I was reluctant for two reasons; first, there had already been accidents in other zoos involving all three species of great apes when animals had entered the water for one reason or another and drowned, and secondly, because our two gorillas had already shown signs of positively enjoying water. On hot days they loved nothing more than to be drenched with water from the hose pipe, becoming very excited and boisterous in the process, although I had noticed that our chimpanzees carefully avoided bodily contact with water at all times.

Apart from outside compounds, it was clearly necessary to provide adequate indoor accommodation for the apes. Such accommodation would also provide additional compartments into which each group of animals could be shut in order to facilitate easy cleaning and maintenance. Thus, although the main point of this article is to describe the moat surrounding the outside compounds, I will first describe briefly the building containing the indoor cages, which in any case was the first stage of the project to be completed.

This building is 36·5 × 9 m (120 × 30 ft), the wall along one (long) side being 5·5 m (18 ft) high and forming on the outside one of the boundaries to the adjacent outside compounds as well as being an integral part of the building itself. For this reason this wall is faced with attractive stone on the exterior. The roof of the building is of corrugated aluminium alloy; it is raised a little above the 5·5 m (18 ft) high wall to allow good air flow and slopes down to about 1·5 m (5 ft) to the other side for rainwater run-off. There is also an air space between the top of this wall and the roof. The building is divided functionally into two – one half for gorillas and the other for chimpanzees – and two pairs of cages measuring 4·6 × 4·6 × 4·6 m (15 × 15 × 15 ft) are built against the inner side of the 5·5 m (18 ft) high wall, a pair for each group of animals. Each cage has smooth, rendered block side walls with the front and top of round metal bars. The floors are of smooth, rendered concrete. The fronts of the

cages face the lower or rear side of the building which has numerous windows. In front of the cages the floor drops by 56 cm (22 in) so that when necessary the animals may be viewed easily from behind a barrier rail set 2·4 m (8 ft) from the cage fronts. It is not intended, however, to allow the general public to enter this building.

Access by the keepers to each indoor cage is via a small safety chamber. After entering the chamber the keeper locks a door behind him before opening the sliding door to the cage itself. There are three such chambers, one in the centre between the two pairs of cages and one at each end leading to the outer cage of each pair. The centre chamber also connects the two inner cages of each pair and if necessary allows the transfer of animals from one pair of cages to the other. From each of the two end chambers another keeper's door leads through the 5·5 m (18 ft) high wall directly to the adjacent outside compounds. Each of the four cages also has a sliding door through this wall into the compounds, each door

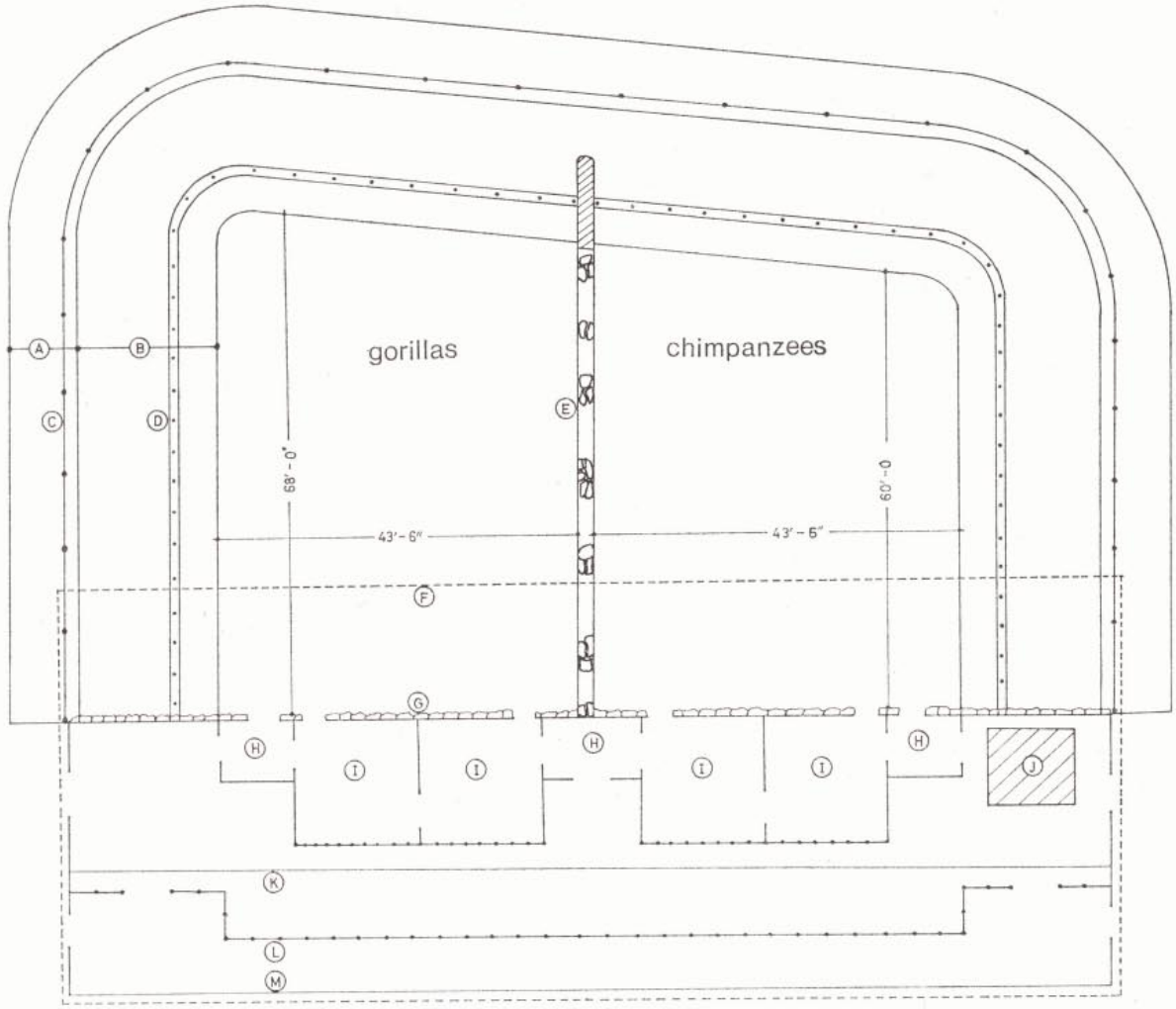

Figure 1. Ground plan of the gorilla and chimpanzee exhibit at the University of Ibadan Zoo.

A. Visitors' viewing path
B. Moat
C. Visitors' safety rail
D. Wall along floor of moat 30 cm (12 in) high supporting underwater rails and electrified wire
E. Stone-faced wall 5·5 m (18 ft) high, rendered at end to eliminate finger holds
F. Roof of building projecting 4·6 m (15 ft) over compounds to provide shelter from sun and rain
G. Wall of building 5·5 m (18 ft) high, stone-faced on exterior
H. Safety chambers
I. Indoor cages
J. Pumping and filtering equipment
K. Floor level falls 58 cm (22 in) to observation area
L. Observers' safety rail
M. Rear wall of building with numerous windows.

being operated by a keeper from one of the safety chambers.

At one end of the building is housed the pumping and filtering equipment for treatment of the water in the moat outside, and at the other end will be built a kitchen or perhaps additional cages.

The layout of the outside compounds is basically simple. A concrete moat is built with each end against opposite exterior ends of the 5·5 m (18 ft) high wall of the building, and forms the perimeter of the compounds. A 5·5 m (18 ft) high, stone-faced wall is built out at right angles from the centre of the outer wall of the building and is carried forward to meet the moat. Due to the relative positions of other existing buildings, the compounds are slightly unequal in size as can be seen in Figure 1.

In order to provide a certain amount of cover from the sun and rain the roof of the building is continued forward and slightly upwards over the compounds for a distance of 4·6 m (15 ft). This roof extension also shades the wall beneath from the sun, thus eliminating much potential heat and light reflection.

It seemed necessary to divide the moat into two sections, with the section on the animals' side separated from the remainder in such a way that if the apes entered the water, either deliberately or accidentally, they would be prevented from rolling across into deeper water and would be able to scramble back to safety easily. On the other hand, it also seemed important to have the section accessible to the animals sufficiently deep and wide to maintain their respect for water even if, as I suspected might happen in the case of the gorillas, the animals became accustomed to it and entered deliberately. Thus, if this latter situation developed, I hoped to minimise any desire on the part of the apes to cross to the other, deeper section. The wider, deeper section on the visitors' side was a necessity in case the animals, when adult, did somehow manage to cross from the near section. I considered it preferable to have a drowned gorilla to an escaped gorilla, especially in such a densely populated area.

The floor of the moat was therefore designed to slope down fairly steeply from the inner side to a horizontal distance of 1·4 m (4½ ft). At that point a 30 cm (12 in) high wall is built along the floor of the moat, parallel with the sides, into which are concreted a series of uprights supporting three horizontal underwater rails. The uprights and rails are made from 3·1 cm (1½ in) galvanised tube, and are welded together. The water at this (deepest) part of the section available to the animals is 1·06 m (3½ ft) deep if the moat is full. Should one of the apes find itself in difficulty here, the 30 cm (12 in) wall prevents the feet and legs of the animal from slipping under the bottom rail, and provides a firm base against which it can thrust with its feet to gain dry land. The rails, as well as acting as a barrier, also provide firm hand holds. The moat floor, from the inner edge to the wall and rails, has a roughened surface to prevent the animals from slipping and also has two 3·1 cm (1½ in) high raised ridges running parallel with the edge to provide additional finger and foot holds.

To prevent the apes passing over the top rail and into the deeper water on the other side a series of vertical metal rods were welded to the rails. The upper ends were twisted into a circular shape and covered with insulating material and a long length of bare wire threaded along the entire length of the moat. With the ends firmly fixed, the wire was suspended about 25 cm (10 in) above the top underwater rail and about 20 cm (8 in) above the maximum water level. One end of the wire was connected to an apparatus designed to operate an electric cattle fence. This is powered from a car battery and passes an intermittent pulse along the wire at the rate of about one per second.

From the wall and rails the moat floor slopes down rather less steeply to the far (visitors') side and unlike the inner section the surface is of smooth, rendered concrete. With the moat full the water depth at this side is 1·98 m (6½ ft). The outer wall of the moat is raised a further 60 cm (2 ft) to bring it to the level of the visitors' path, which is thus raised above the level of the compounds for improved viewing.

Our three chimpanzees (one male and two females) and pair of gorillas were finally released from the building into the completed compounds in March 1970. I anticipated that the animals, particularly the chimpanzees, would be somewhat excited when first released and might behave erratically. I therefore adjusted the water level in the moat so that in the inner section it was only a few inches deep. This also gave the animals

easier access to the electrified wire which I wanted them to experience for its unpleasant properties as early as possible.

When the adult male chimpanzee emerged for the first time into the compound he was in a highly excited and aggressive state with all his body hair erect. He walked around the compound briefly, then went down the side of the moat into the shallow water and grasped the wire, obviously with the intention of climbing over. He immediately received a shock, screamed, and then retreated with his body hair rapidly subsiding. He looked up at me in such a way that I knew he wanted to be held and comforted. He again tried to cross the wire, apparently in an attempt to reach me (although of course this would have been impossible because of the deeper water on the other side), and again received a shock which evoked another loud scream. This happened perhaps six times in the space of a few minutes, after which he rushed back, still screaming, to the far corner of the compound where he sat motionless for a long period. From that day on, whatever the depth of the water, he has never attempted to leave the edge of the moat.

The two young female chimpanzees were more cautious in their initial explorations but each nevertheless soon touched the wire and received a shock. They, too, have never since attempted to leave the edge of the moat although one of them very occasionally stands with her feet and ankles in the shallow water at the edge itself, carefully holding on to the raised concrete kerb all the time. There can be little doubt that all three chimpanzees remember these unpleasant incidents of the first day, but apart from this they have also kept their basic dislike of water, and except for the rare occasions just mentioned have never bodily entered the moat deliberately or accidentally. Even if one of them were to fall in accidentally I am convinced that it could either scramble back or hold on to the underwater rails and stand up with its head above water.

The gorillas, when released, were also initially cautious and moved around their compound inspecting their new surroundings with great deliberation. Their self-confidence soon increased however, as did their chest-beating, and eventually both climbed down into the moat and grasped the wire. The reaction of the female was to retreat immediately, accompanied by a low whimper and frequent puzzled glances over her

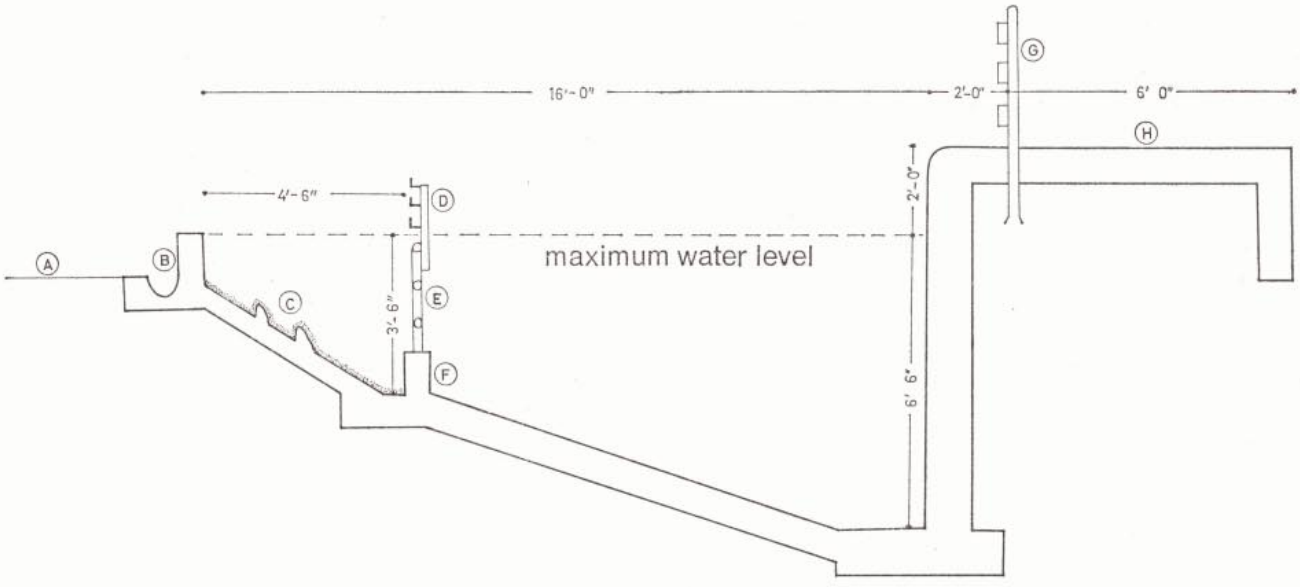

Figure 2. Cross section of moat of the gorilla and chimpanzee exhibit at the University of Ibadan Zoo.

A. Level of ape compounds
B. Gutter, draining compounds and moat
C. Moat floor, inner section, with roughened surface and two 2 cm (1½ in) raised finger holds
D. Support with three insulated hooks for electrified wire barrier
E. Support with three underwater rails
F. Wall 30 cm (12 in) high
G. Visitors' safety rail
H. Visitors' viewing path.

shoulder at the wire. She has since done her utmost to avoid contact with the wire and has certainly made no attempt whatsoever to cross from the inner moat section.

The reaction of the male, on receiving a shock, was to screw up his face and duck as though he had been attacked from above. He climbed back to the moat edge and moved around there, sitting down frequently and staring at the wire. After a few minutes he again went down and reached out and then withdrew his hand several times before his fingers eventually made contact with the wire and he received another shock. Again he ducked and retreated, and after a few more stares renewed his inspection of the compound.

I maintained the low water level for some days, with a keeper on constant watch and then, after the moat had been emptied for a structural inspection, it was finally filled to near the maximum water level. As I have said, the chimpanzees have presented no problem whatever, although as a precaution a keeper is permanently employed to watch both groups of animals at all times.

A development of great interest, however, occurred with regard to the gorillas. Within a few days of having access to the maximum water depth in the inner moat section, both animals were entering the water with tremendous enthusiasm. They sat on the bottom of the moat with the water up to their chins, always taking care not to submerge their faces below the surface. As their confidence increased they began to beat at the water with their hands, delighting in the variety of noises that could be thus produced and standing up frequently, with water pouring off their bodies, to beat their chests violently and then submerge again. With the water up to their necks they were, of course, very buoyant and soon they began to propel themselves along in a sitting position – their faces just above water – by pushing their hands and feet against the underwater rails and moat bottom. They took great pains to avoid the electrified wire, soon becoming adept at moving along the moat with just 5 to 8 cm (2–3 in) separating them from it. Their prowess in the water developed rapidly and it was only a week or so before the male was able to launch himself with a kick from the moat bottom, travelling several feet in a horizontal 'breast stroke' position with arms out straight in front of him, before slowing down and kicking out from the moat bottom again. He also launched himself by pulling with his hands against the underwater rails.

Both animals soon learned to run across the compound and either leap diagonally into the water in a tremendous belly-flop or twist around at the last minute and plunge in backwards, all the time being careful not to submerge their faces. They took turns in chasing each other along the edge of the moat, the one behind attempting to push the other into the water.

Within a few days of being outside, the male gorilla discovered that by lying flat on his stomach he could squeeze sideways between the top rail and the electrified wire without touching the latter. Further, he developed a technique of squeezing between the top and centre underwater rails by carefully passing first his legs then his body between the rails and moving across until only his head was left above water. Then very quickly he pulled his head under the water and between the rails to the other side, grimacing furiously on surfacing. Having crossed to the deeper section by one method or the other he then walked sideways up and down the moat, hanging on to the top rail as he did so. He was able to regain the inner section by jumping clumsily back into it from the top rail at the bend of the moat, where the electrified wire ran somewhat inside the curve of the rail instead of being directly above it.

Both methods of crossing the barrier were easily stopped, however. Alternate rods supporting the electrified wire were removed and replaced by another set of supports consisting of lengths of 2·5 cm (1 in) galvanised tube projecting above the maximum water level to a height of 45 cm (18 in). Three hooks were welded to each new support and it was thus possible to suspend three wires one above the other with a narrower space between the bottom one and the top underwater rail. Despite attempts to cross this new electrified barrier, the male gorilla was unable to do so and he soon showed no further interest in the matter.

To stop him from passing underwater between the rails, lengths of wire rope were woven criss-cross fashion across the spaces. These have now been removed as the animal has grown too big to pass through.

At the time of writing (June 1971) the compounds have been in daily operation for over a

year. Indian almond trees *Terminalia catappa* have been planted around the edge of the visitors' path, and although these trees will have to be kept trimmed they will soon provide shade for the visitors and eliminate reflected glare from the concrete path. Tubular metal scaffolding and wooden platforms have been erected in the compounds and these provide adequate opportunity for climbing. All the apes are in good health and we are fortunate to be able to call upon the services of the University's Department of Veterinary Medicine at all times.

The major fascination continues to be the gorillas' astonishing use of water, and there is no doubt that the availability of this medium has added a whole new dimension to their activities. They are regularly inspected and appear to have suffered no ill effects from their frequent contact with water. At first I thought that perhaps the animals' skins might be affected in some way but so far my fears have been proved groundless. Another possibility was that the water would be effective in harbouring and passing on unusual levels of bacterial and parasitic infections but indications to date are to the contrary, although there is yet time for further evidence. The moat water is filtered and lightly chlorinated and this treatment appears to be adequate. It also keeps the water crystal clear and aesthetically pleasing. Yet another fear was that the gorillas would become chilled; but they appear able to judge the situation perfectly well, and on cool days and during much of the rainy season they enter the water less frequently than on warm days. The development of colds is now a rarity compared with the period when the animals had no access to adequate outdoor exercise.

When the animals breed and small infants are present in the compounds it may be necessary to adjust the water level or carry out certain modifications. However, for the time being we have solved most, if not all, of the problems both envisaged and encountered and have created an exhibit that has not only attracted great interest but which I believe will result in the satisfactory development of both groups of apes.