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6 Infancy in Hunter-Gatherer Life: An Ethological Perspective*

Since this paper is the only report on studies of a 'free-ranging *human* primate,' it may seem somewhat curious in the context of this volume. Nor can the studies reported here be called 'ethological' in the same sense as those undertaken by, for example, Eibl-Eibesfeldt (1970). Yet our studies have been strongly influenced by the concerns and theoretical issues raised by ethological studies, and the definition of the field 'ethology' becomes less precise every year (Lockhard, 1971). Richard Borshay Lee and DeVore began the 'San (Bushman) Project'[1] in 1963, not only with prior experience in non-human primate studies, but also with a determination to gather data on hunter-gatherers as objectively and quantitatively as possible. For example, in the first period of the study the observers neither accepted food and water from, nor offered it to, San (!Kung) groups residing nearby. While this did not ingratiate us to the local San, it enabled us to gather quantitative data on food consumption, residence patterns, group movement, and so forth in a way that would not have been possible had we engaged in the more common

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Only one of us (DeVore) attended the conference at McMaster. Following the conference Melvin Konner had returned from 20 months of research on infancy among the Bushmen, a topic that seemed particularly pertinent to the concerns of the conference. The second portion of the paper is a partial description of Konner's data.

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1 Although these people are traditionally referred to as 'Bushmen,' scholars have recently replaced this term with the non-pejorative 'San.'

pattern of convivial communality that has characterized most field work among hunter-gatherer peoples. Further, the technique of non-interfering observation was practical at a time when none of us had learned the language. Finally, these studies of the San are ethological in spirit in their emphasis on the description of observed behaviour patterns, rather than reliance on the more common anthropological technique of the interview.

As the project has progressed, eight of the field workers have become fluent in the local language, and we have used the interview extensively. But we continue to emphasize the collection of data uncontaminated either by the fallibility of recollection, or by the tendency of the informants to shape their answers to the expected response of the interviewer or by the strictures of their own value system. (It is both curious and sad that much of the popular 'ethological literature' becomes anecdotal and inferential when it turns to considerations of human behaviour and institutions.) This is not to imply that interview data are not valuable; obviously men perceive the world through cognitive filters, and structure their lives by the manipulation of symbols. But this kind of information alone, abundant in the monographs of social anthropology, is at best one-sided, and may be very misleading with respect to the kinds of information an ecologist or ethologist would value. To take an example: the !Kung group of San in the Kalahari are preoccupied with food – its acquisition, distribution, and consumption. Their traditional greeting is often followed by the declaration 'father (or mother), I'm starving!' Yet our data indicate that these same persons are among the best fed in the world. That they have food *anxieties* is perhaps significant in understanding the attitude of hunter-gatherers toward an unpredictable subsistence base, but to conclude from this attitude that they are chronically *malnourished* (as has often been done in hunter-gatherer studies) is unwarranted (e.g., Lee, 1968; Sahlins, 1968).

THE HUNTER-GATHERER PAST

It is reasonable to ask why a small, remote population of hunter-gatherers on the edge of the Kalahari Desert of Africa should be singled out for intensive study, and why we feel that this population may have more theoretical interest for understanding the basis of human behaviour, development, and society than other populations. The answer, of course, is that all mankind lived a hunter-gatherer existence for more than 99 per cent of the some three million years cultural man has occupied this planet. Even if we ignore our more remote hominid ancestors, we see that *Homo sapiens* assumed a modern form at least fifty thousand years before the species began to domesticate plants and animals or modify the environment in any significant way.

FIGURE 1 A !Kung baby at play (photo: Irven DeVore)

In terms of time, the human line has been separated from its nearest primate ancestors by at least five million years, quite possibly much longer, and throughout this period we adapted and evolved as hunter-gatherers. The 'agricultural revolution' began about ten thousand years ago, and by the time of Christ, eight thousand years later, agriculturists and pastoralists had replaced hunter-gatherers over only about one-half of the globe. Today what was once the universal method of human subsistence is confined to isolated remnants of peoples in refuge habitats. But the last few thousand years are but a moment in evolutionary time, and it seems worthwhile to ask whether the hunter-gatherer way of life, that was so instrumental in shaping our bodies, may not have left its imprint on our psyches as well – a suggestion elaborated by the psychiatrist D.A. Hamburg (1963). Human patterns of aggression, of affection, of reaction to stress, and the structure of family and group life, were all fashioned in a hunting and gathering context, and in our studies we are seeking to understand this way of life as completely as possible.

There are obvious problems in this approach. Although it was a conceit of nineteenth century anthropology to seek living relics of our own past among the 'primitive peoples' of the world, arranging them along a scale of development from the benighted aborigine to the exalted Victorian Englishman, one need hardly argue today the futility of such an attempt. Yet one can still encounter (in a recent medical journal) such statements as 'of course the Bushmen have only a rudimentary language containing about fifty words.' Suffice it to say that the San of the Kalahari Desert are fully modern, psychologically and physically, and their behaviour and institutions have continued to evolve in parallel to those of people around them. One finds among them the full range of human emotional and intellectual potential. Our interest in this people, then, is not that of the entomologist who discovers an extinct insect perfectly preserved in amber, but an interest in the degree to which they represent universally human behavioural and social responses to the hunter-gatherer way of life. By this criterion we are just as interested in the adaptation and behaviour of all hunter-gatherer peoples, but the Kalahari San do represent the largest intact population available for study.

In a paper as brief as this very little attention can be given to the problem of comparison between different hunter-gatherer societies, but many of the modern studies are compared in *Man the Hunter* (Lee and DeVore, 1968). This volume was the result of an international conference of some seventy-five scholars who met to reassess current studies of hunter-gatherers throughout the world, and explore the implications of these studies for social anthropology, human biology, archaeology, demography, and ecology. How generally representative of hunter-gatherers the San in our studies have been

can best be appreciated by reference to that volume. Not unexpectedly, the more environmental variables are held constant, the more comparable the social institutions of hunter-gatherers. Tropical Old World hunger-gatherers seem very similar in certain basic ways, and some of these are indicated below. More specialized hunter-gatherers such as arctic hunters, a recent and divergent adaptation, show important contrasts, (but even they are similar in many important respects). Since human evolution took place in the Old World tropics, under climatic conditions and in association with plants and animals quite comparable to what they are at present, generalizations based on hunter-gatherers in this region have the advantage of introducing the smallest number of extraneous variables.

One problem when using contemporary hunter-gatherers for prehistoric reconstruction cannot be easily overcome: contemporary hunter-gatherers live in refuge habitats. Since the beginning of the neolithic, agriculturalists have been steadily expanding at the expense of the hunters; today hunter-gatherers are found in areas either very remote, or unattractive to agriculturalists and pastoralists. The more favourable habitats have long since been appropriated by populations with larger, more cohesive, more aggressive social systems. Jungles, deserts, and tundras often pose difficult problems of survival, leading observers to assume that the lives of contemporary hunter-gatherers (and therefore the lives of our own ancestors) were a constant struggle for survival – lives that were, in Hobbes' words, 'nasty, brutish, and short.' These conclusions, and their implications, are very much mistaken, as indicated below.

THE SAN PROJECT

Our studies have been centered on a population of about 1600 !Kung San living in western Ngamiland, Botswana, near the border of Namibia (South West Africa). Although only a small fraction still live entirely by hunting and gathering, there are about 55,000 persons who can be considered (linguistically) 'San' living in Botswana, Namibia, and Angola (Lee, 1965). About 13,000 of these are traditionally called the !Kung, although in the area of our studies (!angwa) they refer to themselves as the 'Zun/wasi.' (The ! and / symbols denote palatal and dental clicks respectively, two of four such clicks in the language. The clicks are a linguistic feature that set apart the South African 'click languages' from other language families.)

Lee and DeVore began the study in 1963-64, Lee spending seventeen and DeVore four months in the field. We returned in 1967 with a larger group of anthropologists in such fields as medicine, nutrition, and demography, to undertake a wide-ranging series of investigations that are still in progress.

FIGURE 2 Part of a San band in repose (photo: Irven DeVore)

These include studies of hunting and gathering techniques, archaeology, demography, migration and population genetics, nutrition and general health, infant growth and development, child-rearing practices, settlement patterns, and the ritual curing trance. For long-term demographic studies, the sample of persons for whom we have basic biographical information now numbers 850 (although only about 600 persons are resident in the study areas at any time); blood samples and birth and marital data have been collected from a total of 2000 individuals. The publications by some 25 research workers since 1963 are too numerous to mention here (a bibliography will be supplied on request), nor can this brief description indicate more than a few selected aspects of !Kung life.

The !angwa region, where we have centred our studies, still contains a viable hunter-gatherer population because the climate and soils of the area are poorly suited for cultivation. Situated on the northwestern fringe of the Kalahari desert, and surrounded by a waterless zone, the !angwa region was buffered from incursions by either Bantu or European pastoralists and agriculturists until a small group of Herero cattle herders settled there in 1925. Today the !Kung share all but the smallest of their eight permanent waterholes with about 350 Hereros (together with several thousand head of

FIGURE 3 It is hard to pose if you cannot stand (photo: Irven DeVore)

livestock), and assimilation of the !Kung as satellites of Herero cattle posts is accelerating rapidly.

A REAPPRAISAL OF HUNTER-GATHERER LIFE

It is traditional in anthropology to view hunter-gatherers as living in tightly knit male-oriented bands, where kinship is traced through the male line (patrilineality) and residence is with the husband's kin (patrilocality) (e.g., Radcliffe-Brown, 1931; Service, 1966). The band was thought to be highly territorial, and very protective of hunting areas, water sources, and so on. While such patrilineal, patrilocal, territorial bands may have existed among some hunter-gatherer peoples, this characterization stems in no small part from armchair theorizing: as the primary food providers, the men would have to dominate hunter-gatherer life; they would co-operate in hunting, drive other hunters away, and lead the band to areas where game was plentiful. Further, it seemed apparent to even trained observers that hunter-gatherer life must be harsh – their nomadic travels and lack of material goods seemed evidence enough that the hunters (and, by implication, our own ancestors) lived in grinding poverty. Such conceptualizations could scarcely be further from conditions we found among the !Kung groups. There are no organized 'bands,' but clusters of families at campsites whose composition changes almost daily; nuclear and extended families move freely over an area of a hundred square miles or more, camping with relatives and kinsmen throughout the region (e.g., Lee, 1972). Kinship is traced equally through the husband's and wife's families, and residence, like all aspects of group structure, is fluid and subject to frequent changes. Far from defending territories, in this free-flowing population the very concept is meaningless. While there are allegedly 'owners' of certain waterholes, their claim to ownership is often recent, disputed, and, in any case, not enforced. Finally, far from living at a substandard nutritional level, the San are able to maintain themselves well above minimum standard nutritional levels, even in drought years, with a modest work week of only two or three days per adult, with older persons, children, and adolescents rarely participating significantly in the food quest (e.g., Lee, 1969).

Earlier students of hunter-gatherer life were not prepared to gather quantitative data on work levels and caloric intake, and they significantly underestimated the role of women in the food quest. Modern investigators have often remarked that peoples such as the pygmies of the Ituri forest, the Australian aborigines, and the San (!Kung) might better be called 'gatherer-hunters,' and indeed we have found that women contribute from 50 to 80 per cent of foodstuffs by weight, depending on the group, the time of year, etc. More important, while vegetable foods can be gathered regularly and

FIGURE 4 Proud mother with her well-nourished and well-beaded infant (photo: Irven DeVore)

FIGURE 5 Sharing plays a predominant role in social organization (photo: Irven DeVore)

infallibly, hunting success is far from predictable; a hunter may return with a hare, an eland, or (more likely) no meat at all. We find no reason to suppose that the relative contribution to the economy by women was ever less, in the past, than it is among contemporary hunter-gatherers. Ironically, however, the only tools a woman needs to collect vegetable staples are a skin bag and a digging stick – neither of which are likely to be preserved in archaeological sites. The elaborate hunting equipment of the men, however, will always be well represented in the form of arrow heads, spear points, knives, etc. The result is an almost inescapable tendency to underestimate both vegetable foods and the economic importance of women in the interpretation of prehistoric living sites.

The staple food of the Zun/wasi of the !angwa region is in fact the remarkable mungongo nut, *Ricinodendron rautenenii* Schinz. A woman collecting mungongo nuts will bring back to camp, on the average, 12.5kg from a single day's collecting trip, and this will yield 1750g of edible nut meats. The caloric value of mungongo nuts is 600 cal/100g per edible portion (about the same as domesticated nuts such as almonds and peanuts), but mungongo nuts contain about 27 per cent protein (compared to 19 per cent in other species) (Lee, 1969).

From the above description one can characterize the Zun/wasi as a people whose work effort is modest and whose leisure time is abundant. An

important key to understanding the San economy is to realize that food (and material goods) are shared, not stored. The food quest is constant, but the returns are more than adequate. Medical examinations, blood tests, and population statistics reveal the San to be well nourished and long lived. Their population density of about 0.4 persons per square mile is relatively high, compared to other estimates of hunter-gatherers living in arid regions. It is important to remember that most hunter-gatherers throughout prehistory lived in regions far *more* favoured than the Kalahari fringe – abundant in water, food plants, and game.

CHARACTERISTICS OF HUNTER-GATHERER SOCIETIES

In this brief treatment it is not possible to compare the !Kung to other tropical hunting and gathering peoples. The following characterization of the general principles of hunter-gatherer life is excerpted from a discussion of recent studies of many such groups, and the reader is directed to that discussion for evidence and details (Lee and DeVore, 1968):

> First, if individuals and groups have to move around in order to get food there is an important implication: the amount of personal property has to be kept to a very low level ... a generally egalitarian system . . .
>
> Second, the nature of the food supply keeps the living groups small, usually under fifty persons ... It is probably necessary to continually redistribute the population between bands in order to maintain food-gathering units at an effective level.
>
> Third, the local groups as groups do not ordinarily maintain exclusive rights to resources. Variations in food supply from region to region and from year to year create a fluid situation that can best be met by flexible organizations that allow people to move from one area to another. The visiting patterns create intergroup obligations, so that the hosts in one season become the guests in another ...
>
> Fourth, food surpluses are not a prominent feature of the small-scale society. If inventories of food on hand are minimal, then a fairly constant work effort has to be kept up throughout the year. Since everyone knows where the food is, in effect the environment itself is the storehouse; and since everyone knows the movements of everyone else, there is a lack of concern that food resources will fail or be appropriated by others.
>
> Fifth, frequent visiting between resource areas prevents any one group from becoming too strongly attached to any single area ...
>
> [Sixth] ... the lack of impediments in the form of personal and collective property allows a considerable degree of freedom of movement. Individuals and groups can change residence without relinquishing vital interests in land or goods, and when arguments break out it is a simple matter to part company in order to avoid serious conflict ... The resolution of conflict by fission ... may help to explain how order can be maintained in a society without superordinate means of social control.

THE CONTEXT OF INFANCY AND CHILD CARE

We were surprised to discover that, on the average, !Kung infants are spaced 4 to 5 years apart. Although !Kung women claim some knowledge of contraceptive and abortion techniques, and although infanticide is occasionally practised (e.g., in cases of congenital deformity, or when an infant is born before the previous infant can be weaned) none of these practises seem capable of explaining the long birth intervals. It is possible that prolonged, frequent, vigorous nursing suppresses ovulation more than in many populations, in which supplementary milk and/or soft foods are available for the infant. What proportion of women achieve this birth spacing, and by what means, is being investigated by Nancy Howell and Marjorie Shostak Konner. It is clear, however, that both the necessity of nursing an infant for several years, and the inability of women to carry more than one child during their food collecting rounds, serve to maintain selective pressures against more frequent birth intervals.

One result of this birth spacing, and of the small, isolated nature of San encampments, is that infants and children are rarely without adult supervision. Patricia Draper, who has studied the context of !Kung child-rearing in detail, estimates an average density in a camp of about 25 square yards per person (Draper, 1972). The central area around which the family huts are clustered is denuded of grass, bushes, or any obstruction to vision. A child in the village is within sight and hearing of all the other adults and children almost all of the time. It is into this rich social network of nurturant adults and children that the !Kung infant is born.

MATERNAL CARE IN INFANCY: AN ETHOLOGICAL PERSPECTIVE

There has been concern expressed about the recent spate of popular works on ethology, including some criticism appearing in this volume. These books purport to integrate the findings of ethology in such a way that they will be of use to professionals attempting to cope with social, pedagogical, and mental health issues, but in fact they are little more than hodge-podges of intriguing facts about animals with tacked-on, and often irresponsible, conclusions about man (e.g., Ardrey, 1961, 1966, 1970; Lorenz, 1966; Morris,

FIGURE 6 Breast feeding may continue for three to four years (photo: Irven DeVore)

FIGURE 7 Domestic life under the Kalahari sun (photo: Irven DeVore)

1968). In this area it is gratifying to refer to at least one responsible and serious attempt to bring together a large volume of research data in a theoretical framework that is at once reasoned, elegant, and testable – the first volume of John Bowlby's *Attachment and Loss* (1969). Bowlby's volume has the added advantage of taking a clear stance in relation to the history of psychoanalytic theories of development, and, further, is derived from a body of work concerned directly with the making of child care policy.

Our work on behaviour, development, and maternal care in infancy and early childhood, though initiated before the appearance of Bowlby's monograph, is in many respects very close to its concerns, and can be seen in part as a testing ground for the validity and appropriateness of Bowlby's conceptualization.

THE BOWLBY POSITION

Briefly, Bowlby's position is as follows: the human infant, like infants of many species of birds and mammals, is born with a set of reflexive perceptuomotor mechanisms. Though they can be blocked under experimental conditions of deprivation, given the normal, expectable environment of a newly-born member of the species, they will inevitably result in the formation

of attachments to caretaking figures and subsequently, to other individuals. For Bowlby, the emphasis in the first half-year is on mechanisms involving distal receptors, such as visual-postural orientation, smiling, crying and the cessation of crying, and non-cry vocalizations. The rooting and sucking reflexes connected with feeding, and the tendency for various forms of tactile stimulation and/or suckling to be very effective in bringing about the cessation of crying and other discomfort signs, are held to be important, but not overridingly important components of the initial attachment propensity. Specifically, Bowlby is critical of 'secondary drive' theory (theory that stresses the role of satiation of hunger and the pleasure of suckling as primary reinforcers for attachment behaviour) common to many psychoanalytic conceptions, including Freud's (1920). Later in the first year, in association with the development of effective locomotion, proximity-maintaining mechanisms and attachment behaviours depending upon proximal receptors come into play. These include grasping, clinging, and scrambling and climbing on the mother, and come to include following behaviour and the use of the mother as a base for exploration.

In lieu of either learning or drive theories of the growth of love, Bowlby proposes an ethological unfolding of attachment behaviour in accord with an imperfectly understood genetic program. This behaviour system is, as it were, 'seeking' an object, in something like the way the neural mechanisms underlying imprinting in precocial birds are 'seeking,' at a certain period, a suitable object for following behaviour -- with the important difference that in man and his close relatives the process is much longer (some seven months in man) and very much more gradual. (What we mean by 'seeking' is that the behaviours in question – attachment behaviours – will fully emerge, change, and function in certain predictable ways only after an appropriate object is found, and that the organism will experience considerable discomfort *until* an appropriate object is found). Because of the need for immature organisms to maintain close physical proximity to more mature members of the species, as protection against death by exposure or predation, these underlying neural mechanisms are under powerful selective pressure.

This emphasis on protection from predation suggests a change in focus for Bowlby, who in his earlier work thought of the function of attachment primarily in terms of healthy adult social behaviour, itself the result in part of healthy early attachment to a mothering figure (Bowlby, 1966). Despite this change of emphasis it is apparent that Bowlby views the mass of information on human and animal behaviour development as generally supporting his earlier view with an evolutionary justification: due to the long-standing relationship, throughout human evolution, between predation and the intensity of attachment, it is now essential to child mental health for infants to

have a prolonged and close relationship in early life to a single mother or 'permanent mother-substitute.'

THE ARGUMENT FROM EVOLUTION

Before we are able to evaluate this statement in relation to the additional evidence from the study of hunter-gatherer infancy, we should examine the variety of inferences involved in making it. There is much confusion as to the ways in which reasoning from evolution really contributes to our understanding of human behaviour. At the extreme of sloppy over-confidence a series of spottily gathered facts about behaviours in various animal species which seem to exhibit analogous patterning becomes the premise for an argument of universality and evolutionary antiquity for a 'territorial imperative' (a slightly dressed-up variety of territorial instinct) (Ardrey, 1966). This is done without giving attention to numerous animal species which exhibit no territorial behaviour, or to the variability of its forms among those that do exhibit it. It is done without distinguishing between animals closely and distantly related to man or recognizing the fact that those closest to man exhibit little or no territorial behaviour. It is done without examining the range of human societies, or giving attention to the effects of subsistence ecology on such behaviour, or even glancing at the appropriate facts about man's behaviour in situations where no territoriality is evident (e.g., a hunting-gathering environment). Among the purported applications of this slenderly based 'imperative' is a presumed explanation for the failure of one phase of collectivization of agriculture in the Soviet Union. A moment's thought (or a knowledge of Russian farm economics) can supply more conventional and better reasons, and we gain nothing from such confused resort to an evolutionary account. The sort of explanation that *can* be useful should:

(1) distinguish between arguments based on phylogeny – descent from a common ancestor in the recent evolutionary past – and those based on convergent evolution – the evolution of similar behaviour (perhaps in distantly related species) because of similar selection pressures. Thus, studies of mother/infant attachment in Old World primates are more appropriately compared to human data than are such studies of precocial bird species. However, with such phenomena as pair-bonding or paternal care, rare in primates but characteristic of most birds, examination of comparable selective pressures may illuminate the origin of such behaviour in the human species (Trivers, 1972).

(2) consider the *variability* of behaviour (a) over a *phyletic range* respecting structure, adaptation, and ecological niche, and locating the human

position in this matrix, (b) *within each species* in, e.g., a variety of environments, (c) in relation to its *basis of flexibility* in a life span.

(3) consider, *in addition to* a behaviour's antiquity and the original selection pressures that led to it, *also* its present function and those pressures maintaining it – without dubious, nonfunctional, 'held-over-from-the-past' explanations. Accordingly, human-primate comparisons would consider the radically new selection pressures (including recent medical practices and social conditions) operating on the human genotype over the past million years, and the potential for rapid change introduced thereby. Probably, nonfunctional, 'held-over' traits will prove few and unimportant.

These questions have to be addressed separately and treated with different conceptions of behaviour change, ranging from the evolutionary through the sociological to the developmental. A demonstration of great antiquity or wide phyletic range, including man and his close relatives for a behaviour, is suggestive of its genic basis, but not of refractoriness to change – nor that a change will have dire consequences. Conversely, a behaviour restricted to man alone (for example, language) can be very permanent and essential. There is a *probabilistic* relationship between antiquity or range of a character and its biological 'imbeddedness,' but this cannot provide a solution for any given behaviour. A proper evolutionary argument can suggest a focus for research and testable predictions. Ardrey's argument is poor because it does neither; Bowlby's is good because it does both.

AN INTRODUCTION TO SAN INFANCY

Preliminary observation and testing of !Kung infants suggest several broad generalizations about *this group* of hunter-gatherer infants (for more detailed data see Konner, 1972; Lee and DeVore, 1974).

(1) Neurological examination of ten infants during the first ten days of life, in accord with the procedure devised by Prechtl (Prechtl and Beintema, 1964), reveals no major departure in the composition of their reflex repertoire as compared with that of European neonates. This does not mean that large matched samples would reveal no difference in the intensity of, for example, the Moro reflex, but simply that the Moro reflex could be elicited in a way comparable to the European pattern from the majority of infants.

(2) From the first few days of life (and continuing through at least the first year) infants are carried in a sling at the mother's side. This not only positions them vertically, but also insures continuous physical contact with the mother's body. In this context it is possible to see naturally occurring instances of certain reflexes, such as placing, stepping, and crawling responses

in the legs, use of the arms to move and free the head, and the grasping response. By these adjustments the infant accommodates to the mother's movements and may prevent himself smothering against her skin and clothing. Equally important, these reflexive movements serve as signals of the infant's state changes, making it possible for the mother to learn to anticipate waking, hunger, or defecation.

(3) Indulgence by the mother of the infant's dependent behaviour throughout the first year is absolute, and in the second year it slacks off only slightly. Nursing can best be described as continual, occurring over and over again throughout the day on a demand basis, and any slightly fretful signs may be interpreted as hunger signals. (It is as if the burden is on the infant to tell the mother when he is not hungry, by extruding the nipple, rather than when he is, by crying). Urination or defecation on the mother or on her clothing is met with no response during the early months except for moving and cleaning the infant after the elimination is completed. Intense physical proximity throughout the first two years makes possible a much more fine-grained responsiveness on the part of the mother with respect to the infant's needs than can be attained in a situation where the mother and infant are frequently separated by considerable distance. For example, during the first year the average amount of time elapsed (based on the data in timed, coded observations) between the onset of an infant's fretting and the mother's nurturant response was about six seconds.

(4) When not asleep or in the sling, infants are typically held sitting in the lap of the mother or another adult or child, with whom they interact in close face-to-face exchanges, or whom they use as a base for interaction with other people in the immediate vicinity. (Thanks to the subsistence ecology and the resulting structure of the band, other people are almost always available.) The frequent nursing bouts are not, in observable terms, passive events connected only with the satiation of hunger, but active behaviours in which, increasingly as the infant grows, the time, setting, choice of breast and length of the nursing session are managed entirely by the infant. This continues to be true until the time of weaning, usually during the third or fourth year. Nursing often occurs simultaneously with active play with the free breast, languid extension-flexion movements in the arms and legs, mutual vocalization, face-to-face interaction (the breasts are quite long and flexible), and various forms of self-touching, including occasional masturbation.

(5) The process of separation is initiated and carried forward almost entirely by the infant. The mother almost never leaves the infant's immediate vicinity until the later part of the second year, and then rarely until the birth of her next, usually during the fourth year. However, the infant begins to move away from the mother as soon as it is mobile, using the mother, who

FIGURE 8 Baby and an over-the-shoulder garment cum receptacle called a *kaross* (photo: Irven DeVore)

remains sitting in the same spot, as a base for exploration. Although the prospect of becoming lost in the bush is extremely dangerous, this is very rare and is prevented both by the infant's consistent return to the mother and by the intensity of fearfulness of strangers and strange situations – an intensity much stronger than that observed in western infants (Konner, 1972). Again, because of the subsistence ecology and the nature of the band, there is usually a dense network of possible relations with children of all ages; the infant passes fairly gradually from an intense attachment to the mother, to the receptive context of a group of children – children who range in age from near-peers to adolescent caretakers, with whom the infant is both familiar and safe.

(6) The process of weaning from the breast begins at the time the mother becomes aware she is pregnant again, usually early in the third year, and weaning from being carried (which means the child, until old enough to keep up with the mother, will cease to accompany her on her gathering rounds) occurs at the time of her delivery. While neither of these processes is very abrupt or very punitive, both are relatively firm and often result in an extended period of depressed and fretful behaviour. However, there remains the consolation of the constantly present and accepting group of children which, within about a year of the infant's weaning from being carried, becomes a major focus of the latter's social behaviour.

(7) The learning of subsistence-related behaviours begins in the first year. By fifteen months of age infants are playing frequently at digging with a stick – the essential behaviour in gathering – and at chasing and striking dogs, insects, and other available living things, including people (hitting people is laughed off and not discouraged) – all essential behaviours in hunting. Particularly in the case of behaviours involved in gathering, it seems clear that infants are modelling their behaviour upon behaviours observed in their mothers, fathers, other adults, and other children.

DISCUSSION

At this stage of our knowledge it is proper to be very cautious in interpreting results, but some intimations as to the possible significance of this material can be suggested. The !Kung are not simply 'just another' non-literate society with curious and puzzling patterns of infant care among many other curious and puzzling customs. They are a hunting-and-gathering people living in a warm climate and, consequently, are constrained and guided by the pattern of subsistence ecology that was common to all human groups for roughly 99 per cent of man's time on earth. Their social organization and behaviour undoubtedly reflect better, in most respects, the situation that Bowlby calls

FIGURE 9 First lessons in peer relations (photo: Irven DeVore)

FIGURE 10 Some day this will be a way to get food (photo: Irven DeVore)

FIGURE 11 Infants are introduced early to other adults (photo: Irven DeVore)

man's 'environment of evolutionary adaptedness' than any other non-literate society for which we have good information about infant care.

The apparent implications for Bowlby's formulation and for the problems with which he is concerned are as follows:

(1) The stress on early attachment to a nurturant caretaking figure, common to Bowlby (works cited), Freud (1920), Erikson (1953), and others, is a suitable one. If anything, this position is strengthened by the facts about !Kung infancy, which reveal a mother-infant relation considerably closer, more delicately responsive, and more nurturant than the western pattern. It is also a relationship which begins relying on proximal mechanisms in attachment at birth rather than, as Bowlby suggests, in the second half year.

It must be stressed again that the importance of these data and their meaning for Bowlby's theory do not rest merely on finding similar events in a very foreign culture. The San are not merely *different* from us, they are representative of the way of life in which man and human mother/infant relations evolved. They thus stand in relation to us in a social evolutionary sequence, so that the data give mother/infant relations an historical dimension. By looking at the changes that have taken place in the mother/infant bond during the course of social evolution, we can begin to discover the antecedents and consequences of the changes.

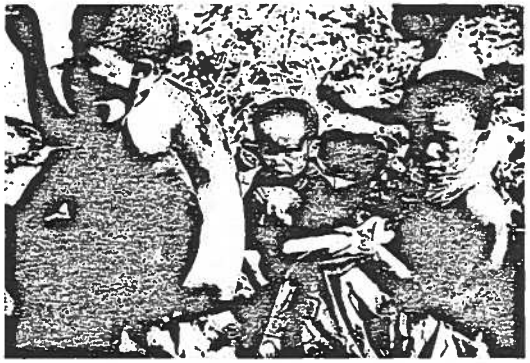

FIGURE 12 Informal affairs of the day do not interrupt contact with the children (photo: Irven DeVore)

In the latest edition of *Baby and Child Care* Spock (1968) advises mothers to become suspicious of possible 'spoiling' of babies by the age of three months, to exercise 'a little hardening of the heart,' and if, by five or six months, the baby still expects to be picked up every time he cries, advises the mother to follow a program of 'unspoiling,' including pretending she is busy when she really is not in order to 'impress the baby' with the impossibility of responding to his fretfulness. In an apparent reversal of his position in earlier editions, Spock thus encourages the tendency of American mothers to begin shaping self-reliance in the early months of life. His advice would be viewed by Zun/wasi mothers with some combination of shock, amusement, and contempt.

However, the socio-ecological circumstances of the San must be taken carefully into account in the comparison. An American mother is not surrounded by a network of relatives and friends who can help absorb some of the practical and, even more, the emotional burdens of baby care. More important, perhaps, her child is not surrounded by a network of continuously available children of all ages who will provide an attractive alternative to attachment to the mother when the need for separation inexorably arises. In other words, the dangers of 'spoiling' may indeed be greater given the socio-ecological context of American baby care of recent decades. However, in an

age of accelerating social change one need not consider the socio-ecology an absolute constant.

(2) While the data do not provide direct support for the notion of secondary drive as a process in the growth of attachment, one cannot but be impressed with the increasingly social complexion of the San nursing sessions as the infant grows through the first year, and by the whole web of attachment behaviours which occurs in the context of nursing (although they occur outside it as well). Bowlby's 'ethological' conception, that there is an innate complex of behaviours strongly predisposing the infant to attach itself to an appropriately nurturant caretaking figure, is powerfully supported by observations of growth of attachment in San (!Kung) babies. But there is no evidence to support the notion that secondary drive does not contribute at all. It is amply demonstrated in the laboratory that habits in a wide variety of animals may be strengthened by reinforcing them with the satiation of hunger. In so far as the behaviour patterns of attachment are habits, or even in the unlikely event that they are strictly innate responses, it is probable that they can be strengthened by association with the experience of hunger satiation.

(3) The observational evidence from a group of people living in man's 'environment of evolutionary adaptedness' suggests that the danger to infants of death by predation and exposure is only one part of a complex of selective forces favouring attachment during the course of evolution. If, for example, it proved to be a general law of animals with complex central nervous systems that inadequate mothering produces individuals who become abusive mothers (as Harlow, 1962, and Harlow and Harlow, 1969, found for rhesus monkeys, under admittedly severe experimental conditions), this law would result in a selection pressure as severe or more severe than any resulting from predation. Furthermore, Bowlby's earlier emphasis on attachment as a necessary base for adult social behaviour is not the mere sentimental inclination of a psychoanalyst. This function of attachment would, if valid, give it as strong an advantage in evolution as many advantageous physical characters. Adequate social behaviour is as essential to survival and reproduction as physical well-being. Finally, observational data on San (!Kung) infants support the view that adequate subsistence behaviour essential to adult survival is acquired beginning in infancy, and that it is made possible by proximity to adult models which, in turn, depends on attachment.

(4) While in the !Kung context infants are cared for almost exclusively by their mothers during the first year of life, this fact can be seen to depend upon certain aspects of the San socio-ecology. Good nutrition for the infant and protection from gastro-intestinal and other disease (a danger manifestly much greater than that of predation) requires extended and continual nursing

and an even maintenance of temperature and state. There is no nutritional substitute for milk, and the danger of gastric upset, chills, and other possible preludes to infant disease must be reduced to a minimum. The likelihood that, in a small nomadic band, there will be a woman other than the mother with freely flowing milk and no infant of her own to nurse, and who might participate significantly in the infant's care, is nil. While the San fathers play with their infants frequently and certainly are inclined toward infant nurturance, their possibilities are limited by the fact that they have no breasts. For these reasons it is easy to see why attachment to the mother exclusively (or, in rare instances, to a 'permanent mother-substitute') is unavoidable in the San adaptive context.

However, there are many other societies of ethnographic record which, under different conditions of socio-ecology, are able to provide a variety of forms of multiple-mothering or multiple-caretaking. As Margaret Mead has pointed out in a cogent critique of Bowlby's position (1966), many studies of multiple-caretaking, from traditional polygynous cultures to modern Israeli kibbutzim have failed to show that multiple-caretaking has any objectively detectable unfortunate sequelae *whatsoever*, provided that the two or three or several caretakers offer an adequately nurturant and uninterrupted human environment. The same conclusion was drawn more recently in a major review of cross-cultural studies of child development (Levine, 1970). Finally, in societies where the risk of infant death is slender, there is no evidence of ultimate biological advantage in leaving infant care exclusively to women. In so far as the mother has been pregnant for several months by the time of birth, in so far as the father can never be entirely sure that his offspring are really biologically his own, and in so far as there are still certain advantages to nursing, mothers and infants (compared to fathers and infants) will be more disposed toward each other. But that in individual cases it would be detrimental to the infant's psychological health and growth for a man and woman to participate equally – or even in a proportion favouring the man – in the care of an infant, has never been supported with reliable evidence.

It will be noted that while we have argued that some aspects of the San adaptive complex, like indulgent mothering, may well prove to be important and refractory to change without serious consequences, we have argued that another aspect, the single mother, may not. Because no data have as yet shown serious consequences of multiple parenting, we have looked for adaptive facts bearing on the need for the single mother in the evolutionary context and found them neither permanent nor compelling. On the contrary, although the natural mother is the primary caretaker, her relationship to the infant is embedded in a social network which provides important support for her. Fathers and women other than the mother absorb minor aspects of the

be related to an extreme version of certain forms of self-reliance demanded by western socio-ecology, and to the absence of a continuously present group of children of all ages in the environment of the baby to whom the latter can transfer his attachment and other social behaviours at the age of two or three, which presents the risk of a detrimentally prolonged or intense attachment to a single mothering figure. This failure of separation could probably occur only where the nuclear family is ecologically isolated, as it is in western society, and on this basis we would be inclined to predict low indulgence of attachment behaviour in early life in other societies where the mother/infant pair has only meagre social resources. Conversely, if such resources were to increase, as is possible in view of current experimentation with forms of day care and communal living, it might be possible, if judged desirable, to return to more indulgent forms of care in early life. In fact, one might predict that this will happen rather automatically, as a result of the pressure of babies upon mothers, through their inborn repertoire of attachment behaviours, evolved during more than forty million years of primate evolution.[2]

2 This has been shown by Whiting (1961). Also, prediction of low indulgence with only meagre social resources was directly addressed by a study by Rafael (1971) who showed that among urban mothers who attempt to breast-feed their infants, failure of milk-flow is most likely to occur in those mothers with the least contact with relatives, friends, and neighbours. Furthermore, intervention by a supportive, friendly (female) 'social worker' (the experimenter), shortly after failure of milk-flow caused the mother to switch to bottle-feeding, resulted in resumption of milk-flow in the majority of cases. This convincing evidence of the importance of the 'embeddedness' of the mother/infant pair in a social network shows that this factor can influence not only the sociology but also the physiology of mother/infant relations