

Maternal Care, Infant Behavior and Development among the !Kung

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A man laughing with an infant



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At the time this study was conceived, infancy had become a major focus of interest for psychologists (Kessen et al. 1970), ethologists (Hinde and Spencer-Booth 1968), and students of the evolution of behavior (Bowlby 1969). Draper's excellent work on !Kung childhood (Chapter 9) was beginning to produce some interesting results pertaining to infancy, but was to focus ultimately on the effects of subsistence ecology on later childhood. So it seemed wise to plan a specific study of infancy as part of the long-range Harvard project.¹ Like other aspects of the expedition, this study suggested itself with a certain amount of urgency. Hunter-gatherer life did not seem destined for a lengthy future, and with it would pass an important chapter in our knowledge of human infancy, especially of the evolution of human infancy. That is, its importance lay not mainly in its uniqueness as an ethnological variety, but in its position as representative of a group of societies resembling, in their basic subsistence ecology, the original human sociocultural form.

The study of infancy was carried out over twenty months between 1969 and 1971 in the !Kangwa, Dobe, and /Du/da areas of northwestern Botswana. It was made technically possible only by the context of the larger expedition, since an infant study cannot be carried out without a secure rapport with the community, or without exact ages for the infants. The ages were available from the basic demographic work of Howell, Lee, and Draper; and the rapport, thanks to all the previous expedition participants, was excellent.

A preliminary descriptive account of !Kung infancy (Konner 1972b) has appeared; as well as a theoretical treatment of its meaning for an overview of the evolution of attachment, especially Bowlby's theory of attachment (DeVore and Konner 1974); and a study of sex differences in the behavior of two- to five-year olds (Blurton Jones and Konner 1973). The present chapter attempts a more quantitative presentation of some test data, and extends the earlier theoretical perspective in terms of quantified new data.

There are several reasons for taking an interest in !Kung infancy, in terms of behavioral science strategy. One is that, like any cross-cultural research, it broadens the variability available to us for study. It has the effect of giving us more variance with which to address any theoretical issue; and occasionally, it may disabuse us of false notions, explicit or tacit, of the universality of some western infant behavior or caretaking procedures. Unlike, however, most cross-cultural research, it adds a temporal or evolutionary and (potentially) causal dimension to the extent that we can guess, by extrapolation from modern hunter-gatherers, what adaptations in infant care and development must have characterized *ancestral* populations of

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hunter-gatherers. That is, we reason from what we know of hunter-gatherer sociobiology and subsistence ecology and how it appears to affect infancy. Finally, it gives us leads, to be checked in an appropriately broad cross-cultural context, on possible universal features of human infant care, infant behavior, and development. This, in turn, gives us a basis for cross-species comparisons.

By way of introduction to the material to follow, three general features of the social context of !Kung infancy should be emphasized. First, the !Kung mother-infant bond is close, of long duration, and characterized by general indulgence of infant demands while remaining low in restriction of infant operations. Second, this relation rests in a very dense social context. The mother-infant pair is typically in constant contact with other adults (relatives and friends). This is in marked contrast to the relative isolation of American mothers, and probably goes a long way toward making the very indulgent !Kung pattern emotionally *possible* for mothers. Third, the infant graduates from his strong attachment to his mother to an attachment to a multiaged child group. This transition begins at the end of the first year and is largely complete several months after the birth of the next sibling, usually at age three or four. It is important to note that this child group is *not* a peer group (see also Draper 1972a). Indeed, given the demographic limitations of foraging subsistence, the likelihood that there would ordinarily be enough children of the same age at the same place at the same time to *form* a peer group is very slender. Multiaged groups have the following implications: 1) older children in the group will discharge many caretaking functions of the mother and father, thus largely obviating the need for parental vigilance after age three or four; 2) the infant's transition from interaction with parents to interaction with children is facilitated by the fact that much of the behavioral equipment he already has for social relations, exercised in relation to adults, is also appropriate in relation to older children, whereas the behavior would not work so well with peers; 3) cultural transmission in general can be carried out more on child-to-child basis, as opposed to adult-to-child only; 4) the acquisition of caretaking behaviors themselves is greatly facilitated by older children's experience with infants in these groups.

Typical Infant Positions and the Infant Sling

From the earliest days of life and throughout the first year, three positions characterize infant posture: 1) awake, held sitting or held

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Newborn, older sister and mother



standing in the lap of the mother or other caretaker (since there are no chairs, adults are typically sitting on the ground); 2) awake or asleep, in the infant sling at the mother's side; 3) asleep, lying on a cloth on the ground beside the mother. Later, sitting on the ground beside the mother is added to these three. Infants are rarely permitted to lie down while awake. Mothers consider that this is bad for infants and that it retards motor development. (This is the opposite of the folk belief in the northeastern United States where grandparents, at any rate, say that vertical posture is bad, at least for very young infants. Hence, presumably, the American parental practice of laying babies down most of the time.)

The sling merits specific description because it differs in important ways from carrying devices in many other nontechnological societies, and from all the carrying devices now acquiring some commercial success in the northeastern United States. It is maximally nonrestrictive, leaving the arms and legs moving freely. It allows constant skin-to-skin contact between mother and infant. And it keeps the infant on the mother's side (hip) rather than on her back or front. The side position has the following noteworthy features: 1) the infant sees what the mother sees, thus sharing her view of the social world and the world of objects, especially a close view of work in the mother's hands and eye-level contact with children, who take considerable interest in babies; 2) the infant has constant access to the mother's breasts, which are uncovered, and after the development of visually directed reaching feeds himself whenever he likes (more or less continually); 3) the infant has constant access to cosmetic and decorative objects hanging around the mother's neck, and often occupies himself in playing with them. These objects appear to function for the infant as do objects hung in American cribs. This is important because the latter have been shown to significantly accelerate sensorimotor development during the first six months (White and Held 1967). (See Figure 10.1 for nursing data.)

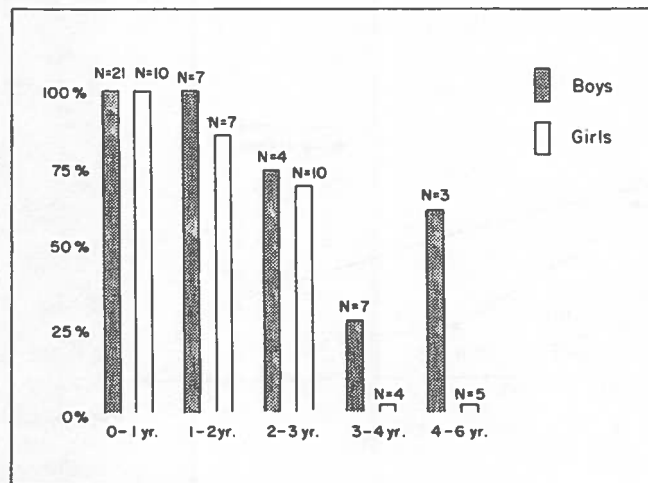
Infant's Physical Contact with Mother and Other Caretakers

The extent of physical contact between the infant and mother during the first two years is shown in Figure 10.2. The graph shows passive physical contact only, excluding active touching of the mother by the infant (unless passive touching is going on at the same time) in order to reflect a more stable aspect of mother-infant contact without the infant's actual initiative playing the dominant role.

The sample in this graph consists of 31 babies ranging in age from one to 94 weeks, each observed at from one to four age-points for a total of 54 age-points. The data are drawn from three spot observations per infant per age-point. Each spot observation was done as the observer approached the mother-infant pair for the purpose of doing longer timed observations. The spot observation, a brief note of the juxtaposition and activity of mother and infant, was made immediately upon entering the village-camp and before the mother or infant noted the observer's presence. The observations were not formally randomized either with respect to time of day or order of mother-infant pairs. The latter is unlikely to have affected the data since there was typically only one mother-infant pair per village-camp. All daylight hours are represented though the earliest are under-represented. The data should therefore offer a fairly pure index of mother-infant contact under natural conditions.

The proportions of observations per age-point per child for which there was passive physical contact were averaged over arbitrary age groupings to give the dots on the solid-line portion of the graph (males and females separately). Each dot represents from two to eight infants at from four to nine age-points.

Figure 10.1. Percentage of infants and children nursing at time of contact, by age and sex groups. Cross-sectional data. Sex difference not significant.

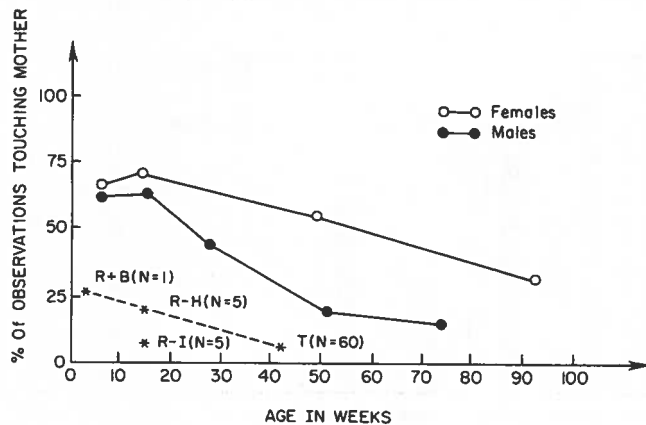


The data indicate a gradual decline in passive physical contact from a high of about 70 percent in the first months to about 30 percent in the middle of the second year. There is also a nonsignificant divergence of the sexes after about twenty weeks, with the females having more passive physical contact than the males.

Other data (Blurton Jones and Konner 1973) from observations of two- to five-year-old !Kung children in the same study area show that girls are more likely than boys to be passively touching, or within two feet of the mother, and suggests that the sex difference in infancy persists (as measured by the Mann-Whitney U test, $p < 0.05$). Draper's (1972a) study of the behavior of !Kung children of all ages shows tendencies for girls to be more in the presence of adults, more in the immediate village-camp vicinity, and less in contexts where there were only children than was the case for boys.

The dotted line graph in the lower left of Figure 10.2 is an effort to present some sort of comparison from already published data on English and American infants. The first star on the graph represents one eight-day-old infant studied by Richards and Bernal (1972) in Cambridge, England. They published a twenty-four-hour diary kept

Figure 10.2. Amount of passive physical contact with the mother. Straight lines, !Kung infants. Dotted line, American and English data from other studies. R-H and R-I, home and institution reared infants in North Carolina, Rheingold study (1960). T, Tulkin (1970). R & B, Richards and Bernal (1972).



for this infant by its mother as typical of their much larger sample. The percentage noted includes all time spent out of the cot, either being fed or being bathed, as a proportion of total waking time. The next group of infants is drawn from Rheingold's study, done in North Carolina (Rheingold 1960), comparing home-reared and institution-reared infants (three and one-half months old). These data are from observations rather than diaries (one instantaneous observation every fifteen seconds for several hours). Again, the percentages include all time the infant was held, plus basinette time, on the theory that infant bathing may be a parental effort to establish contact in a culture where "purposeless" physical contact is largely unacceptable. The ten-month data are from Tulkin's study of social class differences in infant girls in Boston (Tulkin 1970; Tulkin and Kagan 1972). The data, from timed-sequence observations, show no class differences in physical contact, so the sixty subjects were pooled to form the proportion.

Both the !Kung and the admittedly makeshift "western" curve show declining physical contact with age, the total amount of physical contact being very much greater for the !Kung infants. Note especially that the order of magnitude of the difference, in the Rheingold study, between the home-reared infants is small compared with the difference between normally reared American and !Kung infants. If orphanage infants in North Carolina are "deprived" of physical contact as compared with infants living at home in the same area, then normally reared infants would appear to be similarly "deprived" as compared with !Kung infants.

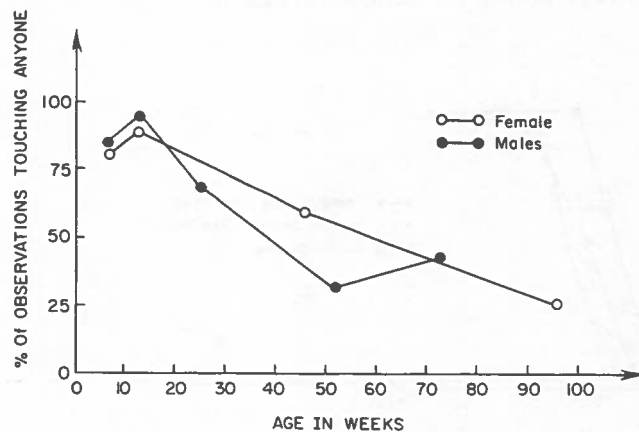
Whether this sort of statement makes any sense will depend upon studies of the consequences of different degrees of early physical contact which have yet to be done. Several facts, however, point to the importance of this issue. 1) American child-training practice (middle-class, as of 1940) is found to be low in the indulgence of dependency (which would include physical contact in infancy) as compared with a worldwide ethnographic range (Whiting and Child 1953). 2) Whiting (1971) in a recent cross-cultural study of mother-infant physical contact found it to be directly correlated with mean annual temperature. Since man evolved in a context of tropical hunting and gathering, the likelihood is that the !Kung pattern of high mother-infant physical contact characterizes human populations during the Pleistocene. 3) Laboratory studies of macaques (*Macaca mulatta*: Hinde and Spencer-Booth 1968; *Macaca nemestrina*: Jensen et al. 1968) show a curve of mother-infant physical contact starting at close to 100 percent, declining to 50 percent during the first

fifteen weeks, and thereafter declining much more gradually until the end of the first year. Apart from the greater amount of contact for the first few weeks, the curve is similar to the !Kung curve. Even though these are laboratory curves, Hinde and Spencer-Booth show that the presence or absence of social context does not alter the pattern drastically. DeVore (1963) and Jay (1963) describe mother-infant relations in free-ranging baboons and langurs, and their data indicate high physical contact as well. The research in general indicates that high mother-infant physical contact is a basic higher primate pattern. The !Kung infant data together with the Whiting (1971) study suggest that man did not evolve away from this pattern, at least not to the extent of the major departure exhibited by Western infant care, until the tropical hunting and gathering mode of subsistence was left behind.

Contact with Other Persons

Figure 10.3, based on the same spot observations collected as described above, shows passive physical contact with anyone, including the mother. This makes the earlier part of the contact curve even more similar to the laboratory monkey curve, although the latter is for mothers only. Wild monkey species are known to vary

Figure 10.3. Amount of passive physical contact with anyone, including mother.

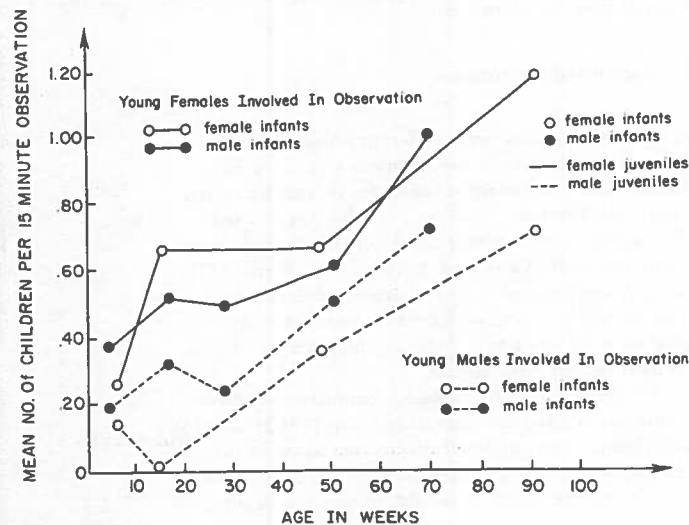


in the extent to which contact between infants and other individuals is permitted by mothers (Lancaster 1971), but descriptions of some, Lancaster's own vervets (*Cercopithecus aethiops*), for example, suggest that two graphs corresponding to Figure 10.1 and Figure 10.2 would make vervets and humans seem very similar.

Figure 10.4 shows an analysis by age of infants of any sort of participation by older children in the course of an infant observation. These are not spot observations but 15-minute timed-sequence observations, 6 per age-point per infant. In these, the observer's presence was known to those being observed. Other sampling characteristics are as described for Figure 10.2 above.

Girls play more with infants of both sexes than do boys. There also appears to be a same-sex preference operating so that girls play more with girl infants, and boys play more with boy infants. These two factors together would explain the graph. It should be noted that the Y-axis does not necessarily reflect the amount of time the infant spent with the child or the number of interactions but only the number of children involved with the infant per 15-minute observations.

Figure 10.4. Mean number of children of either sex appearing in 15-minute observations of infants, female and male.



Data from observations of two-to-five-year-olds in London and among the !Kung, conducted by Blurton Jones and myself, show that English children in this age group are more likely to be face-to-face with the mother than are !Kung children (Mann-Whitney U test; girls $p < 0.02$; boys, $p < 0.002$) and less likely to be face-to-face with other children (girls, $p < 0.02$; boys, $p < 0.10$). This finding suggests that despite early intensive contact between !Kung mothers and infants, these infants do not become excessively attached toddlers or children. The maximum number of feet from the mother during the hour of observation is greater for !Kung than for English children (girls $p < 0.10$; boys $p < 0.02$), and there is no difference between the cultures in the amount of time touching or within two feet of the mother. If anything there is a suggestion that English children in this age group are more concerned with their mothers than are !Kung children, and independently recorded facial expression data (Blurton Jones, personal communication) support this tendency.

To summarize: while !Kung infants have very much more physical contact with their mothers than do English and American children, they also have a good deal of social contact with others. Although they face a difficult and often depressed separation experience at the time of weaning and the birth of a sibling (around age three or four, see Shostak, Chapter 11), they eventually adjust to this separation, and become closely involved with the multiaged child group which becomes the focus of their social interest.

Neuromotor Maturation and Neuromotor Learning

As part of an effort to assess as many different aspects of infant development as feasible, neuromotor development tests were administered. A neurological assessment schedule for infants up to ten days of age (Prechtl and Beintema 1964) was administered to ten infants. For older infants, a neuromotor development schedule based on the work of McGraw (1963) was used (Richards and Bernal MS). That this test has the advantage of more elaborate and detailed descriptions of motor behavior and stages than is usual in other infant tests should improve one's confidence in comparisons of samples assessed by different investigators.

Figures 10.5–10.9 show the results of such a comparison between the sample of !Kung infants and the original McGraw (1963) sample on the age of attainment of one phase of sitting, one phase of the assumption of erect posture, and three phases of erect locomotion, respectively. In each case the Y-axis shows the proportion of infants

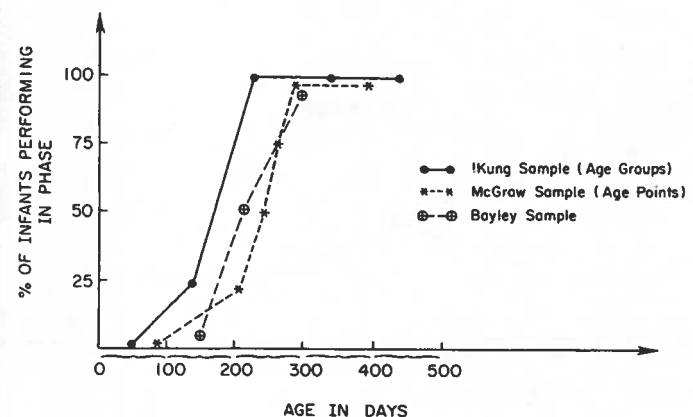
tested who give phase-appropriate behavior; the X-axis shows age in days.

The !Kung sample consists of twenty-one infants tested mainly cross-sectionally at various ages, though with some semilongitudinal data mixed in. The McGraw sample is a larger and completely longitudinal one tested weekly and thus monitored much more closely than the !Kung sample, some of whom were tested only once, while others were tested two to four times a month or two months apart. This would mean that the entry of one of McGraw's infants into a phase would have been noted within one week of its occurrence, whereas a !Kung infant's entry into a phase might be noted only a month or more later. This would tend to bias the data so as to make the McGraw American sample appear to attain phases earlier, relative to the !Kung sample, than they actually do.

In spite of this bias, in three of the five graphs, the !Kung infants are performing in phase earlier than the American infants. The dots on the !Kung solid line graphs are percentages of groups of infants whose ages fall within 100-day blocks. The stars on the McGraw graph are percentages of infants all actually at the specific age indicated.

Figure 10.5 shows the attainment of the phase of sitting characterized by the ability to maintain an erect sitting posture without

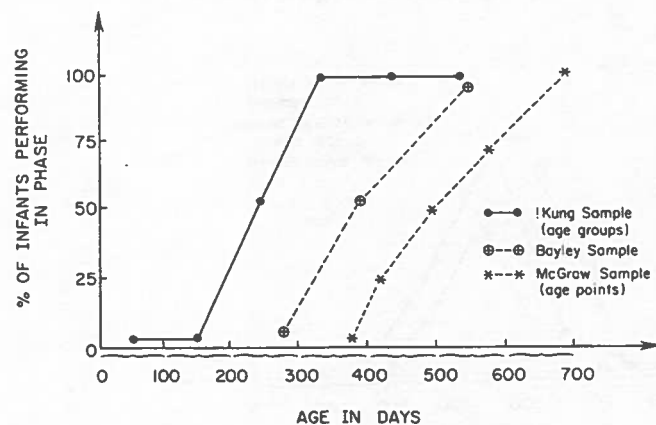
Figure 10.5. Attainment of independent sitting in !Kung infants, compared with McGraw (1963) data. For description of phase (F) see text.



support from the arms. Figure 10.6 shows the attainment of the rising phase characterized by the ability, in the testing situation, to rise from the supine position on the ground, without assistance and without holding on to anything, to the erect standing position. Figure 10.7 shows the highest phase of walking, characterized by "synchronous arm-swinging with associated opposite leg movement." Compared with the behaviors shown in the other four graphs, this behavior is less dramatic and probably less reliable from one observer to another. In consequence, one might want to be more skeptical about the comparison between the two studies in this instance than in the other four. Figures 10.8 and 10.9 show the phases of walking with both hands held, and initial walking without assistance but without heel-toe progression or synchronous arm movements, respectively. These latter two graphs show descending as well as ascending segments because they do not represent the highest stage of a given locomotor development sequence, and so show infants passing out of the phase as well as into it.

While Figures 10.5-10.7 indicate a clear motor advancement of !Kung infants compared with American infants, Figure 10.8 shows no difference and Figure 10.9 shows a slight reversal of this effect. The Bayley age norm (including both black and white American

Figure 10.6. Attainment of independent rising from lying to standing in !Kung infants, compared with McGraw (1963) data. For description of phase (F) and sampling see text.

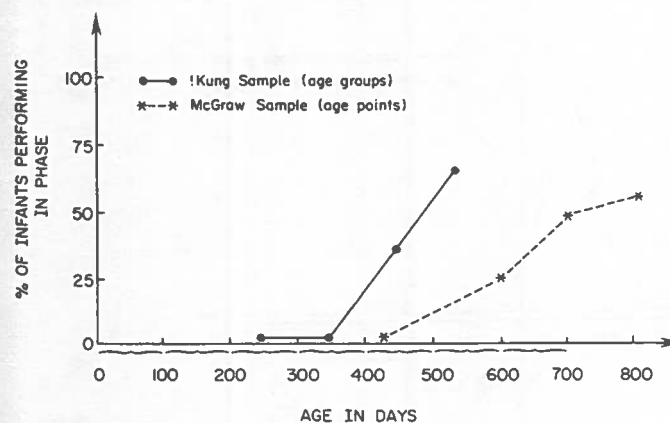


infants, Bayley 1969) for independent walking is shown on Figure 10.9 to indicate that the McGraw sample may be walking a bit earlier than the American norm, assuming that McGraw and Bayley were looking at the same thing. On the whole, considering that the procedures biased the data in favor of the McGraw longitudinal sample, it seems reasonable to conclude that !Kung infants are advanced in motor development in general as compared with their American counterparts.

The question of why this is so is a very complicated one. The precocity of African infants in motor performance as they develop (though not at birth) is a well-accepted phenomenon (LeVine 1970); and Warren's (1972) cogent critique of the research, although it points to the need for more careful work in this area, does not convincingly dispel one's belief in the phenomenon.

The first explanation that comes to mind, of course, is that the genetic basis of the developmental rates exhibit some sort of racial polymorphism. One would expect, if this were so, to find differences at birth. While one well-known study has found such differences (Geber and Dean 1967), its methodology has been heavily criticized (Warren 1972). Warren's restudy of the same Ugandan population failed to find evidence of precocity at birth, and Geber's own study of African newborns in Zambia (T.B. Brazelton, personal communi-

Figure 10.7. Attainment of highest phase of independent walking in !Kung infants, compared with McGraw data (1963). For description of phase (G) and sampling see text.



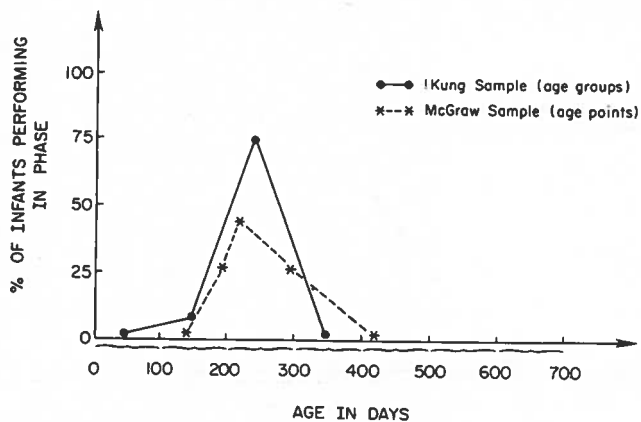
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cation) also failed to find evidence of precocity. Infants of the !Kung, who are considered racially distinct from these other African populations, likewise do not give evidence of perinatal precocity. (These findings are described in somewhat greater detail in Konner 1972b.)

While the absence of differences at birth makes the existence of genetic differences less likely, it is still possible for postnatally emerging differences in developmental rate to be genetically based. Before reaching this conclusion, however, one would want to rule out the possibility of environmental influence. It was the opinion of Ainsworth (1967) that the precocity of her and (Geber's) Ugandan infants in the first two years resulted from the exercise and stimulation of unrestricted freedom of movement and from being held all the time.

Though the question of how much these neuromotor developmental rates are subject to environmental influence and learning has been a controversial one, Zelazo and his associates (1972) have demonstrated indisputably that exercise of the placing and walking reflexes of the newborn for only twelve minutes a day during the first eight weeks not only greatly increases the response rate for these reflexes, but also accelerates the attainment of walking alone by from six weeks to two months as compared with different groups of

Figure 10.8. Attainment of walking with hands held in !Kung infants, compared with McGraw data (1963). For description of phase (D) and sampling see text.

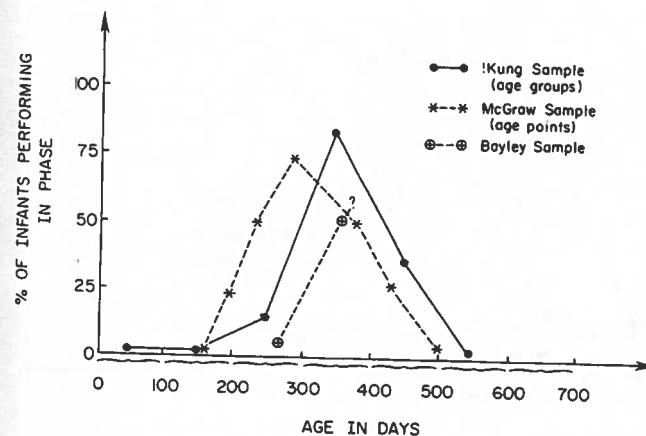


controls. Passive exercise of the legs also has an accelerating effect, but one significantly smaller than that of active exercise.

The Zelazo finding strongly suggests that neuromotor maturation of the !Kung infants may be accelerated by their exceptional amount of experience in the vertical position, since they are held sitting and held standing from the earliest weeks throughout infancy. While the age of independent walking itself is not accelerated, neither is the walking reflex at birth specifically exercised. Perhaps, as Zelazo (personal communication) has suggested, the marked acceleration of the age of walking alone depends on exercise of the centrally organized mechanism of walking, rather than just muscle exercise. This would help explain why !Kung infants walking alone at the same age as their American counterparts reach the mature phase of walking (synchronous arm-swinging) earlier. Once the central mechanism emerges, the months of previous muscle exercise then greatly shorten the clumsy-walking phase and accelerate the attainment of mature walking.

Another factor which demands attention is the !Kung parental attitude toward motor development. This attitude was among many aspects of parental belief studied in child behavior seminars² held with various groups of !Kung men and women. Although their be-

Figure 10.9. Attainment of first phase of independent walking in !Kung infants, compared with McGraw (1963) data and Bayley (1969) norm. For description of phase (E) and sampling see text.



lie about most aspects of development involves a sort of cognitive-alimentation-adaptation view (the child plays and tries to do it and teaches himself) with some basis in maturation for the behavior, they do not believe in the maturation of motor milestones. They insist that a child not taught to sit, crawl, stand, and walk will never perform these behaviors (even as late as age three) because the bones of his back will be "soft" and "not tightened together." So they go through a training routine for each of these behaviors. Infants too young to sit are propped in front of their mothers in the sand with a wall of sand around their buttocks to support them. When they fall, they are propped up again. Incipient walkers are lured with bits of food to push the limits of their ability. And so on.

In general, it seems reasonable to accept the explanation of environmental influence for the partial precocity of !Kung infants. In view of recent evidence for the lability of these developmental systems, it would be wise to investigate this possibility in all cases of population differences in motor development rates. The burden of proof seems to have shifted to those who believe these differences are genetically based. They will have to either 1) show conclusively that there are population differences in motor capacity at birth, and that these are not the result of differences in prenatal care, maternal nutrition, or perinatal insult or 2) show that there are population differences in postnatal development rates where there are no differences in aspects of parental care and experience which are likely to affect these rates.

Cognitive Development in Early Infancy

In an effort to assess some dimensions of mental or cognitive development, data were collected by means of the Einstein Scales of Sensori-motor Development (Corman and Escalona 1970; Escalona et al. 1969), based on the infant studies and sensorimotor development theory of Piaget (1954; 1962). Only the results from the Prehension Scale, for infants in the first six months, have been analyzed so far. These results are presented in Figure 10.10.

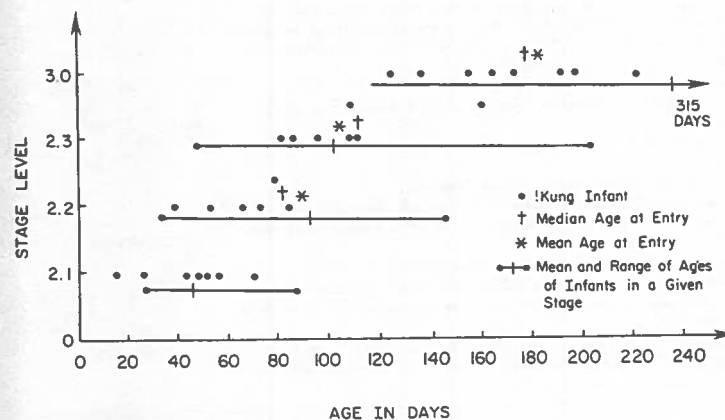
The scale is ordered into stages, each consisting of several items all believed to reflect the same level of cognitive maturity. The scalability of the items, that is, the consistency of clustering within the stages, has been demonstrated for a sample of American infants (Corman and Escalona 1970). It was our impression that the clustering is very similar for !Kung infants, but our sample (18 infants in all, from 5 to 8 per stage) is not sufficiently large or sufficiently

longitudinal for a numerical demonstration of clustering. Strictly speaking, this is a flaw in the comparison.

The graph in Figure 10.10 shows the four-stage levels of prehension discontinuously along the Y-axis, and age on the X-axis. Each !Kung infant performing at a stage level is represented by a dot. The rest of the data represented are from Corman and Escalona's (1970) fully presented results on their longitudinal American pilot sample (14 infants). For the American infants the median and mean age of entry into the stage is shown, as is the mean and range of ages of all infants in the stage, whether having just entered or on the verge of "graduating." It is the latter measure which is most appropriate for the comparison with !Kung infants because, again, the American infants are closely monitored while the !Kung infants are "catch as catch can," and therefore most likely to be in mid-stage.

Important items in the various stages are shown in Table 10.1. According to the instructions in the manual (Escalona et al 1970), infants are scored as performing in stage if they make two or more separate responses appropriate to the stage, or if they make one response on two or more separate trials. There were two observers,

Figure 10.10. Prehension scale, Einstein scales of sensorimotor development. Y-axis, discontinuous graph of four stages of sensorimotor development in the first six months. Points are !Kung infants. Other data are from Corman and Escalona (MS) sample. For description of scale see Table 10.1. For sample description see text.



and both had to agree that a response had been made before it could be scored. The ages of the !Kung infants in a stage on the graph are compared with the midpoints, for individual American infants, between age at entry and age at leaving the stage, using the Mann-Whitney U test (two tailed). The !Kung infants are younger than the American midpoint ages for Stage 3 ($p = 0.002$) and Stage 2.3 ($p < 0.002$) and younger than the American age at entry for Stage 2.2 ($p < 0.02$).

Thus the general trend is for !Kung infants to be ahead of American infants in the Corman Escalona sample on these indicators of very early cognitive or sensorimotor development. Clearly these items are not free from the influence of motor maturation. No available test of infant intelligence is (although Tulkin's [1971] study has made made important progress in this direction). Still, behavior such as

Table 10.1. Prehension scale items administered (brief summary)

- (1) Infant touches, rubs, scratches or grasps objects or surfaces. Stage 2.1.
- (2) Infant touches, grasps, releases, re-grasps, releases and re-grasps in continuous sequence. Stage 2.1.
- (3) Infant brings any portion of his hand to his mouth. Stage 2.1.
- (4) Infant touches hands together in any way. Stage 2.1.
- (5) Object placed in infant's hand, out of visual field:
 - Response 1: After three seconds or more, object is brought to the mouth, without visual regard. Stage 2.1.
 - Response 2: As above, but with no delay. Stage 2.2.
 - Response 3: Visual regard, three seconds or more, before bringing to mouth. Stage 3.
- (6) Object presented visually, infant's hand out of visual field:
 - Response 1: Sucking movements or mouthing of hand (3X), while looking at object. Response must begin only after presentation. Stage 2.2.
 - Response 2: Energetic arm waving or groping following presentation. Stage 2.3.
 - Response 3: Reaching following light touch of infant's hand with object. Stage 2.3.
 - Response 4: Hand to mouth followed by reaching and touching object. Stage 2.3.
 - Response 5: Coordinated reach and grasp. Stage 2.4.
- (7) Object presented visually, infant's hand in visual field:
 - Response 1: Infant looks alternately at object and at hand. At least four shifts in focus. Stage 2.3.
 - Response 2: Infant reaches for and contacts object. Stage 2.3.
- (8) Hand regard:
 - Response 1: Transient but repeated hand regard. Stage 2.1.
 - Response 2: Longer continuous regard, at least four seconds. Stage 2.2.
- (9) Infant's hand grasped and restrained by examiner, out of infant's visual field (twice with each hand):
 - Response 1: Infant tries to free hand, without visual regard. Stage 2.2.
 - Response 2: Infant turns to look at hand and/or face of examiner. Stage 2.3.
- (10) An object is placed in infant's mouth. Infant brings one or both hands to object as if holding at his mouth. Stage 2.2
- (11) Infant transfers object from one hand to the other with visual regard. Stage 3.
- (12) Sustained shaking of rattle while facial expression and movement indicate attentiveness to sound. Three separate occasions. Stage 3.

the Stage 3 items "shakes rattle with regard to sound" and "transfers object from hand to hand with visual regard" have as their crucial features not motor adeptness but the mutual articulation of two separate sensorimotor systems (or schemata) reflecting, presumably, the maturation of some central organizing mechanism. It seems reasonable to suggest that !Kung infants are advanced with respect to a cognitive development factor (in the first six months) which is separate and distinct from their advanced neuromotor maturation.

In attempting to explain this difference, one thinks first of environmental enrichment, since many studies (e.g., Robinson and Robinson 1971; Fowler 1972) have now shown that social and environmental enrichment significantly enhances the cognitive development of infants. Figures 10.2 and 10.3 above indicate that infants are getting very considerable social stimulation in the first months, both from the mother and from other individuals. White and Held (1967) have shown that one aspect of sensorimotor development, the growth of visually directed reaching, can be accelerated significantly by the presence of hanging objects in the infant's crib. Observations suggest that cosmetic and decorative objects hanging around the !Kung mother's neck within reach of the infant on her lap or in the sling serve much the same function as the White and Held crib mobiles.

One final factor deserves mention in relation to this cognitive advancement: the fact that !Kung infants have much more experience in the vertical position than do their American counterparts. Vertical and horizontal positions have very different effects on levels of alertness, particularly in early infancy. A number of investigators of infant cognition (Bruner 1968; Bower et al. 1970) have found that positioning young infants (who cannot as yet sit) in a vertical or semivertical posture in an infant seat improves their performance on cognitive tasks. Vertical posture is also linked to a phenomenon known as the "orthostatic pressor reflex." This homeostatic reflex, present in most mammals, is a response to vertical positioning which activates the sympathetic nervous system. The adrenal medulla, part of the sympathetic nervous system, produces epinephrine which causes arousal and which may facilitate the cognitive process.

Vertical posture is well known as a soothing device for crying infants (Oken and Heath 1963), including newborns (Konner and Grobstein 1966). Konner and Grobstein demonstrated that eye-opening and visual scanning occurred more frequently ($p < 0.01$) in newborns held upright against the shoulder than in controls. The combined stimuli of this experimental treatment would be quite

similar to those present for the !Kung infant in the sling. One would predict, on this basis, more visual scanning in !Kung infants than in American and other Western infants. Korner and Thoman (1970; Korner 1972) extended these experiments, finding that of six interventions in crying newborn infants "vestibular stimulation had a far more powerful effect in evoking visual alertness than did contact" (Korner 1972, p. 90) and that raising the infant in an infant seat to the vertical position, without contact, was effective, although it was not as effective as the same intervention with contact. In sleeping newborns "the only two interventions which elicited any visual activity were interventions entailing vestibular stimulation and the upright position" (Korner 1972, p. 91). Referring to Humphrey (1965) and Langworthy (1933), Korner reasons that the vestibular system is a likely principal mediator of early stimulation effects because it is one of the earliest myelinated (beginning at four months gestational age) and is fully mature at birth.

In another study, unrelated to infant posture, White and Castle (1964) showed that twenty minutes of additional physical handling per day increased the amount of visual exploration in infants observed after thirty days of such handling (beginning at one week of age). While this treatment did not significantly affect sensorimotor test performance, the authors hypothesized that "increased visual attentiveness together with increased mobility in an enriched environment should constitute the optimal circumstances for visual-motor development." These are essentially the conditions experienced by !Kung infants. Korner would probably argue that the key independent variable in the handling here was vestibular stimulation rather than contact. The important point here would seem to be that all the candidates for "key variable" in these studies—vestibular stimulation, upright posture, and physical contact—have some effect on attentiveness, at least in crying infants. All are almost continuously present in the !Kung infant's stimulus envelope, whether in the sling or on the lap of the mother or other caretakers.

Comparative Data: Density of Social Context and the Course of Mother-Infant Interactions

The notion that density of social context may regulate the degree of maternal indulgence of infant dependent demands (and/or the extent of dependent demands) is supported by laboratory studies of three primate species (Hinde and Spencer-Booth 1967; Kaplan 1972; Kaplan and Schusterman 1972; Wolfheim, Jensen, and Bobbitt

1970). Hinde and Spencer-Booth observed mother-infant pairs of rhesus monkeys (*Macaca mulatta*) longitudinally with or without the long-term presence of other animals. In isolate pairs, they found that mothers avoided and left infants more, although infants approached and followed more, than in group-living pairs. Isolate pairs were more frequently physically separated than group-living pairs. The amount of time spent more than two feet from the mother, expressed as a proportion of total time off the mother, showed the following developmental course: for the first ten weeks, isolates more; from eleven weeks on, group-living more. This may suggest that when infants are still motorically immature, and have little control over this distance, isolate mothers will maximize it. When locomotor facility emerges (eight to seventeen weeks), isolate infants can minimize the distance, subverting their mothers' attempts to escape them. Finally, isolate mothers tended to carry infants on their backs rather than in the ventral position during transport, after the infants climbed on them from behind, instead of from in front, as was more common in group-living infants.

In Kaplan's (1972) similar study of squirrel monkeys (*Saimiri sciureus*), mothers in isolated pairs avoided and punished their infants more and retrieved them less than mothers in group-living pairs; and isolate-pair infants made more attempts to play with mothers and stayed closer to them, although (at least at some ages) group-living infants nursed more. Grooming and looking at infants, likely indicators of maternal concern, were done more by group-living mothers. Thus the pattern, for isolate pairs, of greater infant dependent demands with lower maternal indulgence of them, resembles that found for rhesus monkeys. One anomalous finding was that group-living mothers make more attempts to shake off their infants. This could conceivably arise from their greater frequency of nursing, at least at some ages.

Wolfheim, Jensen, and Bobbitt (1970) found a similar pattern in pigtailed monkeys (*Macaca nemestrina*). Mothers in group-living pairs (infants age fourteen to fifteen weeks) were more retentive, spent more time in ventral contact with their infants, and nursed more than mothers in isolate pairs. Data from later ages were not presented. The authors interpret this in terms of protectiveness of infants who may come to harm from other group members. Hinde and Spencer-Booth interpret their data similarly, and this seems a plausible explanation. However, Kaplan's explanation that isolate mothers are under so much steady pressure from the infant that they are not inclined to indulge them ("familiarity breeds contempt") seems equally plausible.

ible. Hinde and Spencer-Booth (1971) summarize the effect as follows:

... the infant's relations with its mother are affected by the other females present, for infants living alone with their mothers were off them more and went to a distance from them more, than did infants with group companions present. Since the infants living alone with their mothers were rejected more and played a larger role in maintaining proximity with their mothers, the difference was primarily due to the mothers. (p. 113)

This is the view most pertinent to the human data.

Two cross-cultural studies of human groups take a similar view. Whiting (1971), in a study of fifty-five societies, found that "the degree of infant indulgence is roughly proportional to the number of adults living in the household" (p. 358). The percentage of societies with high infant indulgence, according to family type, is: extended, 87; polygynous, 83; nuclear, 42; mother-child, 25. Minturn and colleagues (B. Whiting 1964), in a more detailed and thorough study of six cultures, found the operationally derived clusters "maternal warmth" and "maternal emotional stability" in relation to children to be correlated with the number of adults in the household (see especially chapters 2, 3, and 17). This relation holds both within and among the six cultures.

A comparison between !Kung and American or English early childhood would seem to be analogous in some respects to the laboratory and cross-cultural comparisons above. Roughly speaking, the situation of the !Kung mother-infant pair in the band context resembles that of the group-living monkey pairs, while the Western middle-class mother and infant, alone together much of the time, resemble the isolated monkey pairs. Exhibiting high physical contact and frequent nursing in the first two years, !Kung mother-infant relations seem to produce, nonetheless, two- to five-year-olds who, in familiar group contexts, interact less with their mothers and more with other children as compared with English two- to five-year-olds (see above), and also tend to go a greater maximum distance from their mothers (boys, $p < 0.01$; girls, n.s., $p < 0.10$). This cultural difference in developmental course parallels the greater initial indulgence of the group-living mothers and the developmental course of proximity to the mother in rhesus monkeys.

Two other parallels are of interest. A subsequent experiment with the same squirrel monkeys (Kaplan and Schusterman 1972), placing the infants in a choice situation so that they could either be near their mothers, a strange adult female, a strange infant, or an empty cage, revealed that the group-reared infants showed a greater prefer-

ence for their own mothers than did the isolate-pair infants. The authors interpret this as indicating "preference" and the "closeness" of the relationship. To view it another way, the "choice" situation in the experiment is extremely frightening to the infants, given the authors' description of their behavior. It may simply be more frightening to the more indulged group-reared infants, just as fearfulness in !Kung infants is greater than that in American infants (Konner 1972b).

Finally, Hinde and Spencer-Booth (1967) found that locomotor milestones and certain aspects of sensorimotor development (corresponding to several behaviors in Items 5 and 6 of Table 10.1) appear earlier in infants from group-living as opposed to isolate pairs, just as !Kung sensorimotor development is advanced relative to American.

To summarize, the theory proposed to account for the developmental course of attachment found in these data is as follows. The dense social context by providing ample alternative stimulation for both mother and infant improves the likelihood that mothers will accept the dependent demands of infants. Paradoxically, this results in decreased proximity seeking and other dependent demands at later ages, except in intensely fear-provoking situations. This proposed relationship between early indulgence of dependency and later reduced dependency runs so contrary to classical notions of reinforcement and even common sense that even with convincing evidence it is difficult to accept.

But a major recent review of the attachment literature (Maccoby and Masters 1970) found this relationship to be confirmed by almost all the studies of human children which raised this question (p. 140).

Some theoretical adjustment to these data seems in order. An ordinary reinforcement model would predict that indulgence of dependency, that is, reward of dependent behaviors with satisfaction of the infant's needs, would increase the incidence of the behaviors. Actually the reverse is the case.

In Ainsworth, Bell, and Stayton's (1972) longitudinal study of infant attachment, infant crying and maternal response to crying were unrelated in the first three months, but lack of maternal response in the first quarter was related to infant crying duration and frequency in the second quarter (episodes ignored by mother vs crying frequency: $r = 0.56$, $p < 0.01$; mother's unresponsiveness vs crying duration: $r = 0.45$, $p < 0.01$). The same relationships obtained between quarters two and three and quarters three and four. This is the opposite of the effect predicted by the "spoiling" theory (e.g., Spock 1968, Section 300).

If we assume, as Bowlby (1969) has tried to show, that attachment behaviors are part of the normal biological functioning of the infant—instinctual, if you will—and thus difficult to extinguish without drastically disrupting the basic homeostasis of the organism, the data begin to make more sense. Attachment behaviors are not randomly occurring operants. Some, at least, such as crying and contact seeking, are behavioral manifestations of organismic distress. They cannot be extinguished by ignoring them any more than shivering in response to cold can be extinguished by ignoring it. Ignoring them simply increases the distress and so increases the manifestations of the distress.

Ainsworth, Bell, and Stayton (1972) suggest that mothers who respond promptly are reinforcing manifestations of distress which occur at progressively lower arousal levels. In other words, infants who come to feel confident of their mothers' basic responsiveness will come to signal their needs less dramatically, while infants with less responsive mothers will habitually proceed directly to higher arousal level manifestations. This is not only because they have learned that higher levels are necessary (an operant strengthening), but because their mothers' unresponsiveness gives them added cause for distress (a positive feedback cycle).

"Spoiling" theorists might argue that what Ainsworth and her colleagues are comparing are not responsive and unresponsive mothers, but responsive and inconsistent mothers. That is, the unresponsive mothers are ultimately responding, but erratically, thus applying the most effective reinforcement schedule (intermittent reinforcement) to the strengthening of the high arousal-level distress manifestations. The biologically based view would argue that this "inconsistency" is almost inevitable, stemming from the fact that mothers are organisms not well suited to ignoring their offsprings' distress. Some background variables, such as isolation of the mother-infant pair, make them better able to do this. It may be that such conditions in the long perspective of human evolution are in some sense abnormal.

Recommendations such as those of Spock (1968), encouraging maternal unresponsiveness, enhance the impact of these background variables on a mother-infant relationship which has evolved away from maternal indulgence of early dependency since the hunter-gatherer era. Whether proposed as practical solutions to parental annoyance and exhaustion or as "ultimate goods" for the child, these recommendations must be viewed with skepticism by developmental scientists in view of the current available evidence. (Ainsworth, Bell and Stayton's "cry-babies," who had had less responsive

mothers, reached the point where they fussed in greeting the mother as well [crying when mother leaves vs negative greetings, $r = 0.54$, $p < .001$]. That is, the unresponsive mothers were faced with infants who began to fret at their mothers' mere appearance. This is not what mothers are hoping for when they follow Spock's "unspoiling" advice.)

It is ultimately possible to stop crying by ignoring it. This is what happens in infants completely separated for long periods from their mothers after the development of attachment (Ainsworth 1962; Bowlby 1952). It is described as protest, followed by depression, followed by a kind of affectless adaptation. There is evidence (works cited) that such separations are not conducive to optimal mental health. There is also evidence on the long-term effects of short separations. In rhesus monkeys (Hinde and Spencer-Booth 1971) infants who had their mothers separated from them for one or two six-day periods between twenty and thirty weeks proved, at twelve months of age, to be significantly more reluctant to enter and stay in a strange environment than were controls and, at thirty months, were less active and engaged less in social play and more in nonsocial manipulative play. Thus even short separations at certain ages can have significant long-term effects. As for less drastic varieties of unresponsiveness, such as letting a child cry himself to sleep, or the relative physical separation characteristic of Western mother-infant pairs, long-term effects are still unknown.

Evolutionary Considerations: Mother-Infant Contact

Blurton Jones (1972) has analyzed comparative data from a number of mammals on patterns of infant care and concluded that those in continuous proximity to their young differ from those which cache or nest their young in certain predictable ways (see also Ben Shaul 1962). Most important are that the "cachers" feed their young at widely spaced intervals, have high protein and fat content in their milk, and have high sucking rates, whereas "carriers" (including followers) feed more or less continuously, have milk with low protein and fat content, and have low sucking rates. Humans, along with all other higher primates studied, have the milk composition and sucking characteristics of continuous proximity or "carrier" species.

Considering the comparative data on these features in relation to the hunter-gatherer data on mother-infant contact, it makes sense to

suggest that such contact was close in man during most of human evolution. (!Kung infants are fed more or less continuously.) The data would seem to warrant some investigation of the relationship of spacing of feeds to digestive difficulties in Western infants. However Harlow's (1958) now classic research on deprivation in infant rhesus monkeys clearly demonstrated that in the development of attachment "contact comfort" alone is more important than feeding alone. This suggests that mother-infant physical contact has an importance of its own completely distinct from its relation to the spacing of feeds.

This entire complex of adaptations—milk composition, sucking rate, the need for "contact comfort"—evolved in response to strong selection pressure favoring close mother-infant contact. This pattern is characteristic not only of foraging people, but of higher primates generally, and so must have considerable antiquity. As Bowlby (1969) cogently argues, the danger of infant loss through predation is a part of this selection pressure, especially in an altricial species. Close contact, however, has other selective advantages. It results in an attachment which prevents the newly mobile toddler from getting lost, and produces long-term proximity to adult models of subsistence-related behaviors. It may also reduce the likelihood of contracting illnesses which constitute the major threat to life in infancy. One adaptive risk of strong attachment, the later failure to separate, is probably much reduced in the dense social context characteristic of human foragers, where the mother has the constant company of adults and the infant has the constant attraction of a multiaged child group.

Summary and Conclusion

A number of findings from a study of !Kung infant care, behavior, and development have been presented. Some of these are as follows:

- (1) Infants are in physical contact with their mothers or other individuals a very large portion of the time, in keeping with the pattern common to hunter-gatherers and higher primates in general.
- (2) Infants are not restricted and have ample social and environmental stimulation and opportunity for self-stimulation.
- (3) Infants are held vertical during most of their waking time and receive extensive vestibular stimulation.
- (4) The transition away from close mother-infant contact is facilitated by the presence of a multiaged child group which becomes the focus of the child's attachments after a sibling is born.

(5) Infants are advanced compared with American infants in neuromotor development. This is probably attributable to their extensive experience in vertical postures and to conscious training efforts undertaken by their parents.

(6) Infants in the first six months are advanced compared with American infants in certain measures of cognitive (sensorimotor) development. This is probably attributable to the unusually high density of social and cognitive stimulation, both generally and in specific relation to behavior tested, in their developmental milieu. Their cognitive development may also be influenced by vertical posture, insofar as the latter appears to facilitate alertness and sensorimotor exercise.

!Kung infant life is far from ideal. Infant mortality is very high (Howell, Chapter 6). In spite of mitigating factors, many infants respond to weaning and the birth of a displacing sibling with a long period of depression, and they may remember this disappointment throughout their lives (Shostak, Chapter 11). However, the general rules are indulgence, stimulation, and nonrestriction.

The data on accelerated neuromotor and cognitive performance must be viewed with caution. Early acceleration of development in African infants has sometimes been found to disappear or even reverse itself after infancy (LeVine 1970). The best explanation for this is the change to a protein-poor diet at weaning, which does not happen for !Kung infants. Still one cannot assume that these early advances are lasting, or that sensorimotor intelligence is related to later intelligence. It has even been argued (Warren MS) that accelerated development may be harmful, since man is an altricial animal needing his long immaturity for learning. This argument, which by a logical extension would constitute a defense of retardation, must be taken with a grain of salt. But much more needs to be known about the long-term effects of specific early experiences and the long-term fate of specific early advances.

The data do show, however, that intensive mother-infant contact and extreme indulgence of infant dependency are not incompatible with adequate neuromotor and cognitive development. They may even encourage it, as Ainsworth (1967) has argued. The data also confirm the lability of developmental systems in relation to early stimulation and learning. Finally, they emphasize two independent variables, vertical posture and vestibular stimulation, which are receiving increasing attention from developmental scientists, and which may prove to have marked effects on infant development.

NOTES

6. The Population of the Dobe Area !Kung

1. The research on which this paper was based was carried out both in the field and at the Office of Population Research, Princeton University. I would like to acknowledge the contribution made to this research by Ansley Coale, Director of the Office of Population Research, through critical and constructive readings of drafts of the work reported here, through my demographic training, and through the provision of a stimulating and pleasant work environment. Jane Menken of OPR also contributed substantially to this work.

7. Regional Variation in !Kung Populations

1. This work was supported by NIMH grant MH 13611 to Irven DeVore and Richard Lee and by the research allocations committee of the University of New Mexico.

8. Medical Research among the !Kung

1. When some of these data were presented at the XI International Congress of Nutrition in Mexico on 1972, D.S. McLaren pointed out that during frozen storage the apparent value of vitamin A, by the method we used (Neeld and Pearson, 1963), can go up. Parkinson and Gal (1972) illustrate an example of this phenomenon. Serum vitamin A's were measured within 4 weeks of our return from Botswana (exact dates can no longer be found) and one of the author's sera (taken in the field) was included at the second visit as a control.

9. Social and Economic Constraints on Child Life among the !Kung

1. This characteristic noncompetitiveness was predicted for hunting and gathering societies as a whole by John W.M. Whiting in his comments during the Man the Hunter Conference (Lee and DeVore 1968, p. 339): "Although I know of no data on the subject, I would be very surprised if there were many competitive team sports among the hunters and gatherers—another reason for the emphasis on individual achievement rather than group responsibility."

2. Konner has pointed out that older children are likely to be doing some informal, nondirective child tending of their own—just by being on the premises as are the adults. I agree with this qualification and that the attention shown by an older child to a child of the 2½- to 5-year-old age group is generally voluntary, spontaneous, and quite erratic. Older children are not imbued with a sense of responsibility for young children.

10. Maternal Care, Infant Behavior and Development among the !Kung

1. I am grateful to Irven DeVore, Jerome Kagan, and N.G. Blurton Jones for all forms of support and friendship from the inception of this work to the present, and to Marjorie Shostak for her assistance and companionship through-

Notes

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2. This technique emerged from a study (Chapter 14) by Blurton Jones and Konner of !Kung knowledge of animal behavior. It consisted of group interview and discussion.

11. A !Kung Woman's Memories of Childhood

1. Memories 1 and 2 probably took place when N#isa was three or four years old; memories 3, 4, 5, and 6 when she was about six or seven.

2. Insults making reference to the genitals are common and are given either in jest or in anger. Even when expressed angrily, they are not very serious.

3. "Stinge": the word "*kxung*," to be stingy, or to withhold, is repeatedly used as a verb throughout the narrative, "Stinge" seemed to me the closest possible English rendering.

4. The bush is a general term referring to all land beyond the village camp boundary.

5. N#isa was probably between the ages of five and seven in memories 7, 8, 9, and 10.

6. "Ruin": the !Kung word *k'xwia* meaning general disruptiveness.

7. The !Kung believe that the expression of intense anger is sometimes followed by sickness in the person to whom the anger was directed.

8. Thumb piano: a musical instrument now very popular among !Kung children. It is questionable whether this is actually the instrument she played because the thumb piano is believed to have been introduced more recently.

9. "Homa": fictitious village name.

10. The caterpillars eaten by the !Kung are about two inches long and have smooth skins. They are considered a great delicacy.

11. N#isa was from six to twelve years old during the episodes in this section.

12. The expression "*tchi*" literally means sexual intercourse, but in reference to children it only means experimental sexual play without actual intromission.

13. The !Kung word "*///xwasi*—" literally means "to work" and is used humorously in this context.

14. The kaross *chikn'a* is a skin worn by women. When it is tied around the waist and neck, a pouch is formed in which children and food are carried.

15. Trance dance: see Katz (Chapter 11).

16. "*Xai, kow-a-di*": cried out during the trance dance by a man in trance and in the act of curing.

17. N#isa was probably about thirteen years old in memory 18 and fifteen years old in memories 19, 20, 21, 22, and 23.

18. N#isa was married five times in all. At the time of the interviews, she was living with her fifth husband. /"Tashay, whom she meets and married in memories 22-26, was her third husband. She was about thirteen years old the first time she married. This marriage lasted only a few days because her husband, who was much older, had an affair with an older woman. Traditionally, when a grown man marries a young girl, an older woman is asked to spend the first few nights with the couple. This gives the girl a sense of protection and helps her adjust to her new situation. In N#isa's case, however, the older woman contributed to the

