The Past, Present, and Future of the Human Family

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I. MATERNAL LOVE AND ITS AMBIVALENCE IN THE PLEISTOCENE, THE EIGHTEENTH CENTURY, AND RIGHT NOW

Over my heart in the days that have flown,
No love like mother-love ever has shown;
No other worship abides and endures,
Faithful, unselfish and patient like yours…

Mary Akers Allen, 1860

It was all very well to say that it was the common lot of women to bear children. It wasn't true. She, for one, could prove that wrong…. she did not love her children. It was useless pretending.

Katherine Mansfield, 1922

…maternal love or maternal hatred, though the latter fortunately is most rare, is all the same to the inexorable principle of natural selection….

Charles Darwin, 1859

Introduction

"Mother-love" is a powerful emotion, rivaled only by the strength of each person's preconceptions about it. For every human life is shaped by being a mother, by having a mother, or by wishing we had one. Phrases like "maternal instinct" are used every day to refer to love or unconditional devotion to children. Yet who knows what this phrase actually means? We observe mothers caring for infants, but where do those nurturing emotions come from? Are they inborn? Are they learned? Do only mothers experience those emotions?

Scientists debate fiercely among themselves whether in the case of creatures so flexible as we humans are a term like "instinct" can mean

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much. For there exists no species-typical suite of behaviors all women engage in right after birth, say licking off the amniotic fluids or eating the placenta, before placing the baby on our breasts to suckle there. There is a dearth of "fixed action patterns" in our species, and mothers respond to babies in myriad ways, from Mary Akers Allen's celebrated "mother-love" that "abides and endures" to Katherine Mansfield's description of disinterest so absolute that the mother feels it is "useless pretending."

Viewed from the privileged vantage point of postindustrial Westerners who cache infants inside predator-free walled nurseries, take out medical insurance, and do their foraging in supermarkets, we take it for granted that mothers will care for each infant they bear. How then to explain headlines like the one that appeared recently in my local paper: "The number of children who died in Sacramento as a result of abuse or neglect in Sacramento county last year was among the highest ever…" (*Sacramento Bee,* July 28, 1998)?

"Highest ever." The accuracy of that claim has to depend on "where?" and on "when?" Compared to northern California fifteen years ago, it's probably true. But compared to Paris in the eighteenth century, Sacramento and Salt Lake City are models of conscientious parenting. Compared to the Pleistocene, the period between 1.6 million and 10,000 years ago, we're doing better than our nomadic hunter-gatherer ancestors in some respects, far worse in others.

Across cultures and through time, including the modern era when official records began to be kept, precise data on infant neglect, abandonment, and infanticide have always been hard to come by. With or without exact figures, there is a general consensus that the numbers in the United States have been increasing of late. One indication is the fact that the number of children taken into foster care has doubled since the 1980s. Such data as we have, together with rivetingly sensational media coverage of selected cases, have provoked legislators into action.

Resulting policy includes a series of stopgap measures intended to insure the physical safety of babies abandoned right after birth. In my home state of California Governor Gray Davis just repealed an old law that made it a crime for mothers to abandon an infant and signed California Assembly Bill 1368, which went into effect January 1, 2001. Bill 1368 permits mothers to abandon infants without penalty, provided they do so at a hospital emergency ward within seventy-two hours of

birth. Similar laws (sometimes designating fire stations rather than hospitals as the depository) have just been passed in Utah, Minnesota, and Texas. These states are following the lead of European countries like Hungary, where an incubator was recently set up on the sidewalk outside Budapest's major hospital. In Hamburg, Germany, social workers now give demonstrations on how to deposit babies safely in "letter boxes"—glass cabinets with a tiny mattress on the bottom.

California's new law was a well-meaning bipartisan response to "reports of abandoned babies found in trash bins, restrooms and parking lots," such as the case in New Jersey where "a high school student attending her senior prom delivered in a restroom, hid it in the trash...."[1] Legislators had in mind a specific profile. They envisioned a teenager from a "respectable" family, desperate to keep her pregnancy a secret. The underlying assumptions here might be statistically reasonable for a population with available birth control and a prosperous economy, but otherwise not. After all, abandonment and infanticide are protean and variable phenomena that go back a long time.

Beyond acknowledging the role of infanticide in the history of our species, though, there is little agreement among scholars as to the cause. In ivory towers distant from the legislative assemblies, fire stations, or dumpsters, academics have been debating among themselves for decades why some mothers exhibit so little interest in the well-being of their children. To the best of our ability to know, around half of the homicides right after birth are by teenage mothers. Unquestionably, young maternal age, closely spaced births, and lack of social support are primary risk factors. But it's worth noting that just over one-half involve mothers older than twenty (Overpeck et al. 1999). Such mothers do not necessarily fit the profile of an unwed teenager seeking to avoid disgrace that Sacramento legislators had in mind.

The most obvious generalization about infanticide and abandonment is that they increase when other forms of birth control are unavailable. Apart from this generalization, risk factors vary. Examining infant abandonment across species and through historical and evolutionary time broadens our perspective. It cautions us not to rely on familiar assumptions, projecting personal expectations upon humans at large.

[1] Quotations are taken from the press release issued by the bill's principal co-author, Republican state senator Jim Brulte.

Broader perspectives and deeper time-depth help guard against ethnocentrism and keep us from confusing wishful thinking with "natural laws."

"Essentialists" versus "Social Constructionists"

For most modern Americans, phenomena like infant abandonment and infanticide are deeply disturbing and hard to explain. After all, if females evolved to be mothers, why would any woman ever want to do anything other than turn her life over to meeting the needs of her little gene replicator? At first glance, the prevalence of infant abandonment would appear to disprove a biological basis for mother love. Or else (as defenders of essentialism are quick to point out) it is only *unnatural* mothers who abandon their babies. The equation of "good mothering" with psychological health, bad mothering with pathology, explains why half the women incarcerated in Broadmoor during the first part of the twentieth century, spending long stints in Britain's state asylum for the criminally insane, were put there for committing infanticide.

From the nineteenth century deep into the twentieth, essentialist ideas about females were woven into Darwinian perspectives. Darwin knew that under duress "primitive" women sometimes abandoned young, particularly when ill-timed infants were too closely spaced. But Darwin assumed infanticide was rare. Other evolutionists, however, could only view infanticidal mothers as depraved. The fact that women are primates only strengthened expectations about instinctive devotion, since monkey and ape mothers are famous for carrying their infants everywhere they go, suckling them several times an hour. In all Old World monkeys and among apes like ourselves, long periods of gestation result in a single infant; and provided that baby clings to its mother's fur after birth and manages to negotiate its way to her breast, the mother becomes attached and thereafter carries her precious cargo no matter what. Even the corpse of a dead infant will be carried for days.

In many thousands of scientist-hours of observation, no wild monkey or ape mother has ever been reported to injure her own infant deliberately, although first-time mothers are often incompetent. Even counting such inexperienced mothers, though, observations of abandonment among primates are exceedingly rare with the exception of hu-

mans and one other family of monkeys, the Callitrichidae, about whom more later.

Being female was seen as synonymous with bearing and nurturing as many offspring as possible. No wonder then that a mother's responses were assumed to be reflexive and automatic, as inevitable as the uterine muscle contractions that ushered her baby into the world. Such devotion was subsumed under the scientific-sounding label "maternal instinct." Accordingly, mothers who abandon infants were viewed as unnatural. Even mothers who merely feel ambivalent must need counseling.

Since, according to this line of reasoning, mothers had evolved to care full-time for infants, it followed that human infants evolved to need a full-time, completely committed, constantly-in-contact mother in order to feel secure and develop normally. This meant that any woman who gives birth and does not then stay at home to provide same must be unnatural. It was taken for granted that this stay-at-home mom required a husband to support her.

Neither side of this essentialist coin was popular among critics of biological determinism. Feminists pointed out how neatly preconceptions about what was "natural" conformed to 1950s stereotypes about how the two sexes should behave. No wonder feminists felt they had a vested interest in denying the existence of innate sex differences, since it was the parent with the double XX chromosomes who was uniquely qualified to care for infants.

From the 1950s onward, dogmatic assertions about "maternal instincts" prodded feminists to join French philosophers and social historians searching for "social constructionist" alternatives to such essentialist claims. The increasingly well documented history of infant abandonment, beginning in antiquity and peaking in eighteenth-century Europe, became the centerpiece for arguments that—if one granted the starting assumption that animals naturally nurture their young—were both logical and very flattering to humanity's self-image. What if, social constructionists proposed, humans, with their higher brain functioning and seemingly open-ended capacity for language and symbolic thought, operate differently from other animals, transcending "nature"? In short, what if maternal instincts have been lost in the human species? If devotion to infants is a learned emotion, no wonder attitudes toward children vary so much.

The idea that maternal emotions are socially constructed, more

nearly maternal "sentiments" than innate biologically based responses, can be traced back to the French social historian Philippe Ariès (with *Centuries of Childhood* first published in French in 1960 and in English in 1962) and to his successors, Edward Shorter in Canada (*The Making of the Modern Family,* 1975), Elizabeth Badinter in France (*Motherhood: Myth and Reality,* 1981), and Nancy Scheper-Hughes in the United States (*Death without Weeping,* 1992). After studying desperately poor mothers in Brazilian shanty-towns, for example, anthropologist Scheper-Hughes concluded that maternal love, "far from universal and innate," was a "Bourgeois Myth": "…anything *other* than natural and instead represents a matrix of images, meanings, sentiments and practices that are everywhere socially and culturally produced" (341).

Shorter and Badinter had already reached Scheper-Hughes's conclusion after researching mothers in eighteenth-century France at a time when 95% of newborns in urban areas like Paris were sent away to be suckled by strangers, the custom known as wet-nursing that resulted in appallingly high rates of infant mortality. Few historians now dispute the numbers. Such lapses in maternal commitment were, if anything, more widespread and extensive than social constructionists originally imagined: hundreds of thousands of babies delegated to distant wet-nurses if not abandoned outright. Yet many of these less-than-solicitous mothers were married, older than twenty, not necessarily destitute, and their pregnancy was not a secret. Presumably they had some choice in the matter. According to Shorter, they simply "did not *care* and that is why their children vanished in the ghastly slaughter of the innocents that was traditional child rearing" (1977:204). If mother love was indeed "natural" and "spontaneous," Badinter asked, how could mothers treat their own flesh and blood this way? How could any mother differentiate between offspring, caring for one, while sending another away? "I am not questioning maternal love," she said. "I am questioning maternal instinct" (1981:ix).

I admired authors on both sides of this yawning divide between the old-fashioned "essentialists" and the late-twentieth-century "social constructionists," especially Badinter and Scheper-Hughes, feminists intent on situating women in historical context. But I was also taken aback by the way the debate had come to be framed as a dichotomy between nature and nurture, with "nurture" recast here as historical circumstance. The baby, as wriggling, messy, and interactive as any other

living organism, was being thrown out with the essentialist bath water. Completely overlooked was just how dynamic the multiple social and biological processes contributing to the emergence of maternal commitment—what humans mean by love—were likely to be.

GENDER IS A PROCESS, BUT SO ARE ALL PHENOTYPES…

By this point, though, who was still listening? In the minds of "social constructionists," gender and all its trappings (including, in the case of women, motherhood) referred to socially transacted processes. Anyone comparing humans to other animals, or talking about what nonhuman animals were doing in the natural world, was assumed to be biased by prescribed categories. *A priori,* such views were prejudged "essentialist" and hence tainted.

By the last quarter of the twentieth century ethologists (scientists who study animals in their natural habitats) and sociobiologists (who seek to understand the biological basis for social behaviors and rely on comparison across species to help them do so) were moving away from moralistic projections toward systematic study of what animals in the natural world were doing. In particular, females were being studied as individuals, leading to a new awareness of the extent to which one female differed from another. A female of the same species, even the same individual at different times in her life, might behave very differently according to her circumstances. By this point, though, social constructionists, flushed by their success in demonstrating how biased by their own preconceptions scientists could be, failed to notice the morphing of their opponents or to acknowledge just how many scientists already concurred with them about the all-too-human problem of observer bias. Unnoticed by social constructionists, there had been a sea change in how females were conceptualized by sociobiologists.

By the late twentieth century anyone with a grounding in evolutionary biology and behavioral ecology took for granted that the same genotype could be very variably expressed depending on local ecological or historical conditions. Virtually all the relevant phenotypic traits—body size, reproductive condition, social status, gender—were viewed as processes, the outcomes of just how genetic instructions became expressed in the course of development. Biologists were increasingly

sceptical of dogmatic assertions about species-typical and sex-typical universals, so that "biological determinists" were getting hard to find.

For critics of essentialism had made their point: history and circumstances have to be taken into account. But not because context is *all*-important. Rather, history is important because it is within historically produced social and ecological contexts that innate biological responses—instincts if you must—are expressed. As ethologists and sociobiologists were increasingly forced to confront the problems of observer bias, they revamped observational methods and set about correcting many of the erroneous assumptions that had distorted the way several generations of evolutionists understood selective pressures on females.

Once biases were identified, field researchers studying the reproductive behavior of insects, birds, mammals, or people sooner or later set out to correct them. But this, after all, is the real strength of science compared to more ideologically based ways of knowing: Sooner or later (and in this case it was often later) wrong assumptions get corrected. From 1975 onward, this reformulation brought new respect for how much individual variation there was among females. Some females were mothers, others were not. Nor were all mothers equivalent, and the same mother could behave quite differently from one stage of her life to another. This highly variable female, a strategic juggler coping with all sorts of tradeoffs, was quite different from the romanticized stereotype of a nonstop breeder intent on rearing every offspring she produced. She might as well have been a new life form.

With this new life form in mind, it is time to revisit the eighteenth century, when so many European mothers either abandoned infants or sent them to wet-nurses, the paradigmatic case study that supposedly *proved* how socially constructed rather than instinctive human maternal emotions have always been. It is time to rethink the options and constraints that shaped their behavior from both historical and sociobiological perspectives. I will explain why I think the infamous "wet-nursing era" has been widely misinterpreted and why, far from *invalidating* the existence of maternal instincts, this extraordinary period in European social history provides insights into the biological underpinnings of maternal commitment. This done, I will return to contemporary efforts to cope with infant abandonment, new legislation like California Assembly Bill 1638, an area where confusion over what we mean by "maternal instincts" is likely to lead to unintended consequences.

The Wet-Nursing Era in Context

Travel with me, then, back to eighteenth-century Europe. The year is 1781, right at the peak of France's "heyday of wet-nursing." Imagine walking toward a substantial stucco house in a prosperous town just north of Paris. The wife of a government official, Madame Roland, is climbing the limestone steps to pay a visit to her neighbor, who gave birth to a daughter the day before. Here's how she described what she saw: "Her husband [who was hoping for a son] is completely ashamed of it; (his wife) is in a foul mood.... The poor baby was sucking its fingers, and drinking cow's milk in a room far removed from its mother, waiting for the hired woman who was to nurse it...so the little creature could be sent to the village..." (cited in Sussman 1982:80).

This image of a newborn sent off posthaste, in the custody of strangers, strikes us as unaccountably odd. Even a contemporary observer like Madame Roland is taken aback by the seeming callousness of her neighbor giving up her baby right after birth. Soon an itinerant baby transporter will arrive at the house, perhaps with a cart, bringing the wet-nurse to pick up her charge, or else leading a mule with baskets strapped to its back, an arduous and risky way to transport neonates. According to police reports from the time, babies occasionally fell out or were lost on the trip. After a journey of indeterminate duration, the baby arrived at a rural destination and was turned over to a nurse who was supposed to be lactating. But who knew?

This apparent "indifference" of mothers became the centerpiece for late-twentieth-century feminist arguments debunking the existence of maternal instincts. According to statistics maintained by the Paris police—who eventually started to track this extraordinary traffic in babies—20,000 of 21,000 babies born in Paris in 1780 were nursed by another woman, usually a "wet-nurse," a recent mother herself who was also lactating. The luckiest babies, born to propertied parents, would be placed directly with wet-nurses chosen by the parents. In the best-case scenario, the wet nurse came to live with the family under maternal supervision—a long-standing European practice among elites. An infant wet-nursed in-house would have the same 80% chance of surviving as if the mother breastfed the baby herself.

More typically, though, babies were sent away, or parents might have the designated heir nursed at home and supernumerary children sent out. The majority of mothers swept up in the wet-nursing business

Fig. 1. *La privation sensible* (The Painful Deprivation) by Jean-Baptiste Greuze (1725–1805) depicts the pick-up of a newborn by an itinerant entrepreneur who will transport the baby to a wet nurse in the countryside. (Courtesy of Bibliothèque Nationale, Paris)

at this time did not have a lot of leeway. For they belonged to working families for whom the wife's labor was essential to keep the butcher shop or other enterprise afloat. Records from the Bureau of Wet Nursing show that survival rates for babies sent away to wet-nurses varied between 60 and 70%. These were the fortunate babies, whose parents were actually involved in and contracted for their care.

The *unluckiest* babies were born to desperately poor mothers, many of them young and/or unmarried, who risked both reputation and their sources of livelihood if they kept the baby. By abandoning her baby, the mother ceased to be directly involved. From medieval times onward, mothers could deposit unwanted babies in foundling homes, often by placing them in a rotating barrel called a *tour,* ring a bell, and fade anonymously into the night.

In an era without other reliable means of birth control, thousands of babies every year were abandoned. Charities and state-run foundling homes had to compete for wet nurses with paying parents. Prices rose, so that parents had to lower their standards and seek nurses farther and farther away. Often there was a dangerously long lag between birth and placement, or else several babies were assigned to the same nurse.

Foundling homes served as magnets for parents with unwanted children, producing unintended consequences on a massive scale. Insufficient wet nurses along with crowding and infectious diseases led to dismally low survival rates. In 1781 only 10–40% of babies abandoned in Paris that year made it to their eighth birthday. Medical professionals and civic authorities were becoming increasingly alarmed, both by these staggeringly high rates of infant mortality and by what was viewed as the "unnatural" behavior of their mothers and the decline in "public morality" it seemed to signify.

Explaining Maternal Indifference

Reform movements gathered steam. By the nineteenth century government committees were listening to testimony about the "sacred duty" of motherhood and drafting legislation to curb infant abandonment and monitor the wet-nursing business. Reformers intent on romanticizing instinctive maternal devotion had a vested interest in equating the use of wet nurses with the worst possible motives. They lumped a range of

different parental choices in one category—wet nursing—and then equated anything less than self-sacrificing motherhood with the worst possible motive: infanticide.

According to the nineteenth-century French reformer Dr. Alexander Mayer, mothers abandoned "a cherished being…to a coarse peasant woman whom one has never seen, whose character and morality one does not know," "with the desire of not seeing them again" (cited in Sussman 1982:122).

Using wet-nurses came to be viewed as a nonprosecutable form of infanticide, which made for effective propaganda. In England and Germany *angelmaker* and its equivalent *Engelmacherin* were the slang for a wet nurse. In France the name *faiseuse d'anges* was used for both wet nurses and, later, abortionists. The underlying logic was that any woman who got pregnant and then did not carry the fetus to term or who did not care for the infant after birth at any cost, including suckling it, was worse than unnatural. She was thought to be *murderous.*

In 1865 Dr. Mayer prophesied that "[t]he whole thing is so revolting to good sense and morality that in twenty years people will refuse to believe [that wet-nursing] ever happened." And, indeed, a generalized amnesia about this period in Western history does seem to have set in. Of the psychoanalysts and historians who still refer to it, most remember wet-nursing from Dr. Mayer's perspective: "It must have been common knowledge," writes the twentieth-century psychoanalyst Maria Piers (1978) in her book *Infanticide,* that the wet-nurse was "a professional feeder and a professional killer."

By this point, wet-nursing had become the prime exhibit in the social constructionist case against the existence of maternal instincts in the human species. Social constructionists like Ariès argued that the concept of childhood itself had only gradually emerged between the Middle Ages and the eighteenth century. As evidence, Ariès pointed to the iconography of fourteenth-century Italian madonnas with the baby Jesus depicted as a little grownup. Demographic historians stressed doubling of European populations between 1650 and 1850, bringing desperate poverty and high infant mortality rates. Mothers conditioned to seeing children die, it was argued, withheld love as emotional self-defense. More overtly politicized anthropologists laid the blame for maternal indifference on colonial and capitalist oppression of third-world peoples.

Clearly such arguments are pertinent. But by themselves they do not explain the phenomenon of maternal indifference. After all, wherever assistance in rearing infants is in limited supply and other forms of birth control are not available, mothers in all societies practice infanticide. Long before the population explosion in eighteenth-century Europe, from classical and medieval times onward, parents coped with excess heirs or unwanted children by selling them, giving them to the church as oblates, or abandoning them on roadsides. Across cultures, many hunter-gatherer societies suffered high rates of infant mortality without compromising close emotional ties between mothers and the infants they are committed to rear. For example, the !Kung San woman who is the heroine of Marj Shostak's wonderful biography *Nisa* lived in a population where 50% of children died before adulthood. All five of Nisa's own children died. Yet she experienced unbearable grief at each death. "[I] almost died of the pain," Nisa recalled (Shostak 1981:312).

Early diaries (kept mostly by literate men rather than by mothers) and ethnographies describe the same continuum of emotions that we find among a cross-section of modern parents. Maternal responses range from sensual adoration of her baby to neglectful or even abusive.

No doubt some fraction of eighteenth-century French mothers were infanticidal. Others were desperately poor and short on options. Yet it is hard to sustain the argument that hundreds of thousands of mothers who could have afforded to rear their children sent them away to wet nurses instead as a legal, nonprosecutable way of killing them. Rather, it looks to me as if mothers whose labor was needed were taking advantage of wet-nursing, a custom that had originally developed among elites, to reduce the opportunity costs (mother's lost labor) of rearing infants. These mothers were adjusting maternal effort to their circumstances.

In a world where the amount paid out in French livres is equivalent to the number of months the baby would be nursed, there was a near-linear correlation between how much parents paid and the probability that the infant would survive. Abandoning an infant right after birth cost the least—in material terms at least. But abandonment also resulted in the lowest survival rates. During much of this period only 10–20% of abandoned infants would be lucky enough to make it. If a mother could manage to pay just forty-odd livres for half a year of wet-nursing before she defaulted and the unpaid nurse was forced to turn the baby over to a foundling home, survival rates would double. Historian

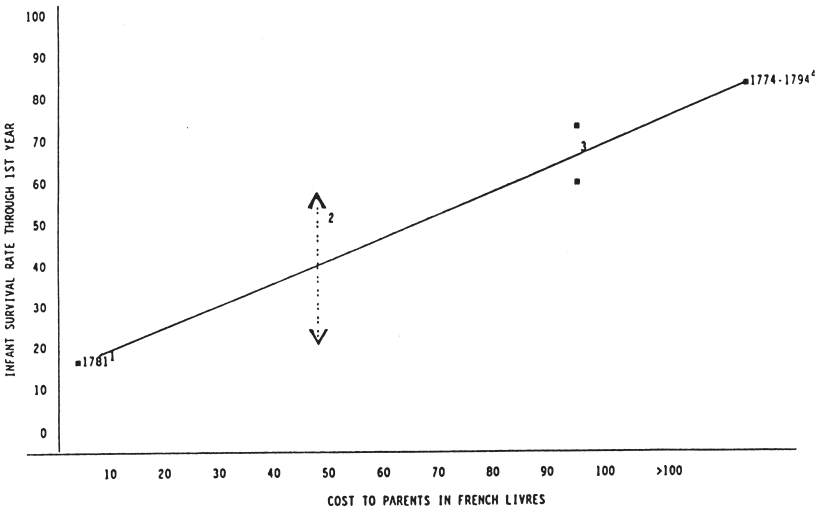

Fig. 2. There is a nearly linear relationship between the amount expended by parents to pay wet nurses and the probability of infant survival.
Notes on how survival rates were calculated:

1. Mortality rates during the first year of life for infants deposited in Parisian foundling hospitals reached 68.5% in 1751 and rose to 85.7% by 1781; 92% of these children would die by their eighth birthday (from data in Sussman 1982).

2. According to Sussman, roughly 10% of parents who sent children to rural wet nurses subsequently defaulted on their payments, with the result that their infants were eventually deposited in foundling homes. Infants who were wet-nursed for six months before this happened had higher survival prospects than those abandoned at birth. The cost here is calculated at one-half the yearly rate for a rural wet nurse.

3. A Parisian artisan might earn twenty to twenty-five livres per month, his wife one-half that. Seven to eight livres per month went to pay the rural wet nurse. Mortality for these wet-nursed infants was 25–40%, rising somewhat over time as good wet nurses became increasingly hard to find. Records kept by the Bureau of Wet-Nursing indicate that mortality had risen to 42% by 1794.

4. Infants tended by live-in wet nurses in their mothers' homes enjoyed roughly the same 80% prospect of survival as infants nursed by their own mothers.

George Sussman calculated that about 10% of parents went this route. If parents managed to increase their payments to 90 livres for an entire first year of wet-nursing, survival chances rose to 60%.

The closest parallel I can think of for parents who seem to me more nearly cost-conscious than infanticidal would be working parents today, parents just barely hanging on to a middle-class status while seeking affordable care so that the wife can keep working or else single working mothers without a supportive kin group who have no choice but to scramble to find whatever daycare they can. The main difference is that in the days before pasteurized milk and rubber nipples eighteenth-century working mothers needed 24-hour *night and day* care from another woman who was lactating and often several days' commute away.

If the goal had been to eliminate infants, as the reformers suspected, sending her baby to a wet nurse scarcely solved the working mother's problem. Freed from lactational amenorrhea, most non-nursing wives became pregnant again within months, which is one more reason why infanticide is such a poor form of birth control. Maurice Garden's (1970) remarkable demography of eighteenth-century Lyon documents nearly annual births in the families of butchers and silk-makers who sent babies off to wet nurses. Mothers routinely produced twelve to sixteen children, one mother as many as twenty-one in twenty-four years. The toll taken by such hyperfecundity could be measured not just in infant mortality, but in maternal anemia, prolapsed uteruses, and early deaths. These bad outcomes came as a consequence of foregoing frequent breastfeeding and with it the more natural three- to five-year birth spacing that would have been typical of our ancestors living as nomadic Pleistocene foragers.

There is little to indicate that mothers used wet nursing as a legal form of infanticide. Rather they were economizing on what rearing infants cost them. But more to the point, there was never any reason in the first place to assume that if some mothers were infanticidal this constituted grounds for assuming maternal instincts had been lost in humans.

Eliciting Maternal Responses

It's time to return to the question of what we can possibly mean by the term "maternal instinct." Even though human mothers don't *automatically* rear each infant they give birth to, systematic rather than selective

observations of other mammals make it clear that they don't do so either. Typically mammals in poor condition just don't get pregnant—the most common form of birth control. But if they do conceive, and circumstances drastically deteriorate, some mammals (like langur monkeys or gelada baboons) spontaneously abort. Other mammalian mothers may carry on but cull or abandon after birth. In his long-term study of wild prairie dogs, biologist John Hoogland (1995) found that about 10% of litters were abandoned at birth. The mothers who abandoned litters tended to be underweight and in poor condition. In certain populations of house mice, mothers choose among pups to concentrate maternal investment on the most robust.

Learning and prior experience caring for babies are particularly important in primates, compared to other mammals. More experienced moms make more competent moms. This is why, across primates, mortality rates among firstborn infants are so high, due to the mother's immaturity (she is not yet full grown) and also to her inexperience. Learning how to care for infants is even more important in the case of human primates. And, as for all primates, the best antidote to maternal inexperience is assistance from other group members. A range of studies of both nonhuman primates and humans, including foraging peoples such as the Hadza, the Efé, and the Aka, demonstrate that having older matrilineal kin nearby reduces the risk of a firstborn dying in infancy. Not surprisingly, perhaps, it is customary among many foraging peoples for young women to remain near their natal families until *after* the birth of their first child.

New mothers learn how to care for their babies, but they also learn to recognize the baby as an individual with whom they feel a special kinship. Because primate babies are born immobile, there is no chance that any baby will wander away and latch on to the wrong mother. There is no way for the mother's milk to get embezzled by the wrong baby. Evolutionarily this is important, because it means that primate mothers *don't have to imprint on their babies right after birth* the way sheep and other ungulates whose babies run around right after birth do; and they don't. Primates are very flexible in this respect. The mother's emotional attachment to her infant *can* begin right after birth; but bonding is an ongoing process, so that the actual window of opportunity stretches out for weeks and months. This is why cross-fostering, the switching of an unrelated infant for the female's own, is accomplished so easily in primates, although the earlier the better.

For all primates, there is a lag on the order of seventy-two hours—roughly equivalent to the delay between birth and the onset of lactation—during which a mother learns to identify her own baby. Within days, though, a human mother can pick out her own baby's clothes by smell alone. Once lactation is established, she not only recognizes her infant, but elevated prolactin levels produced by the baby's sucking (the body's work order for "more milk") intensify her feelings of protectiveness. The more the baby sucks, the more milk the mother produces and the higher her prolactin levels. Pressure of milk built up behind her nipples guarantees discomfort should the mother, for any reason, be separated from her baby and unable to nurse. In addition to the growing bond between the mother and her infant, this is another, quite literally pressing reason for a mother to seek out her baby.

The lag in formation of these bonds turns out to be critical for understanding the willingness of eighteenth-century French mothers to give up their babies. Recall Madame Roland's observation: the baby is kept *in a room far away.* The situation is structured to prevent the mother from responding to infant cues, and by and large events are scheduled to take place before nursing gets under way. It is worth noting that California Assembly Bill 1368 unintentionally does the same thing, decreasing rather than increasing the chances that a mother ambivalent about keeping her infant will become attached to the baby and decide she wants to care for it, a point I will return to.

Conscious and Unconscious Bases of Maternal Commitment

An odd experiment from early-nineteenth-century Paris illustrates what I mean. As described by historian Rachel Fuchs, 24% of women who gave birth at the state-run charity hospital La Maternité in 1831 subsequently walked across the street and abandoned their babies at the foundling home conveniently situated there. A group of reformers intent on reducing child abandonment decided to force one subset of indigent women to remain with their infants and to breastfeed them for eight days after birth. An experiment that most human subjects review boards would not permit today proved extraordinarily effective: the proportion of new mothers who abandoned their babies fell from 24 to 10% (though, of course, we don't know how these stories end).

It is as if two separate systems inform the mother's actions. One

involves her practical, conscious decisions that take into account her economic plight, cultural norms, and her uniquely human awareness of the future: "I cannot afford to keep this baby!" The other system is informed by her tactile and emotional experience with the baby. And in this context it's worth noting what so often goes unremarked in the social constructionist literature debunking maternal instinct: *none* of the "indifferent" mothers from eighteenth-century France or the differentially neglectful mothers in the shanty towns of Brazil—the mothers thought to prove that there was no biological basis to mother love—were breast-feeding.

It is indisputably true (as pointed out by the anti-essentialists) that there is no one root source of emotion or urge equivalent to "the maternal instinct." There *are* a range of biologically based maternal responses to a range of circumstances, however, that, taken together, make it more or less likely that a given mother will become committed to her offspring. The best way to visualize this complicated and multifaceted process is to consider specific features of the mother's condition that increase—or decrease—the chances that she will respond to the various cues produced by a new baby. Given just how important it is for a mother to respond appropriately, it is not surprising that "mother nature" has built multiple redundancies, checks, and failsafes into a system that generally speaking is biased toward inducing a mother to nurture her baby.

Because of the way primate ovaries function, a woman would not normally ovulate or conceive in the first place unless she had the bodily resources to sustain both pregnancy and the costly period of lactation that follows. All through pregnancy, physical changes in the mother's body are under way, lowering her threshold for responding in a positive way to babies. The placenta itself, the baby's supply line, produces progesterone that helps sustain the pregnancy and contributes to changes in estrogen and progesterone levels that ready or "prime" the mother to respond maternally. During the birth process itself, further endocrinological changes, particularly secretion of oxytocin (from the Greek for "swift birth"), produce the muscle contractions that push the baby out. Oxytocin also has an opiate-like, soothing effect, preparing the mother for her first encounter with a tiny stranger.

Physical transformations within the mother's body continue after birth. Continuous proximity to the infant, along with the act of caring for it, produces endocrinological and neurological changes. Care-taking

inscribes new pathways in the brain. These retraceable paths in turn lower the threshold of stimulation needed to elicit maternal responses in the future. Memories interact with existential experience. Stimulation from a baby's sucking on her nipples releases oxytocin, making a woman feel relaxed. At the same time (based on work with birds and lab rodents) higher circulating levels of prolactin may increase maternal protectiveness toward infants. Across many species (even in birds or in male mammals that are not lactating) higher prolactin levels are correlated with protective and caring responses. In some mammal mothers, higher prolactin levels are correlated with the fierce protectiveness of their offspring that animal behaviorists call "lactational aggression."

Even without all of the special hormonal changes associated with being pregnant and giving birth, female primates are attracted by infants. Even females far too young to breed find the sounds, smells, and appearance of infants irresistible. Human females of all ages, and many men as well, are attracted by small creatures with rounded head, tiny features, and big eyes. Add to this the very special role of plumpness, prolonged gazing, and fleeting, soon to become directed, smiles. These are specialities of human babies, not displayed by other apes that are equipped from birth to catch hold of their mother's fur and maintain contact with their mothers.

Why Human Maternal Responses Are Peculiarly Contingent on Social Context

Mothers in a broad range of insects, birds, and mammals rely on other group members to help them rear their young. These helpers, male or female, are called *allomothers,* from the Greek prefix *allo-* meaning "other," as in other than the genetic mother. Allomaternal assistance ranges from casual babysitting to extensive help carrying or provisioning the young. When the genetic father of an infant is also known (difficult to do without DNA testing) scientists can talk about "alloparents," individuals other than the mother *or* father, but more often the identity of the genetic father is unknown. When allomothers remain in the group and to varying degrees help the mother protect, carry, or provision her infants, this shared rearing is termed "cooperative breeding" (Sherman et al. 1995).

Primates are well represented at the casual babysitting end of this continuum—as in the case of infant-sharing among vervet or langur monkeys, where other females, especially young and inexperienced ones, take and carry a baby so that its mother is freed to forage unencumbered. Comparative analyses across primate species show that, where mothers have the option to delegate even a small portion of the cost of carrying babies to allomothers, babies grow faster. Hence, babies can be safely weaned sooner, with the result that mothers breed again after shorter intervals than would mothers without assistance. Based on data from human hunters and gatherers compiled by anthropologist Barry Hewlett, allomaternal assistance contributes to larger completed family sizes among human nomadic foragers, presumably because allomothers help keep children safe from hazards and reduce the energetic burden on the mother (Hewlett et al. 2000).

When mothers in cooperatively breeding species produce large litters or large, especially costly or slow-maturing offspring beyond their means to rear alone, they are essentially gambling on having help. For only with allomaternal assistance can they rear them. Should help not be forthcoming, it is unlikely that their young will survive. Worse, a mother who tries anyway may so deplete her bodily reserves that she dies in the attempt. I assume that this is why maternal commitment in cooperatively breeding species is so contingent on circumstances.

Rarely are primate mothers as dependent on allomaternal assistance as are cooperatively breeding Callitrichidae, the family of South American monkeys that includes tamarins and marmosets. While the prospect of allomaternal assistance permits a staggering reproductive pace—mothers give birth to twins or triplets as often as twice a year—the combined weight of the babies is 20% of the mother's body weight. This is why allomothers are needed to carry infants most of the time, except when the mother is actually suckling them. The allomother in charge of carrying the babies is usually the male, or one of several males, with whom the mother mated. Other males and immatures who are often but not always siblings catch insects to supplement the diet of the juveniles about the time when they are weaned (Bales et al. 2000). For three of these species—moustached tamarins (*Saquinus mystax*), common marmosets (*Callithrix jacchus*), and the spectacularly beautiful golden lion tamarins (*Leontopithecus rosalia;* shown in figure 3)—there is a direct correlation between infant survival and the number of adult males present to help rear them.

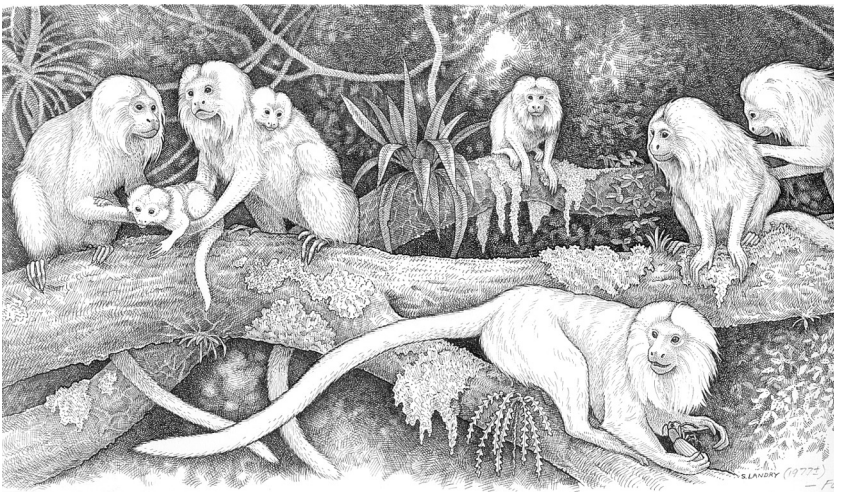

Fig. 3. Among cooperatively breeding tamarins, males who have mated with the mother along with pre-reproductive group members help by carrying the heavy twins when they are not suckling and provisioning them with small prey about the time the infants are weaned to help them survive the transition from weaning to independence. In the upper left-hand corner, a male who might be the father takes the infants after the mother finishes nursing them. A subadult in the lower right catches a beetle for them. (Pen and ink drawing by Sarah Landry)

This is full-fledged cooperative breeding where help from allomothers has allowed the evolution of especially large and costly infants that are produced after very short breeding intervals. Such fecundity forces Callitrichid mothers to rely on help. This dependency explains why, compared to other primates, tamarin mothers are so unusually sensitive to their social circumstances.

Although infant abandonment is rare in most nonhuman primates, not so in these tamarins. If her mate dies or there are no young tamarins in the group to help her, the mother bails out, typically within the first seventy-two hours. Based on decades of data from a colony of tamarins (*Saguinus oedipus*) at the New England Primate Center, there was a 12% chance of maternal abandonment if the mother had older offspring to help her, but a 57% chance if no help was available. In these instances abandonment was especially likely in the case of twins or triplets.

The evidence is clear: where allomothers defray the burden of carrying infants, mothers freed to forage more efficiently breed after shorter interbirth intervals without suffering higher infant mortality, a usual

consequence of fast-paced breeding. Learning just how much allomaternal assistance can increase maternal reproductive success changes the way we look at this phenomenon. Instead of asking why mothers always care for babies, we are now inclined to ask: why don't mothers delegate care to others more often? The answer is that reliable, willing alloparents are in short supply, and for most primates using allomothers is not a safe option.

So here comes my punch-line: where else among primates do we find such big babies along with tamarin-like sensitivity to social support? In humans, of course, who, I believe, must have evolved as cooperative breeders. How else to explain the most curious puzzle of all about human life histories? How could there have been selection on any ape female to produce babies so far beyond her means to rear alone? In all apes mothers give birth to one baby at a time and then nurse that baby for four or more years. But in nonhuman apes youngsters, once they are weaned, provision themselves. Not so among human foragers, where the diets of children as old as eighteen are still being subsidized by adults. Children are dependent for so long that mothers have a new baby long before weaned older children are on their own. A foraging mother without allomaternal assistance can not possibly provide the ten to thirteen million calories that anthropologists like Hillard Kaplan calculate are needed to rear offspring to independence. So who helps?

Fathers Are Important, But Not Always Reliable, Providers

Since Darwin, anthropologists have assumed that hominids evolved to be bipedal and then men evolved to be uniquely clever because smart, large-brained hunters were best able to provide for their families. Yet these long-standing assumptions are not consistent with other assumptions simultaneously being made. It was taken for granted that husbands provisioned wives and offspring within the context of a "nuclear family." Yet human males were also presumed to be hardwired to desire sexual novelty and to seek to copulate with additional women when they could, inclined to polygyny when feasible. What happened, then, when a man's desire for sexual novelty came into conflict with providing for the wife (or wives) and children that he already had?

The idea that Pleistocene mothers relied on a "sex contract" in which

wives exchanged sex for provisioning by a husband when motherhood rendered her most needy is not consistent with what men say. As anthropologist Kristen Hawkes has pointed out, men in foraging societies are candid when interviewed. They bluntly explain, for example, that they find pregnant women less attractive than nonpregnant women and the smell of mother's milk repulsive. Disapprove if you like, but think about it. Surely there is a reason why perfume manufacturers in our society select names like "Pheromone" or "Obsession." When was the last time any of us bought a perfume named "Mother's Milk"?

There *are* species out there, like the famously paternal California mice or titi monkeys, where the highest priority of males is to remain near their immature offspring. Not surprisingly, perhaps, mothers in such species are often more anxious to stay near their baby-lusting mates than near their own offspring. And no doubt even in species like our own, where males fall short of this high standard, some men are very tender toward infants and motivated to care for them hour after hour. But only a small proportion. Furthermore, eliciting such "paternal" care requires particular circumstances. Usually it takes intimate and prolonged exposure.

For by and large humans do not act like titi monkeys and the other species in which males have evolved a very low threshold for responding to infants. Some textbooks still depict stone-age fathers as dutifully subsidizing their mates and their highly dependent, slow-maturing young, but in reality it seems unlikely that stone-age men were any more singleminded than modern men are. According to the United Nations report from the Commission on Status of Women, one in four households in the world today are designated "female-headed." Scanning the world around us, relatively few such women receive child support from husbands. In the United States alone, the White House reports that some $34 billion in child support due goes unpaid annually, while according to a 1994 study by the Children's Defense Fund fathers "are more likely to make car payments than pay child support" (Associated Press 1994). Arguably, supporting children from defunct relationships is not a top priority for males in our species.

Recently Kristen Hawkes and her collaborators (1998) have focused attention on this disconnect by demonstrating that fathers in foraging societies are often more interested in prestige-enhancing grand gestures than in maximizing protein yield. Hunters, she argued, were more

inclined to "show off" by seeking large, elusive prey like eland than to bring home more reliably bagged small game. The same effort applied to catching tortoises and hares, for example, would yield higher protein returns on average, because the effort expended and the failure rates are both so high for big prey items.

So what happens when meat is in short supply? The gap between what weaned children need and the amount of gathered food mothers can supply is met by other group members—typically kin. Even among the !Kung, a foraging people famous for close and nearly exclusive maternal care of infants, anthropologists Pat Draper and Ray Hames (2000) found that children with many siblings, especially older siblings, were more fertile in adulthood, suggesting that siblings must be doing something important to keep nieces and nephews alive. Other categories of kin are also important. Among Hadza foragers of Tanzania, weaned still-dependent offspring grow faster and are more likely to survive if they have a postreproductive kinswoman helping to dig up something (literally)—in this case probably underground tubers—for immature kin to eat. Hawkes and O'Connell make a compelling case that reliance on gathered food like tubers—-and with it the opportunity for kinswomen to contribute—dates far back in human prehistory to the emergence of *Homo erectus* 1.7 million years ago.

To sum up, then, I am arguing that humans evolved as cooperative breeders. Whether living in the Pleistocene, in eighteenth-century Europe, or in the United States right now, mothers have sought help rearing their children from fathers, other males, female relatives, or anyone else they could rely upon. As a consequence of this dependency, the emergence of maternal commitment, always a complicated process in mammals, is unusually contingent on social circumstance. Mothers lacking allomaternal assistance are forced to take chances or bail out altogether.

The surprisingly high levels of maternal abandonment for some times and places, long assumed to distinguish us from other animals, are in fact predictable when our evolutionary history is taken into account. Rather than proving that women lack maternal instincts, the noteworthy thing about eighteenth-century France or twentieth-century Brazilian shanty-towns is how poorly prevailing social arrangements accommodated the needs of a cooperatively breeding ape. This brings me back to California Assembly Bill 1368.

BACK TO THE PRESENT

It was ridiculous {Dr. Guttmacher} told the committee, to blame mothers on welfare for having too many children when the clinics and hospitals they used were absolutely prohibited from saying a word about birth control. So we took the lead in Congress in providing money and urging…that in the United States family planning services be available for every woman….

U.N. AMBASSADOR GEORGE BUSH, 1973

No question about it, abandoned babies are better off in emergency wards than in dumpsters. New laws like CAB 1368 are an improvement over the old ones aimed at punishing mothers rather than protecting infants. But what of the unintended consequences? History warns us that if we set up depositories for "unwanted" infants human mothers are likely to avail themselves of them. Nor will all these abandoned infants be born to teenage mothers whose top priority is keeping their pregnancy secret. If the economy deteriorates, and allomothers remain scarce, young women twenty and older, unmarried or married, will also avail themselves of an opportunity to delegate care of their infants to others.

An all too obvious by-product of "safe havens" for abandoned infants will be even more infants in state custody. This might not be a bad thing, were it not for the fact that our foster care system is notoriously overburdened and with few exceptions inadequate. I will not belabor a point already widely discussed (as in the November 13, 2000, cover story in *Time,* which focused on "The Shame of Foster Care" in America). There is a cruel, yawning divide between having all infants, born or unborn, "protected by law" (the pro-life position) and what I regard as the more humane proposition that "every child should be a wanted child" (the position of Planned Parenthood).

A brief examination of the comparative evidence for primates and for women giving birth in different times and places warns that specific features of the new legislation may be counterproductive. For example, it is precisely during the first seventy-two hours after birth that primate mothers are at greatest risk of terminating investment in an infant, especially for inexperienced, first-time young mothers and cooperatively breeding primates.

If policymakers want to reduce the numbers of abandoned infants

entering a floundering foster care system as well as protect the well-being of those infants, why limit amnesty to seventy-two hours? For a mother ambivalent about keeping her infant, the chances of her deciding to abandon it are *greatest* in the first seventy-two hours, before there has been an opportunity for the hormonal and neurological changes that would otherwise occur in a mother in close and secure proximity to her infant—especially if she is breast-feeding. Although the new law provides that the mother can reclaim her baby within fourteen days simply by presenting the identifying code she was given when she left the baby, how likely is this? Why not, then, safe but anonymous—and hassle-free—havens for new mothers and infants? I say hassle-free because I assume that most young women giving birth in secret to an unwanted infant almost by definition lack social support. They are likely to be deeply suspicious and frightened off by any intrusion from what they may perceive as a hostile and judgmental "system." Why not extend the grace period to weeks rather than hours?

The answer has more to do with politics than with infant needs. Fairly obviously, the figure of seventy-two hours was not arrived at on the basis of scientific research. No one familiar with the primate evidence would have chosen a time limit that *precedes* the onset of lactation in primates. It's a time limitation that will if anything *decrease* the chances of an abandoning mother changing her mind and keeping her infant. Rather, it turns out, the figure of seventy-two hours was arrived at as a political compromise between the bill's authors and legislators who wanted the grace period even shorter.[2]

Similarly, for reasons that are more political than sensible, policymakers focus on the physical safety of abandoned babies—a symptom of the problem rather than talking about the problem's source. This is because talking about the source of the problem would require policymakers to discuss sex education and contraception, not to mention abortion, and they view even nonsensical social policies as preferable to the prospect of political suicide.

Looked at comparatively, rates of teenage pregnancy (which happen to be higher in the United States than in any other developed nation) have less to do with moral decline than with changes in the nutritional

[2] Telephone interview with Gloria Mengino-Ochoa, counsel to the California Senate Judiciary, December 12, 2000.

status of human beings over the last tens of thousands and hundreds of years. Teenage pregnancy, then, is very much a human-made problem, a human-solvable public health issue, not a moral one.

That is, even though we talk about "the problem of teenage pregnancy," the problem is more nearly one of "failed contraception," an undermining of evolved safeguards that under conditions more typical of human existence protected young girls against inopportune pregnancies. As in all apes, human ovaries evolved to factor how much fat a woman's body had stored. For a still partially dependent girl living among nomadic hunter-gatherers, this indicator of nutritional status would have been synonymous with how much social support she had. Among nomadic foragers, where youngsters depend on shared nutritional subsidies from other group members, a young girl's fat reserves provided a fairly good indicator of how much social support she could expect from parents, grandparents, boyfriends, her mate perhaps, as well as other group members.

By and large, the plumper a girl is, the sooner she matures. Girls growing up in nomadic foraging society on the African savanna remained active, intermittently fed, and very lean, menstruating for the first time closer to sixteen than twelve, the average age of girls today in sedentary, hypernourished Western societies. Menarche would typically have been followed by a long period of adolescent subfecundity, which made conception even in a sexually active girl unlikely. Instead, first births tended to fall around nineteen years or older.

Even in the Pleistocene, *some* girls may have matured and conceived earlier, but only under conditions of spectacular abundance, and if—and this is important—the teenager was enmeshed in a supportive network of kin and other group members willing to provision her. These same supportive group members who shared food with her would presumably have helped her rear any infant she bore. Today, however, adolescents in industrialized nations can lack all manner of social and economic support yet still be well enough nourished to reach menarche at twelve, able to conceive shortly after. Crudely put, the amount of fat girls have on board has become a dangerously misleading physiological cue, telling a girl that it is an auspicious time to go ahead and reproduce, when it is anything but.

No amount of legislation can ensure that mothers will love their babies. But fortunately this particular problem, the problem of artifi-

cially produced hyperfertility in U.S. teenagers, is (as Ambassador Bush pointed out) readily solvable.

II. ON WHY IT TAKES A VILLAGE: COOPERATIVE BREEDERS, INFANT NEEDS, AND THE FUTURE

…the maternal instinct is the root whence sympathy has sprung and that is the source whence the cohesive quality of the tribe originated.

Eliza Burt Gamble, 1894

So Why *Does* She Carry Her Baby?

Anyone who has ever spent time watching chimpanzees will be familiar with the cozy image of a mother tenderly using one arm to hold her newborn baby snug against her body. How natural this seems! The mother-infant bond is the first, the most crucial, and in many social creatures the most enduring social relationship. Who would bother to ask: "Why is that mother carrying her baby?" The answer seems obvious: that's just what primate mothers do. We take it for granted that among our closest primate relations mothers carried their babies all the time, just as we assume our Paleolithic ancestresses must have.

With few exceptions (and most of these include ruffed lemurs and other prosimians still so "primitive" as to stash their litters in nests), primates bear one baby at a time. The mother then carries her single baby wherever she goes. In ancestral environments, infants left on their own would quickly have succumbed to starvation or predation. This was humankind's "Environment of Evolutionary Adaptedness" according to John Bowlby (1969), who in the 1950s was arguably the world's first evolutionary psychiatrist. No wonder *all* baby primates desperately seek "the set goal" of physical contact with somebody and find it comforting to be close to their mother, said Bowlby. No wonder baby monkeys become emotionally attached to whichever warm and familiar creature reliably responds to their needs. Most often, that individual is the mother.

Today Bowlby's theory of attachment is basic to our understanding of infant development. But breast-feeding aside, are mothers the only individuals qualified to provide babies with a secure base? This brings us back to the question of *why* chimp mothers carry their babies.

For anyone who has ever had to care for a newborn baby (especially one that can't cling to body hair the way a chimp can) it scarcely comes as news that carrying a baby is awkward, reduces efficiency, and interferes with activities like hunting or even socializing. Adolescent chimps, for example, travel gregariously in groups. Yet after they become mothers chimps are almost invariably solitary because their slowness puts them at a competitive disadvantage in foraging for ripe fruit (Wrangham 2000). As gregarious as almost all primates are, chimp mothers carrying babies cannot afford to be. So why doesn't the mother hand her infant over to a babysitter, say her adolescent daughter pushily eager to take hold of the baby? The answer is: it's not safe for a chimp mother to do this.

Wild chimps are hunters with a lust for animal flesh. There is a real danger that other chimps in the community might try to wrest and eat a baby. A subadult allomother might not be able to prevent that. Unable to take advantage of allomaternal assistance, a chimp mother carries her baby everywhere not because this is what the mother instinctively "wants" to do, or because it is essential for her infant's healthy development, but because she lacks safe alternatives.

Not long ago, I was visiting a colony of bonobos in Holland and happened to be watching a mother with her baby. A keeper had just given the bonobos some sugarcane. Using one hand to hold the stalk, each bonobo was using the other hand to strip off sweet portions to eat. But this was a daunting challenge for a young, and also subordinate, mother who could not hold her baby and eat at the same time. In order to do so, she moved away from the other bonobos (who in any event were preoccupied with their own treat) and set her baby down on the straw on the bottom of the cage—something she would never do in the wild. Then she tore into her sugarcane. Clearly, this mother's object was to protect her infant, not necessarily to carry it everywhere. When she had a safe alternative to toting her infant everywhere, she used it. Human apes confront the same tradeoff between keeping the infant safe and keeping themselves fed.

Homo Daycarensis?

True, *Homo sapiens* is clever enough to manufacture special devices—woven slings, leather *karosses,* or modern *snuglis*—that make it easier to work with a baby on the mother's body, as well as hammocks and cradles

that position infants safely off the ground. We build houses with walls to keep predators out of nurseries. Still, the more incompatible with childcare the mother's work is, the more pressure on mothers to delegate care. The more available, willing, and competent allomothers are, the more readily a mother uses them. Consider the case of the Efé of Central Africa, the most traditional of pygmy peoples. The Efé still hunt small prey communally with nets, much as archeologists believe humans were doing tens of thousand of years ago (Soffer et al. 2000).

Among the Efé, infants are passed around among group members on the first day of life. By three weeks of age, babies are with allomothers 40% of daytime, with mothers the rest. By eighteen weeks, hours with allomothers (60% of the time) exceed time with the baby's own mother. Infants average fourteen different caretakers, including fathers, brothers, sisters, aunts, grandmothers, as well as unrelated individuals living in the village—orphans fostered in from other families are especially active caretakers. Similar childcare patterns have been reported for some—but by no means all—foraging peoples (e.g. the Aka, Agta, or Andaman Islanders). Yet we take it for granted that the chimplike pattern of *mother exclusively*—which is the pattern made famous for hunter-gatherers like the !Kung—is the normal one. Hence even the anthropologists studying them still assume that communal care systems like the Efé's are "unique" (Ivey 2000), unusual for our species. I'm not so sure.

In just the last quarter-century, as anthropologists and sociobiologists have started to compare notes, one of the spectacular surprises has been how much allomaternal care goes on, not just among village and urban as well as foraging people, but also—once we started to look—among animals generally. Diverse organisms have converged on cooperative caretaking as a way to rear large litters, or offspring that are especially large, or (as in the human case) infants that are both especially large and slow maturing and also (for an ape) closely spaced. In general, cooperative breeders are characterized by unusually flexible and opportunistic breeding systems, as well as by various adaptations that increase the availability of allomothers (group members other than the mother who help her rear her offspring).

Where it occurs, cooperative breeding permits mothers to produce especially costly young or to rear more offspring than otherwise would survive. Among wild jackals, for example, parents raise about two extra

pups for every alloparent in the group helping them. Anyone who has ever wondered how social insects—bees, wasps, and termites—managed to expand to fully one-third of the animal biomass in Amazonian rainforests need look no further than the world's most extensive and reliable communal nurseries. While honeybee queens specialize in doing what they do best, devoting their enormous abdomens to the task of squeezing out 2,000 eggs a day, nonreproductive group members (genetically equivalent to queens, but fed ordinary fare instead of ovary-building "royal jelly") work away at what they do best: tending the hive and the next generation (Wilson 1975).

Cooperative breeding allows animals to take advantage of processes and resources (like honey-making or coordinated hunting) as well as allowing them to move into, and even dominate, new habitats that otherwise would not be available. The cooperatively breeding Florida scrub jay, for example, persists where other jays can not. These avian hunters and gatherers, living on lizards, frogs, and berries, breed in relict patches of scrub oak in spite of unrelentingly heavy predation pressure on their nests from hawks and snakes. They manage to fledge at least a few young by relying on help from young jays who have not yet started to breed, who serve as lookouts and helpers. Since suitable habitat is scarce, helpers benefit as well by remaining in the group until a breeding position opens up (Woolfenden and Fitzpatrick 1990). It was cooperative breeding, with its divisions of labor, sharing, and extra help for mothers, that permitted scrub jays and naked mole rats to occupy novel habitats and social insects and wolves to spread over vast geographic areas. With the emergence of the genus *Homo,* cooperative breeding was to permit a hunting and gathering ape to spread more widely and swiftly than any primate ever had before, moving out of Africa 100,000 years ago, gradually covering and (temporarily at least) dominating the globe.

Flexible Phenotypes

Cooperative breeding is an option only for creatures that already live in groups. The story begins with offspring remaining near their mothers in *philopatric* associations—from the Greek for loving one's natal place "home country." Benefits of philopatry include remaining safe in familiar terrain (migrating is dangerous) and continuing to take advantage of

remaining near kin, near known resources such as safe sleeping places, fruiting trees, and stored food. On average, these benefits from philopatry must outweigh the advantages from dispersing: leaving competitors behind, finding a new territory, starting to breed in one's own right. Delayed dispersal, along with delayed maturation, means that "prereproductive" group members—teenagers, "spinster" aunts, real and honorary uncles—will be on hand with little better to do (in a Darwinian sense) than stay alive and help kin rear young. But helpers need to be ready to shift to breeding mode should the opportunity arise. Thus cooperative breeding requires phenotypic flexibility. The same individual has to be prepared morphologically, physiologically, and behaviorally to assume different roles at different life stages and in response to different opportunities. A female marmoset may be a helper this year, a mother the next. She may have one mate or several.

Phenotypic flexibility lies at the heart of cooperative breeding and has led to fascinating adaptations. Many of these involve delayed or suppressed reproduction, with some fairly bizarre side effects, as in allomothers who, without ever being pregnant or giving birth, start to lactate and suckle babies.

An alpha female wolf, paired for life with one male, will typically be assisted by younger group members, who hunt and devour prey then return to the den to regurgitate partially digested meat for her pups to eat. Sometimes the belly of one of these subordinate females will swell up as if she were pregnant. During this pseudopregnancy, she undergoes hormonal transformations similar to real pregnancy and begins to make milk. Vestiges of cooperative breeding frequently crop up in domestic dogs, distant descendants of cooperatively breeding wolves. I once observed a pseudopregnant Jack Russell terrier chase away a mother cat and then adopt and breastfeed *her* kittens. Suckling young of another species is scarcely adaptive behavior, but in the environment of evolutionary relevance where this female's responsiveness to infant cues evolved, pseudopregnancy followed by lactation increased the milk available to large litters.

So why doesn't a subordinate female breed herself instead of helping out? In a number of cooperatively breeding species, like wild dogs, wolves, hyenas, dingos, dwarf mongooses, and marmosets, the reason is: if she did, the alpha female would most likely destroy her young. Worse still, sometimes (as has been observed among wild dogs and marmosets)

not only are gestational resources from the subordinate female wasted on doomed young, but thereafter even more somatic resources are diverted to the dominant female's babies, who use the subordinate as a wet nurse (Digby 2000). The threat of coercion makes postponing (or "suppressing") ovulation the better part of valor, the least bad option, for females who then wait to breed until the coast is clear (Solomon and French 1997).

Women did not evolve to suppress ovulation or spontaneously lactate to nurse someone else's baby—although humans have sometimes consciously converged upon this pattern by hiring or enslaving wet nurses. But even without suppressed ovulation, human life histories assure the availability of unusually well qualified allomothers. Delayed maturation means pre-reproductive babysitters are usually on hand, but even better—and uniquely among primates—long lifespans after menopause (Hawkes et al. 1998) make post-reproductive kin available. Lacking infants of their own, their own reproductive careers behind them, such allomothers are likely to be as dedicated and single-minded in caring for immature kin as they are experienced.

The Usefulness of Extra "Fathers"

Although cooperative breeders are often monogamous, they may also be found in polygynous groupings (one male, several females) or in polyandrous ones (one female, several males) when circumstances permit. Since Darwin, we have assumed that humans evolved in families where a mother relied on one male to help her rear her young in a nuclear family; yet, as mentioned above, the diversity of human family arrangements (encompassing as it does the full spectrum of monogamous, polygynous, and polyandrous permutations) is better predicted by assuming that our ancestors evolved as cooperative breeders.

Looking across traditional societies, mothers can be found in monogamous, polygynous, or polyandrous unions. In some traditional matrilineal societies, mothers remain among their kin without a mate in residence at all. Yet nowhere is it feasible for a mother to rear children on her own. Even in the modern world, where terms like "single mother" are widely used, survival of mother and young can not be considered apart from shelter and food provided within a larger social

framework. The one absolute constant is that a mother needs assistance, although, as is typical of cooperative breeders, women are flexible and opportunistic concerning just who provides the help they need.

Indeed, human symbol-generating cultural capacities offer interesting bonuses in this regard. Social customs and propaganda are used to increase availability of allomaternal assistance. I like to imagine that it was a cagey white-haired grandmother who first invented—thousands of years ago—the folktale to beat all folktales in terms of its helpfulness to her daughters. According to this folk mythology—which by now has spread over a vast area of South America, encompassing peoples belonging to six different language groups—each foetus has to be built up from installments of semen contributed by all the men that a woman has had sex with in the ten months or so prior to birth. Although in fact women do not bear litters sired by several fathers the way wolves, jackals, and other cooperative breeders do and there is no such thing as a human baby with more than one genetic father, this biological fiction about partible paternity has proved extremely convenient for mothers who needed to elicit extra assistance rearing their young and getting their children fed.

However it came to pass, from the Aché of Paraguay in the south, to the Mehinaku, Kaingang, Arawete, and Curipaco peoples of central and eastern Brazil, then westward to the Matis of Peru and northward to the Yanomami and Bari in Venezuela, mothers rely on this convenient biological fiction to line up multiple honorary fathers who will help provision them and their children (Beckerman and Valentine, in press). Based on data from the Aché when these people still lived as nomadic foragers, anthropologist Kim Hill found that 63% of children were ascribed to more than one father and survived better with two men helping. Among the Bari, a fishing-horticultural people, two dads were similarly optimal. According to Steve Beckerman and his co-workers, 80% of 194 children with one secondary "father" in addition to their primary "father"—the man the woman is married to—survived to age fifteen, compared to a 64% chance of survival for 628 children without a secondary father. This makes sense in societies where provisioning by males is unpredictable—as is often the case with fishing and hunting—and where fathers have a high probability of dying or defecting, relying on several fathers has the same beneficial effects as the presence of many males in marmosets. Not surprisingly, as soon as a woman suspects pregnancy she attempts to seduce one of the better fishermen or hunters

in her group, which may be the flip side of the finding that the best hunters and the best fishermen have the most lovers.

Across cultures, polyandrous arrangements take many forms. Often polyandrous unions are temporary. For example, among the Shirishana Yanamamo, all marriages begin monogamously; thereafter, if the husband gets his way, an extra wife is added. But if wives are in short supply, or there are other problems to be solved, it is an extra husband who is temporarily added to the family unit. The Yanamamo are best known as "the Fierce People," among whom men raid other groups to steal many wives for their harems. But this is only part of their story. Many Yanamamo women spend at least some portion of their married lives in polyandrous unions, a time-honored standby to insure that children get provisioned and tended in a part of the world where children without fathers are at a serious, even lethal, disadvantage.

The South American belief in partible paternity facilitates cooperative provisioning. But even without this myth, an informal style of clan-based polyandry produces the same outcome in parts of central Africa and Asia. Should a husband die, his real and fictional clan brothers will look out for his children.

Ethnocentric Stereotypes

Forget the image of promiscuous women having "fun." At stake is a serious endeavor: mothers making do under difficult circumstances. Mother-centered models force us to rethink long-held assumptions about the nuclear family. Not long ago, a *Wall Street Journal* editorial entitled "Feminism isn't anti-sex: It's only anti-family" complained that feminism and especially birth control are responsible for the contemporary breakdown of families in America, with special reference to what is going on in America's inner cities. But given that polyandrous mothers probably predate by thousands of years that most modern of postindustrial luxuries known as "feminism," we would do better to focus instead on demographic and economic realities constraining maternal choices: high rates of male mortality, imprisonment, and defection and job prospects that translate into poor "hunting" prospects, making it impractical for a mother to rely on one man.

Just as surely as romanticized preconceptions about what mothers instinctively want and should do shaped our understanding of what

mothers actually did do, so too ethnocentric stereotypes about mothers evolving in nuclear families shaped the way we viewed the world around us. Even when we observed allomothers caring for young, we assumed the helper must be a co-parent and the mother's only mate.

It has been known since the eighteenth century, for example, that male marmosets are attracted to and carry babies; when zookeepers reported that infants fared better when a male was in the same cage as the mother, primatologists—with the ethnocentrism so characteristic of our species—assumed that Callitrichids must be monogamous, adapted to live in nuclear families. Since marmoset mothers do have better luck rearing young with their mate in the cage with them, the matter might have ended there, had primatologists not noticed that mothers, when they could, mated polyandrously with *several* males. Furthermore, these mothers with help from multiple males weaned babies sooner, bred even faster, and had an even higher proportion of their young survive. From the mother's point of view, reproductively monogamy is fine, but polyandry is even better.

Male care is essential in all the Callitrichids; but for three of the four genera (*Callithrix jacchus, Saquinus mystax, Leontopithecus rosalia*), the more adult males in the group, the higher a mother's reproductive success. Extra males (who may also have mated with the mother) help the parents to carry the infants and provide solid food for the rapidly growing twins so the mother can wean them sooner (Bales et al. 2000; Snowdon 1996).

Primability of Caretakers

It would not make a shred of difference, though, how many allomothers were on hand, were not other group members inclined to respond to infantile cries or gaping beaks or outstretched hands by picking babies up, delivering food to them, and so forth. Neural and endocrine systems that can be activated, and once activated lead to nurturing, have to be in place. For cooperative caretaking to happen, allomothers have to be susceptible to infant charms and solicitations, amenable to priming.

Fortunately for infants, individuals in many species—including *all* primates—find babies at least interesting and under some circumstances irresistibly attractive. Furthermore, where shared caretaking has paid off, and was selected for over time, thresholds for responding have

fallen lower, making allomothers more sensitive to the tantalizing signals babies emit.

Typically it is tougher to elicit nurturing responses from a pre-reproductive female or from a male than from a recent mother. But it is rarely impossible. Sufficiently primed by the right circumstances, a virgin female or a male eventually responds—even in species where nurturing is not a commonly observed part of the male repertoire. This is one reason why the annals of primatology abound with astonishing adoptions, orphaned chimps adopted by older brothers who never before seemed much interested, or abandoned babies left in the forest and picked up by a female belonging to some other species. As it happens, we know most about priming in rodents.

When male mice encounter a strange pup, they either ignore it or eat it. When sufficiently "primed," however (that is, presented with pup after pup until the males become sensitive to pup signals), males finally quit cannibalizing and caretake: licking pups, gathering them in nests, hovering over them to warm them with their bodies. Primed males do just about everything mothers do, short of lactating. The hormonal basis of such maternal-seeming behavior in males—including humans—is only beginning to be studied.

One reason for the delay was preconceived ideas about which individuals "mother." The flip side of the notion that all mothers are nurturing was the idea that "maternal instincts" will be confined to mothers. This was a mistake. When Alan Dixson discovered that male marmosets carrying babies had higher prolactin levels than males not exposed to babies, the first reaction was skepticism. Even after Dixson's finding was replicated, higher prolactin levels were interpreted as paternal care by a monogamous mammal. Only in the last few years has it become clear that elevated prolactin levels can be found in *any* allomother defending or nurturing immatures, not just in genetic parents. Prolactin levels in yearling scrub jays, for example, go up when they are carrying food back to nestlings. Among cooperatively breeding primates like marmosets, close contact with infants stimulates release of prolactin in nonreproductives (among *Callithrix jacchus:* Roberts et al., in press) as well as leading to reductions in testosterone (among *Callithrix kuhlii:* Nunes et al. 2000). The longer the male carries the infant, or the more experienced the male is prior to caretaking, the stronger are these effects.

The biggest surprise, though, was discovering that changes in hormonal levels during a woman's pregnancy might play a role in priming

nearby men. Prolactin levels in men living with pregnant women go up over the course of their pregnancy, as do cortisol levels and to some extent estradiol. The most significant effect was the 30% drop in testosterone in men right after birth. Declining testosterone might increase "paternal" behaviors simply by reducing male involvement in other behaviors that divert them from nurturing—like competing with other males. The more responsive to infants men are, the more likely it is that their testosterone will continue to drop (Storey et al. 2000; Wynne-Edwards and Reburn 2000).

No one is suggesting that fathers are equivalent to mothers, male caretakers to female ones. Indisputably, hormonal changes during pregnancy and lactation are far more pronounced in mothers than the modest but still detectable changes in men consorting with them. But the point is that *both* sexes are primable in the sense that their threshold for responding to infants will be lowered by proximity to pregnant mothers and newborn babies. By themselves, proximity and involvement can elicit nurturing. This explains why a fully engaged father, in frequent contact with his infant, can be even more committed to infant well-being than a detached mother. This point tended to be overlooked in early studies because it was taken for granted that mothers evolved to be the sole caretakers of their infants. Attention was riveted by the mother-infant pair, ignoring the social unit around them.

The general primability of both mothers and allomothers helps explain why genetic relatedness by itself can be a surprisingly unreliable predictor of involvement. The fact that humans turn out to be quite primable helps us understand, for example, why adoptive parents, wet nurses, or daycare workers can become so emotionally attached to the infants they care for. Based on DNA data, both !Kung San and Aka men have roughly equivalent (95%) chances of being the father of their mate's children, yet the former engage in relatively little infant care, the latter a great deal. The likeliest explanation is the opportunity for priming to matter among Aka men, who remain in close proximity to infants—within arm's reach—roughly 47% of the time (Hewlett 1988).

In the environments in which humans evolved, immature group members were more likely than not relatives. Predispositions to help them evolved according to Hamilton's Rule. But practically speaking, our ancestors did not think in terms of genes. What mattered were cues from infants processed at an emotional level. This brings us to the source of all these appealing signals: human infants.

The Twofold Tasks of Human Babies

As soon as we become convinced love is not possible, love becomes impossible.
Randy Nesse, 2000

Right from birth, newborns are powerfully motivated to stay close, root—even creep—in quest of nipples, which they instinctively suck on. These ancient primate urges to stay close and to get lactation under way are the first instinctive behaviors any of us engage in and are among the most powerful in the human repertoire. But maintaining contact is harder to do for little humans than for other primates. For starters, the newborn's mother has no hair for the baby to catch hold of. The mother herself has to position the baby on her breast and go to some trouble to keep him or her there. The mother must be motivated to pick up her baby hours and days before lactation is under way. There follow myriad decision points where a mother can invest to the fullest extent or take shortcuts.

The mother's commitment to her infant is the single most important determiner of survival prospects. But a long evolutionary history of cooperative breeding has meant that both a mother's commitment to her newborn and the level of support she is able to provide are linked to how much social support she herself has. More than in any other ape, a mother's love is contingent on her circumstances. So what (in an evolutionary sense) have been the consequences for human infants of their highly precarious dependence?

Within days of birth, human babies are capable of the same kind of contact calls and piteous cries that other primates make, but in addition they can read and perform all sorts of facial expressions, fully engaging in eye-to-eye contact with people who put their faces within the range that babies can see (around eighteen inches). Babies may reward such attentions by imitating the faces peering at them. Orang and chimp babies are also interested in their mothers' faces and take a brief look now and then. But they do not gaze deep into the mother's eyes like lovers in the early phases of a relationship, what pediatricians call *en face* socializing, the way human babies and their caretakers do. To the extent that psychiatrists and pediatricians thought about this at all, they tended to assume they were witnessing the artifacts of human mental agility and our ability to use language. Interactions between mother and baby, including all

the vocal play and intermittent babble, were interpreted (following Colwyn Trevarthen) as "proto-conversations." Yet even babies lacking face-to-face stimulation (say babies born blind) learn to talk. Furthermore, very few other primates engage in such continuous contact noises or "babbling" (Papousek et al. 1991; Elowson et al. 1998); and although none of these babbling monkey babies learn to talk, all, rather curiously, belong to the cooperatively breeding Callitrichidae, little primates that like human babies may have a more pressing need than most other primates to engage allomaternal attentions. (This is not to say that babbling is not important for learning to talk, only to question which came first: babbling so as to learn to talk or being predisposed to evolve into a talker because that creature was born a babbler!)

But back to my point: infancy is the most perilous life phase—why linger there? Why not grow big as fast as possible, into a juvenile? Yet instead of using available energy to outgrow their vulnerability, human babies are diverting calories into sophisticated, metabolically costly neurological machinery for eye contact, imitation, emotional expression—into equipment that other primates (who also need to be attached to their mothers) manage perfectly well without.

What is all this energetically quite costly infantile face-watching about? One possibility is that the infrastructure for later human cognition is so intricate that babies need to start early. But there is an alternative, not necessarily mutually exclusive, explanation. The baby may also be monitoring his or her mother, learning to read her moods and assaying her level of commitment. If human infants have had to become connoisseurs of maternal responsiveness, this would explain why babies become so upset when experimenters ask their mothers to wear expressionless plastic masks. It could also explain why babies become so unnerved when mothers are depressed.

Ambivalent Mothers and Pathological Outcomes

To the Darwinian-minded John Bowlby, each infant was a composite put together from innumerable past lives forged from what Bowlby (1969) called "the Environment of Evolutionary Adaptedness." Separation from the mother meant death by predation, so that any ape that survived to reproduce must have managed to stay attached. Being attached was normal and led to security; being detached was abnormal.

For mid-twentieth-century attachment theorists, children could be divided into those that were securely attached to their mothers and those that were "maternally deprived," insecurely attached children, at risk for developing into delinquents—the youngsters Bowlby designated in his early writings as "juvenile thieves." These were children who grow up unmotivated to respect "authority," short on "compliance," empathy, and conscience, less liable to dwell on social consequences and on how others would feel, and liable to take things without asking or paying.

One of the strongest case studies consistent with Bowlby's belief that maternal deprivation put children at risk derives from data compiled in the book *Born Unwanted* (Dytrych et al. 1988). The centerpiece is a study of 220 children in Prague, Czechoslovakia, born between 1961 and 1963 to married women who had twice sought and twice been denied abortions. On this basis, the mothers' subsequent infants were designated "unwanted." In this study 110 of the "unwanted" boys and 110 "unwanted" girls were pair-matched with controls of the same age, school class, sex, and birth order who had the same number of siblings and whose mothers were all matched for age and socioeconomic status as determined by the husband's educational level. All were from two-parent homes. (Had young and/or unmarried mothers been included the results would presumably have been even more dramatic.)

When Professor Zdenek Dytrych, a psychologist at Charles University, and his co-workers relocated 160 of the unwanted pregnancies and 150 of the controls twenty-two years later, following up on the initial "Prague Cohort," more than twice as many of the "unwanted" children had received criminal sentences (41 versus 19), and more than twice as many (22 versus 9) had been sentenced to prison, all statistically significant differences.[1] Children born "unwanted" were also less likely to describe themselves as happy or satisfied with life, but I focus on the criminal records because the results seem more clear-cut.

This is a remarkable study consistent with the hypothesis that children born unwanted are at greater risk for the behaviors that our society considers deviant. But why? Nothing is known about actual childcare.

Much of the research on unwanted children has been done by those advocating particular social agendas. It is not a domain that invites

[1] One reason we don't hear more about studies like the Prague Cohort and others has to do with concerns about stigmatization or what might be seen as "developmental profiling"—so-and-so is just bound to turn out poorly—as well as with concerns about the pressure such findings put on mothers to love children unconditionally.

dispassionate analysis. Furthermore, and as always, it is difficult to evaluate causal relationships when many different factors are involved. Was the mother the critical variable? Or was her unwillingness to bear the child merely symptomatic of a nonsupportive social situation when she was pregnant, the same situation that the developing child picks up on after birth? (Note that the Prague study controlled for many variables, but not allomaternal interventions.) And what of all the subjects that did not end up with criminal records? Some mothers may of course have grown more committed, or else their "sociopathic" children just did not get caught. But we also want to know: who else might have been involved in rearing these children? No doubt Bowlby was right about pathological outcomes for the most extreme cases of maternal and social deprivation. (Neurological and other deficits in the most neglected victims of Nikolae Ceausescu's Romanian orphanages come to mind.) But the idea that insecurely attached youngsters grow up at risk of developing into sociopaths has itself developed in interesting ways since Bowlby.

Why We Need to Consider Models Based on Cooperative Breeding

So far, most researchers studying development have presumed the antiquity and the normalcy of the nuclear family with a fixed division of labor (mother nurturing, father providing). Variables studied included (1) availability and responsiveness of the mother; (2) presence or absence of the father; and (3) whether or not the baby was in daycare or mothercare. Studies with this model in mind reveal that children with less responsive mothers are at greater risk for being noncompliant, becoming aggressive, and doing less well in daycare and later in school.

I know of no studies designed to take into account the possibility that humans evolved as cooperative breeders so that infants are cued to the traits most relevant in that context, namely: (1) availability and responsiveness of mother along with (2) availability and responsiveness of allomothers. That is, in terms of developmental outcomes the most relevant variables might be secure versus insecure, rather than securely or insecurely attached to the mother. Even though we do not know what kind of childcare characterized our ancestors in the Pleistocene, it is

worth noting that the most comprehensive study we have on the effects of allomaternal care is just as compatible with predictions generated by the hypothesis that humans evolved as cooperative breeders as the same results are with predictions generated by the hypothesis that human babies are adapted to be reared exclusively by mothers.

Alarmed by statistics showing that 62% of U.S. mothers with kids under age six are currently working outside the home and that the majority of these mothers are back at work within three to five months of giving birth, the National Institute of Child Health and Human Development (NICHD) set out to study how the children of these women were faring in different childcare arrangements. Beginning in 1991, 1,364 children and their families from diverse ethnic and economic backgrounds were studied in ten locations around the United States. The main finding of the study was that the maternal and allomaternal sensitivity to infant needs was a better predictor of subsequent developmental outcomes (in terms of traits like respect for others or "compliance" and self-control) than actual time spent apart from the mother was. In other words, the critical variable was not the presence of the mother per se, but how secure infants presumably felt when cared for by familiar people who the infants had learned would be sensitive and responsive to their needs.

An Aside on Why We Still Need to Worry about Daycare

Those convinced that babies need full-time care from mothers were no doubt surprised by the results of the massive NICHD study. The study found no ill effects from rampant daycare, even daycare for infants. No doubt, advocates of daycare felt vindicated. The additional information that allomaternal care is not particularly unusual in nature, and may even have been part of our Pleistocene heritage, might tempt some to think that the book is now closed, and daycare is not something we need to worry about. This would be tragically irresponsible.

Keep in mind what the NICHD study actually showed: daycare was better than mother care if the mother was neglectful or abusive—no one's idea of a good situation. Excluding these "worst" cases, there were no detectable ill effects of daycare *provided* that infants had a secure relationship with parents to begin with (which I take to mean that babies

felt wanted) and care was of a high quality, meaning plenty of staff, the same caretakers all the time, and caretakers sensitive to infant needs—in short, daycare workers who are going to behave like committed kin. These conditions are not easily met.

Where it exists at all, this caliber of infant daycare—unless family volunteers happen to be available—is expensive. Down the price range, there can be long waiting lines even for inadequate daycare. Such daycare as is available may be unlikely to foster secure relationships. *Average* rate of turnover among all workers in daycare centers is 30% per year. At least one reason for this is obvious. Daycare workers are paid an average hourly wage of $6.12, less than parking attendants ($6.38). Family providers earn even less—$3.37 per hour (from U.S. Bureau of Labor Statistics for 1998, cited in Shonkoff and Phillips 2000:315). Yet daycare places can be so hard to come by that mothers desperate to get back to work may forget to ask "What is the ratio of caretakers to infants?" in their eagerness to inquire "When can we begin?"

So we return to the crux of the matter: why should good daycare be so developmentally indistinguishable from mother-only care?

Sociobiologists Move beyond Bowlby

Over the last twenty years, researchers familiar with natural history and a broader array of ethnographic cases have started to move beyond the preconceptions that characterized early attachment theory. New disciplines like sociobiology have led to a greater awareness of just how variable mothers themselves, their circumstances, and their level of commitment might be. Along with that awareneness came the growing realization that there might be caretakers on the scene *other than the mother* (Hinde 1982; Lamb et al. 1985). So what about all the conditions intermediate between the two extremes of a totally committed mother and no caretaker at all? And what about the role of allomothers in developmental outcomes?

Since Bowlby, evolutionary-minded developmentalists have speculated that infants are monitoring mothers and other caretakers not just to keep caretakers engaged but also to learn about the kind of world they have been born into and developing accordingly (Hewlett et al. 2000). A Pleistocene mother responsive enough to make her baby feel secure was likely to be a mother embedded in a network of supportive

social relationships. Without such support, few mothers, and even fewer infants, were likely to survive.

This takes us back to the suggestion that babies are up to more than just maintaining the relationship with their mother, the hypothesis that babies are monitoring mothers to gain information about their social world. Impressed by just how variable rearing conditions could be, evolutionary-minded anthropologists and psychologists including Pat Draper, Michael Lamb, Jay Belsky, Jim Chisholm, and Mary Main recognized that over evolutionary time babies who used their mothers as a cue to determining the kind of world they had been born into, and who developed accordingly, might have a survival advantage. It would be important for a baby to know: Is this world filled with people who are going to help me survive? Can I count on them to share? Can I myself afford to share, and to count on others, or should I just take what I need however I can?

The optimal way to behave might differ very much depending, say, on whether the father was around or whether the mother had kin to help. Perhaps one parent was dead, and the infant was being reared by someone else. In that case the baby needs to know: "Will I be better off in this life predisposed to reciprocate and share, or should I be looking out for what I can get and taking it?" Being extremely self-centered or selfish, being oblivious to others or lacking conscience, traits that early attachment theorists assumed to be pathological, might in fact be adaptive, making an individual without much support from kin better able to survive.

As Bowlby was well aware, there would have been pitifully little opportunity among Pleistocene foragers for infants without committed mothers to survive. And if humans evolved as cooperative breeders, few mothers without social support would have been likely to commit. Nevertheless, with increasingly sedentary lifestyles, survival chances for children—even those without committed mothers—go up. Over the last tens of thousands of years, as people lingered longer in one place, eliminated nearby predators, built walled houses, stored food—not to mention came to use rubber nipples and pasteurized milk—infant survival became to some extent decoupled from continuous contact with mothers and other caregivers.

Ragged bands of street urchins or orphans in refugee camps come to mind, surviving all manner of neglect. Even in our own homes, children routinely survive caretaking regimens that an Efé or a !Kung mother

would view as appallingly negligent: what kind of mother leaves her baby alone at night—and on this point our babies would agree. Miraculously, we can leave our infants in a crib and come back hours later to find them still healthy, all ten fingers and ten toes intact. Never before in the history of humankind have so many infants deprived of social contact and continuous proximity to caretakers survived so well to reproduce themselves so successfully.

Even If We Persist, Will We Still Be Human?

The truth is that the least-studied phase of human development remains the phase during which a child is acquiring all that makes him most distinctively human. . . .

John Bowlby, 1969

There are all sorts of humanitarian reasons to worry about this situation. But from my peculiar evolutionary perspective, there is even more at stake here than individual suffering. What I see at stake is loss of the very traits that define us as what we are. When I hear people fretting about the future of humankind in the wake of global warming, emergent diseases and rogue viruses, crashing meteorites, and exploding suns, I find myself wondering: but even if we persist, will our species still be human?

Arguably, the capacity to empathize with others has served humans well. The reason our species managed to survive and proliferate to the tune of this planet's six billion current occupants has more to do with how readily we learn to cooperate than with what good conquerors we are. It is no accident that humans are so good at remembering who gave us what or invited us to dinner, predisposed to learn that sharing and reciprocating are rewarding and make us feel good. Reciprocal exchange was part and parcel of our long stint as hunters and gatherers, permitting two families to eat even though providers in one had come home empty-handed (Cashdan 1985; Wiessner 1996).

It is because humans are so good at cooperating that we can coordinate complex activities that allow us to exploit resources so effectively. Indeed, it is only because our *Homo ergaster* ancestors could cooperate

and share that human mothers could afford to bear such slow-maturing *Homo sapiens*–like babies in the first place. But this type of sharing and cooperation breaks down without trust. Emotional habits like being able to notice what others feel and need, caring about them, and being able to respond to them are learned in the first three years of life.

At a rudimentary level, all sorts of creatures are good at reading intentions and movements and anticipating what other animals are going to do. Predators from gopher snakes to lions have to be able to anticipate where their quarry will dart. Other apes can figure out what another individual is likely to know or not know—say about where an experimenter hid some bananas. But compared to humans, this capacity to entertain the psychological perspective of another individual (what psychologists call "perspective taking") is crude.

The novelist Edmund White has defined compassion as "taking an interest in all the details of (other peoples') existences and understanding their fears and motives, their longings and griefs and vanities." Cognitive neuroscientists like Marc Hauser describe compassion as being able cognitively and emotionally to put oneself in someone else's shoes and articulate how that person feels. This is why humans spend time and energy worrying about those they have never even seen—for example, AIDS orphans in Africa. This capacity for articulate empathy is uniquely well developed in humans; so much so, that many people (including myself) believe that along with language and symbolic thought this capacity for compassion is quintessentially human—what along with language defines us as human.

This capacity for articulate compassion is uniquely human. But its expression in any particular human varies with both innate propensities and each person's experiences in the course of development. Heritable capacities and development, nature and nurture, are both involved. First, there is each individual's emotional, empathetic component, which studies show is to some degree heritable. Already by fourteen months of age, identical twins (who share all genes in common) were more alike in how they responded when an experimenter pretended to pinch her finger on a clipboard and went "ooooh" than were fraternal twins who share only half their genes (Emde et al. 1992; Davis et al. 1994). Second, there is a learned component, having more to do with analytical skills than emotion, as each individual learns to look at the world from someone else's perspective. In most people, learning to

adopt someone else's perspective occurs in the context of their earliest relationships with mothers and allomothers, where children are also learning to trust or count on other people.

And this is where someone standing back and taking a long-term view of our species sees a serious problem. There is no reason to think that just because humans have evolved to be smart enough to chronicle our histories and speculate on our origins, evolution has come to a standstill. For gene frequencies in human populations have not ceased to change. Rather, they are in constant flux, which is all evolution ever meant—changes in gene frequencies. (A classic example would be the genes that permit people to continue digesting milk after infancy. They are common in populations with a history of herding and milking cattle, absent among those who never did.) But no matter how useful it might be, natural selection can not operate on a genetic potential, only on traits that are expressed in the course of development. For example, no one doubts that fish benefit from being able to see. Yet fish reared in darkness, like the small cave-dwelling characin fish of Mexico, never develop their capacity to see. In populations of characins long isolated in caves, youngsters no longer develop eyesight even when reared in the light because through evolutionary time traits never expressed are lost.

And this is why the idea of so many children reared without learning to trust in others is so worrisome. Selection only works on developmental outcomes, on phenotypes. But if the human capacity for compassion develops only under certain circumstances, and if an increasing proportion of the species is surviving to breeding age without developing these capacities, it won't make any difference how beneficial compassion was among our ancestors. There is no opportunity for this trait to be selected for. Like sight in cave-dwelling fish, the capacity to empathize will be lost. No matter what the dividends might have been in terms of high levels of interpersonal cooperation, natural selection can not continue to favor a genetic potential that is not expressed. Worse, as larger proportions of people who never had occasion to develop their capacity for empathy survive, empathetic tendencies themselves become less valuable. Who, after all, will there be worth empathizing with?

No doubt our descendants thousands of years in the future will be bipedal symbol-generating apes. They will be adept at utilizing sophisticated technology. But will they still be human in the way we—shaped by a long heritage of cooperative breeding—currently define ourselves?

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