

**Learning establishes specific  
links between experience  
and behavior**

(Examples: Tinbergen's digger wasp nest location  
experiment & Lorenz's imprinting geese)

# Learning is behavior based on experience:

- **Learning:** A change in an animal's behavior resulting from experience.

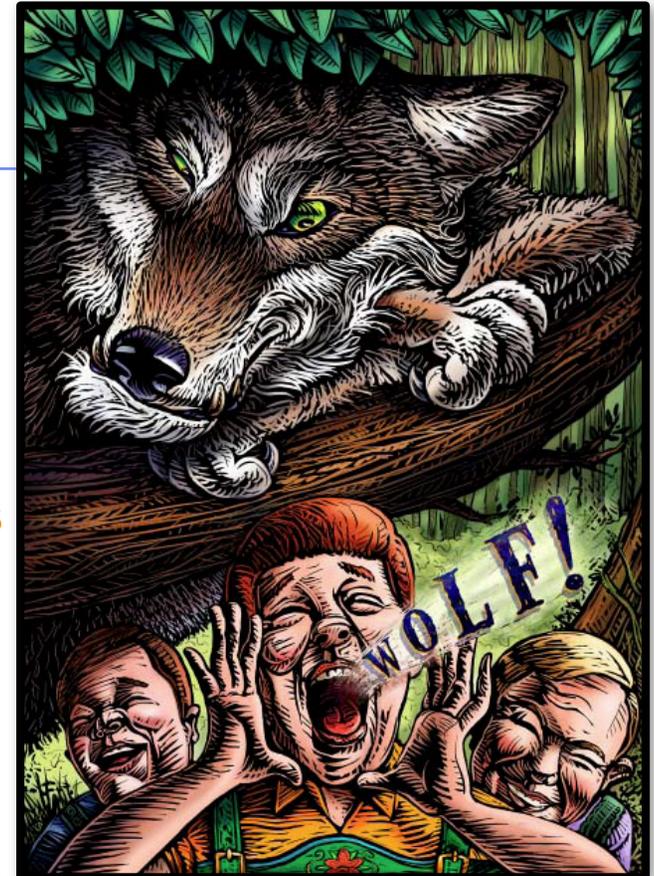


- One of the simplest forms of learning is **habituation**
  - ◆ **Habituation:** Type of learning in which an animal learns ***NOT*** to respond to a repeated stimulus that conveys ***little or no important information.***
- Why is habituation beneficial to an animal?

**Hypothesis:** Allows an animal's nervous system to focus on stimuli that signal food, mates or real danger, and ***not waste time or energy on other, less important stimuli.***

# Learning: Habituation

- Involves the loss of a response to a stimulus
  - ◆ “cry-wolf” effect
    - decrease in response to repeated occurrences of stimulus
    - enables animals to disregard unimportant stimuli
  - ◆ Animal’s nervous system is able now to focus on important stimuli for survival and reproduction, like food, mates, or real dangers
    - Ex: falling leaves not triggering fear response in baby birds
  - ◆ Habituation **increases organism’s fitness**



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## Learning is behavior based on experience

Behaviors often have learnt and unlearnt (innate) parts.

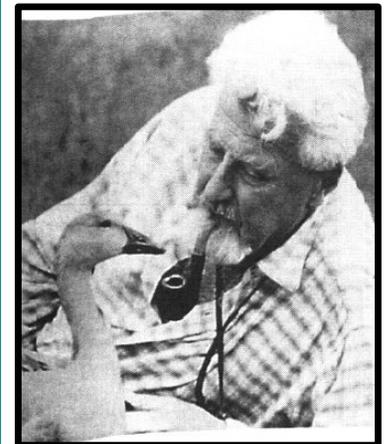
**Imprinting:** The formation at a specific stage in life a long-lasting behavioral response to a particular individual or object. *Learning that is limited to a specific time period in life and that is usually irreversible.*

**Significance:** Important in forming strong bonds between mother and infant.

Study by **Konrad Lorenz:** Divided a group of eggs.

**Control Group:** Stayed with mother goose.

**Experimental Group:** Placed in incubator and spent time w. Konrad the first two days after hatching.



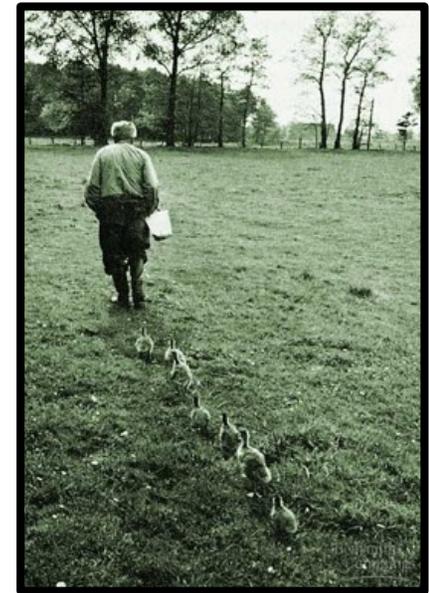
## Learning is behavior based on experience:

**Control Group:** Showed normal Behavior: following mom, mating and interacting with other geese.

**Experimental Group:** Showed **no** recognition of their mother or other adults of own species.

Preferred the company of Lorenz and humans over geese.

***Imprinting occurs during a Critical Learning Period (sensitive period)!***



# Innate & Learning: Imprinting



- Imprinting is distinguished from other types of learning by having a sensitive period, a **critical period**.
  - ◆ There is a limited developmental phase when certain behaviors can be learned.
  - ◆ At this time:
    - Young imprint on their parents
    - Young learn basic behaviors of their species
    - Parents learn to recognize offspring.



## ■ Problem & solution for conservation.

- ◆ Whooping cranes imprinted on Sandhill crane foster parents and never formed a mating pair-bond with another whooping cranes

Captive breeding programs now isolate young cranes and expose them to the sights and sounds of members of their own species

- ◆ Also, young whooping cranes are imprinted on humans in “crane suit”



# 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.

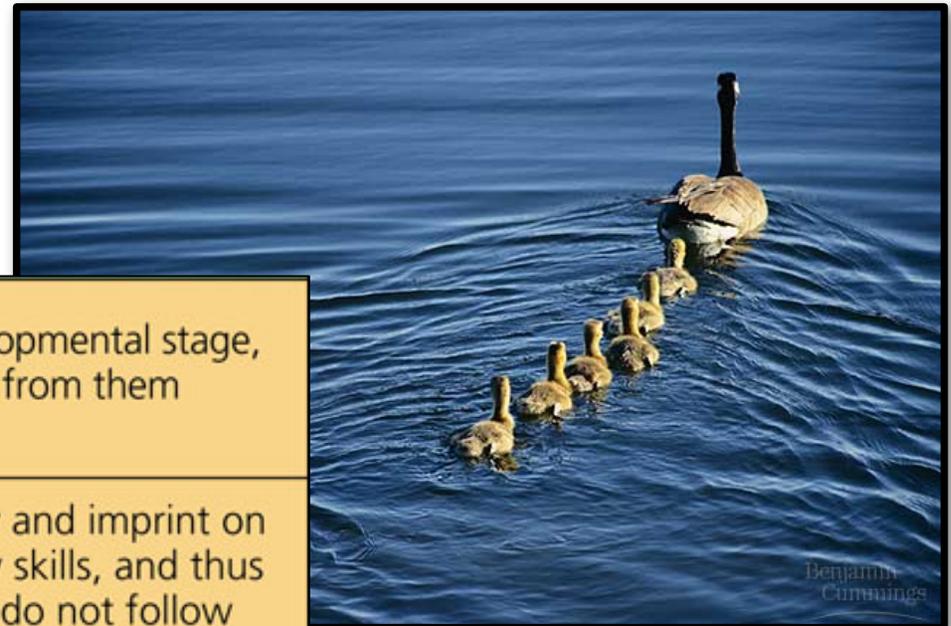
Young learn to follow “parents” along new migration routes.



# Innate & Learning: Imprinting



- The tendency to respond is innate
- The outside world provides the imprinting stimulus
  - ◆ In Konrad's geese, principal imprinting stimulus is a nearby object that is moving away from young.
    - Involves both learning & innate components
- What's the cause of imprinting?



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

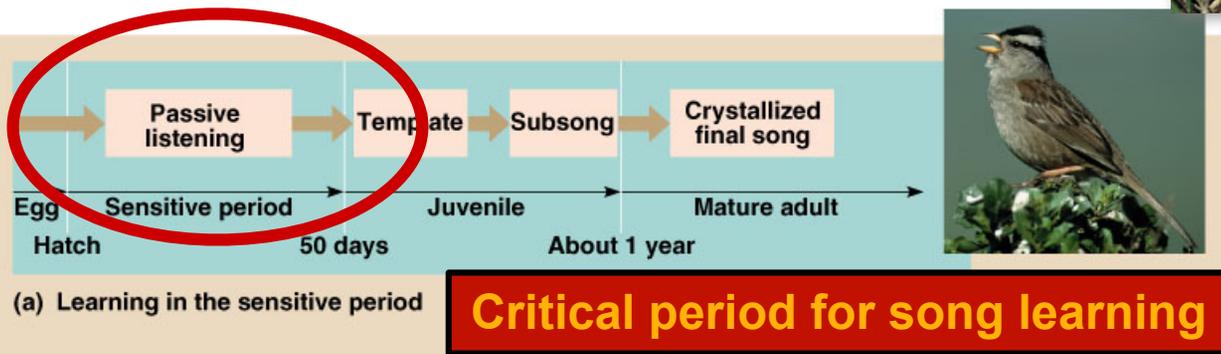
**ULTIMATE CAUSE:** On average, geese that follow and imprint on their mother receive more care and learn necessary skills, and thus have a greater chance of surviving than those that do not follow their mother.

# Critical (sensitive) period

- Sensitive phase for optimal imprinting
  - ◆ **SOME** behavior must be learned during a receptive time period
    - Once this critical period passes, proper learning of these behaviors can no longer occur



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



imprinting/critical period in humans?

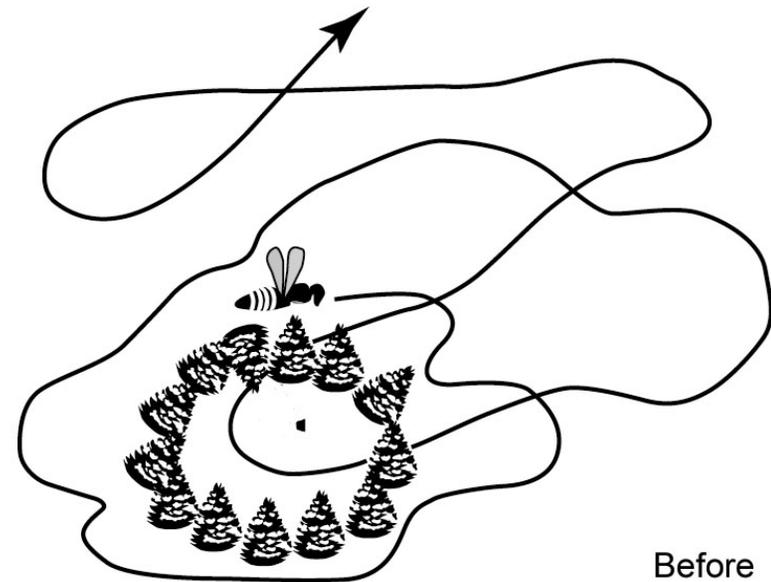
# Spatial Learning in Digger Wasps

- An organism's fitness may be enhanced by the capacity for spatial learning
  - ◆ The establishment of a memory that reflects the environment's spatial structure and variations.
    - Organisms may be able to build cognitive maps = representations in the nervous system of the spatial relationship between objects in the surroundings
- 1920 - Dutch ethologist Niko Tinbergen noticed (observation) that female digger wasps build nests in small burrows in the sand
  - ◆ She covers it with sand before she flies out to hunt bees to bring back to feed her young.
- Question: How does each wasp keep track of her nests?

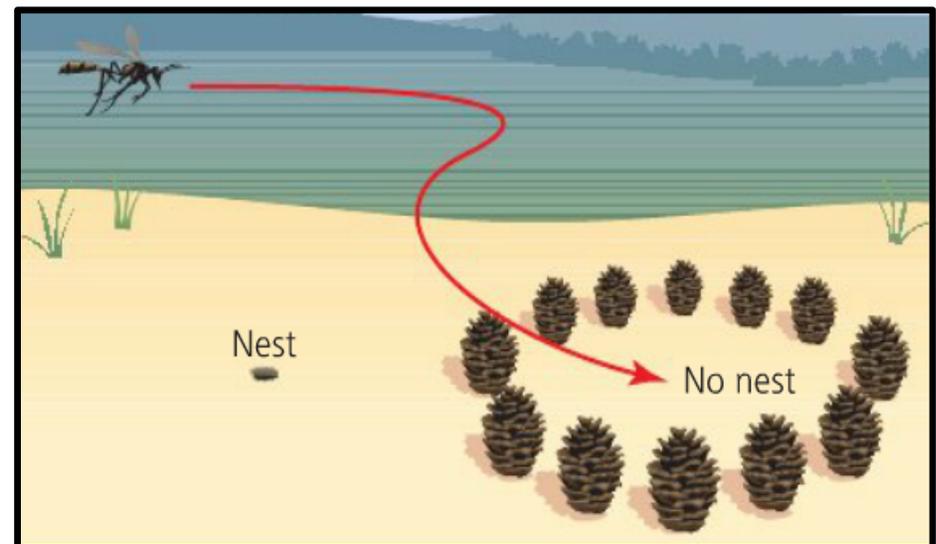


# Digger Wasps

- **Hypothesis:**
  - ◆ Wasps use **landmarks (location indicators)** to locate their burrows.
- **Experiment:**
  - ◆ To test this hypothesis, he placed a circle of pine cones around a nest.
- **Observation:**
  - ◆ She flew around them when she left as if getting her bearings.
    - Then he moved the cones.
- **Results:**
  - ◆ The wasp flew to the center of the pine cones not her actual nest.



Before



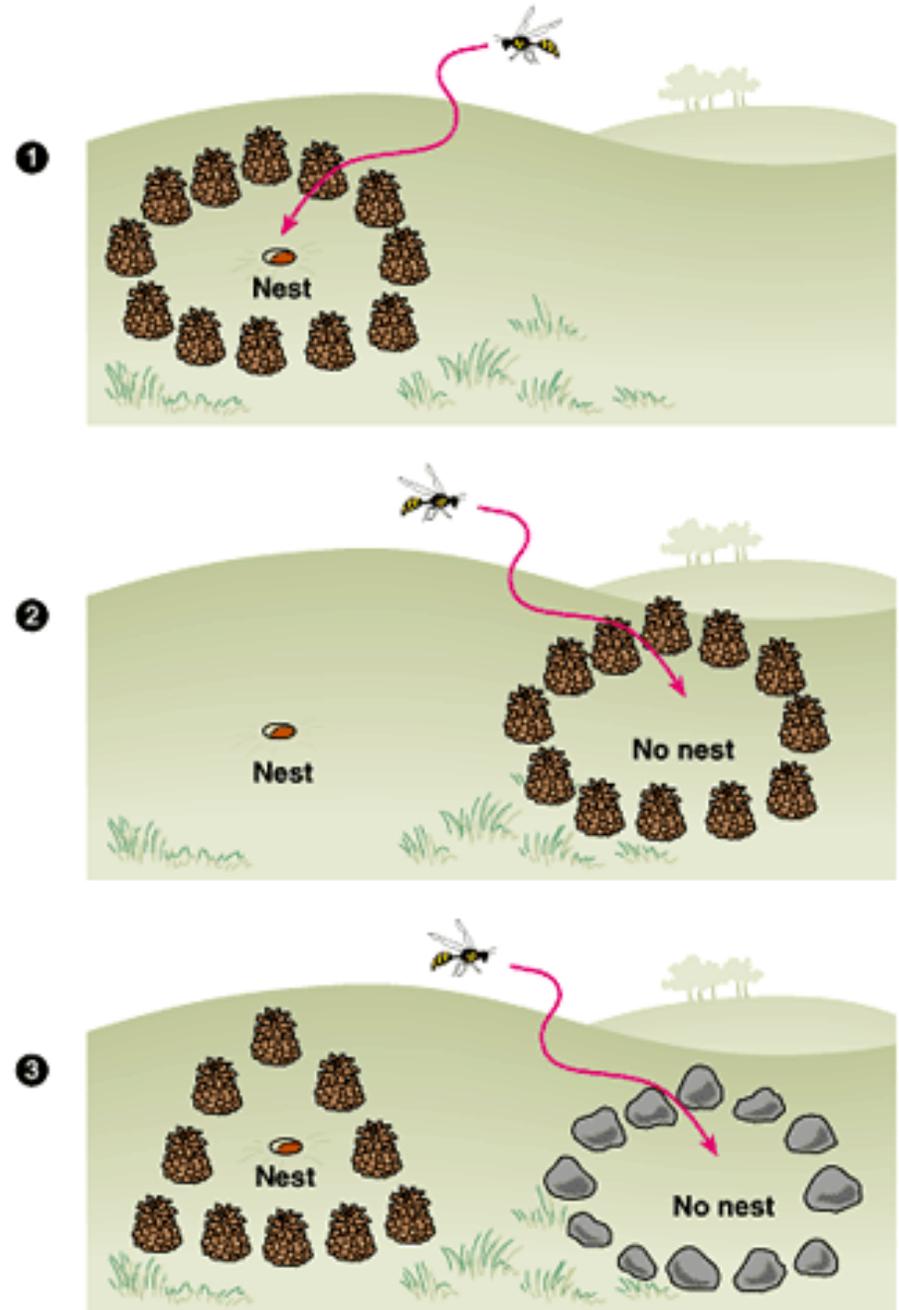
# Digger Wasps

- **Conclusion:**
  - ◆ **The digger wasp uses landmarks to find her next and she can learn new ones.**
- **This invoked a new question:**
  - ◆ **Do the wasps respond to the pine cones or just to the geometric arrangement of them?**



# Digger Wasps

- He put a circle of stones next to the nest and a triangle of pine cones around the nest.
  - ◆ Sure enough the wasp flew to the stones.
- Digger wasps respond to the arrangement rather than the landmark itself.



# Types of Causes for behavior



## Proximal (Immediate) Causes:

- Explanation in terms of the organisms immediate interactions with the environment.
- “how” does the organisms do what it does.
- Ex: The immediate cause of the wasps nest-locating behavior is her ability to recognize arrangements of landmarks.

## Ultimate Causes:

- Explanation based on the organism’s evolutionary adaptations.
- “How did the behavior first arise” “What is the function of the behavior”
  - ◆ How does it help the organisms survive and reproduce?



# Learned behavior - associating experiences

## ■ Associative learning

- ◆ Involves learning to associate a stimulus with a consequence

### 1. operant conditioning

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

### 2. classical conditioning

- ◆ Pavlovian conditioning
  - associate a “neutral stimulus” with a “significant stimulus”
  - Leading to an arbitrary stimulus becoming associated with a particular outcome



**Conditioning** - Learning that a particular arbitrary stimulus or response is linked to a reward or punishment.

**Classical Conditioning - Pavlov**

A meaningless stimulus is associated with a meaningful stimulus that is paired to a reward or punishment.

1. *Dog Salivates when it sees food*
2. *Dog does not salivate when it hears a bell*
2. *Bell rung every time dog was fed*
3. *Over time, dog associates bell with food and salivates when it hears the bell **EVEN when no food is present***



**Existing behavior is shaped by a new stimulus**

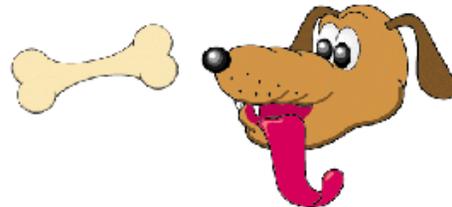
# Classical conditioning

## Ivan Pavlov's dogs

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

Before conditioning

**FOOD (UCS)**      **SALIVATION (UCR)**



**BELL**      **NO RESPONSE**



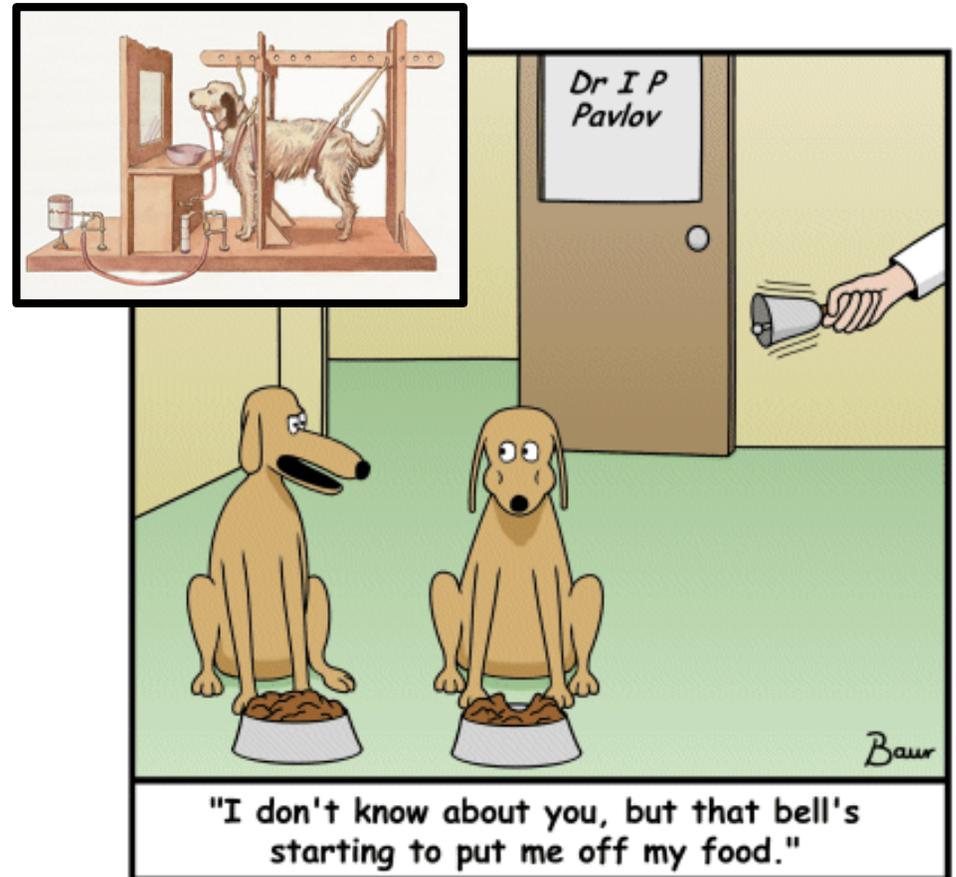
During conditioning

**BELL + FOOD (UCS)**      **SALIVATION (UCR)**



After conditioning

**BELL (CS)**      **SALIVATION (CR)**



# Classical Conditioning

1. Before conditioning



→  
response



Food

Salivation

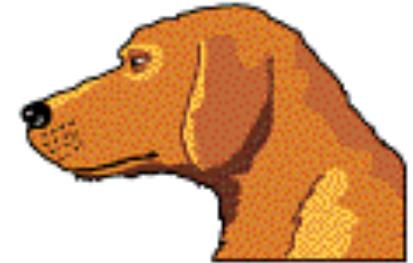
**Unconditioned stimulus**

**Unconditioned response**

2. Before conditioning



→  
response



Tuning fork

No salivation

**Neutral stimulus**

**No conditioned response**

3. During conditioning



→  
response



Tuning fork

Food

Salivation

**Unconditioned response**

4. After conditioning



→  
response



Tuning fork  
**Conditioned stimulus**

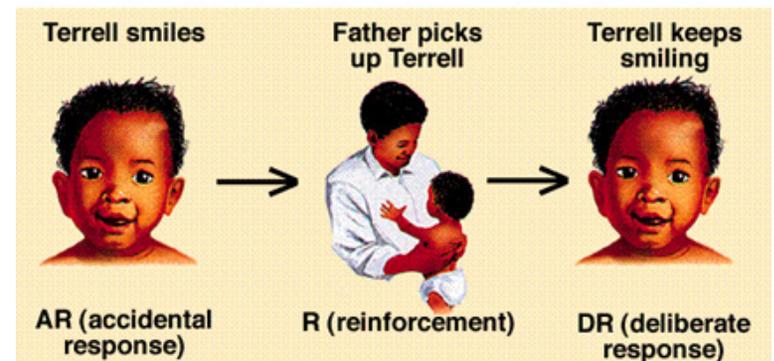
Salivation  
**Conditioned response**

# Conditioning - Learning that a particular stimulus or response is linked to a reward or punishment.

## Operant Conditioning - Skinner

- **Trial-and-Error Learning.**
  - ◆ A much more common form of conditioning
- **An animal learns to associate one of its own behavioral acts with a positive or negative effect.**
  - ◆ *Animal will repeat the behavior if the response was a reward.*
  - ◆ *Animals will avoid the behavior if the response was harmful.*

### Operant, or Instrumental Conditioning

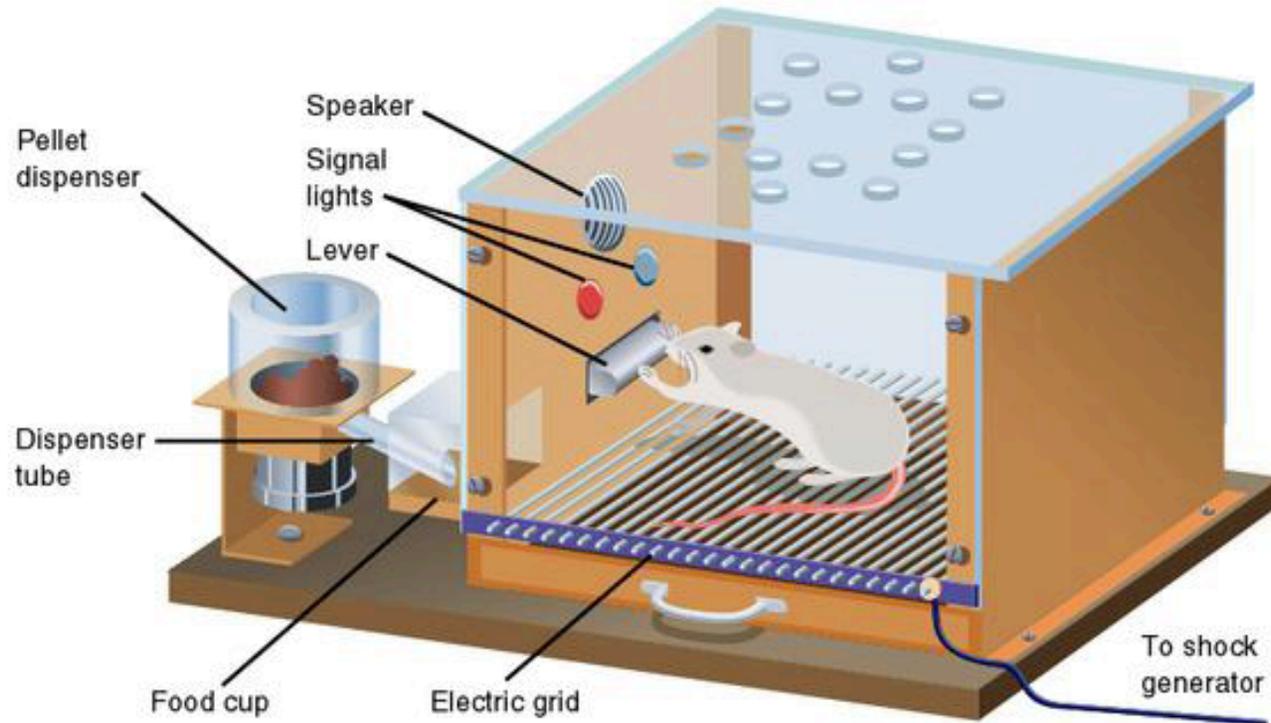


**B. F. Skinner**



# Operant conditioning

## ■ Skinner box



**mouse learns to associate behavior (pressing lever) with reward (food pellet)**

# Operant Conditioning

## Positive reinforcements

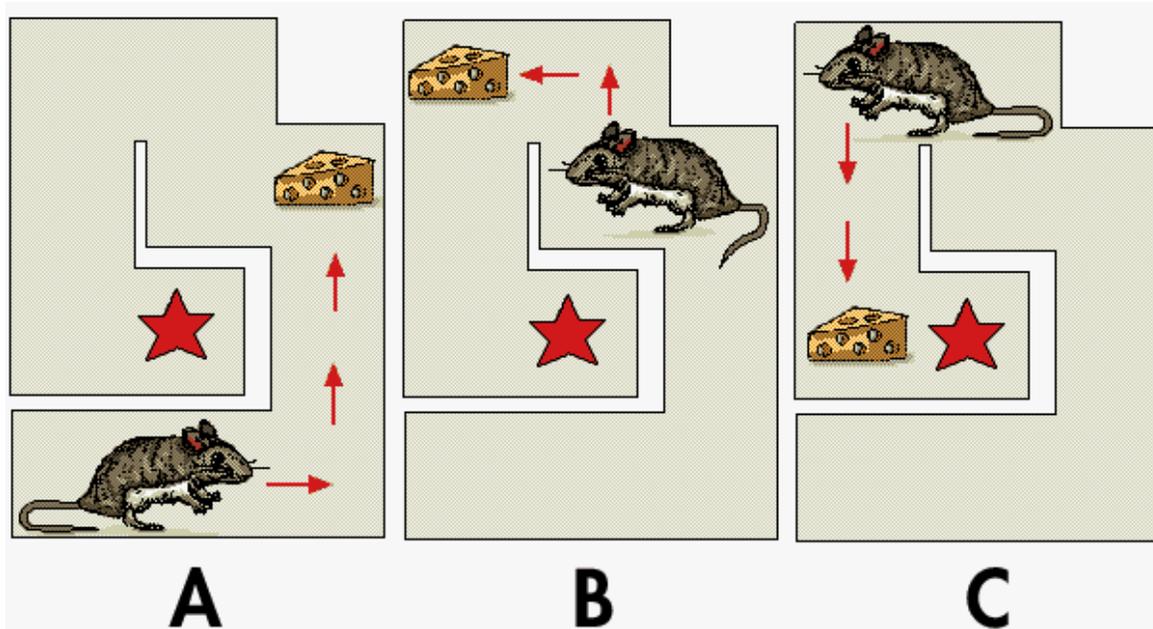
*Ex: Baby repeats behavior if they encouraged with clapping.*



**Operant conditioning, pioneered by American psychologist B. F. Skinner, is the process of shaping behavior by means of reinforcement and punishment.**

# Operant Conditioning

## Positive reinforcements



**This illustration shows how a mouse can learn to maneuver through a maze. The mouse is rewarded with food when it reaches the first turn in the maze (A). Once the first behavior becomes ingrained, the mouse is not rewarded until it makes the second turn (B). After many times through the maze, the mouse must reach the end of the maze to receive its reward (C).**

# Operant Conditioning



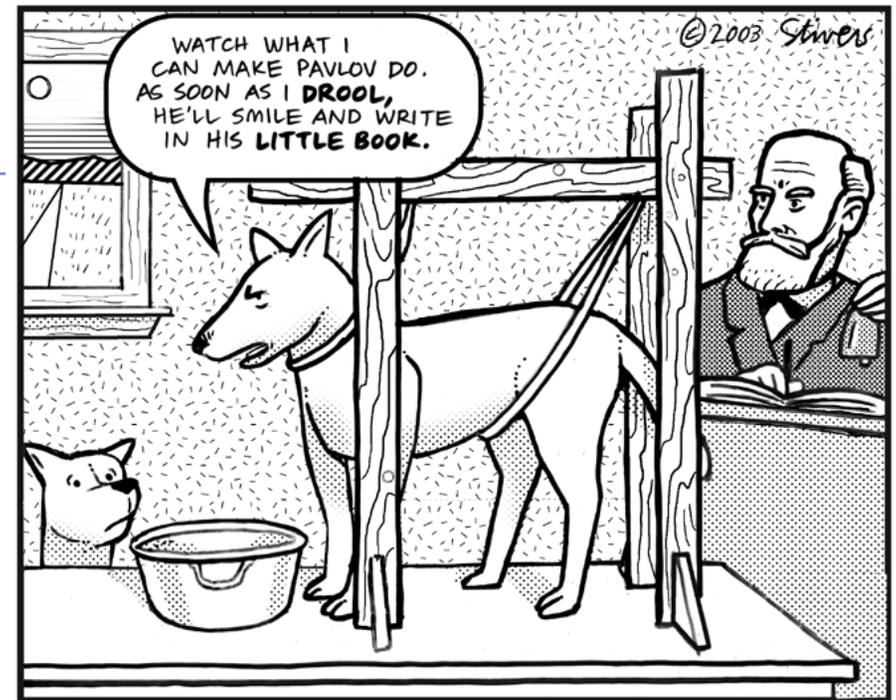
- ***Negative reinforcement is not the same as punishment.***
- **In punishment, a negative stimuli is applied.**  
**Ex: you get a spanking**
- **In negative reinforcement a stimulus is withdrawn.**  
**Ex: Favorite toy taken away (removed) make the baby cry and will thus the baby's behavior.**



# Associative Learning



"The light goes on. I pull the lever. The food comes.  
It's a full life."



## In Classical Conditioning:

*Stimulus is associated with a reward or with a punishment.*

## In Operant Conditioning:

*Behavior is shaped by reinforcements or punishments that follow the behavior.*

# The most complex learning involves cognition

*- the process of knowing represented by awareness, reasoning, recollection, and judgment.*

- **Insight:** The ability to respond appropriately to a new situation without previous experience.



- This involves the ability to analyze problems and to test possible solutions!
- **THIS IS NOT TECHNICALLY A FORM OF LEARNING BECAUSE IT INVOLVES NO PREVIOUS EXPERIENCE.**
  - ◆ **IT DOES CONTRIBUTE TO LEARNING and IS AIDED BY LEARNING THAT OCCURRED THROUGH EXPERIENCE WITH RELATED PROBLEMS.**

**Learning: Problem-solving** - the cognitive activity of devising a method to proceed from one state to another in the face of real or apparent obstacles.

■ **Do other animals reason?**



**tool use**

chimpanzee

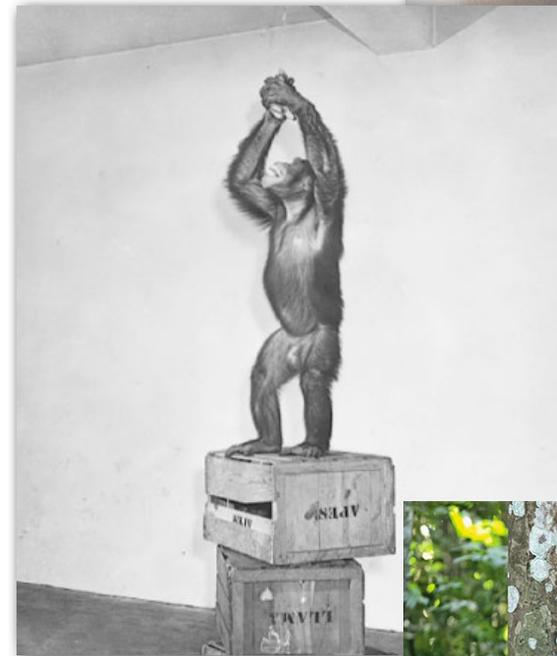
**problem-solving**



sea otter



**crow**



**Chimpanzees will figure out to stack boxes to reach a banana**  
**Many young learn to crack a palm nut by watching others**

# How much is nature and how much is nurture?

- **One approach to identifying environmental contributions to behavior is conducting a cross-fostering study**

- ◆ Young of one species are placed in the care of adults of the another species.

- **The extent to which the offspring's behavior changes in such a situation is one measure of how the social and physical environment influences behavior.**



**Table 51.1 Influence of Cross-Fostering on Male Mice\***

Species	Aggression Toward an Intruder	Aggression in Neutral Situation	Paternal Behavior
California mice fostered by white-footed mice	Reduced	No difference	Reduced
White-footed mice fostered by California mice	No difference	Increased	No difference

- ◆ **What about in Humans? Do twin studies comparing identical twins are raised apart vs raised together.**