Extracts from the literature on the origin of human pair-bonding and the significance of paternal provisioning

(1) Primeval Kinship: How Pair-Bonding Gave Birth to Human Society by Bernard Chapais (Harvard University Press, 2008)

Chapais addresses the very early formation of kinship structures in hominids. An obvious question is just how relevant his views are to modern humans. Nevertheless, Chapais presents his work as an hypothesis about the origins of human society. He considers that, prior to his work, the evolutionary approach to the origins of human society had been largely neglected. As Chapais himself puts it,

"*The evolutionary history of human society is an orphan research topic. The upshot is that sociocultural anthropology is a science whose study objects (societies) are evolved entities - that is, whose unitary core structure has a phylogenetic history - but whose research program largely neglects this basic fact*."

No doubt such words are a red rag to any constructivist anthropologist. As Robert Wilson put it in his review of Chapais' book, "*biologists entering the world of human kinship do so under suspicion of reductionism, biocentrism, and worse from cultural anthropologists*". However, internecine academic feuds are no concern of mine.

Chapais summarises his thesis as follows,

"*The stable breeding bond between a father and mother provided a reliable means for the father to recognize his offspring and for an offspring to recognize his father. In this context, the cognitive abilities and developmental processes involved in the recognition of uterine kin enabled hominids to recognize their kin on the father's side. In short, old abilities were coopted for use in a new context. In retrospect, therefore, the abilities involved in the recognition of uterine kin were preadapted for agnatic kinship recognition*." [NB: Roughly speaking, uterine kin are those on the mother's side, whilst agnatic kin are those on the father's side].

"*I shall argue on strictly structural grounds that the evolution of pair-bonding preceded the evolution of alliances between local groups (the tribal level of organization) and that the reverse sequence, the tribe preceding the evolution of pair-bonds, is structurally and logically unlikely*."

This is a remarkable claim which I might paraphrase as "the pair-bond is the basis of human society". To amplify Chapais' argument a little I borrow again from Robert Wilson's review, with some comments of mine in square brackets,

"*From Levi-Strauss, Chapais takes reciprocal exchange of females as the key to understanding the deep structure of human society*." [NB: The marrying of females out of the local group is known as exogamy].

"*Chapais's primary conclusion is that there is a 12-component exogamy complex that is the distinctive mark of human kinship, and he attempts to show how this complex was derived, in three phases, from a base in primate sociality.*

In the first phase of hominid kinship, human societies have a multi-male and multi-female composition with male residence and female dispersal giving rise to a basic form of outbreeding. A form of uterine kinship exists, stemming from the basic facts governing parturition and infant care amongst primates. Incest avoidance among primary uterine kin exists, but mating is otherwise sexually promiscuous in the group. Parenting is monoparental, paternity is either not recognized or inconsistently recognized, and siblinghood is weak.

During the next phase, the key changes are the evolution of both monogamous and polygynous forms of pair-bonding as a mating system, and the consistent recognition of paternity, with four major effects: incest avoidance is extended to father-daughter dyads, parenting becomes biparental (though not immediately so), sibling bonds are strengthened, and kin recognition is extended to patrilateral kin. Here we have the beginnings of multifamily groups, with biparental care a later consequence of the mating system shift from sexual promiscuity to pair-bonding."

[Note that any possibility of a paternal influence on offspring survival first requires that the father recognise his offspring, hence the significance of the evolution of mutual father/offspring recognition - and thence the recognition of agnatic kin. That paternal recognition evolved at all implies evolutionary benefit, though through what mechanism is not clear].

"*In the third phase, resulting in the full-blown exogamy complex, matrilateral kin come to be recognized, sibling bonds become lifelong or at least extended over time and space, and there is a diversification from previous patrilocal residence patterns. This generates fully bilateral descent and the possibility of a supragroup kinship structure, what Chapais calls 'the tribe', that creates the opportunity for non-hostile, pacifying relationships between local groups. Chapais places special importance on the evolution of siblinghood, viewing the brother-sister complex in particular as 'perhaps the single most original trait of human kinship from an evolutionary outlook'*."

[This restates the point made above that Chapais is claiming that the evolution of stable, cooperative, large scale social structures was contingent upon the prior evolution of recognised kin structures including pair-bonding. Simply put: families are the basis of society. I also note that this presupposes the ability to recognise individuals at all - the very capacity which, as I argue in the main text, is crucial to the evolution of cooperative behaviour, a facility which is also required in the formation of large stable social groups].

"*Chapais is sketchy on just how empathy, emotional responses, conceptualization, and self-consciousness make for the transition from mere behavioral regularities to socially-sanctioned rules, resting content here with a modest extension of some ideas on this from Westermarck, which were focused on the feeling of aversion. To this, Chapais adds possession of the concept of siblingship and an ability to apply it in the first-person case as additional psychological capacities. I (Robert Wilson) predict that central to further accounts here will be feedback loops between existing behavioural regularities, emerging cognitive and emotional capacities, and nascent social rules that gradually build relevant, full-blown psychological capacities and social rules. Just as recognitional capacities that are psychological in nature play a*

role in the phasal evolution of the exogamy complex only in conjunction with shifting patterns of residence, dispersal, and sibling bonding, so too should the role for psychology here be decidedly non-reductive in nature. I suspect that the most promising accounts here will draw on attachment theory."

[This is a recognition that whilst Chapais outlines the *steps* in the evolution of social structure, he does not explain why it happened in the sense of the driving psychology behind it. Wilson opines, with many others (see below), that attachment theory is the key psychological element.]

(2) Direct Male Care and Hominin Evolution: Why Male–Child Interaction Is More Than a Nice Social Idea by Lee T. Gettler (American Anthropologist, **112**, 7-21, March 2010).

ABSTRACT Early members of the genus *Homo* experienced heightened absolute metabolic costs, partially owing to increases in body size. However, as is characteristic of modern humans, they also likely began reproducing with shortened interbirth intervals. Male investment in offspring may help explain how this life history shift occurred. Evolutionary models of hominin male investment in offspring have traditionally focused on provisioning of females and young, yet the extent to which direct male care of offspring was evolutionarily important, from an energetic perspective, is largely unaddressed. I propose an evolutionary model of direct male care, demonstrating that males could have helped reduce the energetic burden of caregiving placed on mothers by carrying young. In doing so, males would have assisted females in achieving and maintaining an energetic condition sufficient for reproduction, thereby hastening the advent of shortened interbirth intervals that played a formative role in the success of our genus.

[This is supportive of the provisioning model of pair bond formation, but appears to be rather speculative].

(3) Human pair-bonds: Evolutionary functions, ecological variation, and adaptive development by Robert J. Quinlan (Evolutionary Anthropology, **17**, 227-238, September/October 2008).

ABSTRACT Stable mating relationships are widespread in our species, with important economic, social, and reproductive implications. Pair-bonds are part of the unique human mosaic, including very large brains, childhood, concealed ovulation, sexual intercourse in private, cultural symbols, and complex social groups. Yet we understand relatively little about the evolution of human pairing, its functions, and consequences for human diversity. We can define pair-bonds as the long-term affiliation, including a sexual relationship, between two individuals. The important point is that the union, whether monogamous or polygamous, is relatively enduring. Recent debate about human pair-bonds highlights apparently conflicting hypotheses: Are pair-bonds the evolutionary consequence of male mating competition or are they an adaptation for paternal provisioning? Unfortunately, a simple answer seems unlikely. The evidence indicates selective pressures from both mating competition and provisioning needs, suggesting different benefits of pair-bonds in different contexts. Whether a bond emphasizes mating or parenting effort may depend on

environmental cues. Childhood experience evidently affects pair-bond development, suggesting further adaptive design for flexible life-history strategies.

[This is consistent, I think, with the view that provisioning becomes more significant in pair bond formation in conditions of relative resource scarcity. The converse implication, as mentioned in the main text, is that affluence may naturally weaken the pair bond].

(4) Applying socioendocrinology to evolutionary models: Fatherhood and physiology by Lee T. Gettler (Evolutionary Anthropology, **23**, 146-160, July/August 2014).

ABSTRACT Owing to humans' unique life history pattern, particularly comparatively short interbirth intervals, early weaning, and prolonged support of multiple dependents, human females have greater reproductive value and higher lifetime fertility, on average, than do their Great Ape counterparts. As hominin females began weaning their young early and 'stacking' dependents of various ages, they must have had cooperative allomaternal care partners already in place or been successful at concurrently soliciting help to ensure a high rate of survival of their offspring. Following Hrdy, I define allomaternal care (and its derivatives, such as 'allomothers' and 'allomothering') as 'care from anyone other than the mother', which thus encompasses a wide range of individuals, including fathers. Who the likely allomother candidates were and what form that cooperation took remain intriguing, difficult-to-answer questions, which are limited, in some capacity, by the lines of evidence available to us. Here, I present a framework for the ways in which we can integrate neurobiological-endocrine and social-behavioral data (socioendocrinology) to contribute to this dialogue in terms of evaluating fathers' roles.

[Whilst supporting the role of allomothering in human social evolution, this work does not provide evidence that the role was fulfilled by fathers, merely that it might have been]

(5) Fatherhood: Evolution and Human Paternal Behavior by Peter B. Gray and Kermyt G. Anderson (Cambridge, MA: Harvard University Press, 2010)

From a review of the book,

"*A helpless baby meant that caregivers were necessary—with fathers included among a cadre of female caregivers. Long-term bonds with a partner were necessary but not sufficient, the authors say, to account for the eventual emergence of more significant paternal care. Fathers were more likely to stick around when babies became helpless, and they mate-guarded mothers to ensure sexual access. Because females largely chose males based on their ability to provide, the nutrient base for themselves and their young ultimately ensured their survival. Gray and Anderson note, however, that arguments that simply reduce male behaviour to 'showing off' or to 'costly signalling' do not fit the story of greater paternal investment. If this were the case, fathers would not care about their paternity status - which they do*."

[This account seems to back all horses at once: provisioning, mate guarding, allomothering and the primacy of father-child attachment to the evolution of the pair bond].

(6) Evolution and Proximate Expression of Human Paternal Investment by David C. Geary (Psychological Bulletin **126**, 55-77, 2000)

Extracts from the paper, not necessarily in this order, as follows,

"*In more than 95% of mammalian species, males provide little direct investment in the well-being of their offspring. Humans are one notable exception to this pattern and, to date, the factors that contributed to the evolution and the proximate expression of human paternal care are unexplained.*

Across many different species, some combination of improved offspring survival rate and quality, alternative mating opportunities, and paternity certainty is the central social and ecological correlate of the evolution and proximate expression of paternal investment. At this point, definitive conclusions cannot be drawn about the evolutionary and proximate mechanisms associated with human paternal investment, but what is known suggests that many of the same features that are associated with such investment in other species are also important in humans. These factors include reductions in infant and child mortality rates in high-risk environments and improvements in children's later ability to compete for essential social and material resources.

The evolution and proximate expression of human paternal investment also appear to be related to relatively high levels of paternity certainty and to reduced mating opportunities. The latter appears to have resulted from physical (e.g., concealed ovulation) and social (e.g., aversion to casual sex) adaptations in our female ancestors, as appears to be the case with socially monogamous primates. In species with lower levels of paternity certainty, the average level of male provisioning is lower than in species with higher levels of paternity certainty.

In some species, paternal investment may be obligate, that is, male care is necessary for the survival of his offspring. In such species, selection pressures strongly favour males who invest in offspring and could eventually result in nearly all males showing high levels of paternal investment, independent of proximate social and ecological conditions. In other species, including humans, paternal investment is facultatively expressed, that is, the level and nature of this investment varies with proximate social and ecological conditions. Although the conditions that influence the proximate expression of paternal investment can vary from one species to the next, there appear to be similar social and ecological conditions associated with paternal care in many of these species, suggesting convergent evolution. Across these species, the facultative expression of paternal investment is typically associated with paternity certainty and alternative mating opportunities and by the strength of the relation between paternal care and offspring survival. Paternal investment is often, but not always, found under conditions where there is a high degree of paternity certainty, where paternal investment improves offspring survival rates, and where paternal investment does not severely restrict opportunities to mate with other females.

The research just described suggests that paternal investment reduces infant and child mortality risks but is not obligate, that is, many children survive without such investment. When investment is not obligate, men have the option of focusing their reproductive energies on mating or on parenting; given the biology of mammalian reproduction, women do not have this freedom of choice to the same degree. Given that some level of paternal investment is found in most human societies, it is almost certain that under some conditions and at some point in our evolutionary past, men benefited reproductively by shifting some portion of their reproductive effort from mating to parenting."

And in the context of the modern world Geary writes,

"*Across all of these different contexts there is a clear and consistent relation between paternal investment (e.g., provisioning) and infant and child physical health and mortality risks. It cannot be concluded, however, that paternal investment is the sole cause of these reduced risks. In modern society, socioeconomic status (SES) is often influenced by maternal employment, and in preindustrial and industrializing Europe, SES was influenced, in some cases, by any dowry provided by the wife's family. Moreover, infant and child mortality rates are also related to maternal and paternal educational levels, even when SES is statistically controlled, in developing nations today and in preindustrial Europe. It appears that better educated parents, especially mothers, are more likely to seek medical services, as contrasted with folk remedies, and to implement new health-related advances (e.g., hygiene in industrializing Europe), which often reduce infant and child mortality risks. In short, high SES fathers provide more resources to their children than do lower SES fathers, and these resource differentials are correlated with infant and child mortality risks. At the same time, high SES fathers are more likely to marry women who have qualities (e.g., better educated) that are also associated with reduced infant and child mortality rates. Thus, the reduced mortality risks associated with paternal investment cannot be uncritically attributed to this investment. Nevertheless, there are several patterns that suggest that paternal investment directly lowered infant and child mortality risks in preindustrial and industrializing Europe and the United States, as well as in developing nations today*."

[Overall this review favours the thesis that paternal investment lowered child mortality in evolution and also in modern developing nations. Paternal investment is here linked particularly to paternal certainty, and also to female sexual crypsis. It is also suggested that paternal investment is favoured when it does not severely restrict opportunities to mate with other females.]

(7) The Ape That Thought It Was A Peacock: Does Evolutionary Psychology Exaggerate Human Sex Differences? Steve Stewart-Williams and Andrew G Thomas, Psychology Inquiry, 24, 137-168 (2013)

The paper goes not deny the existence of evolved psychological sex differences in our species. The authors accept both that there are differences and that they have their ultimate origin in our evolutionary history. The paper claims that Darwin's "males compete / females choose" mating strategy is misleading when applied to humans. Rather both sexes are choosy about their mate, and lengthy courtships result. The point is made that, if fathers invest significantly in their offspring, then they will

naturally be more careful in their choice of mate (just as women are with men, for the same reason). Extracts from the paper are as follows. The first model they describe (MCFC) is the traditional model which they reject.

"The males complete / females choose (MCFC) model
Human beings are a sexually dimorphic species. We exhibit profound sex differences in sexuality. These trace back to sex differences in parental investment. Historically, women invested more into their offspring than men. For a start, eggs are biologically much more expensive than sperm. More important, mammalian reproductive pysiology obliges women to bear the biological costs of a 9-month pregnancy and, until recently, several years of breastfeeding. Men's minimum contribution to the production of offspring is much smaller. Because of the sex difference in minimum parental investment, the maximum number of offspring a man can have in his lifetime is much higher than that of a woman. If a man mated with 100 women in a year, he could potentially have 100 offspring; if a woman mated with 100 men in a year, on the other hand, she would have no more offspring than if she had only mated with one. As such, males in our evolutionary past who pursued quantity of mates rather than quality had more offspring than other males, and the tendency to favour quantity became more and more common among males over the generations (i.e., it was selected). In contrast, ancestral females who sought quality of mates rather than quantity had more surviving offspring than other females, and that tendency was selected among females. The net result is that men evolved to pursue short-term sexual relationships with as many women as possible, only opting for long-term pair bonding if they failed in this strategy, whereas women evolved to be choosier than men about their sexual partners, and to favour long-term pair bonds with men who helped provide for their offspring. Men court women and compete with one another to gain sexual access to as many women as possible. Women, in contrast, choose from among the available men. Women's choices then exert a strong selection pressure on men, shaping male courtship 'ornaments' such as facial symmetry, status seeking, creative intelligence, and humour - all of which are human equivalents of the peacock's tail.

This is not, in our view, an entirely unreasonable position. That said, we suggest that every sentence is either false or, if true, potentially misleading without appropriate qualifications. To see why, consider our preferred model:-

The Mutual Mate Choice (MMC) Model
Human beings are a relatively monomorphic species. Certainly, there are some average differences between the sexes, and certainly these trace back to the fact that women invest more in offspring than men. However, sex differences in sexuality are fairly modest in our species, precisely because sex differences in parental investment are fairly modest - much more modest than we would assume if we focused on gamete size, pregnancy, and lactation alone. As brain size increased in the hominin lineage, our young became progressively more dependent and the childhood period became progressively longer. As a result, pair bonding and male parental care became central elements in our reproductive repertoire. This dramatically reduced the discrepancy in the maximum number of offspring that men versus women could produce. Although in principle a man could impregnate hundreds of women every year, in practice the reproductive ceiling for even the most attractive men was almost always much lower. Consequently, we exhibit reduced psychological dimorphism.

Moreover, we are not the kind of species in which females alone exert mate choice or males alone compete for mates; we are a species with mutual courtship. Because men often invested in offspring, they evolved to be choosy about their mates - in other words, to pursue mate quality rather than just quantity, at least in long-term relationships. Similarly, because men differed in their capacity to invest, women evolved to compete for the most desirable partners. Mutual mate choice has an important implication, namely, that sexual selection does not act wholly on human males. We are a species in which both sexes have their equivalents of the peacock's tail. Indeed, when it comes to physical beauty, the usual sex difference has arguably been reversed: Females are the showier sex.

As large brains evolved in our lineage, the need for allomaternal care increased dramatically, especially during pregnancy and infancy. Selection appears to have taken several paths to satisfying this need: Mothers commonly receive aid from a variety of interested parties, including grandparents (especially maternal grandmothers) and siblings (especially older sisters). For present purposes, though, the most important development was the evolution of male parental investment, often within the context of a pair bond. The idea that humans form pair bonds, and that males often invest in their young, has a long history in biological anthropology. Early incarnations of the idea were criticized for painting an overly simplistic picture, according to which "Man the Hunter" provisioned his dependent wife and children with meat in a stable nuclear family, suspiciously reminiscent of a 1950s-style Western family. However, with appropriate amendments and qualifications, the idea that pair bonding and biparental care are a central part of our evolutionary endowment appears to be viable.

Human pair bonds are held together by various factors, both social and psychological. It is the psychological factors that are most relevant here, however, as they are plausibly products of selection. They include sexual desire, romantic love, and long-term attachment. They also include romantic jealousy. The pair bonds inspired by these psychological states serve at least three evolutionary functions. The first is the impregnation of the female; this is, of course, closely linked to sexual desire. The second applies only to the male; it is to increase his probability of fathering the woman's offspring (this is known as the mate guarding hypothesis). And the third is to facilitate male provisioning and protection of the female while she is pregnant and breastfeeding, and biparental care of the child for a time thereafter. The extent to which a pair bond serves each function depends on its duration. Some pair bonds are short-lived and thus can only serve the first two functions. But others last for many months, years, or even for life, and may therefore serve all three. It is important to remember that the proposed functions do not describe people's motivations for establishing pair bonds. Instead, they describe the selection pressures shaping the disposition to form these bonds - in other words, the selection pressures shaping emotions such as romantic love, long-term attachment, and jealousy. These emotions can lead people to form pair bonds without them having any awareness of the evolved function of the bond."

[The last point being made above is exactly the thesis of my main text, namely that the 'romantic' emotions are the proximate motivation of the individual towards behaviours which are actually evolved].

"*In many forager societies, children without an investing father have lower survival rates than those with one (e.g., Dwyer &Minnegal, 1993; Hill & Hurtado, 1996). Admittedly, one study detected this "father effect" in only one third of small-scale societies (Sear & Mace, 2008). However, virtually all the societies in this study were agricultural societies, and thus it is unclear that the finding is representative of most of human evolution. Furthermore, survival is only one, rather exacting measure of male investment. Paternal care could boost the father's fitness even without boosting offspring survival. It could, for example, help shorten the woman's interbirth interval, through reducing the workload and calorific toll associated with raising a young child (Marlowe, 2001)*."

[The dissenting source, Sear & Mace, 2008, is discussed further below]

"*We would argue, however, that despite the variability in childcare arrangements, men everywhere have the capacity to fall in love, to form pair bonds, to form bonds with their offspring, and to invest in offspring. Even when a culture is set up so that these potentialities are only sometimes actualized, the potentialities still seem to be there. This suggests that, throughout the course of our evolution, the selection pressure for investing fathers was strong enough to shape a male psychology capable of pair bonding and paternal care.*

Among men, the sound of a baby crying, when coupled with nurturant behaviour, leads to a slump in testosterone levels. Aside from testosterone, human pair bonding and paternal behavior have been linked to oxytocin, prolactin, and vasopressin in ways comparable to those observed in the males of other pair-bonding primates. It is hard to argue that these hormonal responses are products of socialization, as opposed to being part of the basic design of male human beings. Socialization may certainly influence levels of male parental behaviour. However, the basic biological machinery of pair bonding and male parental motivation appears to be a fundamental component of the male phenotype in human beings."

[Overall this work by Stewart-Williams and Thomas is a powerful advocacy for an innate (evolved) bonding tendency of men towards both their female partners and their children. It speaks against the traditional male competition theory of mating and in favour of a higher degree of mutuality in male-female mating choice. It also emphasises the significance of paternal investment. It is argued that it was the rise of paternal investment which mitigated against the 'males compete / females choose' mating strategy].

(8) **The place of attachment in human mating** by Cindy Hazan and Lisa Diamond, Review of General Psychology, Vol 4(2), 186-204 (Jun 2000)

ABSTRACT Application of the principles of evolution and natural selection to the phenomena of human mating does not lead inevitably to a single theoretical model. According to the standard evolutionary model, formally known as sexual strategies theory, biologically based sex differences in parental investment have resulted in hard-wired sex differences in mate preferences and mating strategies. A critical analysis of the logical and empirical foundations of the theory reveals several weaknesses and limitations. This article demonstrates how attachment theory (J.

Bowlby, 1969/1982, 1973, 1979, 1980, 1988) can be used to integrate a diverse set of ideas and research findings and provide a more grounded account of human mating.

[This article also argues against the 'males compete / females choose' (MCFC) mating strategy but places the emphasis on the psychological phenomenon of attachment].

(9) On the Dynamics of Human Bonding and Reproductive Success: Seeking Windows on the Adapted-for Human-Environmental Interface by Lynn Miller and Stephanie Fishkin in J. A. Simpson & D. T. Kenrick (Eds.), *Evolutionary Social Psychology*, pp.197–235 (1997), Mahwah, NJ: Erlbaum.

I quote at length from this paper (extracts only),

"*Are close, relatively enduring, relationships fundamental to human beings? In this work, biological and psychological evidence is presented that suggests the intriguing possibility that our current biological design - rooted in our Pleistocine hunter-gatherer past - strongly favours relatively enduring relationships....Futhermore, this biological design appears to dovetail with the attachment system , a system with roots in our primate past. The adaptations of humans to their physical environments, it will be argued, interfaced with adaptations to their social environments to enhance both maternal and paternal infant-caregiver emotional bonding and adult pair-bonding. Because human infants were exceptionally dependent primates, the involvement of paternal as well as maternal caregivers was critical for offspring survival. As they are today, high levels of paternal involvement would be expected to be associated with close, relatively enduring pair-bonds. Design features supporting these systems (e.g., caregiving, attachment, pair-bonding) and their interfaces are consistent with Bowlby's evolutionary ethological position. Consistent with Bowlby, we would argue that all humans born today share this evolutionary heritage, as well as the latent design features.*

Draper and Harpending and others have suggested a dichotomy between human culture differing in male reproductive strategies in which fathers are absence and those in which fathers are present. Father-present societies are those with close pair-bonds and high levels of provisioning directed towards a mate and their male and female offspring. Those offspring, in turn, seek more enduring pair-bonds as their predominant mating strategy. Father-absent societies are those with more transient bonds, higher prevalence of polygyny, and lower levels of parental investment, especially paternal investment in offspring. Those offspring engage in sex at an earlier age, forging less stable relationships. There are more marked sex differences in behaviour and more negative perceptions about the opposite sex....With such behavioural variability across cultures, within cultures, and between men and women, how can humans share universal design features?...

...current behavioural variability, including differences between men and women, may well be the result of relatively modern differences in the social environment encountered by human that were not present during the Pleistocene era; such recent changes are unlikely to be the result of adaptations.

In contrast to environments encountered by some humans today, that involve relatively low levels of paternal investment (e.g., father-absent societies) the stable

pattern for humans over hundreds of thousands of years is likely to have been one which included maternal and paternal involvement with offspring and emotionally intimate relations between mates. For ancient hominids (e.g., during the Pleistocene era) and for most contemporary hunter-gatherer groups, there was high maternal and paternal involvement with offspring.

After the end of the Pleistocene era, and perhaps less than 10,000 years ago, with the advent of agricultural societies and the differential accumulation of individual wealth, close paternal caregiving of offspring - apt to have been so critical to the survival of highly dependent human offspring - was no longer essential. For example, as agricultural societies supported larger and larger human bands, kin and others coulc more easily have assumed, or been assigned, the role of caregiver. Procuring food, shelter and the protection of offspring would have required less and less sustained vigilance and daily maternal and paternal involvement. During this period, increased variability in the importance of paternal caregiving for offspring survival may have emerged.

As Tooby & Cosmides elaborated, the "evolved structure of the human mind is adapted to the way of life of Pleistocene hunter-gatherers and not necessarily to our modern circumstances.....it is improbable that our species evolved complex adaptations even to agriculture, let alone to post-industrial society. Moreover, the available evidence strongly supports this view of a single, universal panhuman design, stemming from our long-enduring existence as hunter-gatherers. If selection had constructed complex new adaptations rapidly over historical time, then populations that have been agricultural for several thousand years would differ sharply in their evolved architecture from populations that until recently practiced hunting and gathering. They do not."

[NB: This view, with which Miller & Fishkin concur, is that evolutionary changes - at least those relevant to mating and reproduction behaviours - would take many millennia to enact. But is this necessarily true? Selective breeding of animals by humans, e.g., pigeons or dogs, can cause significant changes within ten or twenty generations - which would translate to a mere few hundred years on human timescales. Of course, the selection pressure in this case, enforced artificially by humans, is extreme. Nevertheless, can we be sure that humans are quite the same as they were in, say, the medieval period? Or in the Roman period?]

"*We argue that pair bonding enhanced the species' survival. With increased levels of infant vulnerability, females probably chose men who would stay around to help care for offspring. Those fathers who played a role in caring for, and pair-bonding with, their mates, and who cared for their mate's offspring, increased their offsprings' chances of survival, thereby enhancing the probability that future generations would share characteristics that fostered pair-bonding and parenting propensities. With a shortage of females, pair-bonding probably also provided the most viable solution for men to have available sexual partners.*

What factors would increase the likelihood that couples would engage in sexual behaviour? It seems likely that chief amongst these would be sexual satisfaction. Curiously, one strong correlate of sexual satisfaction is emotional bonding. At first glance one might argue that the reinforcing properties of sex may enhance the

likelihood that the couple will form and maintain strong emotional bonds. However, the role of sex in affecting later bonding is unclear. For example, amongst dating couples, having sexual intercourse early in the relationship did not necessarily enhance emotional bonding or relationship longevity. In recent longitudinal work, cross-lag part correlations suggest that newly wed couples' early emotional bonding predicted their later sexual enjoyment and not the reverse; this was the case for both husbands and wives.

(Evidence suggests) that a variety of design features, including biological and chemical features, argue for the adaptive advantage of both caregiving and having close, relatively enduring relationships in which emotional bonding and sexuality are apt to be interwoven.

As mentioned earlier, Draper and Harpending noted that, across and within cultures, warm spousal relationships and paternal caregiving styles seem to cluster together. In father present societies, relationships between women and men are intimate and close with high levels of bonding, whereas those in father-absent societies either involve mutual avoidance or pronounced hostility and sometimes violence, and are more transient, with a higher prevalence of polygyny and more pronounced sex roles reinforcing male dominance and female subordination. In father-present societies, both male and female offspring, as adolescents, are more careful and reticent in choosing partners and entering into sexual relationships, have good skills for forming and maintaining close relationships, and tend to form a pair-bond with a single mate. Where fathers are emotionally aloof, boys are more likely to engage in competitive and aggressive behaviours; daughters are less coy, begin sexual activity earlier, and form less stable pair-bonds.

We would argue that humans, over vast stretches of human history, were adapted to experience responsive caregivers, both fathers and mothers. When humans do not encounter this social environment as offspring, this lack of fit between what humans were adapted for and what they encounter is likely to have a number of emergent outcomes. Chief amongst these may be the impaired ability to trust and feel that one can get close to and dependent on others. Control for such insecure individuals may instead be achieved through emotional withdrawal or attempts to dominate others."

[Miller & Fishkin conducted a survey to examine whether men or women were more likely to seek short term, as opposed to stable long term, relationships. Traditional "male competition" mating strategies, and public prejudice, would suggest that men will be keener on short term relationships. But this is no what Miller & Fishkin found. Instead they found no significant difference between the sexes in this respect. "*Both women and men are more inclined to seek an enduring relationship compared to a short-term one*".]

"(Miller & Fishkin) argued that a number of design features support the view that emotional closeness, pair-bonding and parental caregiving - including the enhanced role of paternal involvement - were important human adaptations. Consistent with this and his theoretical position regarding the prevalence and centrality of long-term relationships as an evolved strategy, Buss et al's cross-cultural findings indicated that mutual attraction and love - as a "state of the relationship, one that signifies mutuality and perhaps reciprocity" - is at the top of characteristics desired in mates.

Furthermore, in related research, we found that mate characteristics such as (being) emotionally warm and kind and understanding, in general, are highly desirable, especially for long term relationships. Humans who pair-bonded and provided a supportive environment for offspring were probably more apt to experience enjoyable sexual encounters and more apt to have offspring that survived to adulthood. Perhaps, in our most intimate relationships, it is not basic needs (e.g., food, sex) alone or even primarily that we seek. Rather, in our own way, we are attempting to achieve the emotional closeness that we, as humans - both with our offspring and with our mates - have evolved to desire."

[This is another paper which emphasises the role of attachment theory. Attachment Fertility Theory (AFT) comes in for some criticism in the later Stewart-Williams & Thomas, item (7) above. Whilst recent authors claim that the traditional MCFC strategy tends to over-estimate sex differences in mating choice, the criticism of AFT is that it under-estimates sex differences in mate choice. However, from my amateur point of view the similarities between Miller & Fishkin and Stewart-Williams & Thomas are more striking than the differences]

(10) Reflections on the Human Family by David C. Geary, Drew H. Bailey, and Jonathan Oxford, Chapter 21 in The Oxford Handbook of Evolutionary Family Psychology Edited by Todd K. Shackelford and Catherine A. Salmon

ABSTRACT Recreation of the socioecology in which the human family evolved can be guided by the paleontological record, comparisons of closely related species, and of course by the study of family formation across human cultures and the historical record. Following this approach, we propose that the socioecology of our australopithecine ancestors was similar to that found in modern gorillas (Gorilla gorilla); specifically, single-male harems with several females and their offspring. Such a social structure explains many features of the human family, including high levels of paternal investment, long-term male-female relationships, and concealed ovulation, that are not readily explained if our ancestors were more similar to modern chimpanzees (Pan troglodytes). Moreover, the evolutionary changes needed to move from a gorilla-like social structure to the current human pattern are much less complex than the changes needed to move from a chimpanzee-like social structure. After describing the gorilla-like start point for the human family and evolutionary changes in our socioecology, we reflect on how this model relates to the different patterns of family formation found across and within human cultures and to our understanding of sibling relationships and grandparental investment.

(11) Perspectives on Human Attachment (Pair Bonding): Eve's Unique Legacy of a Canine Analogue by Ronald S. Immerman and Wade C. Mackey, Evolutionary Psychology vol.1 (January-December 2003)

Extracts as follows,

"*The mother-child bond is undoubtedly homologous with that of other primates (and mammals). However, the man-woman pair bond and man(to)child pair bond are not paralleled by any terrestrial primate nor many mammals. Hence, knowledge of primate behaviour would not be predictive of the pan-human (i) social father and (ii) the extended pair bond between a man and woman (with the cultural overlay of*

marriage). It is suggested that female choice of mating partner shifted in the direction of a canid analogue in which men's motivations to share resources with the female and to exhibit paternalistic behaviours were positively selected. Accordingly, it would be predicted that, compared to other terrestrial primates, the neuro-hormonal bases for the mother-child affiliative bond would be similar, but the bases of man-woman affiliative bond and the man(to)child affiliative bond would be dissimilar.

The Man-Woman Bond *(extensive references suppressed - see original)*
As ethnographies on both historical and contemporary cultures illustrate, males - who had been selected over millennia by females - return to the domicile and willingly and systematically share resources with the woman in the pair bond, i.e. his wife. The man-to-woman sharing is found across subsistence and ecological parameters viz. Amazonia, China, Tibet, the Dani of New Guinea, Eskimos, Japan, Australian aborigines, the Dobe !Kung of the Kalahari desert. This sharing of resources from man-to-woman is a universal; see for additional human universals. The provisioning is not totally exclusive. Systematic food sharing has been ritualized in many, if not all, societies. Rarely can a hunter claim a large kill for only his own family. But, within these contexts, a man provides singular attention in terms of provisioning and protecting the legitimate children that he has fathered and his wife or wives. When resources are not forthcoming from a prospective groom, brides are difficult to acquire and wives are difficult to keep. For example, in a sample of 50 cultures which had economic deprivation as a sanctioned reason to divorce, the wife could divorce the husband in 49 of the cultures. In one, either of the spouses could initiate the divorce. In no culture could only the husband divorce the wife on the basis of her economic deficiencies. When the pattern of male provisioning does break down across the overall society, e.g. the Ik, the breakdown signals an overall societal disintegration and is a focused topic of the ethnographer's analysis.

Conclusion
Across cultures, men develop extended pair-bonds with women (they marry women) and provision these women. The men also nurture their own children. Within the context of these two universals, the argument is presented that the affiliation which mediates these behaviours is, in part, neuro-hormonal in character and thus part of the phylogenetic heritage of our species. The drive-wheel for these behaviours, which would not be predicted by knowledge of terrestrial primates, is argued to be based on a successful reproductive strategy of our female ancestors, a strategy analogous to that of female canids - convergent evolution - that enables them to exploit a novel resource for predictable sustenance for themselves and their offspring: men."

[This work champions male provisioning and the view that it is adaptive (evolutionary)].

(12) Who keeps children alive? A review of the effects of kin on child survival
by Rebecca Sear and Ruth Mace, Evolution and Human Behavior **29** (2008) 1–18

ABSTRACT Children pose a problem. The extended period of childhood dependency and short interbirth intervals mean that human mothers have to care for several dependent children simultaneously. Most evolutionary anthropologists now agree that this is too much of an energetic burden for mothers to manage alone and that they must enlist help from other relatives to share the costs of raising children.

Which kin help is the subject of much debate. Here, we review the evidence for whether the presence of kin affects child survival rates, in order to infer whether mothers do receive help in raising offspring and who provides this help. These 45 studies come from a variety of (mostly) natural fertility populations, both historical and contemporary, across a wide geographical range. We find that in almost all studies, at least one relative (apart from the mother) does improve the survival rates of children but that relatives differ in whether they are consistently beneficial to children or not. Maternal grandmothers tend to improve child survival rates as do potential sibling helpers at the nest (though the latter observation is based on rather few studies). Paternal grandmothers show somewhat more variation in their effects on child survival. Fathers have surprisingly little effect on child survival, with only a third of studies showing any beneficial effects. Overall, this review suggests that whilst help from kin may be a universal feature of human child-rearing, who helps is dependent on ecological conditions.

(13) Beyond the nuclear family: an evolutionary perspective on parenting
Rebecca Sear (2015) Current Opinion in Psychology, **7**. pp. 98-103.

ABSTRACT There has been a recent shift in the evolutionary behavioural sciences towards the view that parenting in our species is cooperative, and that mothers require help from others to raise children successfully. This shift is not yet reflected in psychological models of parenting, which still emphasise the centrality of the nuclear family. This emphasis is problematic both because it neglects the importance of alloparents, and because it assumes the fathering role is consistent across societies. While paternal investment is often substantial in our species, it is also shows considerable ecological variability. This article highlights recent, cross-cultural research on the cooperative nature of human 'parenting', and illustrates the flexible nature of both parenting and alloparenting across human societies.

(14) Attachment and Pairbonding by Eli J Finkel and Paul W Eastwick, Current Opinion in Behavioral Sciences **3**, 7–11 (2015).

ABSTRACT Relative to other primates, Homo sapiens are born immature. To survive, they require intensive provisioning and nurturance across many years. One evolved mechanism for fostering such caregiving is for parents to pairbond - to develop and sustain a deep emotional connection to each other — which bolsters fathers' contributions to childrearing. Such paternal investment increases the likelihood that offspring survive long enough to reproduce. On average, once a pairbond has formed, partners typically provide each other with emotional and motivational support and, ultimately, promote each other's psychological and physical health. Furthermore, they tend to exert themselves to sustain the pairbonded relationship over time, including by engaging in biased cognitive processing to derogate alternative romantic partners.

Extract: "*Scholars are converging on the view that the primary mechanism through which evolution increased paternal investment was a deep emotional bond between the mother and the father of young children [see paper for references]. This bond motivates mothers and (of particular relevance to the present discussion) fathers to develop a long-term relationship predicated on mutual love and affection, and it*

would have had the additional benefit of helping mothers of young children acquire high-quality food and protect their food stores against theft."

(15) Pair-Bonding, Romantic Love, and Evolution: The Curious Case of Homo sapiens by Garth Fletcher, Jeffry Simpson, Lorne Campbell and Nickola Overall, Perspectives on Psychological Science, **10**, 20-36 (2015)

ABSTRACT This article evaluates a thesis containing three interconnected propositions. First, romantic love is a "commitment device" for motivating pair-bonding in humans. Second, pair-bonding facilitated the idiosyncratic life history of hominins, helping to provide the massive investment required to rear children. Third, managing long-term pair bonds (along with family relationships) facilitated the evolution of social intelligence and cooperative skills. We evaluate this thesis by integrating evidence from a broad range of scientific disciplines. First, consistent with the claim that romantic love is an evolved commitment device, our review suggests that it is universal; suppresses mate-search mechanisms; has specific behavioral, hormonal, and neuropsychological signatures; and is linked to better health and survival. Second, we consider challenges to this thesis posed by the existence of arranged marriage, polygyny, divorce, and infidelity. Third, we show how the intimate relationship mind seems to be built to regulate and monitor relationships. Fourth, we review comparative evidence concerning links among mating systems, reproductive biology, and brain size. Finally, we discuss evidence regarding the evolutionary timing of shifts to pair-bonding in hominins. We conclude there is interdisciplinary support for the claim that romantic love and pair-bonding, along with alloparenting, played critical roles in the evolution of Homo sapiens.