

first feed the twins were given was 5 cc of warm water, 80 minutes after removal from the mother. Two and a half hours later they were given 100 cc of warm water containing 9 g of powdered milk. Both chimpanzees urinated 24 hours after birth, following massage of the perineal area. Meconium was discharged 38½ hours after the birth.

The size of the hole in the nipple of the feeding bottle was very important. Too large a hole caused the baby chimpanzees to choke, while too small a nipple made it difficult for them to drink sufficient milk.

MONTHS	KINCHAN ♂	GINCHAN ♂
	kg	kg
6	4	3.9
8	4.8	4.7
10	5.8	5.8

Table 3. Weight increases of twin chimpanzees *Pan troglodytes* born at Kobe Zoo.

'Alvila' - San Diego Zoo's captive-born gorilla

Gorilla g. gorilla

DUANE M. RUMBAUGH

Institute for Comparative Biology and San Diego State College, USA

'Alvila', born at 0958 hours on 3 June 1965, was the first gorilla *Gorilla g. gorilla* to be conceived and born at San Diego Zoo. Her parents, 16-year-old 'Albert' and eight-year-old 'Vila' had both been captive-reared at the zoo from a few months of age.

PREGNANCY AND PARTURITION

Changes in Vila's temperament and behaviour during late January 1965 suggested that she might be pregnant. She became less active while outdoors and, in general, quieter and more withdrawn. She became intolerant of the antics and mauilings of a young male gorilla, 'Trib', whereas previously she had been indulgent with him. During the last few weeks before the birth she was let out alone into the outside enclosure for a few hours in the early morning while the other gorillas remained inside. Before they were due to be let out, Vila would voluntarily return to her own quarters, thus avoiding association with them.

In response to the behavioural changes noted (Nelson, 1965) during January, Dr Lester S. Nelson, the zoo veterinarian, had a sample of Vila's urine gravidex tested for the presence of chorionic gonadotropic hormone (18 February 1965; Obstetrics and Gynecology Department,

US Naval Hospital, Balboa Park). The report was that if the sample were human urine, the female would unquestionably be pregnant. Urine samples collected from two other female gorillas and tested as 'controls' proved negative for pregnancy, indicating that even though the antiserum used in the Gravidex test was designed for detection of human chorionic gonadotropin, it was sensitive to gorilla chorionic gonadotropin as well. Subsequent testing of a second urine sample from Vila substantiated the results of the first test.

During pregnancy Vila's diet consisted of fruits, raw vegetables, *Hibiscus*, *Eugenia*, bamboo, hard-boiled eggs and Monkey Chow (Ralston Purina, St Louis, Mo., USA). Her ration of whole milk was increased to 1.8 litres a day, to supplement calcium, and in addition she was given daily a sweet-flavoured tablet containing 20 mg of iron.

PARTURITION

Shortly before 0800 hours on 3 June a keeper, Kenneth Willingham, reported to the zoo's hospital that birth was probably imminent, for Vila had been lying prone, her knees parallel with her body and her face buried in her open palms.

Delivery occurred within two hours at 0958 hours. It was rapid and without complications. Though the birth itself was not observed, it could be deduced reliably from the observations of Philip Stovall (a keeper) just seconds before that Vila must have been positioned on her knees and elbows.

Within the minute following the birth, Vila was observed to manipulate cursorily the umbilical cord as she supported herself by one forearm and knees. She picked the infant up with her hands, pressed it against her groin and then carried it under an arm as she moved next door to the solarium. Two minutes after the birth she licked the infant's head and then wrapped a lot of straw bedding material completely round the infant. All actions were relaxed and well co-ordinated. At no point did Vila appear frightened by the birth, the baby, or the actions of those in attendance – the keepers, Dr Nelson, Dr George Pournelle (the Curator of Mammals) and the author. As she carried the infant under an arm, there was no suggestion that it bothered her. She seemed to carry it simply as though there were nothing better to do with it; its presence initially elicited no more interest than what might be expected in response to any novel, non-frightening object. This point is of particular interest for it was Vila's first infant (and probably her first pregnancy) and it was known that she had never had the opportunity to observe other non-human primates caring for their young, except perhaps during her first half year's life in the wild.

THE INFANT'S CLINGING RESPONSE

At 1005 hours, only eight minutes after the birth, the infant was observed clinging to Vila's ankle as she walked a few steps. Again at 1007 hours, while being licked by Vila, it was seen clinging, though up-side-down, to her leg. The infant's ability to grasp and cling to its mother's hair for a few seconds is of considerable interest, for accounts of other baby gorillas indicate that generally they are unable to support their entire weight when clinging. By this standard, Alvila was particularly vigorous and strong. She could not, of course, support her weight by clinging for indefinite periods of time. Increasingly Vila provided additional hand support for the infant, but frequently it grasped its mother's hair firmly, particularly with its hands, except while asleep.

Gorilla babies appear to differ markedly in manifest strength in the first few hours and days following birth.

FEMALE'S REACTION TO THE INFANT

Though Vila kept the infant with her, she gave little indication that she knew what to do with it. It was only during the subsequent hours that she came to respond to the infant as other than a novel object of unknown properties. During the first 20 minutes following birth, for instance, Vila repeatedly and with great persistence pulled the infant about by a hand-hold on the umbilical cord (it was about two hours after the birth that Dr Nelson finally succeeded in manoeuvring Vila into a position close enough for him to sever the cord). While being dragged, large quantities of straw bedding accumulated round the infant's body, and at times it was impossible to tell where the infant was, except by noting the ball of straw trailing behind Vila. Aperiodically she would stop, sit, and with the infant between her legs, pick a few bits of straw from its body, before once again pulling it along by the cord. On yet other occasions Vila would sit and put the infant under one of her thighs, then gradually lower the thigh to rest on its body. No vocalisations were heard from the infant on these occasions, and it did not appear to suffer. At other times, with the infant under a thigh, Vila worked bedding materials with her hands, over, under and around the infant's body. As the result, the infant was soon totally dry (but that is not to imply that Vila did it for that reason). A more disconcerting activity was that Vila would place the infant supine on the bedding, squat directly over its face, and then slowly rock back and forth in a manner that probably brought her vulva in contact with the infant's face.

Within the first 30 minutes after the birth, Vila began both to hold and to carry the infant in what we called a *thigh cradle position*, which consisted of securely holding (by pressure rather than support) the infant's body between either thigh and the lower abdomen. The infant's head might be face up or face down, but invariably it was directed towards Vila's head. She carried the infant in this position by assuming a tripodal gait, using her arms somewhat as crutches as the free leg swung forward. On later occasions she frequently lay prone, her fore-weight supported

by elbows, with the infant maintained in the thigh cradle position. Only the infant's head could be seen when held in this manner. In retrospect, the end of the first half hour marked a critical point—the infant was gaining strength, Vila had never responded aggressively to the infant, she had come to hold it (rather than pull it about), and had remained alert to its presence, never once deserting it. In general, she had responded to the infant with care and gentleness.

During the second half of the first hour following birth, there was rapid improvement in the quality of treatment and care which Vila showed her baby. As she used her hands more and more for lifting and supporting the infant, she ceased dragging it by its umbilical cord. There appeared to be a transitional stage in which Vila picked up the infant by one of its arms, its body dangling as though lifeless; but soon Vila used her other hand to support the infant's back or suspend its otherwise dangling arm. Occasionally she would lick the infant's ears, head and face.

There were also many occasions when, in a sitting position, Vila would gather large quantities of bedding and either shuffle the straw from one side of her to the other, or throw it up and over her head. At these times the infant was in a thigh cradle position or on the floor, either between Vila's legs or at her side. Vila continued to bundle the infant completely into a ball of straw, cradle it in an arm, and start peeling masses of straw from it, eventually revealing the infant, grasping for a hold on its mother's hair. It appeared that this chain of events elicited detailed inspection of the infant's body; for Vila would turn it end from end, leaving no orifice uninspected by touch, probe, sniff, and taste. Then, very gently, she would lift the infant to her neck, position it under her chin, cock her head to the side to press the infant securely, and embrace the infant's body with both her massive arms. In contrast, there were other instances when Vila would casually flip the infant over her back and let it slide headlong down to the cement floor, fortunately cushioned by straw. However, Vila became increasingly attentive and solicitous of her infant.

Before the first hour had passed, the infant gave a few whimper-like cries after losing its hold on Vila's belly and dropping to the floor. In response Vila gave a single-phased guttural answer. This sequence of vocalisations proved more than coinci-

dental, for throughout their remaining hours together there emerged a few well-defined infant vocalisations that were almost invariably followed by the single-phased guttural answer from Vila.

The infant continued to gain strength throughout the first hour, and in a few instances supported its entire weight by the grasp of its hands and feet on to the hair of Vila's abdomen as she walked a few steps quadrupedally. Its strength was limited, however, for after a few seconds its grasp would weaken and its body would fall. Increasingly, Vila provided additional support for the infant whenever this happened, by either placing a hand or flexing a leg against the infant's back, pressing its body to her own.

On at least one occasion within the first hour the infant nuzzled and mouthed Vila's abdomen in a manner that would have facilitated nursing had it occurred near a breast. While the nuzzling and searching was not vigorous, it gave reason for hope that the infant would soon suckle. This hope was also strengthened by two other observations: the first was the improved position of the infant's head in relation to Vila's body (by this stage it only rarely clung up-side-down on a leg or to the rear of the mother's body); the second was that as Vila increasingly held and cradled the infant, either in a thigh or arm, the infant's face was more frequently pointing up and towards her breasts. The infant, in turn, tended to reach up before grasping and pulling. It should not be inferred that in any real sense was the infant trying to reach the breast or that Vila was trying to assist any behaviour that might lead to suckling. It is appropriate to assess these responses only in relation to their affecting the probability that the conditions necessary for suckling might occur together in time.

VOCAL COMMUNICATION

The events which occurred after the first hour were primarily modifications and extensions of those that had occurred earlier. Vila remained calm throughout the day and never appeared to be uneasy about the presence of attendants.

From about 1200 hours onwards Vila virtually stopped bundling the infant in the bedding and pulling it around as though it were just an object and the umbilical cord its tether. She became increasingly responsive to the infant, compensating for its weakness by giving it support and

checking its well-being when it vocalised. At 1150 hours, for example, Vila was prone, her hindlegs drawn up alongside her body and her elbows on the floor. The baby was supine between her forearms, when it uttered a series of small cries. Immediately Vila raised herself to a sitting position, gave her characteristic guttural answer, cradled the infant, and inspected its hand. From this point on whenever the infant gave other than a single, low-frequency, soft call, Vila almost invariably shifted her position, answered gutturally, and examined the infant visually and manually. Though the infant never cried with a persistent, full-lunged gusto, many of its cries clearly resembled those of a human baby.

From 1200 hours until the middle of the afternoon the infant continued to gain strength, both squealing and crying more vigorously whenever subjected to excessive pressure or loss of support. It was able to hold its head erect quite well for two or three seconds and to support its full weight for about five seconds at a time by grasping with all fours (only once with its hands alone) on to Vila's hair as she took a few steps quadrupedally.

It was not until 1200 hours that Vila took her first drink of water and it was 1330 hours when she first distinctly left the infant for about 15 seconds. Immediately after this short interval she started working the straw into a nest with a hole in the middle, an act that was possibly stimulated by fatigue for she gave a long yawn 10 minutes later. She did not sleep throughout the course of the day, however.

Suckling would have been possible on any of at least seven occasions when the infant's face was positioned immediately against a breast; but unfortunately it never once seemed alert enough at the moment to make the necessary gesture, though at least twice its mouth was in direct contact with a nipple. Why it failed to do so is open to conjecture. Vila surely would have permitted suckling; but even if she had, there was no assurance that her supply of milk would have been adequate. It was, nonetheless, a critical failure, for as the day wore on, the infant progressively weakened. It dozed off at every possible moment, only to be awakened each time Vila moved. It would then cry briefly and Vila typically would give her guttural response and inspect it. As Vila lifted it or moved it about, the infant appeared limp as a rag-doll. It seemed unlikely that its

strength would return to the point where it might succeed in suckling.

FATIGUE

Both animals showed fatigue in the evening—Vila would often lie on her back, the infant either lying prone, longitudinally, high on her chest, or transversely, low on her abdomen. But Vila would not go to sleep, and every time she moved, the exhausted infant would awaken and make whimper-like cries. In response, Vila, too, would vocalise, then turn the infant from end to end to inspect it, which, of course, only denied the infant any immediate chance of rest. When in the judgement of those in attendance it became clear that the infant would probably not survive (denied rest and with its strength waning rapidly) if left with its mother, preparations were made to separate them.

REMOVAL OF THE INFANT

Shortly before 2400 hours Vila was given an injection of 50 mg Sernylan® (Parke, Davis & Co), *via* Cap-Chur pistol. As the drug took effect, she left the infant, making it possible for Dr Nelson to enter the cage and remove it. It was taken to the Children's Zoo Nursery and its umbilical cord ligated and medicated. It was first fed 60 cc of Similac (Ross Laboratories®), diluted to half-strength, every four hours for the first day. From her weight when removed, it was concluded that the infant had weighed 2.14 kg at birth and would require about 350 cc of fluid and 235 calories daily. (See Nelson, 1965, for additional information.)

Before discussing certain aspects of the young gorilla's growth and development, certain points should be made clear. First, though both of Alvila's parents were captive-reared from infancy, they were nonetheless able to mate successfully (unlike so many hand-reared primates); secondly, Vila though basically naive to infants of all kinds, was potentially an excellent mother. Never once did she inflict harm on her baby, and throughout the hours which followed the birth she became increasingly efficient at handling and caring for it. Thirdly, initially the baby was apparently strong and vigorous, supporting its weight more successfully than has been typical of other infant gorillas born in captivity.

GROWTH AND DEVELOPMENT OF THE GORILLA COMPARED WITH A GIBBON

As a gibbon, *Hylobates lar* × *H. moloch*, was born six days before the gorilla (on 28 May 1965) it was possible to compare the development of these two primate forms, one primarily arboreal and the other primarily terrestrial. I am aware of the limitations intrinsic in the drawing of comparisons where only one specimen of each kind is available and these should also be recognised by the reader.

A. VISUAL DEVELOPMENT

1. *Gorilla gorilla*

(a) Days 1–7. Movement of the eyes was not well co-ordinated; there was slow pupillary reflex to pen-light stimulation after dark-adaptation; no visual tracking of either a moving pen-light in the dark or of a red plastic square in the light occurred. She squinted in brightly lit areas.

(b) Days 8–14. Tracking of a pen-light for about 7–10 cm on a horizontal plane but not on a vertical plane was indicated on Day 8. Good pupillary reflex was present; she blinked vigorously in response to touching of the eyelashes; she started to gaze at the attendant while being fed (in arm cradle). She 'grinned' when tickled on the chin.

(c) Days 15–21. Strong tracking of moving stimuli on the horizontal plane, with tracking (though weak) on the vertical plane was now suggested. She twisted her body to follow the attendant visually as she walked about the room.

(d) Days 22–28. Active visual exploration of the room occurred while being cradled and bottle-fed. She looked before reaching for a proffered blanket or a finger (Day 26).

(e) Day 58. From this day tracking was judged to be well developed on both vertical and horizontal planes. Strong auditory stimuli (clapping of hands, slamming of a door) would cause a blink, but not necessarily a whole-body startle response.

2. *Hylobates*

During the first month the infant gibbon, 'Gabrielle', was not observed in any particular detail. At the end of the month, however, it appeared that her visual skills were well advanced, with movement of both eyes well co-ordinated. Fixation and tracking was present on all planes.

Sensorily she appeared considerably advanced, compared with the young gorilla.

B. HEARING

1. *Gorilla gorilla*

From her startle responses to strong auditory stimuli on Day 4, it appears safe to conclude that by that age hearing was functional. Additional observations were as follows:

(a) Day 12. She appeared to become calm as the attendant walked towards her crib or opened the door to the nursery. General activity would cease in response to subtle sounds (e.g. the snapping of fingers).

(b) Day 92. The attendants believed that Alvila was beginning to recognise her name when called. That she was not responding specifically to the word 'Alvila' was indicated as other words called out with the general intonation normally given to her name would elicit the search response (creeping about in her crib) and vocal answer pattern (whimper-like cries).

2. *Hylobates*

From one week of age, vigorous startle responses continued to be effectively elicited by even subtle auditory stimuli. By one year they were markedly reduced in strength, but evident. Pinna reflex was strong from one week (it was never seen in the gorilla).

C. LOCOMOTION AND POSTURE

1. *Gorilla gorilla*

(a) Days 1–7. By Day 4 the infant gorilla could roll from stomach to back easily and creep back and forth the length of the crib. Creeping was at first unassisted by arm movement; power for movement came first from simultaneous pushing with the legs, but before the end of the first week the legs were used alternately. Toes were tightly clenched just before a leg was extended for creeping. The gorilla turned round at the crib's end by pivoting on the belly. She was able to lift her foreweight to support it on her elbows for a few second. Though her hands were strong enough for grasping, the arms otherwise seemed weak. In contrast to the hands, the feet seemed weak for grasping but the legs were stronger than the arms. She slept prone with her legs to the side of her body.

(b) Days 8–14. On Day 12 she sat up by grabbing and holding on to the bars of the crib. She could not hold her head erect, unless supported by both hands. She began to sleep supine as well as prone. When she was held so that her four limbs just touched the mattress, a weak 'prancing' gait was seen.

(c) Days 15–21. The foot-grasp was now about as strong as the hand-grasp. The arms were still not used effectively in creeping, but they were becoming stronger.

(d) Days 22–28. Grasping strength markedly increased over the previous week. She could suspend her full weight by grasping with feet on to the attendant's fingers. When allowed to grasp the fingers with her hands and then pulled to a sitting position, her head was lifted from the mattress first, followed by her shoulders and body (all accompanied by vocalisation suggesting strained effort). On Day 27 she started to use her arms effectively but weakly in a creeping pattern. She 'chinned' herself when lifted by handholds on an attendant's fingers.

(e) Days 29–49. The hands were used more effectively as 'skids' in creeping, usually with one hand open, the palm facing upwards, and the other clenched with its knuckle-palm surface on the mattress. She still could not sit properly supporting herself with only one hand (Day 37). By Day 48 the foreweight of the body was supported on the elbows when creeping, with the belly coming slightly off the mattress momentarily and aperiodically while creeping. On Day 49 she held her full weight by one handhold.

(f) Days 50–63. Day 50: when placed prone and a full milk bottle was put 5 cm beyond her reach, Alvila made no effort to procure it, but she gazed at it fixedly for about six seconds. Her creeping now involved alternate use of arms in addition to the legs. Thrusting of the right leg to the rear was associated with a forward extension of the left arm, and thrusting of the left leg to the rear was associated with a forward extension of the right arm. True crawling had not yet emerged, for the torso was still in contact with the mattress. By two months she would 'chuckle' while romping in play. Toe and thumb sucking were infrequently observed. She played a lot with her feet while

lying on her back. She could now roll from her back on to her stomach.

(g) Days 64–84. By Day 81 crawling seemed imminent. The hind-legs were positioned at an angle of not more than 90° to the mattress. She was seen lifting her belly free of the mattress with the left elbow on the mattress while extending the right arm with the back of the hand on the mattress.

(h) Days 85–121. By Day 99 she was observed hanging by footholds on the bars placed on top of the crib; the body was freely suspended vertically. She could sit up from a prone position easily by this time, but handholds were required to maintain a sitting position for indefinite periods. Without holding on she would fall backwards and hit her head. By Day 99 she pulled herself to a standing position at the rail of her crib, lifting the weight primarily by extending both legs simultaneously. On Day 107 she stood quite steadily on all four legs with the foreweight on the knuckles.

(i) Days 122–365. On Day 153 she beat her chest with one open hand with considerable vigour while playing in the crib. She seemed exuberant at the time. Temper tantrums became frequent. From the age of three months on, four-legged walking replaced creeping. There was only a very short interval (a couple of days) when something like a modified crawl was seen: the elbows were used with increased effectiveness to raise the belly from the mattress. She rarely fell from a four-legged walk, but at first she was unsteady. She strutted in 'gorilla-style' with lips puffed and head to one side – and also ran on all fours – when she was 9½ months old. At one year of age she stood erect and straight on her hind-legs for a few seconds at a time.

2. *Hylobates*

(a) Days 1–31. During this period the gibbon was mostly cocooned in a blanket for otherwise she seemed to become very emotional and disturbed. She had become a chronic thumb-sucker at one month old. At one month when placed on her stomach she made no attempt to crawl but gave a series of whimper-like cries of high frequency. Though movement of her whole body through space was limited, she was

able to move her head in a very co-ordinated manner and to track a moving stimulus with greater skill than the gorilla could at that age. She remained quite still, in contrast to the gorilla's limb flailing (when on her back) and creeping. She was given to clutching anything nearby with hands and feet, whether it was a diaper, mattress, or even her own face, body or hair.

(b) Days 32-91. On about Day 67 the gibbon reached up with both hands to two red rings suspended above her, grabbed them and swung her body free of the mattress (an ability essential for brachiation). By Day 81 she was brachiating with considerable skill. At times she would throw a foot up and over the side of her bassinet, sit on its edge, and look about for long periods of time. When startled she would drop to the mattress, clutch at a blanket and suck her thumb (always the left). By Day 91 she would sometimes walk on her hind-legs while supporting herself with handholds. Lifting of the body to a standing position was mainly effected by the arms (in contrast to the gorilla which used its legs to do this). She did not sit up as frequently as the gorilla did, and whenever she did it seemed that she was about to reach up for over-the-head handholds for swinging. Whereas the gorilla's locomotion emphasised first the legs, then the arms, the gibbon's locomotion stressed first the use of arms and then legs. On Day 81 she was observed creeping in a pattern similar to the gorilla's, except that power was provided primarily by the arms (her legs were quite ineffective for creeping).

(c) Days 92-182. By six months brachiating was skilful. No four-legged crawling was ever observed and only a minimum amount of creeping. Brachiation was accompanied by a marked increase in whole-body locomotion. She could swing through space with her body momentarily unsupported (something which the gorilla never did during the first year).

(d) Days 183-365. At 9½ months she was observed walking for about 2 m bipedally with no hand-support. The gorilla has never been seen walking bipedally (though she did stand bipedally at one year). At one year the gibbon was able to run bipedally and only occasionally touched the ground with her hand (frequently the back of it).

D. EMOTIONAL RESPONSES AND OTHER OBSERVATIONS

1. *Gorilla gorilla*

On Day 4 the first marked startle response was observed: the limbs were brought to the body's midline and the eyes blinked (the stimulus was a jackhammer in a nearby work area). The young gorilla never startled readily except as the result of very strong stimuli. During the first week of life, stimulation of the soles of her feet, unless it was firm and sustained, caused her to withdraw them as though it might have tickled. Firm touch of her palms or her feet elicited vigorous grasping. When she clenched her fists, the thumb projected from under the fingers. Sucking reflex was not strong until Day 4. During the first week she vocalised infrequently, unless apparently hungry. She flailed with all four limbs if she was supine and the blanket was taken from her. Belching was noted but no hiccoughing (in contrast to the gibbon). There were pronounced bulges on the cheeks which appeared to be muscular in character: possibly they assisted sucking. On Day 9 she gave her first real scream. On Day 12, stroking of the sole of her foot caused her first to grasp and then to fan her toes. Stimulation of the cheek on Day 12 elicited head fanning with the mouth wide open. If no nipple was found, she would vocalise. On Day 19 gumming on a pad was noticed (the gums were swollen but no teeth had appeared). By Day 28 she 'laughed' when tickled, and screamed if food was delayed. She frequently dozed while feeding. By Day 50 she neither sneezed nor hiccoughed, unlike the gibbon which did both. By Day 58 her body had 'filled out' and she was also more diurnal. On Day 85 she resisted a dental examination with considerable vigour; the gibbon had done this at two months old. Perhaps possession of teeth determines the tendency of these animals to bite. From the age of three months onwards it was the gorilla, not the gibbon, that 'begged' for attention from the attendants. During the first year pigmentation filled in the white areas on the soles and the palms, but these areas were still apparent, particularly on the tips of the toes and fingers, at the age of one year.

2. *Gorilla gorilla* and *Hylobates* contrasted

The gorilla always appeared to 'like to be held', in contrast to the gibbon which, if at all, liked to

cling. The gibbon's body was much more supple than the gorilla's.

At three months the gorilla would sweep any novel object directly to her mouth with a rather crude, clumsy swing of the entire arm. In contrast, the gibbon would first delicately touch and then taste an object with protruded tongue before putting it into her mouth. Only the gibbon would reliably give a small 'hoot' when inspecting novel objects.

The gibbon was more likely to bite and frequently grimaced with apparent threat, particularly at strangers or familiar people it disliked. The gorilla only rarely threatened people, and then the threat was primarily vocal, rather than grimacing and teeth-baring.

The gorilla has been much more labile emotionally - screaming one moment, playing actively the next, and then perhaps falling asleep with little warning. After being startled, the gorilla would calm quickly; in contrast, the gibbon,

once startled, would withdraw and only slowly become active again.

New foods were frequently rejected by the gorilla, but apparently relished by the gibbon.

E. DENTITION

Table 1 indicates that the incisors erupted (the lower ones first) before any other teeth in the *Gorilla gorilla*, *Hylobates* sp and *Hylobates syndactylus* under observation. Their eruption, however, was considerably earlier in the gibbon and the siamang than in the gorilla. The gorilla's upper and lower deciduous first molars were next to erupt, whereas the canines appeared next, together with one deciduous first molar, in the gibbon. In both the gorilla and the gibbon the lower deciduous second molars tended to appear before the upper ones, but the delay for the upper second molars was about 50 days in the gorilla and only a week at most in the gibbon. In both the gorilla and

TOOTH	ORDER	<i>Gorilla gorilla</i> ♀ DAY	<i>Hylobates</i> sp ♀ DAY	<i>Hylobates syndactylus</i> ♀ DAY
lower l. med. incisor	1	41	by 34 days all 8 incisors	by 33 days all 4 med. incisors
lower r. med. incisor	2	44		
upper l. med. incisor	4	71		
upper r. med. incisor	3	70		
lower l. lat. incisor	8	85		by 48 days
lower r. lat. incisor	5	78		by 48 days
upper l. lat. incisor	6.5	81		by 70 days
upper r. lat. incisor	6.5	81		by 70 days
upper l. dec. molar 1	9.5	158	by 74 days	
upper r. dec. molar 1	9.5	158	by 74 days	
lower l. dec. molar 1	11.5	170	by 48 days	
lower r. dec. molar 1	11.5	170	by 55 days	
lower l. dec. molar 2	14	276	by 151 days	
lower r. dec. molar 2	13	266	by 151 days	
lower l. canine	15	301	by 55 days	
lower r. canine	18	309	by 55 days	
upper l. canine	16.5	302	by 55 days	
upper r. canine	16.5	302	by 55 days	by 180 days all deciduous teeth through
upper l. dec. molar 2	19	326	by 151 days	
upper r. dec. molar 2	20	327	by 158 days	

Table 1. Deciduous tooth eruption in a gorilla (*Gorilla g. gorilla*, born 3 June 1965), a gibbon (*Hylobates lar* × *H. moloch*, born 28 May 1965) and a siamang (*Hylobates syndactylus*, born 16 September 1965). All three animals were born at San Diego Zoo.

	<i>Gorilla gorilla</i> ♀			<i>Hylobates</i> sp ♀			<i>Hylobates syndactylus</i> ♀
	3 MONTHS	6 MONTHS	12 MONTHS	3 MONTHS	6 MONTHS	12 MONTHS	6 MONTHS
	cm	cm	cm	cm	cm	cm	cm
Crown to heel	50.8	58.4	71.1	38.1	43.2	57.2	45.1
Torso length	24.8	30.5	38.1	17.8	20.3	26.7	23.5
Arm span (fingertips)	68.6	80.6	111.8	68.6	78.7	94.0	71.8
Head circumference	33.0	35.6	40.0	21.6	24.1	25.4	25.4
Neck circumference	23.5	26.7	30.5	15.2	19.1	20.3	22.9
Chest (under arms)	36.8	41.9	51.4	21.6	25.4	31.8	25.4
Arms (shoulder to finger tips)	33.7	38.7	50.2	29.8	37.5	47.6	34.9
Leg length to ankle	20.3	22.9	28.6	17.1	19.1	28.6	18.4
Wrist (right)	11.4	12.7	15.2	6.4	6.4	8.9	7.6
Ankle (right)	11.4	13.3	15.9	6.4	6.4	7.6	7.6
Weight * (in kg)	4.08	6.29	11.06	1.11	1.46	2.72	

* At 15 hours after birth the gorilla weighed 2.14 kg; at 48 hours after birth the gibbon weighed 0.54 kg. The expected adult weight of the gorilla is 73.00 kg; the expected adult weight of the gibbon is 5.44 kg.

Table 2. Measurements of a gorilla (*Gorilla g. gorilla*) and a gibbon (*Hylobates lar* × *H. moloch*) compared at three age levels in cm. Measurements of a siamang (*Hylobates syndactylus*) at the age of six months are also included.

gibbon, the last deciduous tooth to erupt was the upper right second molar.

Table 2 presents a number of measurements for the gorilla and gibbon at different ages, together with some measurements for the siamang at six months. Whereas both animals increased their weight at birth by a factor of about 5, by the end of the first year, the proportional gain relative to probable weight as an adult was much greater in the gibbon than in the gorilla: the gibbon weighed perhaps half its adult weight and the gorilla only one sixth of its adult weight.

GENERAL COMPARISON AND SUMMARY

Compared to the gibbon, the gorilla was retarded in its visual perceptual development though advanced in its locomotor skills. But it used its hands crudely and clumsily as compared with the gibbon. Emotionally the gorilla was a far more stable animal than the gibbon, much less subject to startle and threat reactions. In physical size, strength and ruggedness, the gorilla considerably exceeded the gibbon. Though both animals were, and remain, sensitive to events about them, the

gibbon appeared to be both hyper-sensitive and hyper-reactive. Both animals became increasingly aggressive throughout their first year, and possibly this may have been related to tooth eruption. The gibbon became aggressive earlier and has remained more inclined to bite and threaten than the gorilla. The strength and toughness of a year-old gorilla is difficult to appreciate unless one has tried to take its measurements or physically tried to force it to release a hold of something or somebody. By contrast the gibbon is weak.

It is impossible to assess how the particular type of care given these two animals has altered their development, but it seems to me that as they were cared for in a manner similar to that given to human infants, the gorilla has probably had some advantage in the situation. The gibbon, always clutching or clinging to something, might have benefited from a mother-surrogate that would have moved about and demanded an equivalent motor activity (clinging) which the gorilla exhibited in creeping. The gorilla, deprived of its mother, can and does creep and eventually walk; the

gibbon, disinclined to do anything except cling, does not or will not creep to any degree and becomes hyper-sensitive and hyper-emotional. (At least, this is a possibility.) Nursery care methods for exotic primates need to be continually assessed.

Though a detailed comparison of the gorilla's development with that of a chimpanzee *Pan troglodytes* and man cannot be included in this report, it is clear that the gorilla's developmental patterns approximate those of the chimpanzee and man more closely than does the gibbon's. This observation is in keeping with their taxonomic status—an important point not to be overlooked.

Knobloch & Pasamanick's report (1959) on 'Colo', the gorilla born at Columbus Zoo in 1956 suggests that in some ways Alvila's development was particularly accelerated. Both animals were able to lift the head while supine and to bring the hands together at the midline from birth, both were able to roll to a prone position by 10 weeks, able to sit with the head held steadily and erect at 12 weeks, and able to sit steadily for indefinite periods by 18 to 20 weeks. In being pulled to a sitting position, however, Alvila lifted her head and assisted in the movement by 3½ weeks, but it was not until 10 weeks that Colo did this routinely. Apparently Alvila was particularly advanced in creeping, doing so within the first week; Colo was not adept at it until 2½ weeks. Further, Alvila pivoted frequently within the first week, but Colo was not skilled at this until the 10th week. Alvila climbed into an adult's chair easily by 10 months, but Colo could not do this until 18 months. As indicated first by her strong grasping reflex on the first day, Alvila has been, in all probability, a particularly vigorous gorilla. Heinroth-Berger's report (1965) on a captive-born chimpanzee would also indicate Alvila's development rate to be advanced.

Lang's report (1962) indicated that Alvila's tooth eruption pattern was similar to the gorillas' 'Goma' and 'Jambo' born at Basle Zoo. Alvila sat up on Day 12, but Goma did not do this until the 12th week and Jambo the 9th week. Jambo's four-legged walking appeared earlier (9th week) than Alvila's.

Dentition of the gorilla 'Tomoko' (Carmichael, Kraus & Reed, 1962), born at the National Zoological Park, Washington, was comparable to the tooth eruption pattern of Alvila, but was advanced by as much as 38 days in some instances (upper first deciduous molars). The patterns were not identical. There is thus reason to expect that gorillas probably differ somewhat in the rate and sequence of dental eruption.

This project points to a great need for a co-ordinated programme of data collection on primates born in zoos so that norms for the development of the species can be established. In my opinion, differences between reports on infant chimpanzees and gorillas are great enough to make me doubt the reliability of many purported differences between them in early development. Diet and method of care probably account for considerable variation in development.

ACKNOWLEDGEMENTS

The co-operation of the San Diego Zoo staff—particularly Dolly Hill, Jacqueline Kellison and Kathleen Shupp—which made these observations possible is gratefully acknowledged. The assistance of many others, including M. B. Pournelle, G. Steinmetz, and my wife Phyllis, whose typing skills assisted record keeping, has been greatly appreciated. The study project has been supported by funds from the National Science Foundation.

REFERENCES

- CARMICHAEL, L., KRAUS, M. B., and REED, T. H. (1962): The Washington National Zoological Park gorilla infant, Tomoko. *Int. Zoo. Yb.*, 3: 88–93.
- HEINROTH-BERGER, K. (1965): Über Geburt und Aufzucht eines Männlichen Schimpansen im Zoologischen Garten Berlin. *Z. f. Tierpsych.*, 22(1): 15–35.
- KNOBLOCH, H., and PASAMANICK, B. (1959): Gross motor behavior in an infant gorilla. *J. comp. Physiol. Psych.*, 52: 559–563.
- LANG, E. M. (1962): The second gorilla born at Basle Zoo. *Int. Zoo Yb.*, 3: 84–88.
- NELSON, L. S. (1965): Mother and infant gorilla. *Zooneos*, 38(9): 5–8.
- RUMBAUGH, D. M. (1965): The birth of a Lowland gorilla at the San Diego Zoo. *Zooneos*, 38(9): 9, 12–17.
- RUMBAUGH, D. M. (1965b): The gibbon infant, 'Gabrielle': its growth and development. *Zooneos*, 38(12): 10–15.
- RUMBAUGH, D. M. (1966): First year of life: the behavior and growth of a Lowland gorilla and gibbon. *Zooneos*, 39(7): 8–17.