

Multilevel Selection

Merging Individual Selection and
Group Selection

“Although a high standard of morality gives but a slight or no advantage to each individual man and his children over the other men of the same tribe... an advancement in the standard of morality will certainly give an immense advantage to one tribe over another.”

--Charles Darwin, *The Descent of Man*

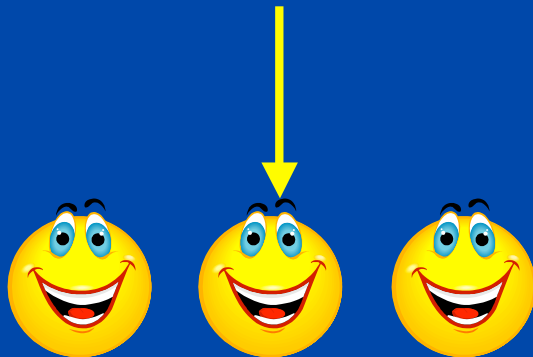
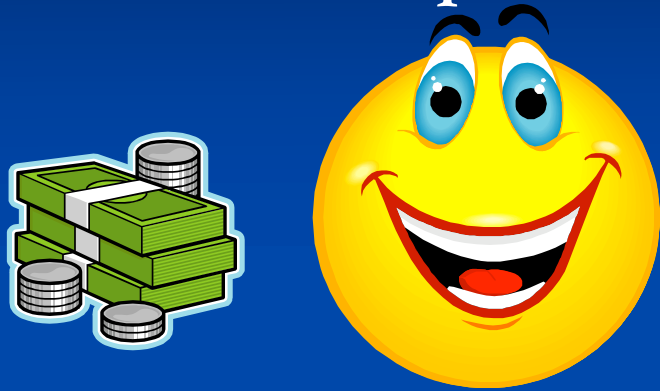
Group Selection

- When individual traits help one group out-compete other groups.

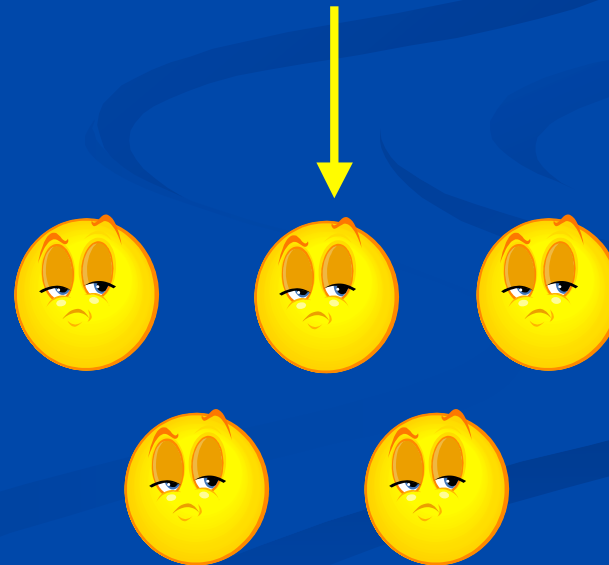


Individual Selection & Cooperation

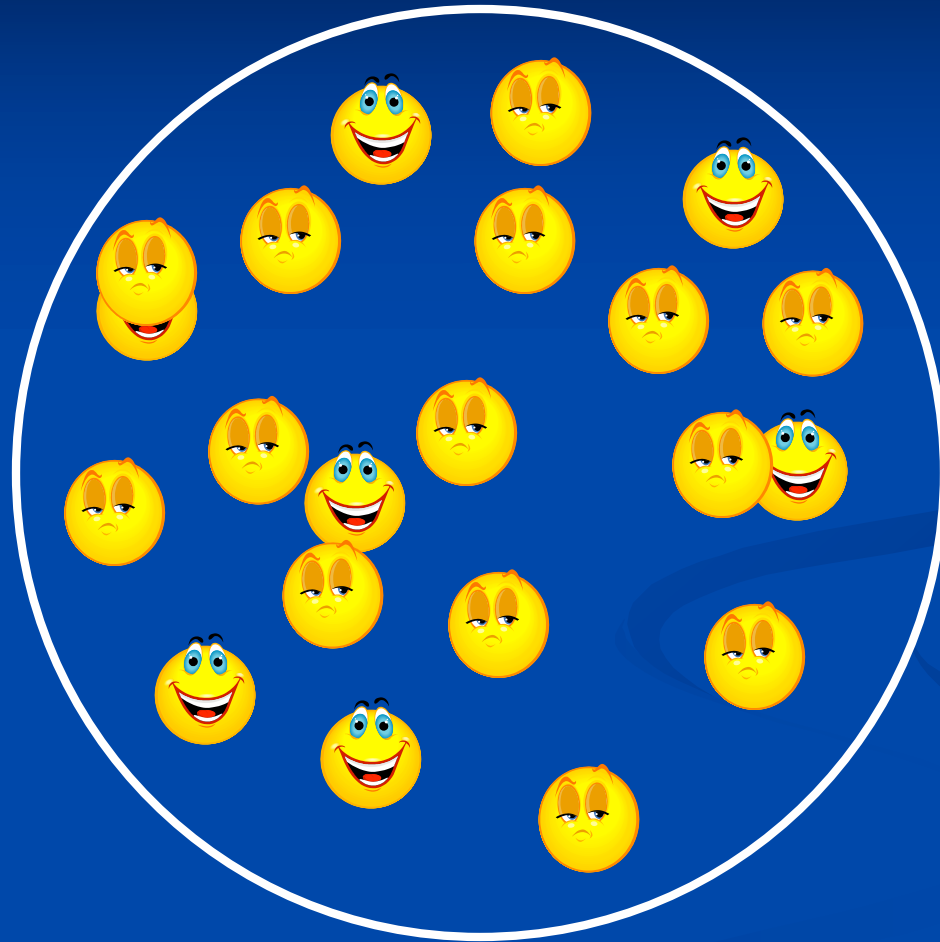
Cooperator



Defector



Individual Selection & Cooperation



Defection is always locally advantageous!

Kin Selection

- Your relatives carry similar genes.
- Helping your relatives is helping your genes.

| Relative | Genetic Similarity |
|---------------|--------------------|
| Parent | .5 |
| Sibling | .5 |
| First Cousin | .25 |
| Second Cousin | .125 |

Kin Selection



Direct Reciprocity

- Helping someone else provided they will help you later.

Direct Reciprocity



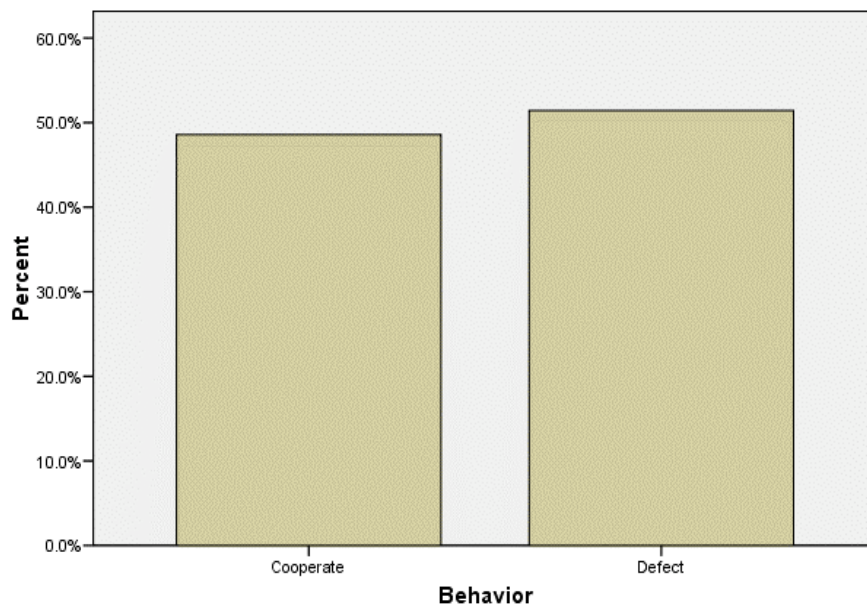
Conditional Cooperation

- Tit-for-Tat strategy only cooperates with other cooperators.

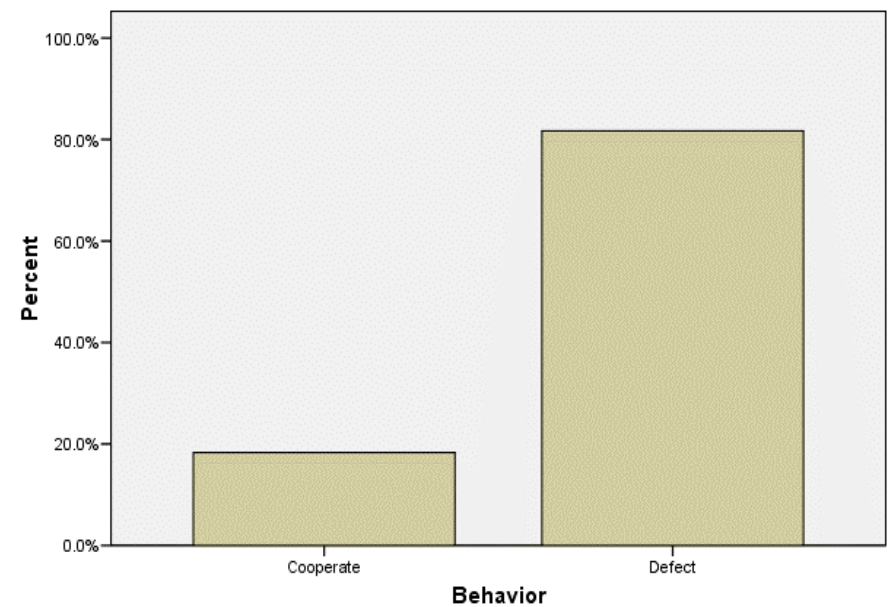


Conditional Cooperation

Behavior as a Second Mover:
Playing with a Cooperator



Behavior as a Second Mover:
Playing with a Defector



Tit-for-Tat in Nature: Birds



Tit-for-Tat in Nature: Fish



Tit-for-Tat in Nature: Primates



Indirect Reciprocity

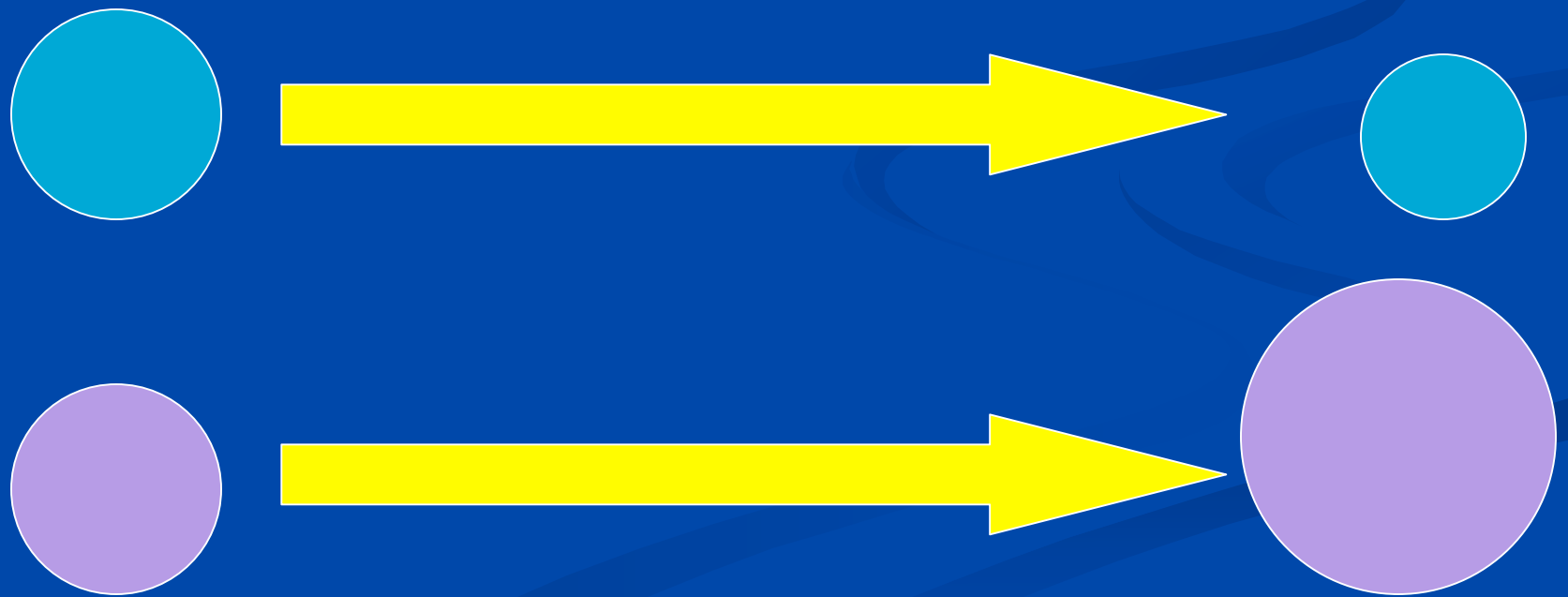
- Reputation, gossip and other signals can be used to determine whether to cooperate or not.

Indirect Reciprocity

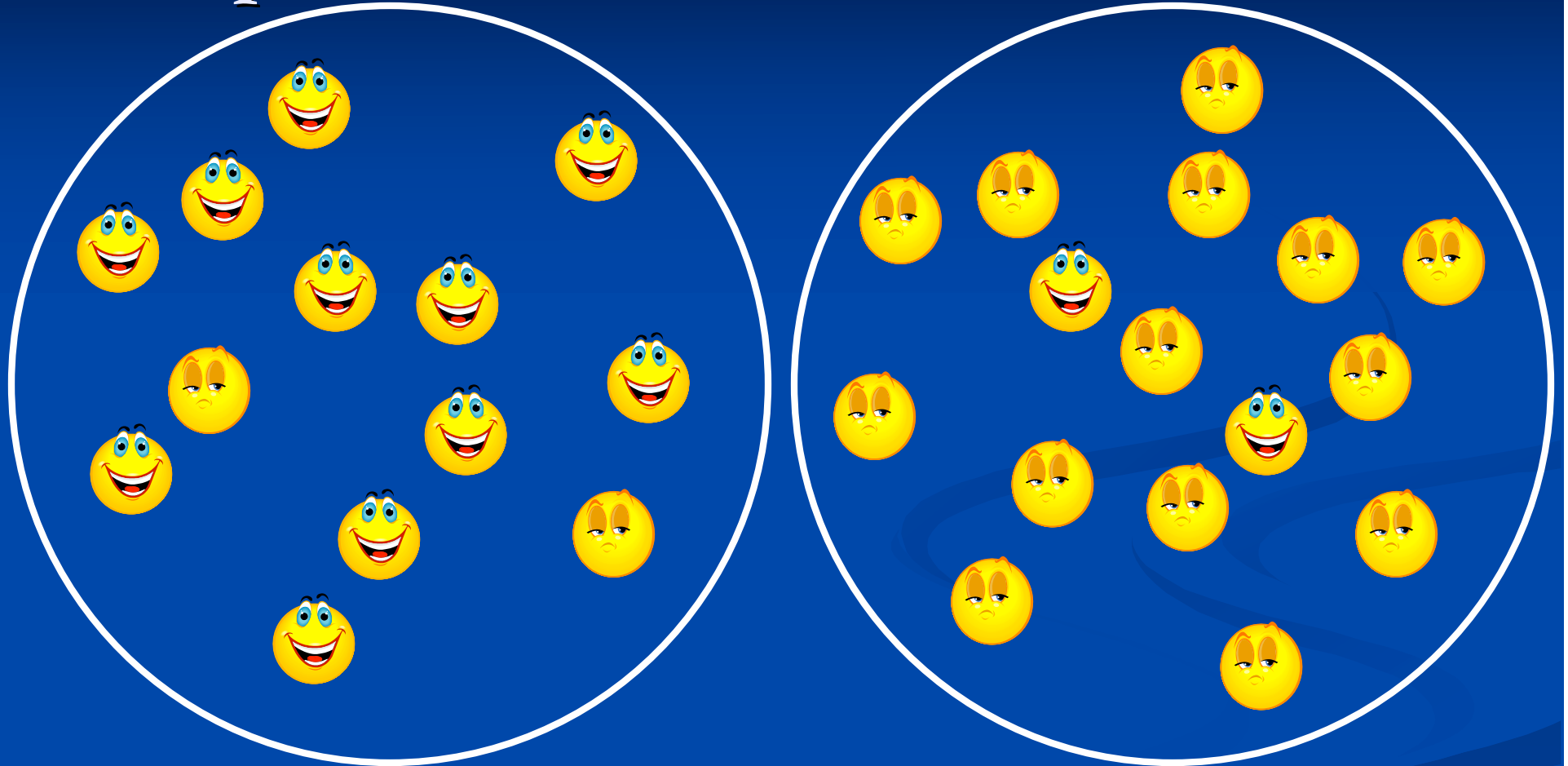


Group Selection

- Variation between Groups
- Competition between Groups



Group Selection vs. Individual Selection



Defection is always locally advantageous!

But cooperative groups can beat non-cooperative groups!

Why Cooperate?



Why Cooperate?



Why Cooperate?



Multilevel Selection

- A framework that combines selection at all levels, from the gene to the group.
- Considers two things:
 - Level benefited by a trait's operation.
 - If that level is being selected for by the environment.

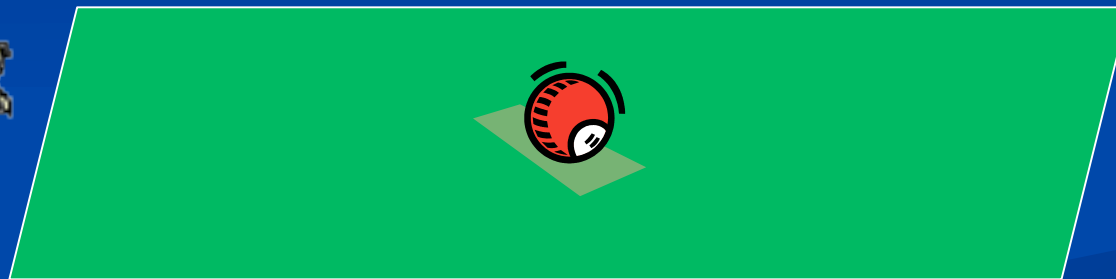
Advantages of Multilevel Selection

- All other examples are just specialized cases of groups!
- Accounts for all evolutionary pressures and estimates their interplay.

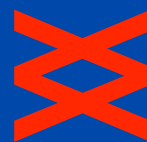
Advantages of Multilevel Selection

Eusociality

Individualism



Individual
Selection



Group
Selection

Other Theories

Eusociality

Individualism

