Recall the gist of Darwin’s theory of Natural selection:

Individuals whose heritable traits are helpful to their own survival and reproduction will leave more offspring than other individuals, thus becoming predominant over evolutionary time.

Organisms are under selection to maximize their (classical) fitness, i.e., the number of offspring.
Hamilton’s inclusive fitness theory

\( \approx \text{Kin selection theory} \)

- Darwinian fitness (= classical fitness): a trait’s effect on the Reproductive Success of its bearer

- Hamiltonian fitness (= inclusive fitness): Darwinian fitness + a trait’s effects on the RS of its neighbors

Organisms are under selection to maximize their inclusive fitness.

Genes for social actions

Hamilton’s rule: \( rb - c > 0 \)

How likely \( r \) does have my copy?!

Bart’s inclusive fitness = \( 1(-c)+r(b) > 0 \)

\( rb > c \)

It defines the condition for the spread of a gene for altruism.

- \( b \): fitness benefit (in terms of the recipient’s extra offspring production)
- \( c \): fitness cost (in terms of the actor’s loss of its own offspring)
- \( r \): genetic relatedness between the actor and the recipient

Altruism could evolve if the fitness benefit to the recipient \( (b) \), weighted by its relatedness to the actor \( (r) \), outweighs the fitness cost to the actor \( (c) \).
If \( rb - c > 0 \), the gene for altruism spreads because it promotes aid to copies of itself. Thus, **kin selection is a logical consequence of gene selection**.

- Altruism at the individual level is actually **selfishness at the gene level**.
- Kin selection includes parental care as well as altruism towards non-descendant kin.

Kin selection works regardless of whether the gene for altruism is rare or common.

Kinship is just **one** way of achieving positive relatedness (i.e., \( r > 0 \)).

- *c.f., green-beard effect*

**Theoretical Implications of Hamilton’s Rule**

- Evolved psychological mechanisms for each type of kinship relationship

**I. Parenting**

Parenting as one “special case” of evolved kinship mechanisms
II. Sibship
Cooperation and competition among siblings – genetic relatedness of .50

Sulloway’s theory of birth order: niche competition
- Different “niches” for children, based on birth order
  - First-borns: conservative
  - Later-borns (esp. middle borns): rebellious

III. Half Sibship
Greater conflict between half-sibs \((r = .25)\) than full sibs \((r = .5)\)

IV. Grandparenthood
Evolution of grandparental mechanisms
Empirical Findings Supporting Inclusive Fitness Implications: Alarm calling in ground squirrels

Individuals alarm call when they spot terrestrial predators (e.g., coyotes, long-tailed weasels, badgers)

Squirrels that hear alarm calls look up, locate predator, &/or run to rock or burrow

Alarm calls do not deter predators from attack

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<tbody>
<tr>
<td>Alarm calling squirrels</td>
<td>12</td>
<td>141</td>
<td>8%</td>
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<tr>
<td>Quiet squirrels</td>
<td>6</td>
<td>143</td>
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Squirrels that call alarms are twice as likely to be killed by the predator than squirrels that stay quiet
Why should an individual warn others when doing so makes it MORE vulnerable to predation?

The behavior does not increase the fitness of the actor. How could it be maintained in the population?

Not all members of the population are equally likely to alarm call

Males disperse at sexual maturity (about 2 years of age), but females remain in the area they were born and are therefore usually closely related to one another.

Even among Females alarm calling is not uniform

- Females with daughters in group = 80%
- Females with mothers & sisters in the group, but no daughters = 80%
- Females with no kin or offspring in group = 20%

It’s not whether you have offspring in the group that determines whether you call, but whether other individuals in the population share your genes.

**Summary:** Alarm calling only in females, and only if kin around

- Despite the fitness cost to the alarm caller, the alarm calling was selected because it benefited the signaler’s genetic relatives around her.
Hypotheses About Evolved Kinship Psychology

- All kin classified in relation to ego or self as focal individual

Sex distinctions will be universal in kinship classifications

Generation is critical, given asymmetries of valuation between parent and child

Kin relations universally arrayed on dimension of "psychological closeness" that will be highly linked with genetic relatedness

Cooperation will be higher among closely related kin

Older kin will encourage younger kin to behave more altruistically toward each other than they are naturally inclined to do (e.g., father is related .25 to his nephew, but father’s son is related only .125 to his father’s nephew)
**Hypotheses About Evolved Kinship Psychology**

- Self-concept will be partly function of kin (e.g., I’m daughter of X)
- “Real” kin v. non-real kin

**H’s About Kinship Psychology**

- Kinship as source of manipulation and influence (brother, spare a dime; sororities; fraternities)

**Potential Kin Recognition Mechanisms**

- Exposure in infancy or while growing up.
- Odor
- Kin classification
- Others? Facial similarity?

**Similarity of Appearance?**
People Who Look Alike Are Judged to be Siblings [Mahoney, 2007]

Patterns of helping in the City of Angels: More toward close kin & younger kin

Life or death helping in humans: Burning building studies
- theoretical issue: return on investment from helping
- close kin rather than distant kin or strangers

Helping as Function of Relatedness
Literal Life or Death as Function of Kinship

- **Mayflower pioneers**: Cold winter of 1620-1621: 51% died; number of genetic relatives in colony predicted who lived or died.

- **Donner Pass Disaster of 1846**: 40 of 87 people died during the winter; number of kin in group predicted who lived or died.

Patterns of inheritance: Who leaves wealth to whom?

- kin rather than non-kin
- close kin rather than distant kin
- children rather than siblings, due to higher RV of children
- sex difference: women distribute more widely than men
- sex difference: men trust their wives; women don't trust husbands! Why?

Investment by Grandparents

- DeKay’s theory of grandparental uncertainty
  - perfect certainty of kinship through maternal line
  - compromises in kinship compounded through the male line

Findings: Grandkids feel closer to maternal grandmother than to paternal grandfather, as well as receiving more resources.
A Broader Perspective on the Evolution of the Family

- **Definition of family**: where offspring continue to live with parents past point where offspring are capable of reproduction
- **Families are rare in nature**: only 3% of all bird and mammalian species form families
- **Simple families**: parents and kids
- **Extended families**: two or more relatives of the same sex reproduce, such as two sisters

Costs of families

- Delayed or suppressed reproduction of kids
- Competition for scarce resources in same niche
ecological constraints model

- families emerge when reproductive "vacancies" are scarce.

family benefits model

- survival, competitive skills, inheritance, helping

Emlen’s Theory of Evolution of Families

- more offspring produced than reproductive vacancies
- offspring are not initially competitive for those vacancies
- benefits of staying at home are large

specific predictions

- families form when shortage of vacancies
- families with more resources will be more stable
- helping higher in families than in other groups lacking kin
- sexual aggression lower in families than in other groups
- when breeder dies, there will be conflict to fill vacancy
- sexual aggression higher when vacancy filled by non-kin
Distinctive Context of Human Families

- families are advantageous in competition with other groups
- human’s engage in extensive social exchange with non-kin
- non-reproductive women have little reason to encourage offspring to disperse

The Dark Side of Families

Major forms of conflict within families

Conclusions About Families

- Inclusive fitness theory predicts that helping and altruism will be directed toward genetic relatives.
- Nonetheless, divergence of genetic "interests" predicts that conflicts within families are predictable outcomes.