

Sociobiology and Evolutionary Psychology

"In the distant future I see open fields for far more important researches. Psychology will be based on a new foundation, that of the necessary acquirement of each mental power and capacity by gradation."
Darwin, *On the origin of species*

General Requirements for Evolution

Richard Lewontin: heritable variation in fitness

- There must be variation of a trait in a population
- This variation must result in differential reproduction (fitness)
- This variation must be heritable (which is always measured in a given environment)

Note—no mention of genes; the framework is not limited to genetically based organisms

Relation of Genotype and Phenotype

The gene-for perspective: each biological trait is coded for by a specific gene and is expressed when that gene is present

But biological traits are often polygenic

Many genes are pleiotropic

There is often a complex interaction between genes and environment circumstances in producing traits, including cognitive ones

Extending the project of evolutionary biology

Relate human social traits (including morally relevant ones) to evolution

Evolution would be expected to promote those traits that are beneficial to an organism

These traits enable the organism to out-reproduce its competitors

How to explain apparently self-less behavior—behavior that is costly to one's own reproductive success but improves that of another?

This is what is referred to as *altruism*



E. O. Wilson: Kin Selection and Sociobiology

Why do sterile castes survive among the social insects: ants, termites, bees, wasps?

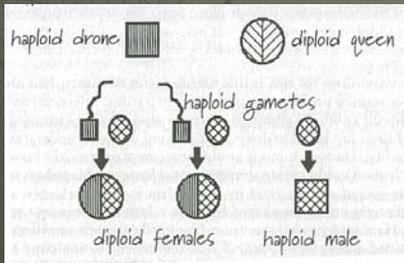
They do not promote their own genes, but those of others--altruistic

A striking fact about the social insects—males are haploid, females are diploid

Sisters are more related than in diploid populations since they all get the same genes from their father and, on average, share 50% of those from their mother
A female will be more closely related to her sisters than to own female offspring.

So, greater advantage in promoting her sister's reproduction than that of her own offspring.

Haploid-Diploid Genetics



Is Kin Selection Unique to Social Insects?

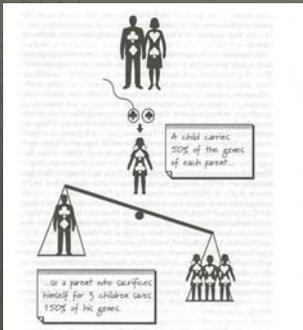
Humans are diploid, so there is not such an obvious to promoting one's siblings over oneself.

Human siblings share on average 50% of their genes

If, by sacrificing the production of one offspring, you are able to insure that your sibling is able to leave more than 2 additional offspring, you increase your genetic fitness

In general, sacrifice for kin *can be* evolutionarily advantageous

Kin Selection



Animal Sociobiology

Research directed at explaining

- foraging behavior
- conflict resolution
- mate choice patterns
- parental investment decisions
- aspects of communication and signaling, etc.

Human Sociobiology

"The central tenet of human sociology is that social behaviors are shaped by natural selection. In spite of perturbations due to time and lag, and random effect, those behaviors conferring the highest replacement rate in successive generations are expected to prevail throughout local populations and hence ultimately to influence the statistical distribution of culture on a worldwide basis" (Lumsden and Wilson)

The Sociobiology Gambit

- If a trait is widespread in human culture, assume that it is a biological adaptation
- Look for an account of selection forces that would promote this trait
- Propose (claim) that the trait is such a product of natural selection under those forces

Why do we like sugar?

Adaptationist account:

- Our ancestors needed to eat ripe fruit to meet their nutritional needs.
- When fruit is ripe, it is loaded with sugars.
- If our ancestor had a taste for sugar, he or she would be a little more likely to eat ripe fruit.
- His or her resulting good health would make him or her stronger and more attractive to potential mates.
- He or she might leave more offspring who, inheriting this taste for ripe fruit, would be more likely to survive to reproductive age.

Why do we have specific tastes in possible mates?

- To enhance the survival of our offspring, we want them to have the best genes
- If a mate is very healthy, vigorous, etc., his or her genes are probably better
- As Darwin noted, some animals develop bizarre traits so as to demonstrate their mate-worthiness

Differential parental investment

David Barash: "Males tend to be selected for salesmanship; females for sales resistance [coyness]."

Why? Differential costs:

women can carry limited offspring, face the risks of pregnancy, increased nutritional needs, etc.
Men can, and do, walk away.

It is in the woman's interest to up the cost for males to enhance likelihood of long-term support. Males will try to get away with less, both before and after the birth of children.

"It might not just be a cultural fluke that men bring flowers and candies, pay for dinner, and so forth." (C. George Boeree)

Male aggression

An expected consequence of the competition for mates

"males engage in a great deal of head-butting. But one can't help but notice that these contests "over" females seldom end in death or even serious injury in most species. That is because these contests are just that: contests. They are a matter of **displays** of virtues, and they usually include actions that serve as sign stimuli to the opponent that the contest has ended in his favor: **surrender signals**. Continued aggression is of little advantage to either the loser or the winner. Even male rattlesnakes don't bite each other!

"Sociobiologists predict that animals that are poorly equipped for aggression are unlikely to have developed surrender signals. Man, they say, is one of these creatures. But we developed technology, including a technology of destruction, and this technology "evolved" much too quickly for our biological evolution to provide us with compensating restraints on aggression. Experience tells us that guns are more dangerous than knives, though both are efficient killing machines, because a gun is faster and provides us with less time to consider our act rationally -- the only restraint left us." (C. George Boeree)

Flanagan's "horizontal" objection

Flanagan notes that sociobiologists tend to emphasize the power of genes in shaping behavior—a vertical relation

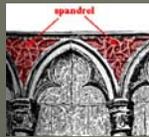
Wilson: genes have culture on a (short) leash
Dawkins: An organism is just a gene's way of making more genes

Flanagan contends this ignores the powerful role of cultural mediation via our cognitive system

The Panglossian Objection: Lewontin and Gould

Not all features of human products are *selected*. Some are by-products of selecting for something else

Example: Spandrels in cathedrals



It is very easy to tell a story about how something might have resulted from selection: *Just so stories*

It is much harder (not impossible) to test selectionist accounts

Evolutionary Psychology

"The goal of research in evolutionary psychology is to discover and understand the design of the human mind. Evolutionary psychology is an *approach* to psychology, in which knowledge and principles from evolutionary biology are put to use in research on the structure of the human mind. . . . It is a *way of thinking* about psychology that can be applied to any topic within it.

"In this view, the mind is a set of information-processing machines that were designed by natural selection to solve adaptive problems faced by our hunter-gatherer ancestors. This way of thinking about the brain, mind, and behavior is changing how scientists approach old topics, and opening up new ones." (Cosmides and Tooby, *Evolutionary Psychology: A Primer*)

The Mind as a set of specialized modules

all normal human minds reliably develop a standard collection of reasoning and regulatory circuits that are functionally specialized and, frequently, domain-specific. These circuits organize the way we interpret our experiences, inject certain recurrent concepts and motivations into our mental life, and provide universal frames of meaning that allow us to understand the actions and intentions of others. Beneath the level of surface variability, all humans share certain views and assumptions about the nature of the world and human action by virtue of these human universal reasoning circuits.



General processes vs modularity

From Descartes, a strong emphasis on the unity of mind

- Flourens' opposition to phrenology
- Opposition to brain localization in 20th century: Lashley, Head, . . .
- Behaviorists general learning principles

But cognitive psychology has tended to emphasize the division of the mind into specific processors, responsible for different cognitive processes

- Memory, language, object recognition, etc.
- Strategies for dissociation designed to separate processing components functionally (and structurally in neuropsychology)

Chomsky's mental organs proposal

"We may usefully think of the language faculty, the number faculty, and other 'mental organs,' as analogous to the heart or the visual system or the system of motor coordination and planning. . . . In short, there seems little reason to insist that the brain is unique in the biological world, in that it is unstructured and undifferentiated, developing on the basis of uniform principles of growth or learning—say those of some learning theory, or some yet-to-be-conceived general-purpose learning strategy—that are common to all domains" (1980, p. 3).

Fodor's modularity of mind

Distinction between horizontal and vertical modules.

Vertical modules:

- domain-specific
- mandatory in their operation
- allow only limited central access to the computations of the modules
- fast,
- *informationally encapsulated*
- have shallow outputs
- associated with fixed neural architectures
- exhibit characteristic and specific breakdown patterns
- exhibit a characteristic pace and sequencing in their development

Central Cognition

Fodor restricted modules to language and sensory processing

Denied modularity of central cognition

- Quinean (degree of confirmation of any belief depends on its relation to any other belief)
 - Isotropic (anything a person knows is relevant to determining whether to believe a given proposition)
- So not informationally encapsulated

Fodor's first law of the non-existence of cognitive science

Others (especially evolutionary psychologists) look for modularity all the way in

Coupled with view that selection must select for modules

Challenges to Fodorian Modularity

Evidence for top-down (as opposed to bottom-up) processing

Speech processing

- Word recognition based on acoustic and phonetic information alone—syntax and semantics have no influence
- Evidence from shadow speech—people restore the correct word despite distortions, which they do not do when the sound is presented in isolation
- Controversial case: McGurk Effect

McGurk Effect



Seeing someone say "ga" while hearing "ba" results in perception of intermediate sound

Could be entirely within language module (motor theory of speech perception)

Massaro: rather invokes more general processing: integration of information and top-down as well as bottom-up processing

Evolutionary Psychology: Modules all the way through

"We have all these specialized neural circuits because the same mechanism is rarely capable of solving different adaptive problems. For example, we all have neural circuitry designed to choose nutritious food on the basis of taste and smell – circuitry that governs our food choice. But imagine a woman who used this same neural circuitry to choose a mate. She would choose a strange mate indeed (perhaps a huge chocolate bar?). To solve the adaptive problem of finding the right mate, our choices must be guided by *qualitatively different standards* than when choosing the right food, or the right habitat. Consequently, the brain must be composed of a large collection of circuits, with different circuits specialized for solving different problems. You can think of each of these specialized circuits as a mini-computer that is dedicated to solving one problem.

More on Modules (cont.)

"Such dedicated mini-computers are sometimes called *modules*. There is, then, a sense in which you can view the brain as a collection of dedicated mini-computers -- a collection of modules. There must, of course, be circuits whose design is specialized for integrating the output of all these dedicated mini-computers to produce behavior. So, more precisely, one can view the brain as a collection of dedicated mini-computers whose operations are *functionally integrated* to produce behavior." Cosmides and Tooby, *Evolutionary Psychology: A Primer*

Five Principles of Evolutionary Psychology

1. The brain is a physical system. It functions as a computer. Its circuits are designed to generate behavior that is appropriate to your environmental circumstances.
2. Our neural circuits were designed by natural selection to solve problems that our ancestors faced during our species' evolutionary history.
3. Consciousness is just the tip of the iceberg; most of what goes on in your mind is hidden from you. As a result, your conscious experience can mislead you into thinking that our circuitry is simpler than it really is. Most problems that you experience as easy to solve are very difficult to solve -- they require very complicated neural circuitry
4. Different neural circuits are specialized for solving different adaptive problems.
5. Our modern skulls house a stone age mind.

Cosmides and Tooby, Evolutionary Psychology: A Primer

A Stone-age Mind

"The key to understanding how the modern mind works is to realize that its circuits were not designed to solve the day-to-day problems of a modern American -- they were designed to solve the day-to-day problems of our hunter-gatherer ancestors. These stone age priorities produced a brain far better at solving some problems than others. For example, it is easier for us to deal with small, hunter-gatherer-band sized groups of people than with crowds of thousands; it is easier for us to learn to fear snakes than electric sockets, even though electric sockets pose a larger threat than snakes do in most American communities. In many cases, our brains are *better* at solving the kinds of problems our ancestors faced on the African savannahs than they are at solving the more familiar tasks we face in a college classroom or a modern city. In saying that our modern skulls house a stone age mind, we do not mean to imply that our minds are unsophisticated. Quite the contrary: they are very sophisticated computers, whose circuits are elegantly designed to solve the kinds of problems our ancestors routinely faced."

General Reasoning vs. Cheater Detection

Which of the following cards do you need to turn over to either confirm or falsify the hypothesis that **if a card has an even number on one side, it has a vowel on the other?**



Only about 25% of subjects get problems such as this right

Transformed Problem

Which of the following cases do you need to consider to see if someone is cheating on the following principle
if you charge a purchase on your credit card, you must pay the bill?

Person charges purchase

Person doesn't charge

Person Pays bill

Person doesn't pay bill

Now 65-80% get the right answer

Cheater Detection and Social Contracts

To achieve self-sacrifice (altruism) without kin selection, need reciprocal altruism

I'll scratch your back if you scratch my back

Useful to have the payoffs delayed

I'll do this for you now if you agree to do that for my children later

Don't want to make such deals with cheaters, so useful to have a means of detecting cheaters

Conclusion: evolution created a cheater detection module!

False Belief Task

While Sarah is watching, you and Jimmy put a dollar under square 1

1

2

After Sarah leaves, you and Jimmy move the dollar to under square 2

You now ask Jimmy where Sarah will look for the dollar. If Jimmy is 3-4, he will say under square 2

Theory of Mind Module

What Jimmy lacks is referred to as a *theory of mind*, which he will probably develop around age 5

One explanation for autism is that autistics lack a theory of mind

Claim: theory of mind is a module which can appear independently of others

It was an evolutionary adaptation

Cognitivism without Modularity?

Is there a middle ground between general learning rules and modularity?

Mind comprised of distinct processors (carry out different types of information processing) but

- at a far lower level than modules usually defined
- constitute a highly interactive system

Components of processing account
