

Evolution lecture #14 -- **Darwin and human culture; sociobiology** -- Dec. 8th, 2008

1138-1142 (ch. 51) **in 8th ed.**

1128-1133 (ch. 51) **in 7th ed.**

• **Summary of lecture:**

Economic theory
Political theory
Evolutionary ethics
Sociobiology
Creationism
Science as a process
Cultural evolution versus biological evolution

• **Economic theory -- "survival of the fittest"**

There has always been a tight two-way relationship between Darwinism and capitalistic economic theory. Adam Smith and his "invisible hand of the marketplace" was influential on Darwin. As we have already discussed, the economist Thomas Malthus had a large impact on Darwin with his theories about population and resource growth. Likewise, Darwin's principle of natural selection excited economic theorists, for example Herbert Spencer, who actually coined the term "survival of the fittest" (not Darwin!).

The "robber barons" of early, raw capitalism in the United States were fond of using Darwin (or at least their interpretation of Darwin) as justification for them having most of the money and the workers little.

Modern advocates of "trickle down" economics even today depend on Darwinian justifications.

Present day evolutionary biologists are fond of using economic analogies in evolutionary biology and ecology: niche relationships, food webs, adaptation, game theory.

• **Political theory**

Marx was likewise enamored of Darwin, and imagined a connection between natural selection and the struggle between the classes throughout history.

Many other politicians, including several American presidents, have used Darwinian metaphors when justifying actions of the strong countries ruling the weak ones, colonialism, etc.

Relationships between the races and between the genders: Darwinian arguments have been used to support racism, sexism, and probably any other -ism.

• Evolutionary ethics

Is what is "natural" good? Many philosophers have looked to nature for guidance on what is right and good. One justification given is that human cultures have evolved their morals, ethics, gender roles etc. through natural selection, and it is dangerous to depart from what has worked through trial and error over the millennia.

The other side of the coin: "is" doesn't imply "ought." "Might" doesn't imply "right." Civilization exists to moderate our animal past.

• Sociobiology

sociobiology: systematic study of the biological basis of all social behavior. Explanations have been attempted for heroism, homosexuality, gender differences in math and science abilities, gender roles in general, and many other aspects of human behavior.

altruism: the aiding of another at one's own risk or expense.

kin selection: a phenomenon of **inclusive fitness**, used to explain altruistic behavior between related individuals (Fig. 51.29 (8th); Fig. 51.35 (7th)).

inclusive fitness: the fitness of a gene or genotype measured by its effect on survival and reproduction both of the organism bearing it, and of the genes, identical by descent, borne by the individual's relatives.

- Many social behaviors are selfish
- Natural selection favors behavior that maximizes an individual's survival and reproduction
- On occasion, some animals behave in ways that reduce their individual fitness but increase the fitness of others
- This kind of behavior is called altruism, or selflessness
- In naked mole rat populations, nonreproductive individuals may sacrifice their lives protecting the reproductive individuals from predators
- Altruism can be explained by inclusive fitness
- Inclusive fitness is the total effect an individual has on proliferating its genes by producing offspring and helping close relatives produce offspring

Hamilton's Rule and Kin Selection

- Hamilton proposed a quantitative measure for predicting when natural selection would favor altruistic acts among related individuals
- Three key variables in an altruistic act:
 - Benefit to the recipient
 - Cost to the altruist
 - Coefficient of relatedness (the probability that if two individuals share a parent or ancestor, a gene in one individual will also be present in the second individual)
- Natural selection favors altruism when the benefit to the recipient multiplied by the coefficient of relatedness exceeds the cost to the altruist
- This inequality is called Hamilton's rule
- Kin selection is the natural selection that favors this kind of altruistic behavior by enhancing reproductive success of relatives
- An example of kin selection and altruism is the warning behavior in Belding's ground squirrels
- Altruistic behavior toward unrelated individuals can be adaptive if the aided individual returns the favor in the future
- This type of altruism is called reciprocal altruism

Social Learning

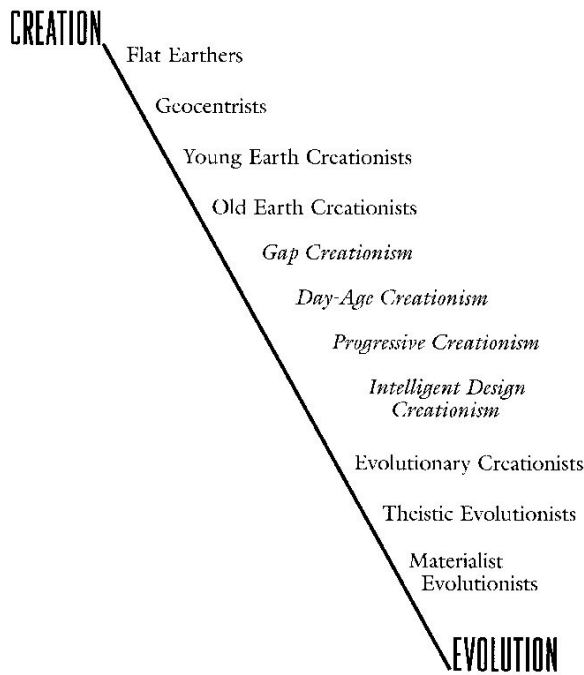
- Social learning forms the roots of culture
- Culture is a system of information transfer through observation or teaching that influences behavior of individuals in a population
- For example, in mate choice copying, individuals in a population copy the mate choice of others
- This type of behavior has been extensively studied in the guppy *Poecilia reticulata*
- Vervet monkeys produce a complex set of alarm calls
- Infant monkeys give indiscriminating calls but learn to fine-tune them by the time they are adults
- No other species comes close to matching the social learning and cultural transmission that occurs among humans

Evolution and Human Culture

- Human culture is related to evolutionary theory in the distinct discipline of sociobiology
- Human behavior, like that of other species, results from interactions between genes and environment
- However, our social and cultural institutions may provide the only feature in which there is no continuum between humans and other animals
- Therefore, sociobiology only provides partial (maybe even limited) insight into human behavior.

Nature vs. Nurture

THE CREATION/EVOLUTION CONTINUUM



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REPORTS

• Creationism then and now

A reminder about the first go-around, in Darwin's time

Current events: creation science, intelligent design; battles in the schools and textbooks

A reminder of the differences between scientific and other ways of looking at the world

What is, or should be, the relationship between science and religion? Good fences make good neighbors...

Diagram at left from *Antievolutionism and Creationism in the United States* by Eugenie Scott (http://www.ncseweb.org/resources/articles/4550_antievolutionism_and_creationi_2_13_2001.asp)

• Science as a process

How does science progress? Ideas (memes) competing in the academic environment for new adherents. Philosophers like Richard Dawkins and David Hull like to make evolutionary analogies: lineages, defining research groups by synapomorphies, competition, natural selection. Are these reasonable approaches?

• Cultural evolution versus biological evolution

Are such analogies between cultural evolution and biological evolution good analogies? What are the possible non-analogies?

Reticulate evolution is rampant in cultural evolution

Directly adaptive variation is possible in cultural evolution

What is cultural evolution, anyway? It is a novel organization that has emerged on top of biological evolution and to a large extent superseded it.

What is the future of human evolution -- is it mainly biological, or cultural?