



# Animal Behavior



# What is behavior?

## ■ Behavior

- ◆ everything an animal does & how it does it
  - response to stimuli in its environment
- ◆ **innate**
  - inherited, “instinctive”
  - automatic & consistent
- ◆ **learned**
  - ability to learn is inherited, but the behavior develops during animal’s lifetime
  - variable & flexible
    - ◆ change with experience & environment



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are needed to see this picture.





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# Why study behavior?

- Evolutionary perspective...
  - ◆ part of phenotype
  - ◆ acted upon by natural selection
    - lead to greater fitness?
    - lead to greater survival?
    - lead to greater reproductive success?



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# What questions can we ask?



## ■ Proximate causes

- ◆ immediate stimulus & mechanism
- ◆ “how” & “what” questions

## ■ Ultimate causes

- ◆ evolutionary significance
- ◆ how does behavior contribute to survival & reproduction
  - adaptive value
- ◆ “why” questions

male songbird  
→ what triggers singing?  
→ how does he sing?  
→ why does he sing?



Courtship behavior in cranes  
A → what...how... & why questions

→ how does daylength influence breeding?  
→ why do cranes breed in spring?

# Evolutionary perspective

- Adaptive advantage?

- ◆ innate behaviors

- automatic, fixed, “built-in”, no “learning curve”
- despite different environments, all individuals exhibit the behavior
- ex. early survival, reproduction, kinesis, taxis

- ◆ learned behaviors

- modified by experience
- variable, changeable
- flexible with a complex & changing environment

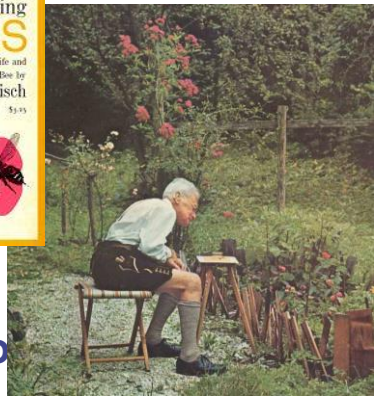
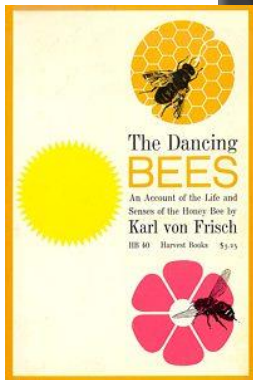


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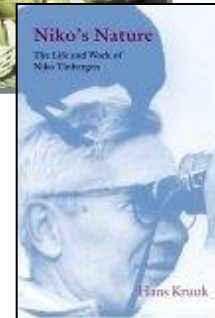
# Ethology

## pioneers in the study of animal behavior

Karl von Frisch



Niko Tinbergen



Konrad Lorenz





# Innate behaviors

## ■ Fixed action patterns (FAP)

- ◆ sequence of behaviors essentially unchangeable & usually conducted to completion once started

## ◆ sign stimulus

- the releaser that triggers a FAP

male sticklebacks exhibit aggressive territoriality



**PROXIMATE CAUSE:** The red belly of the intruding male acts as a sign stimulus that releases aggression in a male stickleback.

**ULTIMATE CAUSE:** By chasing away other male sticklebacks, a male decreases the chance that eggs laid in his nesting territory will be fertilized by another male.

Actual colour & shape

Male stickleback:  
red belly,  
bluish-white back



Model characteristics

Red belly



Reaction of males to model

Attack

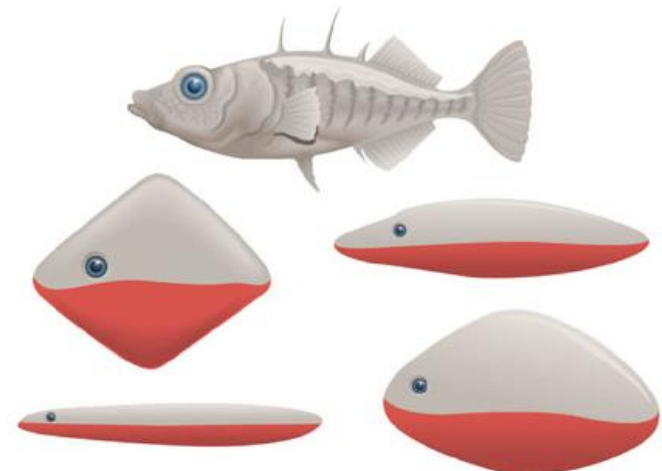
Female stickleback:  
greyish-green body,  
swollen silvery belly



Swollen belly



Court



**attack on red belly stimulus**  
**court on swollen belly stimulus**



# Fixed Action Patterns (FAP)



egg rolling in geese



Do humans exhibit Fixed Action Patterns?

The “eyebrow-flash”





# Innate: Directed movements

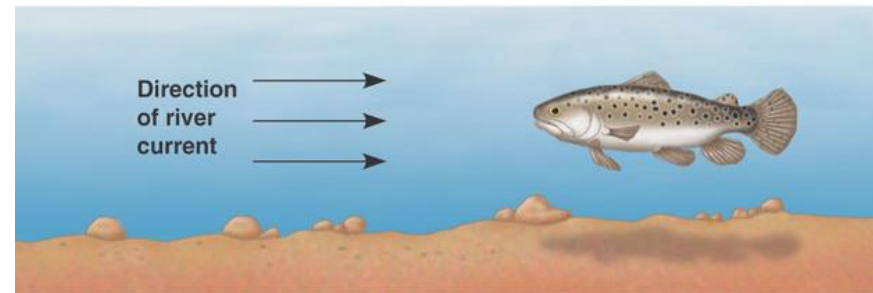
## ■ Taxis

- ◆ change in direction
- ◆ automatic movement toward (positive taxis) or away from (negative taxis) a stimulus

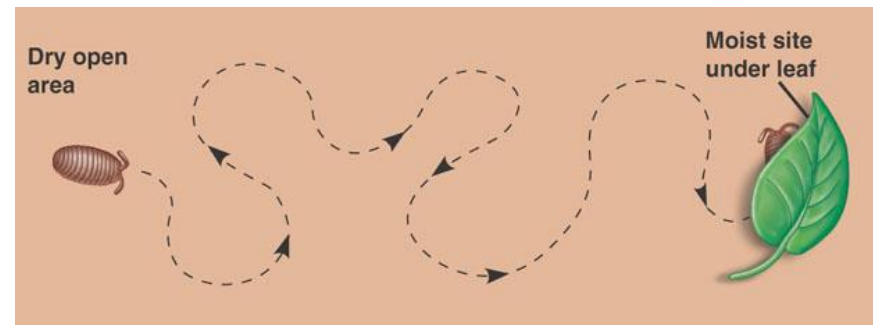
- phototaxis
- chemotaxis

## ■ Kinesis

- ◆ change in rate of movement in response to a stimulus



(b) Positive rheotaxis keeps trout facing into the current, the direction from which most food comes.



(a) Kinesis increases the chance that a sow bug will encounter and stay in a moist environment.

# Complex Innate behaviors

## ■ Migration

- ◆ “migratory restlessness” seen in birds bred & raised in captivity
- ◆ navigate by sun, stars, Earth magnetic fields

Sandpiper



Bobolink

ancient  
fly-  
ways



Golden plover



Monarch  
migration



# Innate & Learning: Imprinting



- Learning to form social attachments at a specific **critical period**
  - ◆ both learning & innate components



**PROXIMATE CAUSE:** During an early, critical developmental stage, the young geese observe their mother moving away from them and calling.

**ULTIMATE CAUSE:** On average, geese that follow and imprint on their mother receive more care and learn necessary skills, and thus have a greater chance of surviving than those that do not follow their mother.



# Conservation

Conservation biologists have taken advantage of imprinting by young whooping cranes as a means to teach the birds a migration route. A pilot wearing a crane suit in an Ultralight plane acts as a surrogate parent.



# Critical period

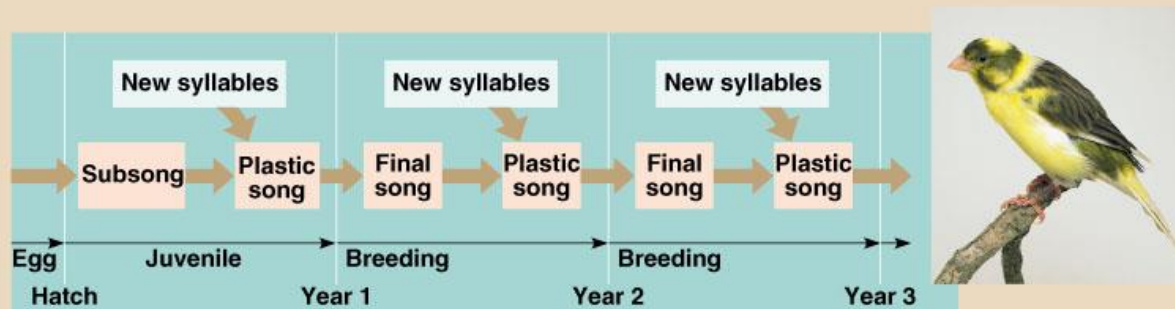
- Sensitive phase for optimal imprinting
  - ◆ some behavior must be learned during a receptive time period



As a brood parasite, the Cuckoo never learn the song of their species as a nestling. Song development is totally innate.



(a) Learning in the sensitive period



(b) Open-ended learning



imprinting/critical period in humans?

# Types of learning

1. Habituation
2. Imprinting (innate)
3. Spatial
4. Associative
5. Social
6. Problem solving



# Learned behavior

## ■ Associative learning

- ◆ learning to associate a stimulus with a consequence

### ■ operant conditioning

- ◆ trial & error learning
- ◆ associate behavior with reward or punishment
- ◆ ex: learning what to eat

### ■ classical conditioning

- ◆ Pavlovian conditioning
- ◆ associate a “neutral stimulus” with a “significant stimulus”



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# Classical conditioning

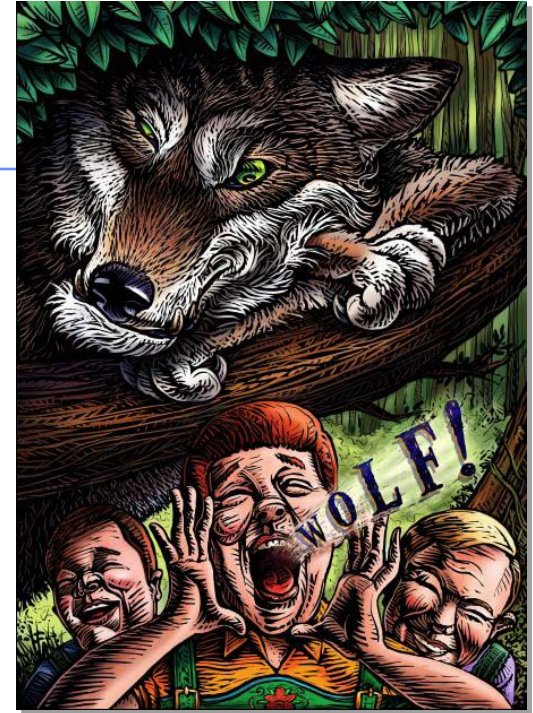
## ■ Ivan Pavlov's dogs

- ◆ connect reflex behavior (salivating at sight of food) to associated stimulus (ringing bell)



# Learning: Habituation

- **Loss of response to stimulus**
  - ◆ “cry-wolf” effect
  - ◆ decrease in response to repeated occurrences of stimulus
  - ◆ enables animals to disregard unimportant stimuli
    - ex: falling leaves not triggering fear response in baby birds





# Learning: Problem-solving

- Do other animals reason?



chimpanzee

tool use



sea otter

problem-solving



crow



# Spatatial

- Creating –cognitive maps of areas (girl directions)



# Social Learning

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- “I learned it by watching you”
- Learning by watching others...
- Often how animals teach their young to hunt



# Social behaviors

- Interactions between individuals
  - ◆ develop as evolutionary adaptations
  - ◆ communication / language
  - ◆ agonistic behaviors
  - ◆ dominance hierarchy
  - ◆ cooperation
  - ◆ altruistic behavior



# Language



- Honey bee communication
  - ◆ dance to communicate location of food source
  - ◆ waggle dance

Let's go to the videotape!



(a) Bees clustering around a recently returned worker



(b) Round dance



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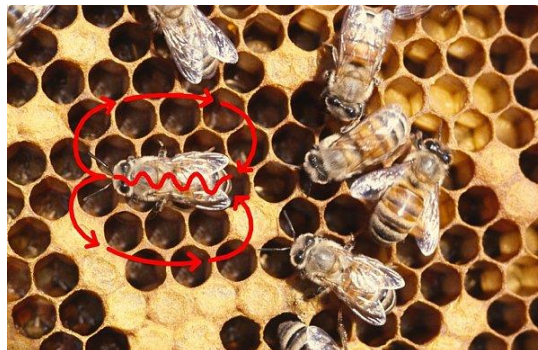
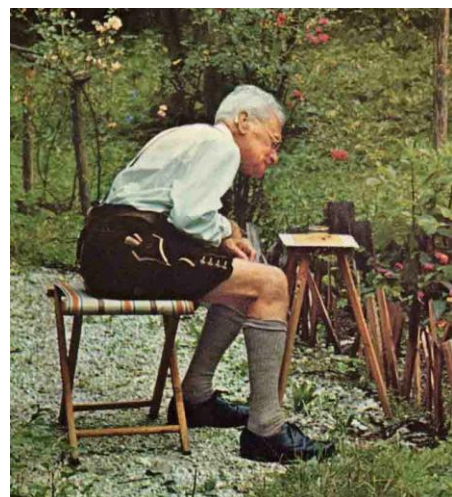
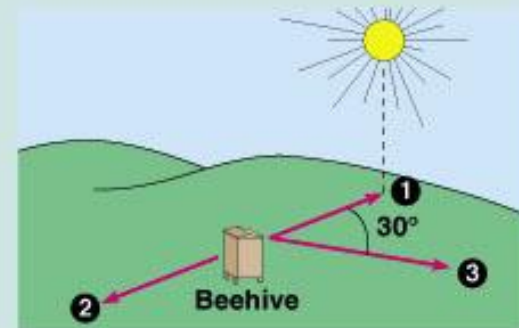


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3

(c) Waggle dance





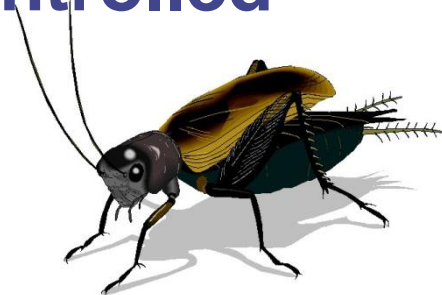
# Communication by song

## ■ Bird song

- ◆ species identification & mating ritual
- ◆ mixed learned & innate
- ◆ critical learning period

## ■ Insect song

- ◆ mating ritual & song
- ◆ innate, genetically controlled



Red-winged blackbird





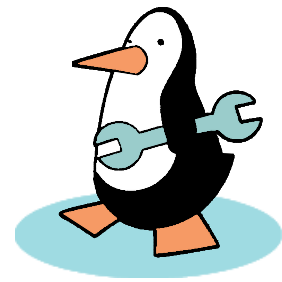
# Social behaviors

## ■ Agonistic behaviors

◆ threatening & submissive rituals

■ symbolic, usually no harm done

◆ ex: territoriality, competitor aggression



# Social behaviors

- Dominance hierarchy
  - ◆ social ranking within a group
    - pecking order





# Social behaviors

## ■ Cooperation

- ◆ working together in coordination

Pack of African dogs  
hunting wildebeest  
cooperatively



White pelicans “herding”  
school of fish

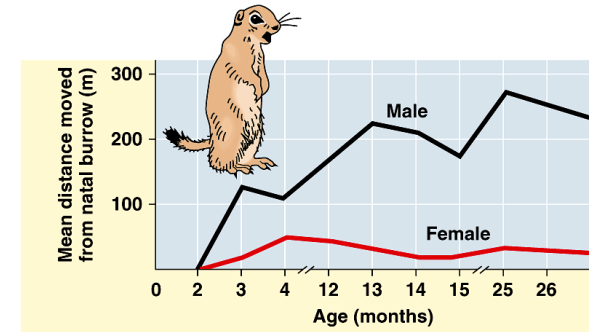




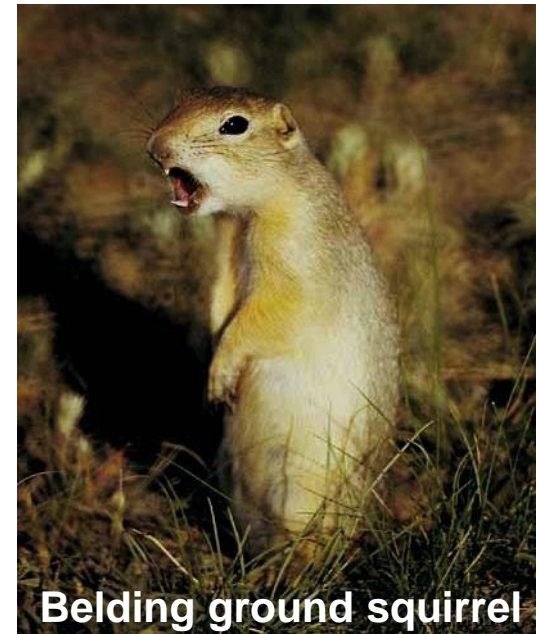
# Social behaviors

## ■ Altruistic behavior

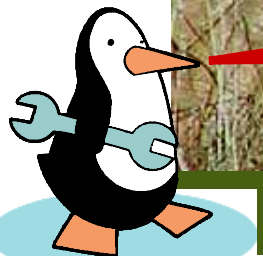
- ◆ reduces individual fitness but increases fitness of recipient
- ◆ kin selection
  - increasing survival of close relatives passes these genes on to the next generation



How can this be of adaptive value?



Belding ground squirrel

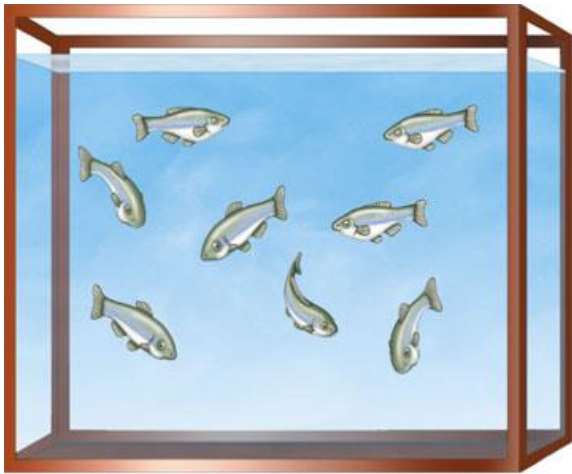


# Social interaction requires communication

## ■ Pheromones

◆ chemical signal that stimulates a response from other individuals

- alarm pheromones
- sex pheromones



(a) Minnows are widely dispersed in an aquarium before an alarm substance is introduced.



(b) Within seconds of the alarm substance being introduced, minnows aggregate near the bottom of the aquarium and reduce their movement.





human sex pheromone?

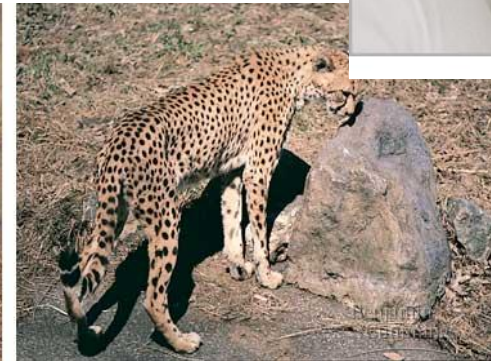
# Pheromones



Female mosquito use CO<sub>2</sub> concentrations to locate victims



marking territory



Spider using moth sex pheromones, as allomones, to lure its prey



The female lion lures male by spreading sex pheromones, but also by posture & movements





# Colonial mammals

**convergent evolution:**  
bees, ants, termites...  
mole rats

## ■ Naked mole rats

- ◆ underground colony, tunnels
- ◆ queen, breeding males, non-breeding workers
- ◆ hairless, blind

“Picture a hot dog that's been left in a microwave a little too long...add some buck teeth at one end, and you've got a fairly good idea of what a Naked Mole Rat looks like.”



**Any  
Questions??**

