Chapter Eight Multi-age Broods

Complementary Evolution

The Universe appears to be isotropic. As such, it exhibits the same characteristics in all directions. Life, by contrast, is often asymmetric. However, a lack of symmetry does not necessarily mean a lack of balance. Indeed, most living organisms complement each other, within the biosphere.

Plants and animals rarely compete directly with other similar specie, as direct competition for the same food source could lead to their extinction. Although there is always direct competition within a specie, the inter-specie competition tends to be indirect, and is often complementary in character.

For example, the Chimpanzee often feeds in the same tree as the Red Colobus monkey, but the Red Colobus monkey feeds on the leaves, while the Chimpanzee feeds on the fruit. The Chimpanzee also feeds on Colobus monkeys, so the latter tend to gang-up on single Chimpanzees and drive them from the trees.

Nevertheless, in terms of their main diet, the two primates tend to complement each other, rather than compete directly for the same food source.

Many tropical plants exhibit a degree of reproductive complementarity with their main animal consumers -- which eat the plants' fruit or leaves. The reproductive success of this complementary evolution has resulted in a degree of reciprocal adaption by these plant consumers, which extends the degree of specie interdependence and plant/animal complementarity.

In addition to complementarity of food sources and reproduction, many species exhibit geographic complementarity. This is generally the case with the hominoid apes. Other forms of complementary behaviour can involve variations of timing -- as between diurnal and nocturnal animals; and variations of breeding cycle -- as exhibited by many temperate, or polar specie.

Competition

However, regardless of the amount of inter-specie complementarity, no specie can avoid a degree of intra-specie competition. As the reproductive rate of specie individuals generally remains constant, there is always a degree of potential competition between the adults of any specie. Likewise, there is always potential competition between the infants of any individual.

Furthermore, in addition to this individual competition there is also potential competition between the adults and the infants. In this regard, if the demands of organic replication are to be maintained, each specie must evolve some way of attenuating this potential adult/infant competition.

As related in Chapter Seven, the mammal female can reduce competition from the males by behavioural manipulation. Likewise, a dominant female can intimidate subordinate females, and if necessary, drive them out of her territory. In the same manner, the dominant males can drive out subordinate males, or create a hierarchical structure.

The infants of mammal specie can also create behavioural stimuli which reduces adult aggression levels, and enables the infants to acquire food from their mothers. In addition, the infants of some mammal specie, for example Wolves, can induce non-maternal adults to give them food.

For example, Wolf cubs can make adult members of the Wolf pack regurgitate food, simply by nuzzling against the muzzle of the adult. When the adult Wolf regurgitates, it is temporarily stricken by nausea -- and loses its appetite. As a result, the Wolf cubs can enjoy their meal in peace. This behaviour of the adult Wolf is not altruistic, as it is the result of a reflex action which is due to a genetic adaption.

Competition between infants is common - if the brood consists of two or more siblings. For example, many predator birds lay two eggs, and the first hatchling will commonly push the other egg out of the nest. Likewise, birds like the Heron, will lay their eggs at different intervals - with the result that some of the nestlings hatch much later than the others.

In the case of the Heron specie, the later hatchlings are not killed. However, in bad seasons, the younger ones tend to die of starvation. This system of staggered hatchings has evolved because the Heron only breeds once per year, and does not share out the food among its young. As a result, the larger, older hatchings take their share of the food - before the smaller, younger hatchlings can start to feed.

Thus, in good seasons, all the young are able to get an equal share of the food , but in bad seasons the younger ones starve. In this regard, if the Heron shared out all the food equally, all the young would die of starvation in the bad seasons. So the staggered system of hatchings ensures that in bad seasons at least some of the nestlings will survive.

These staggered forms of birthing are rare among mammals. However, the Indian Tree Shrew gives birth to a second brood of young -- before the first brood has been weaned. In the case of this specie, the female makes a nest, and then gives birth to her first brood of four, or five infants. After their birth the female suckles them, and then leaves the infants alone for two days. She then returns to suckle then, and then leaves them again, for another two days. This behaviour is repeated throughout the first brood's infantile period.

The nursing females of this specie come into oestrous immediately after giving birth to their first brood. However, because the gestation period is shorter than the first brood's infantile stage, the second brood is born in the same nest. As the first brood still needs to suckle, the second brood are excluded from the mammae and cannot suckle. When the female leaves the nest, the first brood usually kills the second brood - although the latter would die of starvation in any event.

This behaviour of the Indian Tree Shrew may have developed as an evolutionary adaption to predation. This is because, unlike most primates, this foliage-dwelling specie cannot carry its young. Nevertheless, the behaviour of the infants of the Indian Tree Shrew shows that mammal young can be just as competitive as the young of birds.

Multiage Broods

Single Age Broods

Most mammals only rear one brood of young at one time. The nursing females then suckle their brood of young, until the young are old enough to eat adult foods. In this regard, the infants of most herbivore species, transfer straight from their mothers' milk to the eating of adult food - which they forage for themselves. By contrast, the infants of most predators are suckled, and then transferred to pre-masticated adult foods. These are brought to them by their mother, or other adults.

The process by which infants become self-sufficient, and find their own food, is called weaning. The weaning stage marks the end of infancy. The individual then starts its juvenile stage. In this regard, most mammal juveniles stay with their mothers until they reach sexual maturity. Then, in the case of a monogamous specie, both sexes of young adults are driven away from their parents territory.

However, in polygynous specie, the young adult females generally remain close to their mothers -- providing they are subordinate to the mother. By contrast, the young adult males are normally driven out of the territory by the dominant males. Here, they often join other similar young adults, on the periphery of the community's territory.

The Chimpanzee is similar in this regard. It has a gestation period of about eight months, and normally gives birth to just one infant. Chimpanzees find it difficult to carry two infants in the trees, so if they give birth to twins, one of them is usually discarded.

The Chimpanzee nursing female suckles her young for about 3.5 years, and then weans it. Thereafter, the infant must find its own food, although it will stay close to its mother until it reaches sexual maturity. The nursing female will come into oestrous about 3 years after the birth of her baby. Thus she normally gives birth to her next infant, about three months after she has weaned her previous infant. This interval allows the female to feed her growing foetus -- via her placenta, in the last few months prior to the baby's birth.

Sometimes, an over-indulgent Chimpanzee mother may give birth to her next infant, before the previous infant has been weaned-off. In such cases, the nursing female immediately (and very abruptly) weans the previous infant. Such over-indulgence can have a bad physiological effect on the new baby, as it is starved of nutrients. It can also have an equally bad behavioural effect on the previous infant. Sometimes, both of the infants may die.

However, normal Chimpanzee mothers will wean their previous infant well before the next baby is born, The other hominoidal ape species behave in much the same way, although there are differences in their gestation periods and weaning times.

In fact, all normal nursing female mammals wean their first brood well before the second brood is born. The only exceptions are the Indian Tree Shrew - and one other specie.

The other exception is the Human specie.

Multiage Broods

The modern Human female of present-day agricultural, industrial and commercial societies, may give birth to a succession of infants at yearly intervals. As the lactation period of the Human specie is similar to that of the Chimpanzee, it will be perceived that in these circumstances, such females may have several babies, before the first baby has completed its infantile stage.

This is somewhat similar to the situation of the Indian Tree Shrew. However, in the case of that specie, the elder infants kill the younger ones. By contrast, as the human nursing females keep their new born babies with them at all times, the elder infants cannot kill the younger ones.

The weaning stage of the Human young takes place at about the age of 6.5 to 7 years. Thus, in theory, if children were born at yearly intervals, it would be possible to have six, or seven children, of different ages -- all of whom would be in their infantile stage of development.

This difference in the rearing patterns of mammals can lead to variations in classification terminology - in respect of any specie's brood stage.

Thus in terms of individual mammal growth, the pre-weaning stage is called the infantile stage. However, in terms of the nursing female's life cycle, the same stage may be classified as the brood stage. At this period of adult life, the nursing female will suckle her young. Furthermore, in the later stages of their infancy, she may be their sole source of adult food.

As a result, in the female brood stage, the infants are totally dependent upon either their mother, or other adults for food and protection.

In the brood stage of most female mammals, a typical brood of young may consist of either a single infant, or a group of same-age infants. In the case of the latter, as they are the result of a single breeding cycle they are effectively either twins, triplets, or quads etc.

Therefore, if no further infants are born or reared during such a female brood stage, these broods may be classified as Single-age Broods.

Alternatively, the nursing female may give birth to a succession of single-age broods, where any succeeding brood may be born, or reared, within a previous brood's infantile stage. Thus, in this female's brood stage, such a nursing female will concurrently rear a collection of differently aged infants; and this collection may be classified as a Multiage Brood.

In this regard, the predatory birds which have staggered hatchings, do not have multi-age broods because all of their young are the result of a single breeding cycle. These specie have multi-age infants, within a single-age brood.

The only mammal specie which rears multi-age broods to maturity, is the Human specie. This is an important specie difference, which must be explained in terms of evolution.

In this context, it is necessary to explain the origin of the human multi-age broods, and their effect on hominid evolution. However, before considering this phenomena, it must be noted that there are different kinds of multi-age broods.

Thus, certain hunter-gatherer tribes do not give birth to their infants at yearly intervals. In fact, they have a breeding and reproductive cycle, which is similar to that of the Chimpanzee specie. The nursing females of these tribes suckle their babies on demand. As a result, whenever the baby wants to suckle, it is able to do so - at any time of day or night.

Prolactin

In this context, when a baby suckles from the breast of its mother, the mammary gland is stimulated into producing more milk -- ready for the baby's next feed. The regular production of milk stimulates the hypothalamus, via the autonomic nervous system. This stimulates the pituitary gland to produce a hormone called prolactin, which acts upon the female mammary gland to produce more milk for the infant.

If a baby is able to suckle on demand, the prolactin will remain at a relatively high level in the bloodstream. As long as the hormone level stays above a certain point, the hypothalamus prevents the pituitary gland from producing gonadotrophic hormones, which normally initiate the female’s monthly breeding cycle. This prevents any pregancy during the early years of the infants life.

Thus, the high level of prolactin, in the nursing female's bloodstream, effectively prevents re-ovulation; and this means that the suckling baby does not have to compete with a growing foetus for nutrition.

However, as the infant develops its teeth, the suckling becomes progressively more painful for the mother, and she gradually transfers the baby on to adult food. This transfer steadily reduces the demand for milk. As a result, the prolactin's degree of concentration in the female bloodstream drops correspondingly.

When the hormone level drops below a certain point, the hypothalamus stimulates the pituitary gland to produce gonadotrophic hormones, which initiates the female breeding cycle once again.

It is this biological process which produces the large interval between the birth of successive Chimpanzee infants. In this regard, the average time interval between the births of Chimpanzee young is 5 years. This could be a four year interval in theory, but the degree of infant mortality produces a higher average figure.

In this context, the average birth interval of the infants born to hunter-gatherer tribes is about four years. However, it would probably have been similar to the Chimpanzee interval in the past. Nevertheless, as the end of the brood stage in the Human specie is between 6.5 to 7 years, the hunter-gatherer tribes of past centuries would still have had Multiage broods of young.

It is the difference in birth interval between the infants of these hunter-gatherer tribes, and the infants of modern societies, which leads to the sub-classification of Multiage broods.

Thus, the broods of the hunter-gatherer type, are called L. B. I. broods, (where the phrase "L.B.I." is an abbreviation for Long Birth Interval). By contrast, the broods of modern societies are called S.B.I. broods, (where the phrase "S. B. I." is an abbreviation for Short Birth Interval). This set of sub-classifications has to be introduced because the S.B.I. broods sometimes lead to behavioural variations.

The reason why most of the nursing females in modern societies are not affected by the reproduction-limiting effects of prolactin, is that most modern nursing females do not breast-feed their babies on demand.

In prehistoric agricultural societies, the normal reproduction-limiting process was bypassed, by using a technique known as wet-nursing. In these societies, the infants of the dominant female were transferred to other females, who suckled the infants on the dominant female's behalf. This allowed the dominant female to come into oestrous immediately, and have another baby within a year of the birth of the previous infant.

This was the common practice of dominant females in agricultural and mercantile societies, until the invention of bottle-feeding. An alternative method to bottle-feeding involved the structured suckling of infants at set intervals throughout the day and night.

All these methods reduce, or eliminate, the need for continual mammary gland activity. Thus, the level of prolactin drops, and the female breeding cycle recommences.

In this regard, the modern nursing female no longer has the inconvenience of breast-feeding on demand. However, the alternative is either a cycle of virtually continuous gestation and birthings throughout most of her child-rearing stage of life; or regular monthly menstruation.

Staggered Hatchings

In order to clarify the evolution of the hominid multi-age brood, and explain its effects on the specie, it may be useful to consider the evolution of the predator birds' staggered hatchings. In addition, the special situation of the Indian Tree Shrew can also be put into its proper context.

The staggered hatching system of predator birds appears to be an evolutionary adaption to the predation of the eggs. Thus, if the first egg is lost, other eggs can be laid later -- without the need to go through a second breeding cycle. This staggered system of hatchings only seems to be a characteristic of birds whose habitat is subject to seasonal variations of food supply.

For example, in the sub-tropical regions, the wet season is more productive than the dry season; while in temperate and polar regions, the summer season is more productive than the winter season. The predator birds of such habitats synchronise their breeding cycles, so that their young are born in the most abundant feeding season. As a result, such birds only have to breed once every year. By contrast, in the equatorial regions, there are no seasonal variations in the food supply. Therefore, the predator birds lay either one egg, or several eggs at the same time.

The multi-age broods of the Indian Tree Shrew are S.B.I. broods. In this specie, the female comes into oestrous straight after the birth of her first brood, because she only suckles her young every 48 hours. Thus, this structured system of suckling means that the female does not suckle on demand, and so her breeding cycle recommences immediately.

However, the fate of the Indian Tree Shrew's second brood is similar to that of the younger nestlings of the type of predator birds, which have the staggered hatchings. Thus the first brood will kill the second brood, or prevent them from suckling when the nursing female returns to the nest. The fate of the second brood of the Indian Tree Shrew, shows why the S.B.I. brood characteristic is rare among mammals.

However, the similarity of this system to that of the predator birds indicates that it evolved as an adaption to predation. As such, it is an example of convergent evolution.

The Multiage brood characteristic of the present day hunter-gatherer tribes, indicates that the first hominid Multiage broods were L. B. I. broods. Here, the size of the birth interval prevented direct competition between the two broods. As a result, the broods were complementary in character. In addition, because the hominid nursing female would keep her new born baby with her at all times, the previous-born infant could not kill the new born baby or prevent it from suckling.

Therefore, it is proposed that the evolution of the hominid L.B.I. brood was due to the development of improved infant-rearing techniques, and was not an adaption to predation.

Adaptations to the Helpless Baby

It is clear that the problems of rearing a helpless baby would be much greater than the rearing of a normal, hominoidal ape infant. As a result, the hominid nursing females would have to adjust their previous hominoidal behaviour to meet the challenge of infantile helplessness. Furthermore, the hominid females would need much more infant-rearing intelligence than a hominoid Ape female.

In particular, there would be a need for an improved memory. For example, the hominid mother would have to remember to feed the helpless baby whenever it needed to suckle. If the suckling was delayed, there would be a drop in the level of prolactin which would result in the recommencement of the female breeding cycle. If the hominid mother was then re-mated, it is probable that both the first baby and the foetus would die.

However, such hominid mothers would get far more practice at rearing their infants, than a hominoidal ape mother. It is proposed that the learning speed of such hominid mothers would increase with each baby -- until the more intelligent females realised the need to keep suckling their babies. It seems probable that these mothers would then feed their babies whenever their infants cried.

Nevertheless, the tendency for the specie's nursing females to recommence oestrous would create an evolutionary advantage for any females whose visible sexual characteristics were less prominent than average. It is proposed that this situation would lead to the evolution of a 'Gorilla' type of non-visible sexual stimuli, to replace the previous 'Chimpanzee' type of visible sexual stimuli, (if any hominid females had such a stimuli).

The hominid nursing females would have to adjust their behaviour to anticipate all of the possible demands of the helpless baby. Initially, the very best mothers would achieve this by means of behavioural adjustment, but in time, the evolutionary demands would lead to genetic variations to improve the degree of child-rearing intelligence. In this regard, it is proposed that the phenomena known as "women's intuition", was developed at this time. As a result, one glance at the baby's face would enable the hominid mother to make an instant assessment concerning the action required.

The main neurophysiological demand would be for improved memory. In this regard, it should be noted that the mammalian memory is very dependent upon the size of the brain. As a result, there would be a demand for an increase in the size of the cortex of the female, together with associated adjustments of the skull. Once again, minute variations in the growth rates of the organic structure would lead to gradual change.

However, the increase in the size of the hominid skull would lead to a consequential increase in the head-to-body ratio, and this would lead to a corresponding increase in the length of the hominid baby's period of helplessness.

In this context, it is proposed that the demands for increased infant-rearing intelligence would not be met in the early stages of hominid development. This is because the increased period of infantile helplessness -- due to the improved brain size, would have been too disadvantageous to the specie in the early period of hominid development.

It is more likely that the early organic evolution of the hominid specie was mainly concerned with the overheating problems of the baby associated with bipedalism. It is proposed that the addition of any further disadvantages would have created a net disadvantage, which would have eliminated the additional characteristic.

However, once the organic adaptations dealing with the overheating problems had been completed, the nursing female would be able to carry its infant over long distances - without accidently killing the baby through heatstroke. At this stage, any increase in child rearing intelligence which led to a consequential increase in the baby’s period of helplessness, would not create any extra problems for the female.

So the increased child rearing intelligence would create a net advantage - which would overcome the potential disadvantage of an increased period of helplessness in the infant.

Fossil Evidence

In conclusion, the evolutionary adaptions related to infant-rearing intelligence could evolve relatively rapidly once the long leg/short arm structure had been developed. The brain size could continue to grow until the period of the baby's total helplessness matched the pre-adapted total period of carriage. This proposition closely matches the fossil evidence, which shows that the hominids did not experience any degree of brain growth, until after the development of the long leg/short arm structure.

It will be recalled that every increase in the baby's period of total helplessness represents an effective increase in the baby's total foetal stage of growth. Furthermore, every increase in the baby's foetal stage leads to a proportional increase in its later stages of growth.

For example, if the hominid baby had to be carried for three months before it could walk bipedally on its own, this would imply a 40% increase in the foetal stage of growth. As a result, the infantile stage of growth would also increase by 40%. Therefore, if the hominid baby's infantile stage of growth prior to any hominidal evolution, was similar to that of the Chimpanzee infant, the hominid infantile stage would increase from 3.5 years to 5 years.

In such an example, the hominid mother would stop suckling her infant after 3 years, but would continue to feed it upon adult food. When the nursing female stopped suckling the baby, the prolactin level would drop, and the female breeding cycle would recommence in the usual way.

When the next baby was born, the hominid nursing female would have a brood which consisted of two differently aged infants. Thus, she would have a four year-old infant, which was still in its infantile stage, and a new born baby. As a result, the hominid mother would have a L.B.I. brood, which would be similar to those of the present day, hunter-gatherer tribes.

In such a situation, the hominid mother would have to suckle her new born baby, while still feeding the previous-born infant on adult foods. However, this would be too much for any hominid mother -- in all but the most food abundant years.

It is therefore proposed that in the early development of the hominid LBI Multiage brood, the need to feed the previous-born infant would tend to prevent adequate nutrition for the newly growing foetus, and this would lead to the birth of still-born young. However, the previous-born infant would survive, and would be weaned-off at the end of the normal brood stage. The female would then recommence her breeding cycle soon after the death of her still-born young; and providing the previous-born infant had been weaned-off, the new foetus would develop in the normal way.

This situation would tend to space out the intervals between the hominid young, and reduce the pressure of competition between adult individuals of the hominid species. However, as the head-to-body ratio continued to increase due to the effects of improved infant-rearing intelligence, the L.B.I. brood would become a reality.

In this regard, the initiation of one of the most significant developments in the behaviour of the hominid species would only require one, exceptionally abundant feeding season. The reason for this change concerns the process of learning.

Learning

In this context, hominoidal ape infants learn to feed, forage, move, climb, communicate and socialise, - by copying the behaviour of adults. Furthermore, in the early period of their infancy, everything that young infants learn becomes the basis of their normal behaviour as adults. In particular, the young ape infants watch their mothers -- and copy their mothers' behaviour. For example, if a mother picks a particular fruit to eat, its infant will try to pick the same sort of fruit.

This is also the way that the young hominid infants would learn everything they needed to know. They too, would copy their mothers' behaviour, so that when they had been weaned they could survive as juveniles.

Social Sharing

Thus, in a hominid L. B. I. brood situation, the newly born infant would learn by copying its mother's behaviour. In this regard, the new born infant would regularly witness its mother feeding the previous-born infant on adult food. As a result, the newly born infant would copy its mother's behaviour -- by likewise trying to feed the older infant on adult foods. Furthermore, as the hominid mother would continue to feed the elder sibling for several months, the younger infant's early copying of this maternal behaviour would become stereotyped for life.

It is proposed therefore that the younger infant would regard the feeding of the elder sibling as a normal, and very important feature of adult behaviour. As a result, when younger infant became an adult, it would continue to feed its elder sibling. In this context, if the elder sibling was a female, who subsequently became a nursing mother, the extra food brought by its younger sibling would enable the female to rear a L. B. I. brood - even in a poor feeding season.

It should be noted that the sharing of food between adult mammals is not a common characteristic. In the case of some mammal species, the nursing females - and sometimes other adults, will share their food with the young. However, the adults of such species do not share food with other adults.

In the hominoid ape species, the nursing females will share food with their young, but adults do not share their own food with other adults - except under duress. The infants of hominoid apes never learn to share their food, because they never witness their mothers giving food to other infants, or adults.

It is proposed that the hominid development of food-sharing, due to the evolution of the L.B.I broods of young, would give a tremendous advantage to those in receipt of the food.

Thus if the elder sibling was a male, he would be better fed than most of the other male individuals, and would probably become the dominant male. Alternatively, if the elder sibling was a female, she would be able to rear her young in relatively predation-free habitats. In addition, her own nutritional strength would give her a substantial advantage over the other females, and she would quickly become the dominant female.

This is a rare example of a "quantum leap" effect in evolution. In this regard, genetic variations normally take tens of thousands of years to spread through a mammal specie's gene pool. However, the development of the food-sharing characteristic would create such an enormous advantage for those individuals which were in receipt of the food, that this behaviour would spread throughout the specie within about 1,000 years.

The improvements in the female's infant-rearing intelligence would be transmitted to both the male and female progeny. Although the male hominids would not need the increased infant-rearing intelligence of the females, they would not be seriously disadvantaged by it. Indeed, the increased memory might improve their own foraging abilities. Thus it is unlikely that this characteristic would have been sex-linked to the females.

There is no reason to believe that either the increase in infant-rearing intelligence, or the development in food-sharing would lead to any immediate changes in the way of life of the hominid specie. However, the improved security afforded to the females by the food-sharing, would tend to encourage a return to the 'Chimpanzee' type of mating system, and a more flexible, fission-fusion community.

At this stage of hominid evolution, the female's infant-rearing intelligence would have been adequate to deal with the demands of the helpless baby. In addition, the food-sharing characteristic would have given the females a sufficiency of nutrition, and a much improved degree of security. These factors, together with the full development of bipedalism, would have increased the quality of life, and should have stabilised the hominids' evolutionary development.

However, this did not happen. The hominid specie continued to evolve - because the L. B. I. brood led to two other characteristics, in addition to food-sharing. These additional effects, initiated a long term evolutionary adaptation which required another substantial increase in infant-rearing intelligence. This is related in the next chapter.