Evolutionary and comparative perspectives

Supported GRE teaching and original transfer practice

Evolutionary and comparative perspectives

- Use **inclusive fitness 广义适合度** and Hamilton's rule for **kin selection 亲缘选择**.
- Describe a **fixed action pattern 固定行为模式** and its **sign stimulus 信号刺激**.
- Explain **prepared learning 预备性学习**.
- Match an evolutionary or comparative claim to the evidence it needs.

Kin selection

- r is relatedness: 0.5 for full siblings and for parent and child, 0.25 for half-siblings, 0.125 for first cousins.
- B is the benefit to the recipient and C the cost to the helper, measured in the same units of reproductive success.
- With equal B and C, help to a sibling is favoured before help to a cousin. The rule predicts direction, not exact human choices.

$$rB > C$$

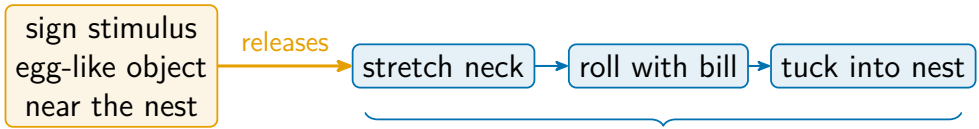
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Fixed action patterns

- A **fixed action pattern** is a species-typical sequence that a **sign stimulus** releases and that runs to the end once started.
- The goose's egg-rolling is the classic case; so is a herring-gull chick pecking at the red spot on its parent's bill to get food (Tinbergen).
- A supernormal stimulus, an exaggerated version of the sign stimulus, can trigger a stronger response than the real thing, as with an oversized egg.
- Real behaviour still varies with the animal's state and context.

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Figure: Fixed action patterns



- Released, then run to completion.
- Match each part of the diagram to the text.

Prepared learning

- Garcia and Koelling (1966): rats easily linked a taste with later sickness, and a light or sound with shock, but not the other way round.
- Taste aversion can form after one pairing, with hours between the food and the sickness.
- Monkeys learn fear of snakes from watching other monkeys far more easily than fear of flowers (Mineka).
- **Prepared learning** shows that evolution and learning work together, not as rivals.

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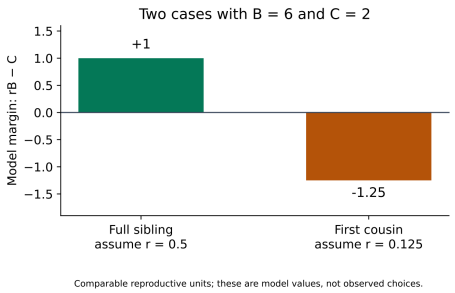
Evolutionary explanations

- An evolutionary explanation is about function: how a behaviour raised reproductive success in ancestral environments. It is a hypothesis about history.
- It needs evidence: comparisons across species, predictions tested in new data, or links to genetics, not only a plausible story told after the fact.
- Comparative caution works both ways: do not read human motives into animals (anthropomorphism), and do not assume a human behaviour is purely learned when similar patterns appear across species.

Worked example: Hamilton's rule

- Full sibling: $rB = 0.5 \times 8 = 4 > 3$, so helping is favoured.
- First cousin: $rB = 0.125 \times 8 = 1 < 3$, so it is not.
- For a cousin, helping would need $B > 24$.

Figure: Worked example: Hamilton's rule



- Hamilton's rule: helping is favoured when $rB > C$, here for siblings but not cousins
- Read the axes and units first.

Worked example: naming the process

- A goose rolls a doorknob into its nest: a **fixed action pattern** released by a crude **sign stimulus**.
- A camper who was sick once after eating clams avoids clams for years: **prepared learning** (taste aversion).
- A ground squirrel gives alarm calls that put itself at risk, mostly when relatives are near: kin selection.

Common errors

- Treating Hamilton's rule as a precise calculator for human decisions.
- Forgetting that B and C must be in the same units.
- Explaining any behaviour as adaptive after the fact, without evidence.

Common errors (2)

- Treating fixed action patterns as learned.
- Thinking an evolutionary account rules out learning.

Key terms

- **inclusive fitness**: Reproductive success counting both one's own offspring and the reproduction of relatives, weighted by relatedness.
- **kin selection**: Natural selection for behaviour that helps relatives.
- **fixed action pattern**: A species-typical sequence of behaviour released by a **sign stimulus** and completed once started.
- **sign stimulus**: A specific feature that releases a **fixed action pattern**.

Check yourself

- What is r for half-siblings?
- A gull chick pecks harder at a stick with three red bands than at its parent's bill. What is the stick?
- Rats learn to avoid a taste after one illness but not a light. What does this show?