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Obligatory parental investment

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Synonyms

Obligatory investment; Parental investment

Definition

Obligatory parental investment refers to the amount of time, energy, and resource expenditures that organisms are minimally required to make in order to ensure offspring survival.

Introduction

Throughout evolutionary history, offspring survival has posed a main adaptive challenge. In some species, this selection pressure has resulted in sex-differentiated forms of parental investment. This chapter describes obligatory parental investment, explores asymmetries in obligatory parental investment between males and females, describes examples of such differences across a range of species, and briefly highlights the implications of such differences in terms of human sexual strategies and conflicts.

Parental Investment Theory

Parental investment is defined as an expenditure of resources made by parents that increases their offspring's fitness at the expense of channeling their resources to other fitness avenues, such as their own survival or mating opportunities (Trivers 1972). Obligatory parental investment thus broadly refers to parental investment that is required in order for offspring to survive.

Differences in Minimum Obligatory Parental Investment

Trivers' (1972) seminal theory of parental investment provides a clear specification of two important components underlying Darwin's (1871) sexual selection theory. These components include intrasexual competition, where members of one sex compete for access to the sexual resources held by members of the opposite sex, and intersexual selection, where members of one sex exert preferential mate choice over members of the other sex. When the minimum obligatory investment is higher for one sex than the other, mating errors (e.g., mating with low-quality mates) tend to be more costly for the higher investing sex. Accordingly, the higher investing sex tends to evolve to be choosier, whereas the lesser investing sex tends to evolve to be more intrasexually competitive in order to gain access to the more reproductively valuable sex.

Offspring production and survival in mammals necessarily relies on internal gestation and postpartum suckling through the mother. These physiological requirements on the part of mammalian females, but not males, produce a typical sex difference in minimum obligatory parental investment for mammals (Trivers

1972). Mammalian females therefore typically invest significantly more in their offspring than males, and humans follow this general pattern of mammalian discrepancy in obligatory parental investment – women’s minimum obligatory parental investment includes approximately 9 months of pregnancy and is often associated with years of lactation and nurturance during the child’s formative years. In comparison, men’s minimum obligatory investment is a single sperm and can end with a single act of sexual intercourse; additional paternal investment during the child’s formative years is not essential for the survival of the child to reach adulthood (Goetz and Shackelford 2009; Trivers 1972).

For many species, including humans, females are the high-investing sex and, as such, have evolved to be more careful and discriminant compared to males in mate selection and are thus more likely to promote intersexual selection by exercising greater preferential choice over mates. This in turn drives intrasexual competition in the low-investing males, because they need to contest against other males who are also eager to gain access to the discriminate and selective females (Buss and Schmitt 1993).

Examples of Parental Investment Theory

These sex differences in intersexual selection and intrasexual competition that arise from discrepancies in minimum obligatory parental investment can be observed in a wide variety of species. For instance, in elephant seals, pups are nursed solely by females; males do not partake in any paternal care and sometimes even kill their own pups by accident when they attempt to copulate with mates in the harem, underscoring the much larger parental effort and investment on the part of females. The value of the sexual and parental resources provided by females is matched by extreme male competitiveness – indeed, less than one third of males have a chance to copulate during any breeding season because the highest rank males secure at least half of all the matings (Le Boeuf 1974). As the desirability of a male as a mating partner is based on his standing in the social hierarchy, female intersexual selection of mates is facilitated by contests between rival males for dominance, and adult males arrive at the beach during breeding season and fight intensely with each other. The winners of the fights become the highest-ranked males, and females then choose these high-ranking dominant males to be their mates.

Intrasexual selection drives the evolution of exaggerated traits, displays, and behaviors in the males of various species, as can be observed from the large antlers of stags and tusks of elephants. Among the satin bowerbirds, males do not partake in any offspring care nor associate with females after mating. However, courtship is quite elaborate and competitive. Males build large, specialized, and highly decorative nest structures known as bowers in order to impress females, and females exercise selectivity based on the males’ bower-building prowess (Borgia 1985). In contrast, females in these species tend to be drab and are designed not to impress but to exercise choice. Interestingly, in insect species such as the water strider, females have evolved abdominal spines, which hinder the efforts of unwanted males and reduce the frequency of costly, unchosen matings.

Although heavier obligatory parental investment is more commonly observed in females than males, the pattern is reversed in some species. Consistent with parental investment theory, where males contribute a larger obligatory parental investment than females, the sex role is reversed and the males of those species are the more selective sex while the females intrasexually compete for the males (Trivers 1972). In a bird species known as the Phalaropus lobatus, the female phalarope’s obligatory parental investment only consists of laying the eggs in the nest. The male phalarope, on the other hand, builds the nest himself, incubates the eggs, and looks after the young alone. As predicted by parental investment theory, the females aggressively court the males and compete with each other to be selected by the males (Johns 1969). Another example of a sex role reversal can be found in pipefish and seahorses. During mating, the females

transfer their eggs onto specialized egg-brooding structures located on the males' tails, where they are nourished throughout the entire duration of gestation. As the lesser investing sex, the females evolved to be brightly colored in order to compete intrasexually to be selected by the higher investing males, who evolved to preferentially choose the most attractive and brightly colored females as their mates (Wilson et al. 2003).

Taken together, discrepancies in minimum obligatory parental investment between the sexes drive the operative components of sexual selection, with the higher investing sex (who faces greater mating costs) evolving to be choosier and the lower investing sex (with lesser mating costs) evolving to be more competitive with members of their own sex for mating opportunities and access to the more valuable high-investing sex.

Implications of Asymmetrical Obligatory Parental Investment for Human Sex Differences and Mating

In humans, differences in obligatory parental investment between males and females gave rise to a host of implications for sex-differentiated mating strategies. This section briefly highlights a few key sex differences between men's and women's mating strategies as predicted by their relative obligatory parental investment.

Sexual Strategies

Asymmetries in obligatory parental investment between the sexes present different constraints for the sexes and, accordingly, have led to the selection of sex-differentiated sexual strategies. In particular, offspring carry much higher costs to women than men if they result from uncommitted sex, particularly for ancestral females who lived without modern-day benefits such as easier access to food and social welfare. Thus, in reproductive terms, the costs of non-committed, casual sexual relationships typically outweigh the benefits for women more so than for men (Li and Kenrick 2006). As such, women, compared to men, have evolved to prefer a selective, long-term mating strategy in order to procure the commitment of a mate who can continually provide protection and resources. Men, on the other hand, do not face this constraint, and their reproductive success is largely constrained by the number of sexual partners to which they have access. As such, men, more than women, have evolved to pursue a short-term mating strategy in order to increase their access to a wider pool of sexual partners (Buss and Schmitt 1993). Consistent with these differences, a classic study found that when approached and propositioned for sex by an attractive member of the opposite sex, a large majority of college men agreed, whereas not one woman consented (Clark and Hatfield 1989).

Sexual Conflict

As a result of asymmetrical obligatory parental investment and the sexes pursuing different optimal sexual strategies, men and women may often come into conflict. As men have a stronger preference for short-term relationships and stand to benefit more from multiple matings than women, men have a stronger desire for sexual variety and are more sexually persistent. Asymmetrical preferences between the sexes predict that men are more likely than women to pursue sex with partners who are reluctant or unwilling (Buss and Schmitt 1993). Studies have found that men are more likely than women to perceive that a woman is sexually interested based on minimal social cues such as a smile, a touch on the arm, or mere friendliness (Haselton and Buss 2000). This sex difference in perception has been proposed to reflect a male sexual overperception bias that evolved given the asymmetric reproductive costs to men of making inferential errors. That is, in judging whether a female is sexually interested in ambiguous situations, there is a greater

reproductive cost associated with incorrectly inferring no interest and missing a potential sexual opportunity compared to mistakenly inferring sexual interest and wasting a bit of time and effort. As such, a male bias to overperceive sexual interest induces, on average, more instances of the less costly error while facilitating the enactment of a short-term mating strategy.

In contrast, women's higher obligatory parental investment, which leads to stronger preferences for committed long-term relationships, makes them more sexually restricted than men (Buss and Schmitt 1993). Women are therefore less eager and thus more likely than men to thwart the sexual advancements of the opposite sex. In line with evolutionary constraints favoring a choosy strategy, women may have evolved to be skeptical about a man's commitment even when it may be sincere, as the reproductive costs to women of wrongly inferring that a man is committed are large compared to the costs of requiring further signs of commitment before engaging in sexual relations (Haselton and Buss 2000). Further, as women value resources in a mate and seek mate quality over quantity, it is in their interest to "lead on" the other sex and entice further investments or induce intrasexual competition in the opposite sex. For instance, a woman might dress provocatively and engage in flirtatious behavior despite having little or no sexual interest so as to attain more investments from interested suitors, or get them to compete so that she can enact a selective strategy and choose from the best competitor.

Together, these opposing interests arising from asymmetries in obligatory parental investment likely contribute to women's experience of unwanted sexual advances (Goetz and Shackelford 2009) and men's frustration with failed and protracted courtships. Indeed, it has been argued that differences in evolved mating strategy underlie historical and cross-cultural patterns whereby men are more likely than women to be the perpetrators of sexual coercion and rape, while women are more likely than men to be the targets (Goetz and Shackelford 2009).

Conclusion

Reproductively successful parents have enacted sexual strategies and mating behaviors that optimized their own reproductive fitness over evolutionary time, and these behaviors are a reflection of, as well as a response to, obligatory parental investment asymmetries. Across many species, including humans, females have a greater minimum obligatory investment than males to ensure offspring survival, which has tended to select for sexually choosy and discriminating females and sexually eager and competitive males. These sex differences in parental investment and mating costs have implications for men and women in terms of differences in their preferred sexual strategies, their judgments of potential mates, and the type of mating conflicts they experience.

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