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New Asiatic primate grotto at Miami Monkey Jungle

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INTRODUCTION

At the Miami Monkey Jungle, our primary speciality is semi-free ranging social units of primates in naturalistic environments (Du Mond, 1967). While this may be practical for most simian primates it is not for the larger anthropoid apes, such as the orang-utan *Pongo pygmaeus*, unless a very large area can be given to them. Aside from the vastly greater ranging habits of this species, the major problem is its nest-building propensity. Each animal builds at least one tree nest a day, inflicting major damage on the tree in which it is constructed. It is not hard to visualise how several orang-utans would rapidly destroy the jungle unless it were a very large area.

Our aim in this project was to create, in a relatively small area, the most stimulating environment possible for these notoriously sluggish apes. One which, while wholly artificial, was designed with primary consideration given to the kind of environment in which the animal spends its life, and to the peculiar behavioural, locomotor, and anatomical characteristics of this vanishing ape. How many elements of their natural environment might be incorporated into a small area of 15·3 × 15·3 m (50 × 50 ft)? What might be done in this area to stimulate interest, not only to the ape inhabitants, but also for the viewing public, who are also worthy of consideration in a public exhibit? Obviously, interested and active animals are far more interesting to watch than sleeping hulks, which adult orang-utans frequently are.

ELEMENTS IN THE DESIGN

A moated grotto type of exhibit was selected, but one somewhat more sophisticated than the usual simulated boulder motif seen in most zoos. Since orang-utans are almost totally arboreal in the wild state, we planned to include a simulated arboreal network of concrete trees and limbs extensive enough to permit the orang-utans really to live 'off the ground'.

It was felt that a more stimulating environment might be provided if several other Asiatic primates were included in the exhibit. Davenport (1967) observed gibbons *Hylobates moloch* avoiding orang-utans in Sabah, but did not observe any truly agonistic interactions between them, while Red leaf monkeys *Presbytis rubicunda* were seen to feed in the same trees with orang-utans. Bernstein (1967) observed lutongs *Presbytis obscura* and gibbons *Hylobates lar* feeding in the same trees with no observed agonistic or competitive interactions, and, indeed, one gibbon family was apparently partially integrated with a group of *Presbytis melalophos*. Bearing in mind these observations from the field, and the facts that the orang-utan is not known as a predator, is much slower than the more agile gibbons or leaf monkeys, and that these three taxa are sufficiently distinct phylogenetically to prevent socio-sexual competition, it was felt likely that they would live together compatibly in the same area. This would be an interesting and natural combination of Asiatic primates, in which the animals would provide a stimulating setting for each other. A comprehensive study of the suspensory locomotor behaviour of primates, including the orang-utan and gibbon, by Durham & Carpenter (in press), was used in designing the arboreal network so that our animals could move about naturally. Further, we decided to incorporate two distinct areas in the network of 'trees', each designed for the comfort and habits of one ape, but not the other, thus tending to keep them apart and minimise fighting.

The lower 'tree' structure was designed with large limbs over 30 cm (12 in) in diameter, and long laterals at spacings which would be most suitable for the orang-utan and its form of locomotion, while the upper tree network consisted of smaller limbs, placed at 1·5 to 2·5 m (4·5–8 ft) spacings, for gibbon brachiation. Shelter areas in the upper level would be constructed so as to be too small for an orang-utan.

CONSTRUCTION DETAILS

A sculptor in concrete, Lewis Van Dercar, was contracted to erect this 9 m (30 ft) tall network and did an excellent job. He had to compromise between the functional aspect, of providing the two specialised environments strong enough to withstand any destructive efforts of a 180 kg (400 lb) orang-utan, and its aesthetic appeal to the visitors. Large masses of simulated foliage were strategically spaced to provide a broken shade texture throughout much of the network. The finished structure was then stained in varying shades of brown and green so as to give it a pleasing naturalistic appearance.

The trees were constructed of solid concrete and steel, then covered with a layer of gunite which was also used on the surface decking and side walls. Gunite was used as it is most practical to apply and, while its surface porosity presents some sanitation problems, it does not present the cold surface smooth concrete does. The sanitation problem has been solved by frequent washing with a fire hose, and by periodically soaking the surface with pine oil which helps to make the concrete water repellent.

Entrances to the heated dens under the deck are concealed behind simulated rock caves. The entrances are studded with 0·95-cm (3-ft) galvanised steel bolts protruding 5 cm (2 in) from the surface. They are spaced far enough apart to permit walking but provide a rather uncomfortable surface should an orang-utan want to lie in the passageway, hidden from view, during the day.

The entrances to the gibbon and leaf monkey dens are too small to permit an orang-utan to gain entry. The animals were conditioned to their respective dens during their quarantine and they have made no attempt subsequently to intrude into each others' dens. The orang-utan dens are in three partitioned sections, each with a sturdy wooden bench for sleeping. The innermost den is larger than the others and has access to the outside. It provides a large enough area to hold an animal for some time, should one become ill or need to be isolated from the others for some reason. The partition doors operate by means of a rack and pinion crank device which is fitted with rachets to prevent the animals from playing with the doors while they are being operated. The small primate dens have open wire mesh bottoms, to permit faeces to fall out of the animal area, and are provided with 8 cm (3 in) diameter pressure treated logs for perches.

The 30 cm (12 in) deep water in the front moat is recirculated through a waterfall which cascades into three natural rock pools as it returns to the moat. This provides drinking water and pools for splashing and play. The natural rock area exposed to soiling is kept to a minimum by making it as nearly vertical as possible. This area is bordered by a 20 cm (8 in) wide gutter to prevent contamination when the main deck area is being hosed down. The entire deck area is constructed so that during hosing refuse is guided to two side drains by means of simulated tree roots and the natural gravity flow of the water.

Side wall heights are 4·5 m (15 ft) above the highest point on the deck, and the same distance away from any part of the concrete trees. Exterior moat wall heights are 4·5 m (15 ft) from the moat bottom while the moat width is the same. These dimensions are similar to those recommended by Crandall (1964). Construction is of steel reinforced poured concrete and concrete block, with all cores poured solid. Each core has a 1·6 cm (0·6 in) steel rod inserted and tied into the foundation and top poured beam. In addition the side walls, which are 7·3 m (23 ft) high, have a 40 cm (15·75 in) poured column every 3 m (10 ft) lengthwise, and a horizontal beam at 2·5 m (8 ft) intervals. Four widely separated feeding stations opening through the side walls were installed, and three other feeding stations, which are serviced by means of a net on a 6·1 m (20 ft) pole, were located in the tree network.

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The Delphinarium at Antwerp Zoo

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Our delphinarium, which was opened to the public on 20 December 1968, is a part of the Jubilee project. This also contains sections for carnivores, including bears, birds of prey and nocturnal animals. There are few dolphinaria situated so far from the sea but our aim has been to house the animals in such a way that they can be properly maintained and that the visitors can watch the animals in all their activities. Since 1945, when the plan of the first building to rise from the post-war ruins of the Antwerp Zoo was worked out, our Society has adopted the procedure of discussing in detail all aspects of a new building with architects, members of the staff and other personnel involved.

The delphinarium consists essentially of five parts.

(1) The section where the dolphins are on view to the public – that is, the main hall with a kidney-shaped tank and a spectators gallery, and a mezzanine floor with viewing ports into the tank.
(2) The training section with two tanks which are connected by a channel with each other and with the main tank.
(3) The quarantine section, which has its own tank which can be completely isolated.
(4) The filter section with duplicate sets of water purifiers in separate rooms so that the water from the quarantine tank can be effectively isolated.
(5) The office-laboratory where the water is checked daily and the data recorded.

As can be imagined, the construction of this building raised a whole host of problems. The necessity of providing the warm salt-water habitat of the dolphins was, however, the main one and both directly and indirectly caused us the most worry. The tanks, which are completely independent of the rest of the building, have been constructed of reinforced concrete which has been made water-tight and salt-proof. Furthermore, to avoid the impression of a swimming pool the walls have been coated with white epoxy resin and not with the traditional faience or glazed tiles. Of course, this epoxy coating has the advantage of forming a watertight layer, thus providing an additional safety factor.

The supply and return pipes between the tanks and the filters have a total length of about 1,000 m (3,280 ft) and diameters varying between 15 and 35 cm (6–14 in). They have been made partly of polyvinylchloride and partly of steel lined with ebonite. The 115 cast-iron Saunders taps and the six filters are also lined with ebonite, so that the entire water purification plant has been made salt-proof.

Heating the water posed considerable problems but we feel that these have been overcome satisfactorily. It has been found desirable to keep the water at a temperature of 18 to 20°C (64–68°F) and this is achieved initially by bringing it to this temperature by means of gas-fired equipment. However, the delphinarium is only a part of the Jubilee project, for which a complete heating unit had to be built. This is a coal-fired unit consisting of two boilers with a capacity of 600,000 Kcal each. These are fed with coal automatically and maintain a temperature in the dolphin rooms of about 21°C (70°F). With this ambient temperature the temperature of the water in the pools remains at an average of 19°C (66°F). The gas-fired plant can therefore be considered a safety measure which need only be brought into operation if the main