The Goal of Evolutionary Psychology

Understanding the Human Mind/Brain in terms of Evolution.

Four Basic Questions:

1.   Why is the Human Mind the way it is?
2.   How is the Human Mind Designed/Organized?
3.   What are the Functions of the Various Components
        of the Human Mind?
4.   How does the Environment (stimulus inputs) interact with
        the Innate, Underlying structure of the Mind/Brain
        to produce Behavioral Responses?

Biological Antecedents to Darwin

Observations:

1. Large variety of species, yet structural similarities
   E.G.: Flippers & Wings
   Suggests one modified from the other
   Hence, Life is not Static
2. Bones from different geological strata dissimilar
3. Dissimilar species have similar embriogenesis
   Suggests common ancestors
4. Characteristics appear to have purpose
   E.G.: Quills
   Functionality requires explanation

Inadequate Early Theories

Jean de Lamarck

Two Causes of Species Change:
1. Natural tendency to progress to a higher form
2. Inheritance of acquired characteristics

1 & 2 Interact -- E.G.: giraffes

Animal's struggle to survive causes trophic nerve secretions in organ involved in struggle

Inadequate Early Theories, cont.

Baron Cuvier

Catastrophism:
    Catastrophes such as meteorites result in Extinction and
        Replacement of species

Theory lacks Explanation for:
    •Why
    •How
    •Apparent purposive nature of forms

Darwin

Observations:

Finches on each of the Galapagos Islands structurally different enough to constitute separate species.

Implications:
- Common ancestor
- Divergence from disparate ecological conditions
- Form is not immutable

Forms appear adapted for function
- E.G.: hooks on seeds to promote dispersal
- Cannot be the result of Lemarckian "Struggle"

Supporting/Stimulating Insight

Thomas Malthus: *An Essay on the Principal of Population*, 1798:

Species exist in numbers too great to survive & reproduce

Implies a Struggle for Existence
Favorable variations differentially preserved
New species emerge therefrom

Darwin's Theory of Natural Selection

Conceptual Troika:

1. **Variation:**
    Including psychological, social-psychological
    Necessary for parts 2 & 3

2. **Inheritance:**
    Excludes acquired variation, e.g., injury
    Evolution exclusively a process of inherited variation

3. **Selection:**
    Some variations facilitate fecundity
        By promoting survival and reproduction
            Darwin's Example: Beaks which promote nut cracking.
                $\uparrow$ Survival $\rightarrow$ $\uparrow$ frequency in next generation

Differential Reproductive Success

Heritable characteristics which Increase or Decrease
- Survival
- Reproduction

Measured by relative reproductive success

Greater Reproductive Success
- $\rightarrow$ Greater frequency of inherited characteristics
- Evolution: Interaction of facilitated **Survival** and facilitated **Reproduction** (Frequency of Inheritance = S x R)
   Darwin: Two Classes of evolved variations (S & R)

Survival & Reproduction

Preference for nutritious foods promotes survival

Elaborated song attracts mates – promotes reproduction
    (But not survival)

Differential variation is **passively** strengthened across generations
    Not the result of intention or design ("Intelligent Design")
    Actual variations are random, accidental, unplanned
        Bad variations:
            Obviously not planned
            Weakened over time

Time Course & Circumstance

Variation of an organism over Time:
    Gradual with periods of inactivity and sudden change
        • *Punctuated Equilibrium*
        • Sudden changes are on a large time scale

Variation across organisms:
    Origin of (Different) Species due to Geographic Isolation
        • Common Ancestor

Ambiguity in Darwin's Theory

1. <u>Mechanism by which characteristics are inherited</u>:
   Darwin proposed Blending of attributes from both patents

   Per color mixing

   But Blue & Brown eyed parents $\rightarrow$ Blue or Brown

   Early conflict between Geneticists and Evolutionists

2. <u>Evolutionary advantage of partially evolved structure</u>:
   Can have advantage -- even if can't be imagined

   "Argument from Ignorance"

   "'Argument from personal incredulity,' not good science"

   But is the assumption of advantage more than dogma???

   Don't we assume H_0?

Ambiguity in Darwin's Theory, cont.

3. Gradualism in conflict with "Intentional (Intelligent) Design"

   "Darwin's theory is the unifying and nearly universally accepted theory within the biological sciences."

   - **"Appeal to Authority"**
   - So was the Ptolemaic Universe

Genetic Theory

Blending "**Intermediate**" inheritance is incorrect

Inheritance is discrete ("**Particulate**")

Passed on intact (**Gene**)

Smallest unit of inheritance

Genotype – Individual's ensemble of genes

Vs. **Phenotype**

Random half inherited from each parent

Not acquired by experience (Lemarck) – must be born with

Allele: Greek – of one another

Yet many genes can summate to **phenotype**

Mendel ignored by Darwin

1930: "**Modern Synthesis**" of Genetics & Evolution

Rejected **Lemarck** & **Blending**

Ethology

The study of organisms (organisms' behavior) in their natural
   Environment.

Kluver-Bucy Syndrome

Ethology studies behavior from an evolutionary perspective
   Historical antagonism with Experimental Psychology
      External Validity

Darwin:
   1. Behavior requires underlying physical structure
         Radical! – Descartes
   2. Therefore, like physical features (Phenotype), psychological
         characteristics can be bread – **Maze Bright Strain**

Imprinting

First behavior studied by ethologists
Konrad Lorenz – Founder of Ethology
Ducklings follow first moving object they see

- Form of Learning
- Learning is Preprogrammed
    Tabula Rasa
- **Critical Period**

Ethology: The study of animal behavior in terms of
1. **Proximate Mechanisms**
2. **Adaptive Value**

Ethology

Reaction to "**American Psychology**"
   Test: "Extreme Environmentalism"
   John Watson – "Father of Behaviorism"

Four "Whys" of Niko Tinberen (1951), Co-Founder of Ethology
1.   Immediate Cause of behavior – e.g.: movement of mother
2.   Developmental causes of behavior
           Brain changes/latent behaviors)
3.   Function of the behavior (adaptive purpose)
           Proximity to mother
4.   Evolutioary/Phylogenic origins of behavior
      Sequence of development
      Hearing from Lateral Line Organs of fish?

Fixed Action Patterns

Innate Behavioral Patterns of Behavior in a given species
   Contra Tabula Rasa

1. Stereotypic – Implies not Learned but Innate – e.g.: Bird Mating
2. Triggered by well defined stimuli – "**Releasers**"
   • Across entire species
   • Inflexibility implies not learned but inherited
3. Performed to Completion once triggered
   Inflexibility $\Rightarrow$ Inherited rather than Learned

Ethologists wished to partition ongoing stream of behavior into
   Discrete Sequential Units

Ethological Philosophy

Response propensities exist prior to experience/learning

- Inherited
- **Shaped** by evolution to be **Adaptive**

Forced Psychology to consider the biology of the organism
"**Equipotentiality**"

Three Problems of Ethology

1. Labels rather than Explanations

2. Observations rather than Underlying Mechanisms
   Per Behaviorism

3. Systematic Criteria for an Adaptation not developed

Ethology's Contribution to Evolution

If response propensities (behavior) is inherited, so might be social behavior

If Social Behavior represents Evolutionary Adaptation, then Darwin's notion of **Classical Fitness** may be *Insufficient* As a **Theory** of **Natural Selection**

Hamilton's Inclusive Fitness:
An Extension of Classical Fitness

Classical Fitness: Quantification of an individuals **Direct**
reproductive success in passing on one's genes

Too narrow to describe (mathematically) evolution by selection

Rather: Selection favors characteristics which perpetuate genes
Regardless of whether the organism **Produces** the offspring
Directly

E.G.: Parental care is a **Special Case** of caring for kin
Who carry copies of (some of) your genes

Inclusive Fitness

Examines all actions or effects (behavior) rather than that of a Single individual.

Inclusive Fitness:

- Classical Fitness -- One's own reproductive success
                    Plus
- Individual's influence on the reproductive success of genetic relatives.
          Weighted by degree of genetic relatedness

Genetic Relatedness of Relatives
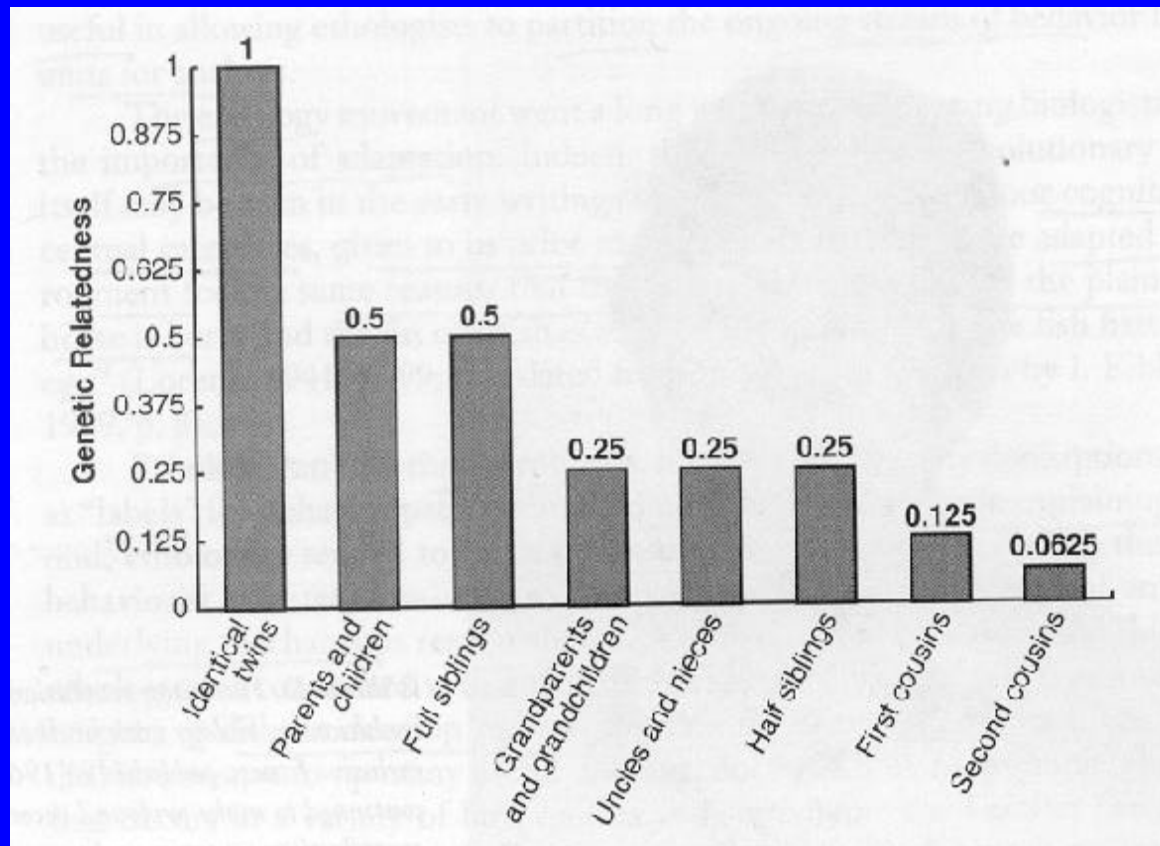
Inclusive Fitness Theory leads to predictions of degree of altruism

Think Like a Gene

1. Survival of your Vehicle

2. Have your vehicle make copies of you (do the nasty)
       Direct Reproduction

3. Do the same for copies of you which already exist
       •   Survival
       •   Reproduction

Classical Fitness: 1 & 2
Inclusive Fitness: 3

Adaptation

Genes which have the effect of increasing their Replicative Success replace other genes (Natural Selection).

- Classically (anatomy, physiology, and behavior)
- Inclusively (behavior)
  - Family
  - Altruism
  - Helping
  - Group formation
  - Aggression

Adaptation, Not!

Group Selection:

Adaptation evolved for the benefit of the group

    Differential survival and reproduction within group
    Only species with characteristics which benefited the group survived
        E.G.: An animal limiting its own reproduction as not to deplete
            food base
Effects of such behavior must be weak:
    This type of behavior results in fewer offspring than more selfish
        behavior and drops out (selection *within* the group)
        Does NOT argue against altruistic/sacrificing behavior
            Just vis-à-vis the Group, not Kin or **Reciprocal Altruism**

Adaptation, Way!

An evolved solution to specific problems that contributes directly (classical) or indirectly (inclusive) to successful reproduction.

Problem: Which attributes are adaptations?

Necessary Condition:

Invoke only when necessary to explain a phenomenon

Criteria:

1. Reliability: Common in all members of species regardless of Environment
2. Efficiency: How well is the adaptive problem solved?
3. Economy: Relative to costs to organism

1-3 $\Rightarrow$ **Improbable Usefulness** – Attribute could not have arisen by **chance** alone