

Lecture 2: Evolutionary Foundations of Behaviour I

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Natural Selection and Evolutionary Adaptation

Natural Selection

The basic idea of Charles Darwin's theory of natural selection is that some individuals reproduce and others do not. Those that do reproduce pass on their traits; those that do not reproduce do not pass on their traits.

Two things influence whether or not an individual reproduces:

- Whether the individual can have sex (which depends on willingness and availability of potential mates),
- Environmental pressures such as food supply, predators, climate.

The key idea of natural selection is that reproductive success depends on inherited traits or characteristics. In this way, characteristics that increase the likelihood of reproduction are automatically selected for and characteristics that decrease the likelihood of reproduction are selected against.

Examples:

If you have two babies and there isn't much food, the one with the lowest need for food is more likely to survive and pass on this trait to its offspring.

Or, if one of the babies is bigger than the other, when it is time for them to mate, the bigger one beats up the little one and gets to mate. Therefore, its traits will be passed on to its offspring.

Or, in many species each sex chooses a mate by looking for certain attributes in the other sex that indicate it is likely to produce good offspring (or be able to care for them).

One such attribute may be **symmetry**.

The following is a summary of an article (titled "Beauty and the Beasts") that appeared in the Globe and Mail on Saturday Sept. 27, 1997. It was originally published in the Economist.

Randy Thornhill of the University of New Mexico studies what makes people attractive. He has discovered that one of the most important factors is symmetry. People can detect asymmetries of only a mm or two.

In reviewing the literature, he found research indicating 42 other

species including insects, birds and mammals that use bodily symmetry to help choose their mates. He and colleagues from around the world have carried out research to follow up this finding.

In one study, they found that men from around the world rank women from ethnic groups with which they are unfamiliar in the same order as men from those groups. (Thus, it seems that this may be some innate preference.)

In another study, photos of women taken from the back, the side, the front, and the face only were ranked for attractiveness. (The face was blanked in the frontal picture). Rankings for all angles were highly correlated. Thus, both bodily and facial symmetry is important.

In other studies, Thornhill and colleagues claim that symmetry is correlated with intelligence and health. (In addition, men who have more symmetric bodies are not only more attractive, they invest less effort in their relationships.)

There may a reason for all this: during development many insults (infections, poisons) can affect how well the embryo develops and leave asymmetries. The fewer the insults, or the better the embryo deals with them, the more symmetric the individual will be. So, symmetry reflects genes and the environment.

The important point about natural selection is that there are pressures that increase the likelihood of having offspring - whether through sex or survival - and these pressures select for some organisms - those that are fit to survive - and thus their traits are passed on.

Random Variation

Natural selection can work only if there is variation in inherited characteristics.

While Darwin did not know about genetics, he appreciated that random variation was essential for natural selection.

The idea is that variations simply occur - they may be "good" or "bad" - and those that confer an advantage are selected for through natural selection.

Thus, evolution is not engineering where design changes are introduced that are thought to improve performance.

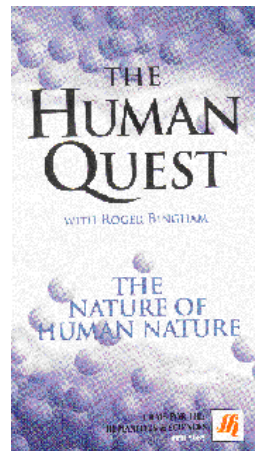
We now know that genes provide the basic for random variation of characteristics. (The combination of Darwin's theory of natural selection with knowledge of genes is referred to as the Modern Synthesis.)

Genetic variation comes from the reshuffling of genes that occurs in in sexual reproduction as well as from mutations - i.e., errors in DNA replication.

It is mutation that is believed to be responsible for differences across species and, with natural selection, is the engine of evolution.

Video: The Nature of Human Nature

This video introduces what the host Roger Bingham calls "the second Darwinian Revolution" - our understanding of the evolutionary history of the human brain. Evolutionary psychologists believe that the brain, like the body, is a product of natural selection. Our minds can be thought of as a kind of patchwork quilt of successful solutions (involving specialized circuits) to the challenges faced by our ancestors over millions of years. Many scientists think that, because of this shared evolutionary history, we are all inheritors of the same legacy: a universal human nature, which explains why people from different cultures have so much in common.



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