Approaches to studying animal behavior

Foundations of modern study of behavior

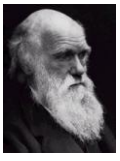
1. Evolution by natural selection

2. Genetics and inheritance

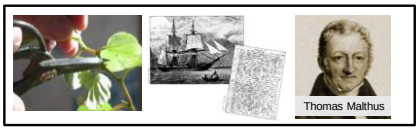
3. Comparative method

Evolution by natural selection

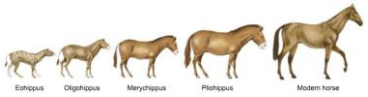
Alfred Russell Wallace (1823-1913)
Contributions to the Theory of Natural Selection, 1870



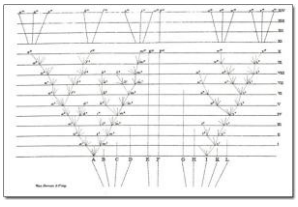
Charles Darwin (1809-1882)
Origin of Species, 1859
Descent of Man, 1871



Evolution by natural selection



Species are not immutable



Descent from a common ancestor

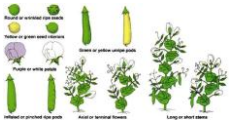
Evolution by natural selection

Reasons why Darwin's (and Wallace's) ideas weren't widely accepted:

Lord Kelvin: Earth is only 15-20 million years old

Darwin had no idea where genetic variability came from

Thomas Hunt Morgan



Gregor Mendel

Darwin didn't understand inheritance

Comparative method

Comparative method: comparing traits and environments across taxa in search of correlations that test hypotheses about adaptation

George Romanes (1848-1894)

Ethology

Scientific study of animal behavior

Douglas Spalding (1841-1877) tests the concept of instinct

Ethology

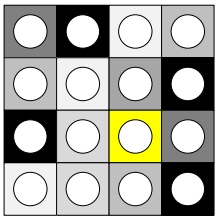
Oskar Heinroth (1871-1945)

Charles Otis Whitman (1842-1910)

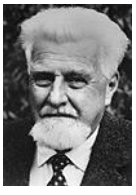
Wallace Craig (1876-1954)
- Appetitive behavior
- Consummatory behavior

Experimental ethology

Karl von Frisch
(1886-1982)



Ethology's triumvirate

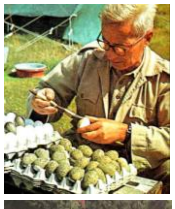


Konrad Lorenz
(1903-1989)

Niko Tinbergen
(1907-1988)

Karl von Frisch
(1886-1982)

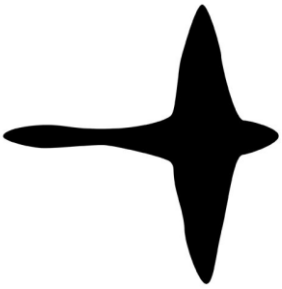
Ethology's triumvirate



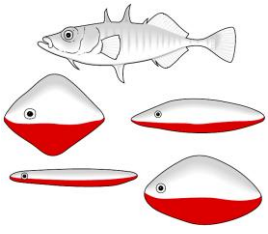
Sign stimuli

Lorenz's accidental discovery of sign stimuli or releasers

Sign stimuli



Experimental ethology



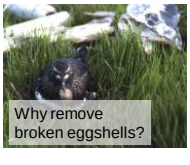
Tinbergen's experiments on three-spined sticklebacks

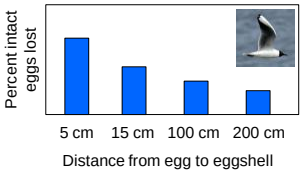
Experimental ethology

Broken egg stimulates removal behavior

Experimental ethology

Experimental ethology

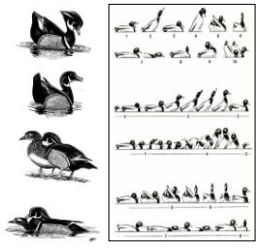




Fixed action patterns

Lorenz and Tinbergen devised concept of fixed action pattern

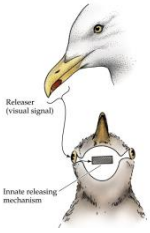
Example of FAP: egg rolling in greylag goose



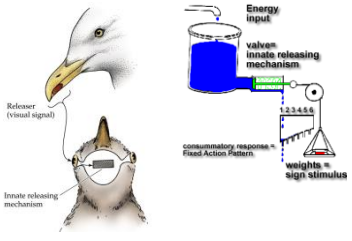
Wood duck (left) and mallard (right) courtship

Fixed action patterns

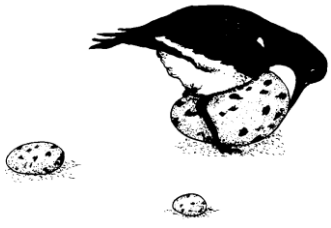
Sign stimulus (releaser) → **Innate releasing mechanism (IRM) (filter + trigger)** → **Fixed action pattern (FAP)**



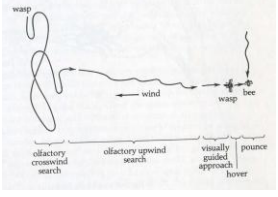
Lorenz's hydraulic model



Supernormal stimuli

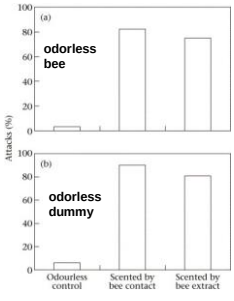


What about more complex behavior?

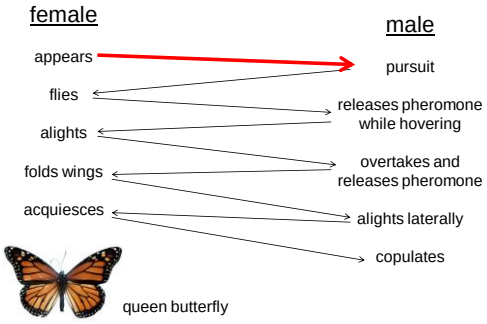


What cues trigger beewolf predatory behavior?

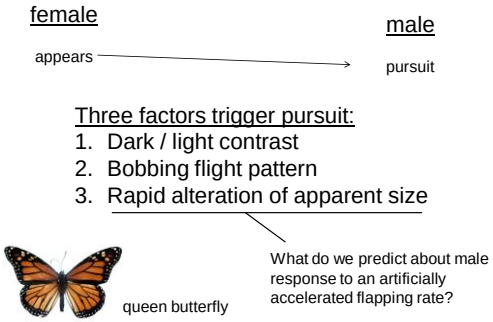
Tinbergen's beewolf



What about more complex behavior?

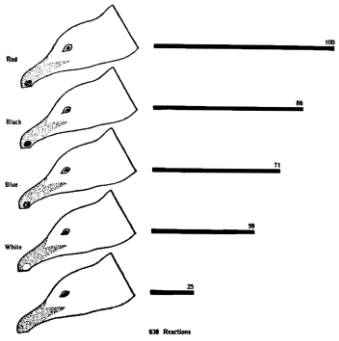


What about more complex behavior?



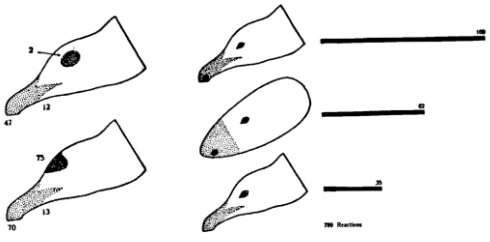
Experimental ethology

Experimental ethology



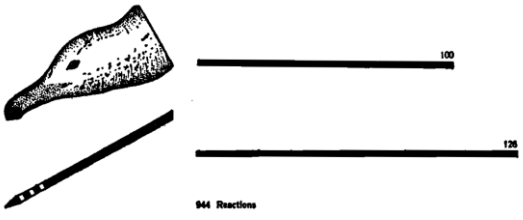
Experimental ethology

Is the red spot a classical releaser?



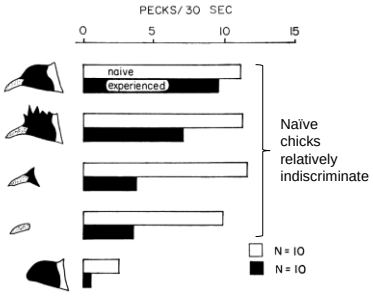
Experimental ethology

How to explain this?

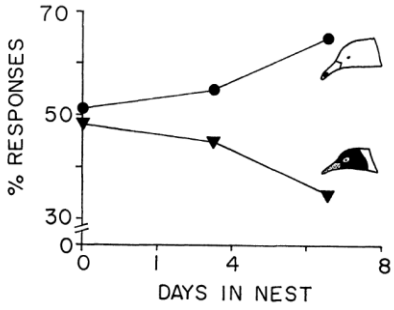


Experimental ethology

Jack Hailman
(1936-)

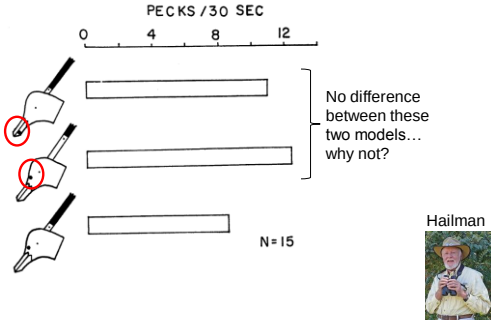


Experimental ethology



Hailman

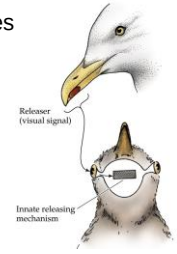
Experimental ethology



Hailman

Experimental ethology

1. Releasers are discrete features
2. Genes cannot encode pictures



Tinbergen's four "questions"

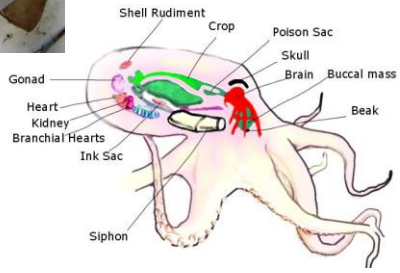
Animal behavior can be explained in terms of

a. causation
b. development
c. evolution
d. function

Why do cephalopods ink?

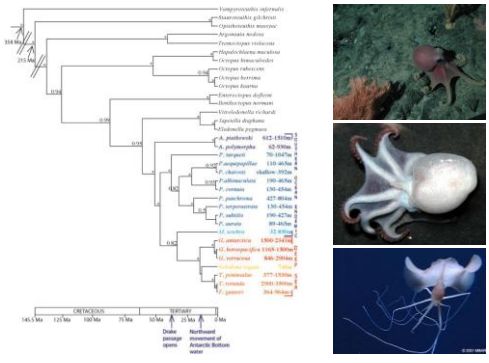
Causation

Ink production
tyrosine ⟶ melanin



Development

Evolution



Evolution

Function

Morgan's canon

"It was sympathetic help, such as man only among the higher Mammalia shows. The excitement and ardor with which they carried on their unflagging exertions for the rescue of their comrade could not have been greater if they had been human beings. This observation seems unequivocal as proving fellow-feeling and sympathy, so far as we can trace any analogy between the emotions of the higher animals and those of insects."

George Romanes
(1848-1894)

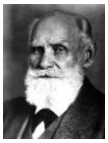
"In no case may we interpret an action as the outcome of the exercise of a higher psychical faculty, if it can be interpreted as the outcome of the exercise of one which stands lower in the psychological scale."

C. Lloyd Morgan
(1852-1936)

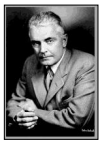
Criticisms of ethology

Pavlov's work provided fodder for critics of ethology

Comparative psychology


Ivan Pavlov (1849-1936)


Edward Thorndike (1874-1939)

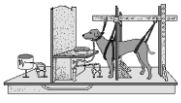

John B. Watson (1878-1958)


B.F. Skinner (1904-1990)

Comparative psychology

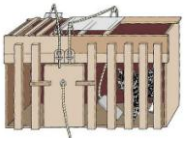
Placed primary emphasis on elucidating mechanisms of learning

Pavlov's experiments in classical conditioning →



Comparative psychology

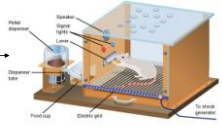
Thorndike's puzzle box →



"In the first place, most of the books do not give us a psychology, but rather a eulogy of animals. They have all been about animal intelligence, never about animal stupidity."

Comparative psychology

Skinner box (operant conditioning) →

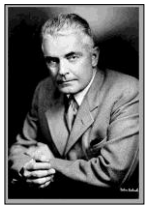



Skinner's "baby tender"

Behaviorism

Rise of the school of Behaviorism

"Give me a dozen healthy infants, well-formed, and my own specified world to bring them up in and I'll guarantee to take any one at random and train him to become any type of specialist I might select – doctor, lawyer, artist, merchant-chief and, yes, even beggar-man and thief, regardless of his talents, penchants, tendencies, abilities, vocations, and race of his ancestors."



"We are now almost at the point of throwing away the word 'instinct.'"

Modern animal behavior

Dichotomy between comparative psychology and ethology now blurred