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Theory of Parental Investment: “Mothers are the Most Important"

Sabina Alispahić*
Enedina Hasanbegović Anić*
Dženita Tuce*

Abstract

The theory of evolution inevitably directs our thoughts towards classical Darwinist concept of the natural selection - competition for survival of the fittest. However, Darwin was trying to explain that a process of evolution is much more than that. Actually survival without reproduction means *genetical cul de sac* (blind road). Looking from evolutional perspective, there is nothing more important than reproduction and parenthood. Therefore, by considering earlier evolutionary concepts Robert Trievers (Trievers, 1972) was among the first authors who described basic reproductive differences between sexes in his theory parents' investment. Sexual selection is in a very gist of Darwin's theory. Understanding differences between women and men in their parent's investment has facilitated a start of human reproduction psychology studies. Reproduction task could be divided into two phases: finding an appropriate partner and raising descendants till their maturity. Men invest more energy in a first phase, while women invest more in a second one. As parent's resources are limited, it is necessary that they invest wisely into their descendants, because if they don't survive and don't spawn invested resources were from evolution point of view - wasted. This paper will analyze some of these questions by considering parents’ investment theory and earlier studies on the theory of evolution.

Keywords: Theory of Parental Investment, Robert Trievers and Evolutionary Psychology

* Corresponding author: Sabina Alispahić; Assist. Prof. University of Sarajevo, Faculty of Philosophy, Department of Psychology Bosnia-Herzegovina; e-mail: binci85@gmail.com; djenita.tuce@gmail.com

* Corresponding author: Enedina Hasanbegović Anić, Assist. Prof. University of Sarajevo, Faculty of Philosophy, Department of Psychology Bosnia-Herzegovina; e-mail: binci85@gmail.com; djenita.tuce@gmail.com

* Corresponding author: Dženita Tuce, Senior Assist. University of Sarajevo, Faculty of Philosophy, Department of Psychology Bosnia-Herzegovina; e-mail: binci85@gmail.com; djenita.tuce@gmail.com

Human Reproduction and Transmission of Gens

According to Geary (2005), for most of the species males invest more into reproduction process (typical competition for access to fertile females) than into parenthood, while females invest more into parenthood than reproduction process (Andersson, 1994; Darwin 1871), although some exceptions could be found (Reynolds & Szekely, 1997). Obviously the more descendants there are more grandchildren people will consequently have. Every descendant will inherit half of our genes, while every grandchild will inherit a quarter of it. Genetic properties that assist men and women to transmit their gens to their descendants are not identical. Strategy that was proven to be effective for men might be counterproductive for women. Girls will get genes that will help them to be successful in a reproduction process, while boys will get a different combination of gens that helped their fathers and grandfathers in the past.

Sexual reproduction is not necessary. There are different ways of reproduction that do not necessary demand fusion of gametes of two persons. For paragenetic species mating is not necessary. With some North American lizards all living units are females and they can get descendants directly. During one mating season they produce about ten non fertilized eggs, which transmit 100% of their mothers DNA (Ficher, 1993, according to Campbell 2002). Described strategy has a couple of advantages. Those females do not waste time and energy on finding a partner, they do not expose themselves to predators during a sexual act. They show no need to impress opposite sex by being attractive and the most important and they do not divide their genetic inheritance to 50%. That last issue paradoxically has become an advantage in a coupling process. Sexual reproduction creates new and unique individuals and that fact has 3 important implications. First, as all descendants are different from their parents, brothers and sisters, they occupy different environmental niches and because of that, present less competition for their relatives. That increases chances that some of them will survive local dangers, such as sudden climate changes. Second implication is that every descendant with its unique genotype has a unique immune system. Attack of parasites could be lethal for some units from the hatch while some others will survive it.

Additional advantage of sexual reproduction is genetic recovery. For instance, DNA normally consists of ranges of four nucleotides C, G, T and A. If a mistake happens-CGX, best way to find out what should

stand instead of X is to examine second unit in range on a complementary DNA. That will not help us if that second unit comes from the same genetic line as a first one, since there is a good chance that it will have the same genetic deviation. In sexual reproduction, cellular enzym mechanism consults appropriate order on DNA branch of another non-related parent and corrects the deviation (William 1996; Campbell 2002). Therefore, it is better to have two parents than just one. Question that comes up is what is a role of an ovule and a spermatozoid? An ovule is about million times bigger than a spermatozoid, and much more expensive to produce. Beside DNA code located in a nucleus, ovule also transmits metabolic mechanisms and nutritional substances for zygote's supply during the period before attachment of a thin cell colony onto uterus and provision of its own supplies through placenta. Spermatozoid is little more than nucleus that contains DNA with a tail helping it finding a free genetical ride to the ovule. Question is why both parents do not give an equal contribution to a zygote formation? Multicellular algae reproduce themselves in that way. Each alga releases cells into water where they mix with other algal cells and form a second generation of complex algae. What is needed for basic sexual reproduction are organisms capable of emission of haploid gametes (those that have half of adult chromosomes) which can couple with gamete of another organism in order to form a sustainable zygote (Cambell, 2002).

A story of sperm and ovule evolution starts with the same scenario. Gametes must accomplish two goals; find a partner and form a well-supplied zygote (Low, 2000). Little gametes handle the first task much better. Spermatozoids are cheap for production, light and mobile. Big gametes will fulfill the second task better. Ovules carry nutritional substances that are essential for zygote survival. Middle sized gametes have none of those advantages and because of that, they lose on both. Once a process of anisogamy begins (size division between ovule and sperm) gap between them could only become bigger. Sperms that are better designed for fast movement while carrying minimum fuel will overcome bigger and slower sperms. Ovules that contain more nutritional substances and are better in saving energy will survive longer, form stronger zygotes and be more numerous than thinner and more active ovules (Low, 2000).

Theory of Parent's Investment

Robert Trievers (1972; according Trivers, 2006) was the first author who described basic reproductive differences between sexes. He named it parents' investment and defined it as "every investment made by parents into a descendant that increases its chances for survival (and also for reproduction), at the cost of parent's investment in another descendant." What this definition is trying to explain is that parents' investment is every investment of resources, time and care for a descendant which helps him or her to survive, and at the same time giving an accent on a fact that what is invested in one descendant (food for example) could not be invested in any other. Therefore it is impossible for any parent to have unlimited number of descendants. Parents' investment is absolutely a main subject of all evolutional analysis of gender differences. Parents invest into their children (descendants) directly and indirectly (Qvarstrom & Price, 2001; according to Geary, 2005). Indirect investment is genetic inheritance, although quality of that investment often varies, depending on parents (Savalli & Fox 1998;, according to Geary 2005). Direct investment implies food and protection (Clutton-Brock, 1991, according to Geary 2005). For highly social breeds direct investment could also include assistance in a process of positioning in a social hierarchy and also in development of social and communication skills.

More time and efforts an individual spends on his children, less descendants he will have. This simple rule is explaining a difference between quantity and quality of descendants. Animals that follow rule of quantity were defined as r-selected kinds. Insects lay thousands of eggs, but they invest very little time and efforts into their descendants. Instead, they produce more and more new eggs. K-selected kinds like primates give birth to one single baby; they feed and protect it for a couple of years. Some animals, like cats, are somewhere in the middle, they give birth to a couple of babies (descendants), provide them with milk and care for some time. Conclusion is that in any case it is about an exchange. More time we dedicate to a single child, less time we would have to create other offspring. It seems that r-k distinction stands for both men and women. Minimal biological reproduction price is higher for women than for men. Every month about 20 ovary follicles prepare *oocytes* for possible ejection. One of them wins in a selection process and matures and then meiosis process begins. After that, ovum goes to an oviduct. In the meantime, uterus *endometrium* must be ready to accept fertilized ovum, even if fertilization doesn't happen, which is usually the case). Those two processes are so long lasting and expensive in terms of

calories, as it will take about 14 days (half of menstrual cycle) for them to get completed. If a pregnancy happens, woman's body will be occupied with it for the next nine months. After child's birth, breastfeeding requires even more calories than it was necessary for pregnancy maintenance (almost double of calories than normal nutritious input) and in a context of our evolutional adjustment, process would be continued for up to next four years. For every mother, every child means huge investment of time, energy and certainly emotions.

Let us compare it with a minimum male's investment. Man could ejaculate a couple of times in a day. Fact is that a number of spermatozoids will decrease with every intercourse, from high number of 300 million in a first intercourse to 30 million of spermatozoids after couple of hours. However, only one spermatozoid is needed for pregnancy in an appropriate time and place. After he gallantly donated his sperm, every further male's contribution is voluntary and not biologically binding. There is no need of being a mathematical genius to calculate that in an optimal condition a man could create as many descendants in a day that a woman would need a couple of years. Psychological differences between males and females originate from a fact that female biological investment is higher than male investment. Still, it is important to emphasize that a key element that defines those differences is parent's investment and NOT manhood or womanhood per se (Cambell, 2002). In our kind, a woman is the one who invests more, but with some animal species like teleost fish, father invests more, which is a result of reproduction mechanisms typical for those fish species (Dawkins & Carlisle, 1976, according Cambell, 2002). However, in human kind, a process of fertilization takes place in a female body where impregnated ovum stays and develops for a couple of weeks of months.

Although birth control, equal rights and access to information have decreased some gender differences in parent's s investment (in some aspects roles were even switched), modern men and women are still sensitive to different signs, just like their ancestors in an environment of evolutional adjustment. For instance, men around the world wish that their long-term partners are attractive, intelligent and kind. Women also want to have attractive, intelligent and kind men for husbands. However, women still assess financial resources as a more important aspect than men do (Buss, 1989; Feingold, 1992; according to Bjorklund & Pellegrini, 2002). As a second example, both women and men feel

jealousy with same passion. However, researches have proven that men get more upset if they think their partner is having an "insignificant" sexual intercourse with another man, than if they think their partner is emotionally (and not sexually) attached to someone else. Women show the opposite pattern (Buss, Larsen, Western & Semmelroth, 1992).

Superficially apparent reason for those different reactions is that a man could never be absolutely sure in his fatherhood, since his partner's sexual intercourse with another man poses a serious threat. Although women either are not very happy with a possible meaningless intercourse that their partner could have with another woman, bigger threat for them is loss of partner's support and resources, which could happen if their partner gets emotionally attached to another woman (Bjorklund & Pellergrini, 2002).

Men and Attraction to Polygamy

An optimal condition for male success in reproduction process is to have access to as many fertile women as possible. If a man stays with a same woman for whole of his life and is being absolutely faithful, he will have as many descendants as his partner is able to give birth to. Her intensive investment period with every child will limit his success in a reproduction process. However, life with one single woman has its own advantages; man can provide protection and resources that will increase probability of their offspring's' survival.

Having in mind that proportion between men and women is about 1:1, every man who impregnate more than one women theoretically leaves another man without a partner. That means that men have to compete for their partners, in order to access as many women as possible and be able to create stronger male descendants in several generations (big males have many children, half of them are sons that will inherit their "big genes". Small males will have fewer children and therefore fewer sons that will carry "small genes". Number of big males is increasing through generations (Campbell, 2002).

Why Do Men Invest at all?

Knowing advantages of polygamy, it is reasonable to question why would men get attached to one single woman and their common offspring? For some animals, answer is simple: their children would die without care from both parents. For some bird species, it is necessary that

both parents provide food and protection to their offspring. In that case male does not have another choice. He could have thousands of partners, but if none of them is able to raise their gentry by herself, his reproduction success would be worthless. Because of that patrimonial care for those birds' species is typical and mandated (Westneat and Sherman, 1993). However, it is not the case with most mammals. Single parent could raise his children with more or less success, which makes male's abandonment an attractive option.

Why Then some Male still Stay?

Important factor is if and to what extent patrimonial care increases probability survival of children. Does father's presence increase chances that his offspring will experience maturity? Although father could offer a great advantage for children (increased resources and physical protection), fact is that majority of children could survive without father's presence. On the other side, there is an agreement that a mother's loss is much more serious than loss of father. Another powerful factor related to father's investment is doubt in fatherhood. Trend is very clear: higher the doubt - male's willingness to invest time and energy into offspring is getting lower.

With the human kind, internal insemination and unclear time of ovulation does not contribute to a phenomenon of doubt in fatherhood. When an insemination takes place inside woman's body, man could never be sure that his own sperm inseminated her ovule. Since exact time of ovulation is not known, male never knows whether he donated his sperm at the "right" time. Couple of researches have proved that fathers, more than mothers, decide on their investment into posterity based on their perception of resemblance between father and a child. (Apicella & Marlowe 2004; Burch & Gallup 2000; Plater, Burch, Panyavin, Wasserman & Gallup 2002; Plater et al. 2004; according to Geary, 2008), although results on a question of newborn and small kids' taking after their fathers more than mothers were not completely clear (Chistenfeld & Hill 1995, McLain i al. 2000; according to Geary, 2008). Some other evidence has indicated that men even before they became fathers are having similar preferences.

Doubt in fatherhood is not unjustified. When male investment is mandated a female will not risk her gentry by committing adultery. However with human kind, where woman is able to raise her children by

herself there is always a challenge for women to find another partner who will offer resources and provide better genes than the other partner, but will not invest into her gentry. Studies on blood types of newborns have shown that between 5-30% of newborns did not have a same blood type as their fathers (Bellis and Baker, 1990 according to Campbell, 2002). Hence, men will rather invest into offspring if they are relatively sure that it is their own. This certainty could be increased by "protecting" a partner. If a man stays with a woman through her entire menstrual cycle preventing her from dating with other men - he could be pretty sure that it is he who is responsible for her pregnancy. However, it usually takes a couple of unprotected cycles before a pregnancy happens and pregnancy itself is not visible for first couple of weeks, that fact ties a man to a longer period of monogamy. It brings us to the third factor of parents' investment – female behavior. Knowing advantages of father's presence for mother and the price that father pays, women have developed several strategies in order to "force" men to invest exclusively into their gentry. Those strategies were increased incentives for monogamy or increased cost of polygamy.

According to Bjorklund & Pellegini (2002), in the past women were forced to develop "political" skills, in order to hide their sexual interest for other men from their partner. Male's response on suspicion of adultery could be violent and even if female's adultery doesn't lead to aggression, it often leads to a divorce that was through history and still is more harmful for woman and children than it is for man (Fisher, 1992). In addition to that, there is limited evidence that women could better control their sexual excitement than men do (Cerny, 1978; Rosen, 1973) and strong evidence that women could better control their emotional expressions, although it is well known that women express their emotion much more than men do.

Women as Picky Investors

In most of modern societies, people expect mothers to love and care about all her descendants equally. However, studies in both modern and traditional societies have proved that those social expectations often were not met. Several factors, including mother’s and child's characteristics, as well as environment they live in, afect quantity of mother's investment into her children. Different level of mother's care for different descendants has its evolutional explanation. Mothers would invest the most into those kids that have the best chances to experience their

reproductive age and transmit mother's genes on a next generation (Bjorklund & Pellegrini, 2002). After a conception, from biological point of view man's investment is over and he is free to go into new expeditions. However women are, unlike men, specialists for quality and quantity. Their investment is not limited on couple of moments of pleasure. They have to live with its consequences for years and have limited number of descendants.

First of all, woman needs to insure that her body has good chances to keep a pregnancy. Also, she has to select carefully which man she will allow to do a free genetic ride into her parental investment. There are two ways by which woman's body could make such a choice; hidden time of ovulation and giving an advantage in a conception process to a man who is healthy and attractive (Campbell, 2002). *Function of a hidden ovulation* has always fascinated evolution scientists. While females of many primate species are showing physical signs of sexual attraction and fertility (for example swelling of genitals), women do not show any of those sexual signals. Not just that men could not know the exact time of their partners ovulation - even majority of women do not know it either (Bjorklund & Pellegrini, 2002).

It has been speculated that one of the functions of the hidden ovulation is to mislead women themselves. If our forefathers would have known the exact time of ovulation and if they would have been familiar with a pain and death related to a delivery, they could have used abstinence as a powerful contraception method (Burley, 1979; according to Campbell 2002). Another useful function of hidden ovulation could be decrease of level of aggressiveness between males and also toward females. If everyone would have known when female is fertile, when all their attention and competition would be directed on that single female and therefore number of injuries would be high. However, more obvious consequence of hidden ovulation is that it is forming a doubt in fatherhood. That is bringing us to two opposite hypothesis. First advantage of that doubt in fatherhood is that it is a way of promoting monogamy. Man had to keep his partner for longer period of time (in order to prevent a possible adultery). However, hidden ovulation also allowed women with multiple partners to deceive every of them by convincing them about their fathering and in that way providing resources for their descendants. Interesting question is why men haven't found a way to disable women strategy by detecting ovulation. In that

way, they could have improved their reproduction success (Campbell, 2002).

Woman would have to asses carefully not just physical characteristics of a potential father of her children (is he healthy, strong and fertile?), but also his access to resources (is he rich, if he has high social status or does he have some other way to support his family?) but also a probability that he will invest his resources into their common offspring. On the other side, men are less worried for resources of their future partner, they care more about her genetic eligibility (is she healthy?) and her ability to conceive, give birth and care about their child (Clutton-Brock, 1991; Trivers, 1972, 1985, according to Bjorklund & Pellegrini, 2002). Even after a sexual intercourse, women have methods to control whether a conception will or will not happen. Only 60% of fertilized ovum will be successful in a process of implementation into uterus. About 60% will not survive longer than 12th day of pregnancy and women will get either normal or more voluminous period. About 20% of those fertilized eggs that have survived past the 12th day of pregnancy will be aborted during a first trimester of pregnancy (Baker, 1996). Even when a pregnancy happens, woman could still decide whether she will keep it, even more, if she will continue to take care of a child, after child birth. Decision on keeping a child or waiting for better emotional and financial condition is closely related with mother's age. Younger women have longer reproductive career ahead of them and they could afford to wait for the optimal time for pregnancy. Financial, personal and interpersonal resources, as well as mother's psychological profile also play an important role in a decision-making process regarding abortion. Once baby is accepted by her mother, woman makes commitment for about two decades of care and nurture so it is no surprise that decision about such an investment should be taken very seriously.

Women as Hard Investors

For a woman, delivery is just a beginning and not the end of story. Key factor in securing survival would not be just mother's ability to protect and feed her child, but also to secure her existence as well. Without mother, probability of children survival is tragically low. Mealey stated that "mother's abandonment means almost certain death for children, while father's departure means reduction of resources" (2000, according to Campbell, 2002). Breastfeeding was and still is the best predictor for child's survival (Hrdy, 1999). In order to feed her baby, mother would

have to add about 600-700 calories to her daily menu. Composition of breast milk is a factor which secured that a mother will always take her child with her. Breast milk contains only 3-4% of fat and about 88% of water. In order to keep a newborn on such a light nutrition, mother had to take her baby with her all the time and feed it several times a day. Breastfeeding would bring benefits to both mother and a baby. For mother it has secured optimal age difference between her kids, as it stopped ovulation. For the baby breastfeeding was providing not just an optimal combination of nutritional substances, but also immunity defense. For both, breastfeeding develops pleasant touch and mutual love. Apart from breastfeeding, men are equally capable to satisfy children needs as women are. Why they do not care about their kids as much as mothers do, especially in cases when fatherhood is unquestionable and both parents are employed, remains unclear.

Sarah Hrdy (1999) believes that a reason for that is a small and probably inbred difference in parent's reactions. Researchers were asking parents to listen to two recordings of children cry (Stallings and Sur 1997, according to Campbell 2002). On the first recording was a cry of a hungry baby, while on second was more soul-stirring cry of a baby that was to be circumcised. After listening, researches were following their reactions and hormonal changes that mothers and fathers had. While both reacted the same way to painful baby cry, mothers have demonstrated more sympathy for cry of a hungry baby. Hrdy explains that above mentioned difference is also present in a real life. When baby cries, mother reacts little faster than father does. Father decides that he will not interfere, as the baby has already calmed down and at that point baby develops a bit stronger cohesion with her mother than before. Shortly after, baby shows different preference toward her mother and father gets ejected out of the story (to his liking or not). However, for men there is an additional evolutional force that does not allow them larger involvement in kids care. Namely, human newborns demonstrate more fears in presence of unknown men than women (Greenberg and coworkers, 1977, according to Campbell, 2002).

Maybe the most critical factor for importance of motherhood is a nature of male's reproduction strategy. Even in officially monogamy societies, men have more pre-marital and adulterine relationships than women (Daly & Wilson 1988; Fisher 1993; according to Campbell, 2002). More often than women, men decide to divorce, and after that they usually get

re-married and have children with other women. Just one out of six divorced fathers keeps regular contacts with his children, while half of divorced fathers do not pay any financial support for sustainment of their children. Sometimes men decide to abandon their families, while in some other cases they get abandoned, as they are not capable to provide sufficient financial or emotional support to their families. After father's departure, most mothers continue to raise their children alone, or in some cases, they find another woman (often their mother to help them in that (Campbell, 2002).

For all those reasons, nature has awarded special relation between a mother and a child. Fathers contribute to child's security in their own way. A good father could improve child's social and economic future (although good fathers usually connect with good mothers, therefore obvious advantages of their kids are more result of good choice of a partner, rather than their direct investment into parenthood (Geary, 2008). Mothers know that it is worth to have a good partner and therefore they compete for high-quality fathers. However, through our evolutional history, mothers were, through child's perspective always the most important while fathers were considered as useful add-on.

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