
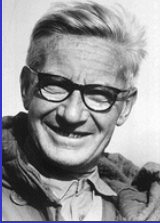
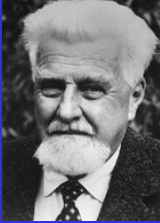



Aug 24, 2006


## PSY 3364 Animal Communication



### Ethology: The naturalistic study of behavior

<p>Niko Tinbergen (1907-1988)</p> 	<p>Konrad Lorenz (1903-1989)</p> 	<p>Karl von Frisch (1886-1982)</p> 
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### Niko Tinbergen (1907-1988)



- The “curious naturalist”
- noninvasive **field experiments**
- Studies of herring gull behavior, spatial learning in insects

### Niko Tinbergen (1907-1988)




- **Search image:** a hypothetical mental picture of a prey item used by a predator to search specifically for a cryptic, common, edible prey.



Red-tailed hawk

### Niko Tinbergen (1907-1988)

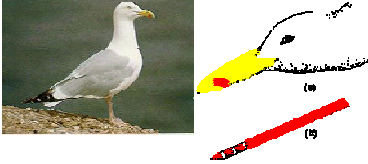
- **Sign stimulus** – the component of an action or object that triggers a fixed response in an animal (e.g., herring gull chick’s begging response)



Red dot

### Niko Tinbergen (1907-1988)

- **Sign stimulus** – the component of an action or object that triggers a fixed response in an animal (e.g., herring gull chick’s begging response)



## Innate or learned?

- Jack Hailman (1967) studied the begging response of herring gull chicks to two different models of adult birds: *herring gull* models and *laughing gull* models.

*Herring gull model*

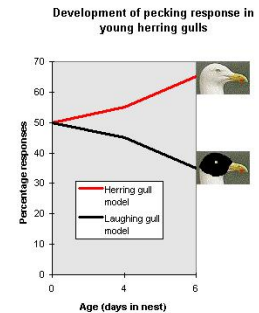


*Laughing gull model*

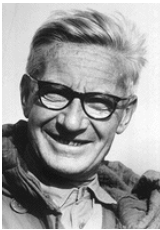


## Innate or learned?

- Hailman found that newly hatched herring gulls do not distinguish between the two models.
- However, at 6 days, they can reliably tell the difference.



## Niko Tinbergen (1907-1988)

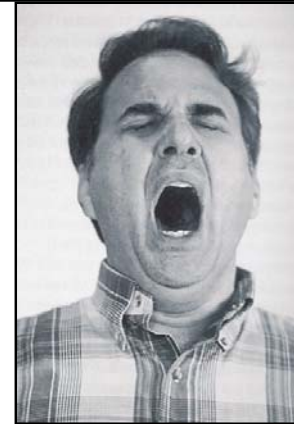


- **Releaser** – a sign stimulus given by one animal to another as a social signal (e.g. *pheromones* – chemical communication signals)

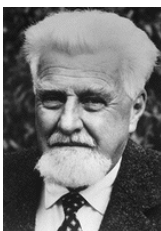
White-tailed deer alarm signal



## Yawning – A Releaser?

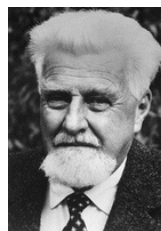


## Konrad Lorenz (1903-1989)



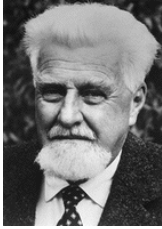
- Studied how innate and acquired components of behavior are integrated
- Emphasized the importance of behavior for taxonomy
- Studied **imprinting** in geese
- Origins and basis of animal and human **aggression**

## Konrad Lorenz (1903-1989)



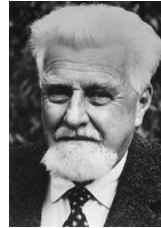
- **Fixed action pattern** – innate, stereotyped response triggered by a well-defined simple stimulus. Once activated, the response is always performed to completion.

## Konrad Lorenz (1903-1989)

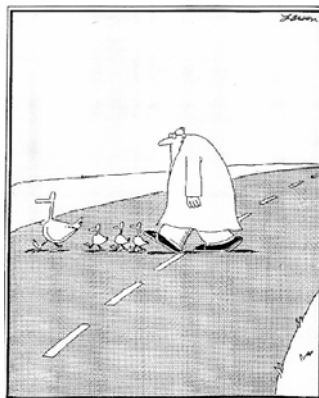
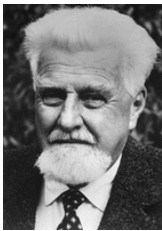


- **Imprinting** – form of learning in which individuals exposed to certain key stimuli, usually during an early stage of development, form an association with the object and may later show sexual behavior toward similar objects.

## Konrad Lorenz (1903-1989)

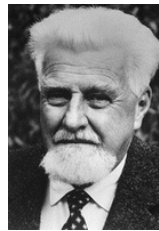


## Konrad Lorenz



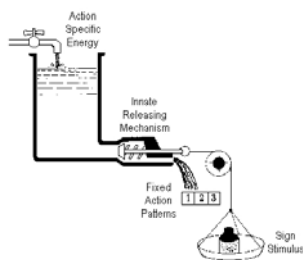
When imprinting studies go awry

## Konrad Lorenz (1903-1989)



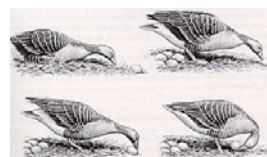
- **Critical period** for learning – a period in the life span of an individual (in birds, a short period just after hatching) where learning or imprinting is greatly facilitated.

- **Fixed action pattern:** an innate, highly stereotyped response triggered by a well-defined simple stimulus; once activated, the response is performed in its entirety.



## Egg rolling in geese

Lorenz & Tinbergen (1939)



Graylag Goose

- **Instinct:** a behavior pattern that reliably develops in individuals that receive adequate nutrition, and that is given in functional form on its first performance.

## Honesty and communication

- Information conveyed by animal signals can provide information about the environment or the sender's intentions (future course of action).



## Honesty and communication

- Most (but not all) communication signals are "honest" (reliable). Why is this?
- **Zahavi (1975)** argued that receivers will not respond (and hence communication will not evolve) if the signal is "dishonest" or unreliable.

## Honesty and communication

- **Handicap hypothesis:** some signals, like the peacock's tail, are costly to produce. Since they are costly, they are more likely to be reliable (and this is why female peacocks prefer them).

Zahavi argued that costly signals are more likely to evolve; he describes these as *handicaps*.



## Intention Movements

- Ethologists proposed that some communication signals originate from movements made when the animal is getting ready to perform a particular behavior. These movements are called **intention movements**.
- Examples: bared teeth display in dogs; upright threat posture in herring gulls



## Displacement Behavior

- Ethologists observed that animals may sometimes engage in "irrelevant" activities when they experience conflict. They called these redirected activities **displacement behaviors**.
- Examples: cat grooms itself when prevented from reaching food; courtship begging in birds

## Ritualization

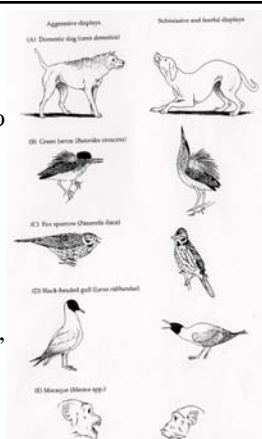
- Evolutionary process that transforms an incidental cue/behavior pattern into a true communication signal (Tinbergen, 1952).
    - **Simplification** or reduction in components
    - **Exaggeration** of the remaining components
    - **Repetition** of the signal
    - **Stereotypy** – reduction in the signal variance
- e.g. courtship feeding in pheasants

## Principle of antithesis

- Darwin proposed that some communication signals arise (evolve) because animals are divided between conflicting tendencies or impulses (e.g. between fear and aggression).
- The **principle of antithesis** states that signals with opposite messages tend to be opposite in form.

## Antithesis

- Opposition between two conflicting emotional states (attack vs. flee)
- Displays often show extremes in posture, orientation, extent of feather erection in birds, or fur in mammals



## Altruism

- **Altruism** is any form of behavior that provides a **benefit** for another individual at a **cost** to the individual performing the action (self sacrifice).



## Lemmings

- Smallest Arctic mammal
- Population fluctuations, 4-year cycles
- Lemmings do not hibernate; survive -25°C temperatures by **subnivean** ("under snow") foraging
- Population crashes affect predator density (snowy owl, Arctic fox)
- Norwegian lemmings migrate from mountainous regions; occasionally climb onto the pack ice (but no evidence for "suicidal" behavior)



Photo: David Gray



Source: Canadian Wildlife Service

<http://www.cws-sc.gc.ca/hww-fap/lemming/lemming.html>

## Reciprocal altruism

- **Reciprocal altruism:** sacrifices made by one individual that benefit another individuals that is later reciprocated, so that *both* gain in the long run. Requires that the two individuals recognize each other as individuals.

### Kin selection

- **Kin selection** is the process that leads to changes in gene frequencies in the population as a result of reciprocal, mutually beneficial actions among related individuals (and who typically live in social groups)

### Individual and group selection

- **Fitness** – *the more fit an individual is, the higher his or her chances of surviving and propagating his or her genetic blueprint.*
- **Individual lifetime fitness** – reproductive output; product of the animal's lifespan and number of offspring produced (**fecundity**).

### Social Behavior

- Social animals live together in **groups** - this practice may lead them to act or behave in ways that facilitate the survival and reproduction of their close **relatives** as well as themselves.
- *Fish traveling in schools*
- *Birds with helpers at the nest*

### Inclusive fitness

- To measure fitness it may be helpful to include close relatives as well as the animal itself.
- **inclusive fitness** is calculated from the frequencies of gene survival among a group of genetically related individuals.

### Group selection

- In the 1960s, population biologists began to consider another possible mechanism, **group selection**, that they postulated might also contribute to genetic change. The idea of group selection is that the group, not the individual, is the unit of selection.

### The problem with group selection

- Behavior that is strictly “for-the-good-of-the-species” (such as lemmings committing suicide to make room for other lemmings) will never emerge if there is an alternative, selfish behavior that does not require self-sacrifice.
- “Suicidal lemmings” would quickly die out in the population, to be replaced by selfish, non-suicidal lemmings.

## Perspectives in the study of animal communication

- **Comparative Psychology** - using animals to study human behavior (Thorndike, Watson, B.F. Skinner)
- **Behavioral Ecology** - the study of how animals use behavior to interact with their environments (J. Krebs & N.B. Davies)
- **Sociobiology** - the study of social behavior from an adaptive evolutionary perspective (E.O. Wilson)
- **Neuroethology** - the study of neural adaptations that underlie behavior

## The horse

**Kingdom:** Animalia

**Phylum:** Chordata

**Subphylum:** Vertebrata

**Class:** Mammalia

**Order:** Perissodactyla

**Family:** Equidae

**Genus:** *Equus*

**Species:** *caballus*

