

The Consequences of Sexual Selection and Uneven Sex Ratios in Humans

Lindsay Hartup

Department of Biology
Lake Forest College
Lake Forest, Illinois 60045

Introduction to Sexual Selection

Natural and sexual selection are commonly misbelieved to be solely positive aspects of evolution, as they favor strong individuals surviving, reproducing, and passing on their traits to their offspring. What many fail to consider are the different ways in which males and females maximize their evolutionary fitness at their partners' expense. While males and females have similar reproductive goals, they are both willing to exploit their mates in order to benefit themselves and their mutual offspring. *Drosophila melanogaster*, commonly known as the fruit fly, is a model species in demonstrating this trend. In a study conducted by Holland and Rice (1999), the idea that sexual selection is always positive is refuted. Without this selection, populations would do better because antagonistic coevolution would not occur.

Antagonistic coevolution occurs in fruit flies. Male fruit flies have evolved to harm females in attempt to be reproductively successful, and females have evolved to become resistant to such harm in an effort to maximize their evolutionary fitness. The result is essentially an arms race between the male and female sexes. Males harm females by ejaculating sperm. In the sperm is a variety of chemicals that cause females to lay more eggs than desirable for them. Males do this to compete with each other, in attempt to make females lay as many eggs as possible with their sperm. Females do not want to be harmed by these chemicals, because they shorten their lives and reduce the total number of eggs they can produce. Thus, females have evolved chemical and physical defenses, which minimize the harm of the males' chemicals and prevent mating from occurring.

In Holland and Rice's (1999) study, through subjecting two replicated populations of fruit flies to a sexual selection test, they found that fruit fly populations do better under monogamy. When there is only one male and female involved in reproduction, the male and female reproductive successes are one and the same. The sexes are not competing against each other, but actually working together. Under these circumstances, it no longer benefits males to ejaculate harmful chemicals, nor is it beneficial for females to have resistance against males. Without these interfering mechanisms, females can lay more eggs and the fruit fly population can grow larger (p. 5083-5088).

Like fruit flies, humans also have their own sexual conflicts between males and females, which can be seen in monogamous and polygamous cultures. While it is not always intentional, humans also harm their mates in various ways to attain their own reproductive success. The results of such harm can be seen in economics, culture, marriage, and mortality. When these variables are examined in an evolutionary context, it can be seen that the most harmful affects of sexual selection stem from the sex ratio shifting in a given population. When one sex becomes the majority in a given population, this puts the minority sex in the driver's seat, increases competition within the majority sex, and leads to inadvertent consequences often for both sexes.

Male Humans in the Driver's Seat: A Decreased Male to Female Sex Ratio

Males seek to reproduce as much as possible. It is in their evolutionary interest to mate frequently and to produce many offspring. When they have more offspring, they are more reproductively successful, because they are passing on their traits to more individuals. Consequently, many males will attempt to mate with multiple females, either simultaneously or throughout the course of their lives (Brooks, 2012). Females have very different reproductive interests, however. They do not seek to mate as frequently or with as many males. Females may choose not to submit to males' sexual desires, especially when they are the minority sex in the population. This limits the extent to which males can achieve their reproductive goals. For males to better achieve their reproductive goals, there must be fewer males than females in the population. Under these circumstances, females will still want to reproduce and will sacrifice some of their reproductive interests in order to find mates in the smaller male population. One such sacrifice many females make is partaking in polygyny.

Polygyny is a form of marriage, where males have multiple wives. One of the worst consequences of polygyny for females can be seen in the affects the marriage has on their health. Bove and Vallengia (2009) examined these affects through studying various polygynous and monogamous households in sub-Saharan Africa. From comparing the two types of households, they determined that wives who participated in polygynous marriages experienced greater susceptibility to illness, sexually transmitted diseases, depression, and anxiety than wives in monogamous marriages. Bove and Vallengia (2009) reasoned that predisposition to STDs increased as a result of minimal condom use and likely participation in extramarital affairs. Depression and anxiety increased due to poor communication between husbands and wives, and power imbalances amongst the wives. Bove and Vallengia (2009) also found that polygyny decreased females' lifetime fertility. They concluded that this was a result of marital instability and the contraction of STDs (p. 21-29). While all of these consequences undoubtedly affect females, they also affect males. When females have reduced fertility, males are also not able to reproduce as much or as often. Additionally, when females contract sexually transmitted diseases, males become likely to acquire such diseases as well. When both partners become ill and are unlikely to receive treatment, staying alive and healthy becomes more important than achieving reproductive goals.

Female Humans in the Driver's Seat: An Increased Male to Female Sex Ratio

While males and females share some of the same general reproductive goals, they have very different interests. One major distinction between the two sexes is their costs of reproduction. While males can hypothetically impregnate multiple females within just a few days, females are physiologically limited to being able to reproduce just once in a given year. They have lengthy nine-month gestation periods and additional needed recovery time before being able to conceive again. Brooks (2012) argues that when these costs are accounted for, it becomes more difficult and far less likely for the mother to abandon her child at birth than it is for the father to leave them both. The year a female uses to carry her baby to term and recover marks a large part of her reproductive lifespan, making

*This author wrote the paper as a part of BIOL138: Biology Inquiry: Human Evolution under the direction of Dr. Houde

it nonsensical for her to desert her offspring (p. 131-132). Since females generally want to keep and care for their offspring, they want the fathers to support and provide for them and their offspring. This support can have negative affects on males, which can be seen in marriage probability and mortality rates.

Pollet and Nettle (2008) performed a study in which they examined the effects of male socioeconomic status on marriage probability and the potential increased effects when the male population is increased in a historical US population. To conduct this study, they used the Integrated Public Use Microdata Series. They collected information on demographics and household composition, and calculated operational sex ratios for each state. From their data, Pollet and Nettle (2008) determined that males with higher socioeconomic status were more likely to be married than males with low socioeconomic status. They also concluded that there is significant interaction between sex ratio and socioeconomic status. When a state became more male dominated, the effect of socioeconomic status on number of times married became even stronger (p. 31-33). This demonstrated that when females become the minority in a population, they enter the driver's seat. With this power, females are able to be selective when choosing their husbands and mates, because males still want to obtain their ultimate goal of having sex and reproducing. While this shift in the sex ratio allows females to achieve their reproductive interest of finding mates who are better able to provide them with support and resources, it also keeps many males who are not wealthy from marrying and reproducing.

Kruger and Nesse (2007) built upon many of Pollet and Nettle's (2008) ideas, including the idea that a decrease in the female population leads to increased male competition. In their evolutionary psychology study, Kruger and Nesse (2007) took the concept of intrasexual competition further, as they examined economy shifts and their potential effects on male competition and the male to female mortality ratio. They selected 14 Eastern European countries and 12 Western European countries. They found the male to female mortality ratios for each of these countries during the pre-transition (1985-1989), transition (1990-1994), and post-transition (1995-1999) economic periods. In all cases, during times of economic transition from centrally planned to market, the male to female mortality ratio increased. While the overall increase was slighter in the Western European countries, the increase was substantial in the Eastern European countries, most notably in early adulthood. Kruger and Nesse (2007) explained these findings as a result of sexual selection and conflict. They argued that the shifting economy led to increased intrasexual competition amongst men, which in turn led to riskier behavioral strategies and increased physiological stress (p. 411-427).

Because females usually have greater parental investment and reproductive costs, they tend to be more discriminating than males in selecting their mates. Thus, for males to compete for potential mates, they must find something that sets them apart, be it socioeconomic status, fighting other males, or displaying other qualities females desire. Typically, the males who win these competitions have traits that foster reproductive success. However, while these traits make it possible for males to have more offspring, they also often lead to behavioral and physiological differences that make males more susceptible to injury, disease, and early death. Since early adulthood is arguably the time when males are working the hardest to impress females, it makes sense that the mortality ratio of males to females is greatest at this time. It is the time when men are seeking new jobs with long hours in attempt to increase socioeconomic status and start building wealth. It is a

time when men are not yet fully mature and are still likely to get in fights with other men. Ultimately, it is the time men are beginning their search for mates.

Conclusion

The reproductive interests of males and females are both similar and different. While both sexes want to have sex and reproduce, the two sexes have different interests and methods for maximizing their evolutionary fitness. Males want to mate frequently and with many females, while females desire to mate with the most superior males who will stick around to support her and their mutual offspring. While these interests are both logical given the biology of the two sexes, their antagonism can lead to unlikely consequences, specifically when one sex is in the minority in a given population. In these cases, the minority sex is able to maximize their evolutionary interests, while the majority sex is faced with major consequences. Ultimately, once the majority sex experiences these consequences, both sexes are negatively affected, because reproduction requires healthy males and females. It can thus be argued that when the ratio of males to females in a population is equal and intrasexual competition is not as prevalent, both sexes would be better off. As shown by Holland and Rice (1999) with the fruit flies, when the reproductive interests of males and females are one and the same, both sexes can achieve their ultimate reproductive goals. It is likely that this is the case for humans as well.

Note: Eukaryon is published by students at Lake Forest College, who are solely responsible for its content. The views expressed in Eukaryon do not necessarily reflect those of the College. Articles published within Eukaryon should not be cited in bibliographies. Material contained herein should be treated as personal communication and should be cited as such only with the consent of the author.

References

- Bove, R., & Valeggia, C. (2009). Polygyny and women's health in sub-Saharan Africa. *Social Science and Medicine*, 68, 21-29.
- Brooks, R. (2012). *Sex, genes, & rock 'n' roll: How evolution has shaped the modern world*. New Hampshire: New Hampshire.
- Holland, B., & Rice, W.R. (1999). Experimental removal of sexual selection reverses intersexual antagonistic coevolution and removes a reproductive load. *Proceedings of the National Academy of Sciences of the United States of America*, 96, 5083-5088.
- Kruger, D.J., & Nesse, R.M. (2007). Economic transition, male competition and sex differences in mortality. *Evolutionary Psychology*, 5, 411-427.
- Pollet, T.V., & Nettle, D. (2008). Driving a hard bargain: Sex ratio and male marriage success in a historical US population. *Biology Letters*, 4, 31-33.