

# Species Learning: Evolutionary Psychology

## Basic Concepts

- The link between Darwinian theory and behaviors is psychology.
- Like physical structure, mental architecture has been shaped by natural and sexual selection.
- “The past explains the present”
- **Domain specific mechanisms**  
(e.g., mating, parental investment, social exchange, foraging ...)
- **Human EEA** (Environment of Evolutionary Adaptedness, i.e., Pleistocene hunter gatherer’s society)
- **Design Features**  
Physical and psychological features of adaptations to reproductive problems
- **Adaptiveness** (if it is adaptive) **and Adaptation** (it was adaptive in EEA)
- **Processes leading to adaptations** (natural selection and sexual selection: reproduce the fittest – domain general) **and the adaptations themselves** (physical and mental mechanisms – domain specific)

## Core Premises of Evolutionary Psychology

- (1) Behaviors depend on underlying psychological mechanisms of the brain activated by external and internal stimuli;
- (2) Evolution by selection is the only known causal process capable of creating such complex organic mechanisms;
- (3) Evolved psychological mechanisms are functionally specialized to solve adaptive problems that recurred for humans over deep evolutionary time;
- (4) Human psychology consists of a large number of functionally specialized evolved mechanisms, each sensitive to particular forms of contextual input.

Natural selection operates over thousands of generations. For ninety-nine percent of human existence, people lived as foragers in small nomadic bands. Our brains are adapted to that long-vanished way of life, not to brand new agricultural and industrial civilizations. They are not wired to cope with anonymous crowds, schooling, written language, government, police, courts, armies, modern medicine, formal social institutions, high technology, and other newcomers to the human experience. Since the modern mind is adapted to the Stone Age, not the computer age, there is no need to strain for adaptive explanations of everything we do. Our ancestral environment lacked the institutions that now entice us to nonadaptive choices, such as religious orders, adoption agencies, and pharmaceutical companies, so until very recently there was never a selection pressure to resist the enticements. Had the Pleistocene savanna contained trees bearing birth-control pills, we might have evolved to find them as terrifying as a venomous spider. Fears in modern-city dwellers protect us from dangers that no longer exist, and fail to protect us from dangers in the world around us. We ought to be afraid of guns, driving fast,

driving without a seatbelt, lighter fluid, and hair dryers near bathtubs, not of snakes and spiders. Public safety officials try to strike fear in the hearts of citizens using everything from statistics to shocking photographs, usually to no avail. Parents scream and punish to deter their children from playing with matches or chasing a ball into the street, but when Chicago schoolchildren were asked what they were most afraid of, they cited lions, tigers and snakes, unlikely hazards in the Windy City.

- Stephen Pinker, "How The Mind Works"

### **Evolutionary psychology research approach**

- (1) Identify typical risks recurrent in human EEA (environment of evolutionary adaptedness)
- (2) Search for design features of the information-processing mechanisms that have evolved for coping with these tasks
- (3) Examine social and personal factors that activate or inhibit these psychological mechanisms in present time.

### **Natural selection -**

Non-random differential reproduction of alternative designs

It favors those phenotypic designs that enhance survival and the efficient transformation of resources into growth and reproduction.

### Sources of Genetic Variation

Mutation

Crossing over during meiosis

Genetic Drift: Any change in gene pool due to chance

Essential components of natural selection

### **Sexual selection -**

Physical and behavioral dimorphism

It favors those phenotypic designs that enhance success in mating competition and selection.

It entails a zero-sum intrasexual competition.

**Peacock's tail:** An example of a compromise of sexual and natural selection.

### **Asexual versus Sexual Reproduction**

Why Is There Sex?

An arms race between human hosts and parasites

## What are unique about humans?

Chimps and humans share almost 99% of

Human Intelligence as Adaptation to a Cognitive Niche

Prolonged childhood and extended parental care (costs) allows the bigger human brain to develop, learn and reason (benefits)

## Key Terms in Genetics

**allele** - One of two or more alternative states of a gene.

**diploid** - Having two sets of chromosomes, referred to as homologues.

**gene** - The basic unit of heredity. A sequence of DNA nucleotides on a chromosome.

**genotype** - The total set of genes present in the cells of an organisms,

**haploid** - Having only one set of chromosomes.

**heterozygote** - A diploid individual carrying two different alleles of a gene on its two homologous chromosomes.

**homozygote** - A diploid individual whose two alleles of a gene are the same.

**locus** - The location of a gene on a chromosome.

**phenotype** - The observable expression of the genotype.

**dominant allele** - An allele that dictates the appearance of heterozygotes.

**recessive allele** - An allele whose phenotypic effect is masked in heterozygotes by the presence of a dominant allele.

## Selection and Altruism

### The Concept of Fitness

Individual fitness and Individual selection

Inclusive fitness and Kin selection

Reciprocal altruism

Moral values

### Hamilton's Rule:

$$c \leq rb$$

### Levels of Selection

## **Kin altruism and social bees**

haploid, diploid, and haplodiploid species

## **Alarm Calling in Ground Squirrels**

Hypotheses:

Predator confusion

Predator deterrence

Reciprocal altruism

Parental investment

Inclusive fitness

## **Patterns of Helping**

## **Patterns of Inheritance**

## **Homicide and Kin Selection**

## **Conflict and Cooperation**

Game Theory and Evolutionarily Stable Strategy (ESS)

	<u>Cooperator</u>	<u>Defector</u>	<u>Net Payoff</u>
Cooperator	$5 - 2 = 3$	$0 - 2 = -2$	1
Defector	$5 - 0 = 5$	$0 - 0 = 0$	5

	<u>Cooperator</u>	<u>Defector</u>	<u>Detector</u>	<u>Net Payoff</u>
Cooperator	$5 - 2 = 3$	$0 - 2 = -2$	$5 - 2 = 3$	4
Defector	$5 - 0 = 5$	$0 - 0 = 0$	$0 - 0 = 0$	5
Detector	$5 - 2 = 3$	$0 - 0 = 0$	$5 - 2 = 3$	6

## **Sexual Selection and Sex Differences**

### **Parental Investment and Sexual Selection (Trivers, 1972)**

(1) The sex that invests more in offspring (typically the female) will be more discriminating or selective about mating.

(2) The sex that invests less in offspring will be more competitive for sexual access to the high investing sex.

**Fertility, Fecundity and Fidelity**

Reproductive quality (ability), quantity, validity

**Reproductive investment**

Women > Men

**Promiscuity:**

Men > Women

**Jealousy:** Men (fecundity related) Women (resource related)

**Mating criteria, Mating strategies and Mate choice**

**Women's Long-Term Mating Strategies**

Resource-oriented

**Preference for**

- Economic Resources
- Good Financial Prospects
- High Social Status
- Older Men
- Ambition and Industriousness
- Dependability and Stability
- Athletic Prowess
- Good Health
- Love (commitment)
- Willingness to Invest in Children

**Men's Long-Term Mating Strategies**

Fertility and reproduction-oriented

**Preference for**

- Youth
- Physical Beauty:
  - “average” facial features,
  - unique facial features,
  - symmetry,
  - waist-to-hip ratio

- Lower WHR is associated with a higher estrogen/androgen ratio and higher fecundity, and is a good predictor of cardiovascular health

## **Aggression:**

“Young males’ syndrome”

Males have a higher variance in reproduction (measured by the number of offspring) as well as in wealth than females. As a result, males

**are more risk taking**

**discount future return more**

## **Mating Systems**

Monogamy

Polygamy

Polyandry

Polygyny

## **Reproductive and Parental Investment**

### **Paternity Un(certainty) and Investment by grandparents**

Parental certainty:

Investment:

Physical Resemblance to the father can be used as an index of paternity (un)certainty or reproductive risk and for parental investment (Wang, 2002, 2006)

### **Why Do Mothers Provide More Parental Care Than Fathers?**

Maternity certainty

Lower abandonability

Higher mating opportunity cost

### **Asymmetries between the Sexes**

	<b>Men</b>	<b>Women</b>
Reproductive Span		
Life Span		
Reproductive Opportunities		
Reproductive Strategy		
Parental Certainty		

### **Sexual Selection, Sex Dimorphism, and Mating -Warring Association**

Questions about the origin of human warfare continue to generate interesting theories with little empirical evidence.

Both intra-sex competition and mate choice lead to wide-ranging sex-dimorphic attributes, which are referred to as weapons and ornaments.

Chang L, et al (2009) showed that an association between mating motives and war-related behavior in the form of faster perceptual processing of war scenes or recognition of war words and more militant attitudes toward hostile countries.

- Male participants primed by photographs of attractive women were significantly more likely to endorse positive attitudes about war in a questionnaire than when primed by pictures of unattractive women.

- Male participants were significantly faster in responding to words related to war when primed with pictures of female legs as compared to national flags.

- Male participants were significantly faster in responding to images related to war but not farming when primed with pictures of fertile (young) women as compared to older women.

## **Evolutionary Cognitive Psychology**

### **Reasoning and Cheater Detection (Cosmides, 1989):**

Reasoning abilities are largely evolved to detect cheaters and to reinforce social contracts

### **Risk Preference and Group Living (Wang, 1996):**

Kinship and small group living has shaped “kith-and-kin” rationality. Risk preferences are more consistent in small group than large anonymous group contexts.

### **Probability Judgment and Natural Frequency (Gigerenzer, G., & Hoffrage, U. (1995)**

In contrast to probability (e.g., 0.24), frequency (e.g., 6 out 25) is a natural format of information.

### **Social Behavior and Theory of Mind (Baron-Cohen, 1995)**

Theory of mind refers to the ability of mind-reading for making social attributions. Fail to detect other’s intension result in mind-blindness (e.g., autism).

### **Foraging and Risky Choice**

Decision makers are sensitive to (1) payoff distributions (variance) and (2) three key reference points (i.e., goal settings, status quo, and minimum requirement), (3) Be risk averse if the expected mean return is above the minimum requirement (MR), and be risk seeking if the expected return is below MR.