

TOPIC STATEMENT THREE: FAMILY DYNAMICS

Kyle Gibson

INTRODUCTION

This statement discusses parental investment theory, life history theory, the evolution of the nuclear family and extends these to social phenomena like adoption and step-parenting.

PARENTAL INVESTMENT THEORY

In his seminal work on the topic, Trivers (1972) defined parental investment as “any investment by the parent in an individual offspring that increases the offspring's chance of surviving (and hence reproductive success) at the cost of the parent's ability to invest in other offspring.” According to Trivers, it is nearly always that female mammals invest more in offspring than males. Male mammals may invest, but generally, they are not obligated to. Females, on the other hand, *must* invest because without milk, offspring cannot survive. Just how this came to be is a topic of debate among biologists (e.g. Kokko 2008). Differential investment by the sexes is relatively obvious in most mammals *post partum*, but it exists in the gametes even before conception. Eggs are large, immobile, and loaded with the nutrients and proteins needed in the earliest stages of development. Sperm cells, on the other hand, contain DNA and relatively little else. The size disparity between the two gametes, “anisogamy,” is the first of many differences in parental investment in mammals.

The fact that females generally invest more in offspring than males is known as “Bateman’s Principle.” Bateman (1948) conducted a series of experiments using fruit flies (*Drosophila melanogaster*) to show how anisogamy, sexual selection, and reproductive effort are interlinked. He found that female reproductive success was limited by access to food, but male reproductive success was limited by the number of times they mated. Competition existed for both males and females, but it was fought over different things. Females competed for food resources, males competed for mating

opportunities (as well as for female investment after birth), and intrasexual selection worked independently on each sex.

Trivers made use of Bateman's Principle in his now classic 1972 chapter "Parental Investment and Sexual Selection." Recently however, the assumption that anisogamy causes differential parental investment postpartum has come under fire by Kokko and Jennions (2003). This criticism is not new, having been made over three decades ago by Dawkins and Carlisle (1977), but it bears reviewing here. Critics argue that Trivers' formulation commits the "Concorde Fallacy" by justifying a current investment based on "sunk" costs. Trivers does use fallacious examples in his paper, *e.g.* "Her initial very great investment commits her to additional investment," but his original formulation of parental investment theory does not necessarily commit the fallacy. If we consider parental investment in terms of opportunity costs and optimization, rather than in terms of sunk costs, we get more traction. Females should not invest just because they have already invested, they should do it because the relative cost of not investing in a current offspring already developed to point x and starting over is high, involving the costs of abandoning the current offspring, finding a new mate, and then rearing the new offspring to point x . Trivers' critics make valid points, but they do not refute his idea, nor do they negate the fact that female mammals invest more than males.

In primates generally, males and females have different reproductive strategies and females invest more in offspring. The caricature of the primate story is that males direct energy toward finding reproductive opportunities (mating effort) and females direct energy toward raising offspring (parenting effort). But in some cases, things are not so clear-cut. Female langurs, for example, mate with many "strange" males to confuse paternity and make their offspring less susceptible to infanticide (Hrdy 2000). Mating with many males may appear to be mating effort when, in fact, it is parenting effort because it protects against infanticide. When females mate with many males, they spread the possibility of paternity widely. The *probability* of paternity varies depending on how near she is to ovulation, but each male has some chance of fertilizing her egg. According to Hrdy, males "never" kill

offspring they have fathered (Hrdy 2000), so mating with many males is a female defense against infanticide. This example shows how difficult it can be to separate mating and parenting effort. I will take up the even more complex human case momentarily.

OFFSPRING DEPENDENCE

All mammalian offspring are dependent on others, but human babies and children seem especially so. Our obligate bipedalism may be partly why. In *Australopithecines*, massive physiological changes took place as selection favored an upright gait. The pelvis became more bowl-shaped and the pelvic opening, through which offspring passed, shrank making birth more difficult than it was for ancestral species. The genus *Homo* saw further physiological change as brain size increased dramatically. As cranial size grew, offspring became increasingly difficult to deliver safely because of the limited size of the pelvic opening. Many point to this “obstetrical dilemma” as the selection pressure which drove females of our genus to pair with males (Lancaster and Lancaster 1983, Lee 1968). However, it is important to acknowledge that the dilemma existed well before rise of the genus *Homo*, and several extant primate species exhibit very small birth canals relative to infant crania but do not pair-bond (Trevathan and Rosenberg 2000).

The long juvenile period of human life history evolved at the same time our species was becoming dependent on foods requiring a high degree of skill to obtain (Hawkes *et al.* 1998b). But does this mean that juvenility is a special time to *learn* foraging, or is it that foraging skills are a function of strength and size instead? There is evidence for both. Blurton Jones and Marlowe (2002), showed a positive relationship between age and how many grams of tubers per hour Hadza children could gather. Similar relationships have been found with foragers on the Meriam Islands (Bird and Bird 2002a, Bird and Bird 2002b). But for the Aché and several other South American groups, Gurven *et al.* (2006) found that men hit their peak hunting ability in their 30s and 40s. It appears that a

person's foraging efficiency is influenced by a combination of size, strength, ability, skill, and characteristics of the target resource.

Proponents of the learning, or embodied capital, hypothesis note that hunting skill increases with age (Kaplan *et al.* 2000). It seems reasonable to assume that intelligence and skill increases with age and experience. However, so do height, weight, and strength; these factors cannot be excluded outright in favor of intelligence.

To separate the effects of embodied capital and physical strength on foraging efficiency, Blurton Jones and Marlowe (2002) conducted a series of natural experiments with Hadza foragers. They compared practiced and non-practiced individuals on three tasks; manufacturing and implementing climbing pegs, locating and digging tubers, and marksmanship. The baobab tree scaling experiment showed a threshold effect – children younger than their late teens either refused to attempt climbing the trees, or were not permitted to try by elders. Older teens and men who did attempt the task were successful and the skill did not improve with age. The tuber gathering efficiency test did not show significant differences between less practiced men and more practiced women. Additionally, there was no difference in gathering ability between children who attended school (less practiced) and those who did not (more practiced). Last, when strength was controlled, there was no difference in archery skill under controlled conditions for those who attended school (less practiced) and those who did not (more practiced). Blurton Jones and Marlowe's empirical work suggests foraging skills are learned relatively easily and improve with physical, not mental, prowess (Blurton Jones and Marlowe 2002). This cuts to the core of the embodied capital model by suggesting our long juvenile life history phase is not a derived period for learning, but is instead a consequence of our long lifespans (Charnov and Berrigan 1993).

This finding has not gone unchallenged. Gurven *et al.* (2006) found that men in several South American groups hunt best between ages 35 and 50. They point to this as support for the embodied capital hypothesis and note that “finding and pursuing prey require significantly more time to master

than marksmanship." While their data surely support this, why would selection favor a life history period for learning skills which pay off only in the long term? Is our need to learn hunting skills what has shaped our life history, or is it something else? Human offspring are dependent for a long time, but not relative to other primates when size is controlled. Tradeoffs between life history characteristics shed light on the human pattern of life history. According to Charnov and Berrigan (1993) age at maturity is determined by the average adult lifespan (the inverse of which is the instantaneous adult mortality rate). When mortality is high, it makes sense to reach sexual maturity as quickly as possible, which means energy shifts from somatic growth to reproduction and the individual stops growing. Low instantaneous mortality, on the other hand, affords time to grow larger. Furthermore, selection for longer lifespans causes later maturity. This means that if selection favored long-lived grandmothers, delayed maturity is a byproduct of selection, rather than the target of it.

Life history variables are interconnected and change in unison. Longer lives are associated with later maturity, so humans are slow to mature. In relation to other primates, humans mature just when they "should" along the slow / fast life history continuum. Applying Ockham's razor to the question of human juvenility leads to the conclusion that the need to learn did not drive the evolution of this life history stage, but selection for longer lives did.

WHO INVESTS?

Children can and do forage, but not as well as adults. They simply lack the size and strength to efficiently acquire resources. Until they are strong enough, they are dependent on others. Mothers are the first of these providers. Not only do they possess the milk necessary for the early stages of life, they are also positively certain children they birth are biologically related to them. In addition to mothers, many other people play a role in offspring survival. A recent paper by Sear and Mace (2008) summarized much of the literature on the contributions different family members make to children.

According to them, kin support in child rearing is a human universal, but *who* contributes is facultative and varies with environment (Sear and Mace 2008).

It is well established that the loss of a mother causes dire problems for children and that maternal effects decrease over time as children become more self-sufficient (Sear and Mace 2008). This stands in contrast to father effects. In 15 of the 22 studies (68%) summarized by Sear and Mace (2008), fathers did not influence offspring survival, at least in the first five years of life. But in the remaining 32% of studies, fathers *did* positively affect survival. Data from Hill and Hurtado (1996) showed that children of divorced Aché parents, for example, were three times more likely to be killed than those from intact families. Clearly, having a father around was important for these children.

Grandmothers are also important to child wellbeing. Maternal grandmothers are particularly good investors, having a positive influence in 64% of the studies surveyed by Sear and Mace (2008). But paternal grandmothers also play a role, making a positive mark in 60% of studies in the same survey. Paternity certainty may once again be at play here. Maternal grandmothers can be certain that their daughter's children are related to them, while paternal grandmothers cannot. Maternal and paternal grandmothers contribute to survival in different ways though. Paternal grandmothers have the greatest influence on survival during the first year of life and maternal grandmothers play a great role later on (Sear and Mace 2008). This suggests paternal grandmothers may make their greatest contributions before birth – by provisioning or otherwise helping their daughters-in-law (Sear and Mace 2008).

People other than parents and grandparents also help children and mothers. Alloparental care is so widespread among humans that Hrdy (2005) suggests we are cooperative breeders. The evidence for this is compelling. For many primates, certainly humans, newly born and young individuals are magnetically attractive – especially to nulliparous females. Until they begin reproducing themselves, it makes good evolutionary sense for young females to invest in their kin, and they often do. Evidence from Gambian families shows that children with more older sisters out survived those with fewer (Sear

et al. 2002). What's more, a Pleistocene mother would have a nearly 100% chance of having a 5 year old daughter she could "put to work" as an allomother, but only about a 50% chance of having her own 45 year mother around. Through kin selection our ancestral grandmothers, sisters, and, perhaps to a lesser degree, brothers and grandfathers, would have made important contributions to their own fitness by taking the role of alloparents.

THE HUNTING HYPOTHESIS

There are two major competing notions about the evolution of the family; the hunting hypothesis and the grandmother hypothesis. They have in common the idea that the human evolution was driven by ecological changes in Africa. Central Africa cooled and dried as the Himalayas rose, which changed the landscape from uniform, dense, jungle into patchy savannah and our ancestors were forced to adapt. Additionally, both theories agree that mothers were the primary providers for their offspring and were aided by kin, but how, and how much, males contributed is a sticking point.

In many societies, men contribute to their families, but what motivates them to do so is debatable. The prevalent view has been the hunting hypothesis as encompassed in the edited volume *Man the Hunter* (Lee 1968). It is rooted in Darwin's own vision of man as provider and woman as nurturer (Darwin 1859). This view has been widely criticized on empirical grounds, largely because it assumes men and women share common strategies for maximizing fitness. However, there is good reason to think that such strategies differ for men and women - men are never 100% sure of paternity, and, as discussed earlier, at the *individual* level, some men have higher reproductive potential than individual women because they are not physically limited in the number of offspring they can father (although, as Fisher noted, *average* reproductive fertility is equal for males and females).

Kaplan *et al.* (2000) have developed a modern synthesis of the hunting hypothesis that integrates parenting, mating, and life history. The authors suggest that several uniquely human life history traits (including large brains) evolved in response to our dependence on high quality, difficult to

acquire foods. They argue that it takes time to learn the skills (embodied capital) necessarily to hunt well enough to provision a family. Our juvenile life history stage evolved to give us this time to learn, and further investments in somatic maintenance and repair evolved to protect embodied capital. The costs of building and protecting embodied capital are subsidized by male provisioning and the sexual division of labor, and since men are key provisioners, selection favors traits that boost male productivity.

So how important are men to their children and do men optimize their behavior for their children's wellbeing? Hurtado and Hill (1992) hypothesized that, where father effects are important, marriages should be more stable than when fathers matter less. Among two South American groups, the Aché and Hiwi, they found that fathers did matter to offspring survival, but the effects were more pronounced for the Aché. According to their initial hypothesis, this should have meant the Aché had more stable marriages. But in fact, their marriages were *less* stable. Drilling down, the authors developed a measure called the "parenting / mating index" (P/M index) to gauge optimal male strategies for reproductive success. The P/M index uses father effect as its numerator and mating opportunities, gauged by fertility units available per male, as the denominator. A higher score on the P/M index reflects higher fitness payoffs for fathering, a lower score means the payoffs for mating are greater. The Aché scored 18.2 on the P/M index while the Hiwi scored 28.2. These scores suggest that the relative benefits of parenting are greater for the Hiwi than the Aché, which explains the greater stability of Hiwi marriages. By pursuing mating opportunities, Hiwi men were unlikely to see a relative fitness benefit compared to parenting, but the opposite was true for the Aché.

Blurton Jones *et al.* (2000) addressed the same issue as Hurtado and Hill (1992), but instead focused on two African groups, the Hadza and Ju/'hoansi (!Kung). When they compared data on these two African groups to Hurtado and Hill's South American data, a trend emerged. For the Hadza, paternal presence had no effect on offspring survival, while the presence of Ju/'hoansi fathers had significant, positive effect on offspring survival. But this failed to predict marriage stability in either

group, just as was the case with the Aché and Hiwi. However, the number of fertility units per male (FU/m) predicted marriage stability across all four groups in the expected manner, those with high FU/m saw high divorce rates and those with low FU/m saw low divorce rates.

The research by Hurtado and Hill (1992) and Blurton Jones *et al.* (2000) demonstrates the facultative nature of male investment. Where FU/m low, mating opportunities are hard for men to come by and deserting is costly. For men, the decision to parent or not depends on mating prospects – and either strategy can be stable within the proper ecological context.

THE GRANDMOTHER HYPOTHESIS

Children receive investment from mothers, fathers, *and others*. Alloparents help women raise more children than they could alone. Most allomothers are female kin, especially young girls and post-menopausal women (Kramer 2005). Nulliparous girls make good alloparents, but have their own children to look forward to, so they abandon the role relatively quickly. Grandmothers, on the other hand, are often devoid of dependent offspring and contribute much more to their children's children. Alloparenting extends the human reproductive lifespan on both sides of the fertility curve.

Life history theory shines light on how this system evolved. Humans have slow life histories, meaning we take a long time to grow, mature, and reproduce. Relative to other primates, we also wean more quickly than we “should” and have short interbirth intervals and midlife menopause. How are these characteristics related? Williams (1957) suggested long post-menopausal lifespans are “artifacts of civilization,” but demographic research on several hunter-gatherer groups living without Western conveniences fails to support this. Howell (1979) showed that, at birth (e_0), over one third of Ju/'hoansi babies could expect to live well past menopause (~45 years). By age 15 (e_{15}), two thirds of girls could expect the same. The numbers are similar for the Aché (Hill and Hurtado 1996) and Hadza (Blurton Jones *et al.* 1992).

Williams (1957) also suggested we might stop reproducing early to focus attention on last-born offspring. For mothers, there may come a point where the optimal strategy is to stop having more offspring and instead focus on existing children. He noted that this time spent investing in extant offspring should not be called “post-reproductive” and current research shows that post-menopausal women can and do contribute to their own reproductive success by helping their offspring and grandchildren (*e.g.* Sear and Mace 2008).

Humans also have a long adolescent period. Supporters of the man the hunter and embodied capital models suggest this is a time for learning. But an adaptation of life history theory from Charnov and Berrigan (1993) and Charnov (1993) suggests humans mature just when we should given our long adult lifespans, and that adolescence requires no special explanation (Hawkes 2003). This means adolescence is not a derived human life history phase for learning, rather, larger mammals simply live longer, take more time to grow to weaning and maturity, and produce fewer offspring than smaller ones. The relationships between adult lifespan, age at maturity, and offspring production is similar across all mammals, and the most important determinant of age at maturity (α) is adult mortality (Charnov and Berrigan 1993). If an animal stands a high chance of dying on any given day, it makes sense for it to mature and reproduce quickly. This requires a shift of effort from somatic development and growth to reproduction and marks the animal's age at maturity. According to this view, humans take longer to reach maturity as a consequence of selection for longer lives, not because they need to develop embodied capital.

Subsequent work incorporating Charnov and Berrigan’s model shows that humans reproduce at a higher rate than they should compared to other apes (Hawkes 2003, Hawkes *et al.* 1998a). The grandmother hypothesis suggests this is possible because post-menopausal women play an integral role in provisioning their children’s children. This is possible because they can acquire types of food children cannot, most notably, difficult to dig roots and tubers. This opens up a wider array of resources to their daughters and essentially allows them to escape the limitations young children place

on foraging decisions. Input from grandmothers shortens interbirth intervals and results in greater fitness.

The grandmother hypothesis has implications for our understanding of human evolution. Contrary to the man the hunter hypothesis, the grandmother hypothesis suggests humans did not evolve in nuclear families comprised of a male hunter, a female gatherer, and their shared offspring. Rather, the human family took shape with the help of post-menopausal women. Hawkes *et al.* (1998a) propose that early members of our lineage had life histories like those of other great apes. Children could procure food and become self-sufficient while still relatively young (4-5 years old). As the African climate began to cool and dry, plants began amassing food in underground in roots and tubers. Children were unable to gather these so they became more dependent upon mothers for food. Selection then began favoring delayed senescence as older women became important providers for grandchildren. Grandmothering led to shorter interbirth intervals for daughters of women who senesced more slowly and these women out-reproduced those without the trait (Hawkes 2003, Hawkes 2004, Hawkes *et al.* 1998a).

THE SHOWOFF HYPOTHESIS

Why do men hunt if not to provision dependent offspring? As Trivers (1972) showed, there is good reason to suspect male and female reproductive strategies differ. An alternative to the man the hunter model of male provisioning is “the showoff hypothesis” (Hawkes and Bird 2002, Hawkes, O’Connell, and Blurton Jones 2001) which assumes these different reproductive strategies enable each sex to best pursue optimal fitness outcomes. According to the showoff hypothesis, women are the primary providers for children, and men hunt not to provision offspring, but to show off and earn mating opportunities.

Some male behavior, like giving food to children, certainly looks like parenting effort. Some of the meat a hunter takes goes to him and his family, but as a widely-shared collective good, it also

benefits the offspring of everyone in the group. Because successful hunters provide *more* meat for the children of others than for their own, big game hunting is not consistent with parenting effort. So why do men hunt large animals? According to Hawkes and Bird (2002), the primary benefits men earn through hunting, aside from meat itself, are selective incentives like mating opportunities and increased social status. Aché hunters, for example, do not preferentially give meat to their own children. Instead, their kills are shared throughout the community, taking their reputations with it.

Who are men trying to impress by hunting? Hawkes (1990) initially suggested men hunt to show off to potential mates. After all, hunting is an honest display of good genes and health which women take notice of. In a later paper, however, Hawkes, O'Connell, and Blurton Jones (2001) suggest female choice does not drive showoff behavior, intrasexual selection does. In other words, men do not show off to women, they show off to other men. This reformulation makes sense for two reasons. First, marriage in foraging groups is often a transaction between men, so it is in a man's interests to show off to other men rather than to women. Second, showing off is a competitive behavior that forms alliances and a "pecking order" among men. This gives good hunters the status to lay claim to women and shows that they can defend them in the face of unsolicited advances (Hawkes, O'Connell, and Blurton Jones 2001). The notion that hunting is an intrasexual display is evidenced by the fact that young, marriageable Hadza women generally cannot name the best hunters in the group, but boys and men can (Blurton Jones, Hawkes, and O'Connell 1997).

The hunting hypothesis is still widely accepted by anthropologists, but the showoff hypothesis is gaining traction. How do the two compare? When classic methods of behavioral ecology are applied to the question of big game hunting, some interesting facts come to light. Namely, if men hunt to provision offspring, they make remarkably bad choices in doing so (Hawkes and Bird 2002, Hawkes 2001, Hawkes, O'Connell, and Blurton Jones 2001). They target animals that are big, dangerous, hard to find, and widely shared. If men hunt to provision, optimal foraging theory predicts they should target resources with just the opposite characteristics - ones that are easy to find, capture, consume, and

keep. If the goal for men is mating, however, targeting animals that require strength and skill to take makes good sense. Of course, this is exactly what men do. Good hunters, just like fierce warriors, are rewarded with high status and mating opportunities which translate to higher reproductive success.

HUMAN MATING SYSTEMS

Polygyny, monogamy, and polyandry map to different ecological conditions. Polygyny is permitted in the majority of the world's societies (Murdock 1967), but it is only possible where men can garner enough social status or resources to marry more than one woman. The reproductive advantage polygyny affords high status men is clear, but polygyny can also give women a way to "marry up" and gain higher social status and more resources for herself and her offspring (Pasternak, Ember, and Ember 1997).

Even where polygyny is allowed, most men marry monogamously because there are rarely, if ever, enough marriageable women in a population for each man to marry more than one. Monogamy is permitted in all societies (Murdock 1967, Murdock and White 1969). According to Hrdy (1999), its primary function may be to reduce conflict between males and females by providing a common reproductive goal, and for it to function well, male survival must be high and men must be willing and able to invest in his wives and offspring.

Until recently, polyandry was thought to be exceedingly rare (Murdock 1967, Murdock and White 1969), existing only in places like the Arctic or Himalayas, where resources are extremely seasonal and difficult to obtain. Polyandrous marriages in such difficult places usually involve brothers sharing a wife. Still, these marriages are short-lived and often occur only when conditions necessitate the input of two men to support one child. Recent research suggests, however, that polyandry is much more common than this - most notably in a form called "partible paternity" (Beckerman and Valentine 2002). The logic of partible paternity rests on the notion that children are "built" over time through multiple sexual encounters. Therefore, if a woman has had sex with two or three men, each has helped

build her child and all are father to it. This special kind of polyandry is common among South American indigenous groups, but has been found as far away as Papua New Guinea (Beckerman and Valentine 2002). Among South American groups, children with two or three fathers have significantly higher survival than those with just one (Beckerman and Valentine 2002). Interestingly, survivorship begins to fall as more than three fathers are named. Why this occurs remains unanswered. One possibility is that introducing more fathers increases the likelihood of collective action problems that overrun the (fictive) kin selection present in these relationships. As four, five, and six fathers are named, they may all assume someone else will take care of their children and bow out of the duty themselves.

STEPPARENTS

Upon entering a new group, male olive baboons sometimes befriend a female. The “friends” spend a great deal of time in close proximity grooming each other, and male friends tolerate and even protect the offspring of female friends. Such behavior may appear altruistic or paternalistic, but it is not. Rather, it is meant to win the paternity of the mother’s next child as females are significantly more likely to mate with males whom they have befriended over those they have not (Hrdy 1999). This behavior is remarkably similar to human stepparenting.

People become stepparents because they are motivated by the prospect of having children with new partners, not to parent unrelated children (Daly and Wilson 1985). As mammals, humans have the ability to discern between “good” and “bad” investments and bias their treatment adaptively. This “discriminative parental solicitude,” or DPS, explains why children in stepfamilies are much more likely to be abused, neglected, or murdered than children from genetically intact homes (Daly and Wilson 1980, Daly and Wilson 1981, Daly and Wilson 1985). In one Canadian sample, children living with stepparents were 70 times more likely to fall victim to these sorts of crimes (Daly and Wilson 1988).

Other studies have shown more subtle occurrences of DPS. Stepchildren in North America complete significantly fewer years of school than genetic children (Case, Lin, and McLanahan 2000). They are also taken to the doctors and dentists less frequently, and made to wear seatbelts less often – but these differences vanish when stepchildren have regular contact with birthmothers (Paxson 2000). DPS is not synonymous with criminal maltreatment.

It is possible for stepparents to develop lasting, loving relationships with stepchildren, but the common existence of “Wicked Stepmother” stories suggests such amicable relationships are not the norm (Daly and Wilson 1999). On the other hand, most stepparents show a remarkable tolerance for stepchildren and do not mistreat them in a criminal sense, as doing so would alienate them from the child’s mother or father.

ADOPTION IN TRADITIONAL SOCIETIES

In many societies, people adopt children who are not their own and there are theoretical reasons to take note of relatedness in adoptive households. Adoption creates novel genetic combinations within households and gives us the opportunity to decouple environmental and genetic effects on behavior. But why do people adopt in the first place?

Many adoptions occur between genetically-related kin. Where this is the case, no further explanation is needed to explain why because kin selection suffices (Silk, 1980, Silk 1987). Yet many adoptions occur between unrelated people, so kin selection does not apply. Silk (1987) suggested that non-kin adoptions can have economic benefits on agrarian economies where family size is closely tied to productivity. Everyone suffers in a family with too many members and a dearth of resources, adoption is a way to make such a family smaller. The “optimal family size” model works because there are also people who have families that are too small and thus lose out on the economic potential of their land. In these cases, biological kinship plays a secondary role to economic considerations (Silk 1987).

ADOPTION IN THE CONTEMPORARY WEST

Genetically, non-kin adoptees are “worse-off” than stepchildren as they are not related to *anyone* in the household. But in fact, adoptive parents may be better than stepparents at generating feelings of “genuine parental love” for their children, primarily because adoptive parents *choose* to adopt (Daly and Wilson 1985). Stepparents do not take on new children because they are motivated to parent them, but adoptive parents do. All things equal, at least some adoptive parents invest in adopted children as much or more than they do their genetic ones (Gibson 2009).

Parents in the West are motivated to adopt for many reasons. Ostensibly, some are altruistic. Parents say they want to “help out” or give homes to children in need (Gibson unpublished data). There may be more self-serving reasons to adopt, though, because people have more positive feelings about parents than about non-parents (Callan 1985). Relative to non-parents, people with children are considered more “devoted,” “emotionally mature,” and “likeable” (Callan 1985). People who *choose* not to have children are considered “selfish,” “individualistic,” and “materialistic” (Callan 1985). Adoption is a way around this social stigma.

BIRTHORDER

The notion that birth order influences behavior is an old, yet contentious one. In 1874, Frances Galton surveyed the Royal Society and found an overrepresentation of firstborn children there. Later, Adler, one of Freud's contemporaries, codified the study of birth order effects. Literally thousands of psychological examinations of birth order followed. Sulloway's (1995), meta-analysis of the subject led him to several conclusions about birth order. According to the Five Factor Model of personality traits, people occupy different ranges in terms of being *conscientious*, *agreeable*, *open to experience*, *neurotic*, and *extroverted*. Relative to later-born children, firstborns are more conscientious, less agreeable, less open to experience, more neurotic, and more extroverted. IQ is also negatively

correlated with birth order, albeit the effect is relatively small, falling by one point per rank in birth order (Zajonc 1976, Zajonc and Markus 1975).

Why these differences? It seems clear that birth order encompasses many other metrics including family income, body size and strength, age, and status (Sulloway 1995); three possible explanations for birthorder effects build from these. First, firstborns serve as surrogate parents for later-borns and are therefore more conscientious of their surroundings and their place within the family whereas later-borns must seek out and occupy their own niches within the family, so they are more outgoing and open to new experiences (Sulloway 1995). Second, firstborns, because they are older and bigger than later-borns, are better able than to employ intimidation and physical strength to motivate their younger siblings. Third, later-borns must use social skill to achieve their goals by appealing to humor, pleading, debating, or turning to parents as a means to an end (Sulloway 1997). Children develop these traits adaptively, which then follow them into maturity.

According to confluence theory (Zajonc and Markus 1975) firstborns have higher IQs than later-borns because they spend more time in an intellectually-rich family environment that is not “diluted” with siblings. Later-borns learn less from older siblings than firstborns learned from their parents, thus they have lower IQs.

A more intuitive explanation for IQ differences is the resource dilution model (RDM) (Blake 1986). The RDM is rooted in simple economics. As family size increases, fewer resources are available for each child. Later-borns receive less investment because there is simply less to go around. The RDM has been used to explain negative relationships between birth order / family size and parent's investment in college, educational attainment (Steelman and Powell 1989), and time spent reading (Mercy and Steelman 1982).

The idea that birth order is so influential in molding behavior is not without critics. Many have taken Sulloway to task for overgeneralizing his findings. His work focuses exclusively on Western populations, yet he suggests birth order effects as transcendent and universal (Steelman *et al.* 2002).

Furthermore, other factors like overall family size and sex composition or interbirth intervals may better explain phenomena Sulloway attributes to birth order (Steelman *et al.* 2002).

Birth order effects must be examined in context. They may be of interest to those who study Western family dynamics, but moving past that requires caveats. In strongly patrilocal and patrilineal societies, we should expect investment to strongly favor males, regardless of birth order. In subsistence populations, older siblings, especially sisters, are often incorporated as alloparents. In these, we should expect lower educational attainment from them as they spend much of their time looking after their younger siblings, not in school (Steelman *et al.* 2002).

The importance of context is becoming better recognized and some recent studies have taken a truly cross-cultural look at the effects of birth order. Steinberg (2001) cataloged every female prime minister and president who came to power between 1960 and 1999. Her sample included dozens of countries ranging from the Central African Republic, Pakistan, Iceland, Bolivia, Haiti, Bangladesh, Canada, Guyana, and Sri Lanka. She found an overrepresentation of firstborn children among the group. This same phenomenon had previously been found in a male-only sample of world leaders (Hudson 1992).

CONCLUSION

I began this statement with an overview of parental investment theory. The fact that human parents invest raises many interesting questions. Who invests? How much? In whom do they invest? I then addressed these questions and how they relate to the two current major theories of human evolution, the hunting hypothesis and the grandmother hypothesis.

Next, I described men's work and variation in marriage. Although monogamy is the most common form of marriage, polygyny and polyandry are widespread. Mothers are the primary caregivers within all marriage forms, as is expected for any mammal, but grandmothers also make important contributions to children - their utility is no less important now than it was in the past. Men

are generally less vested, spending more time in activities likely to increase mating prospects, but they make important contributions in many societies.

Many phenomena we witness in the modern West are rooted in our evolutionary development. Stepchildren fare worse than genetic children, adopted children fare as well or better. Parental motivation is the key to understanding why. When parenting effort motivates people, they treat their children better than when mating effort does. Men are often motivated more by mating effort, leading them to pursue optimal strategies in this arena.

I ended with a brief overview of birthorder and its effects on behavior. Birthorder does appear to have some effect on personality, but a relatively small one compared to other influences.

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