

# Learning



# **Learning and reinforcement**

## **Learning**

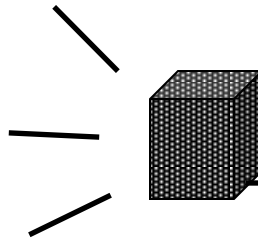
A long-lasting change in behavior,  
or potential to change behavior,  
that results from experience

## **Reinforcement**

Anything that affects the probability  
that a particular behavior will occur

# Simple learning

Repeated presentation of stimulus

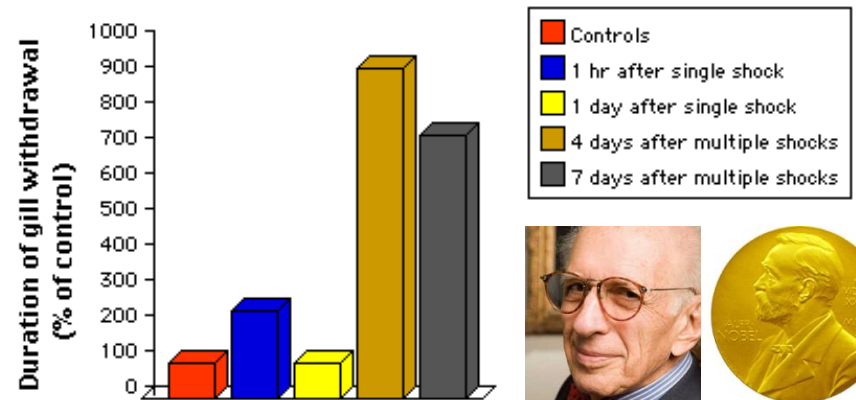
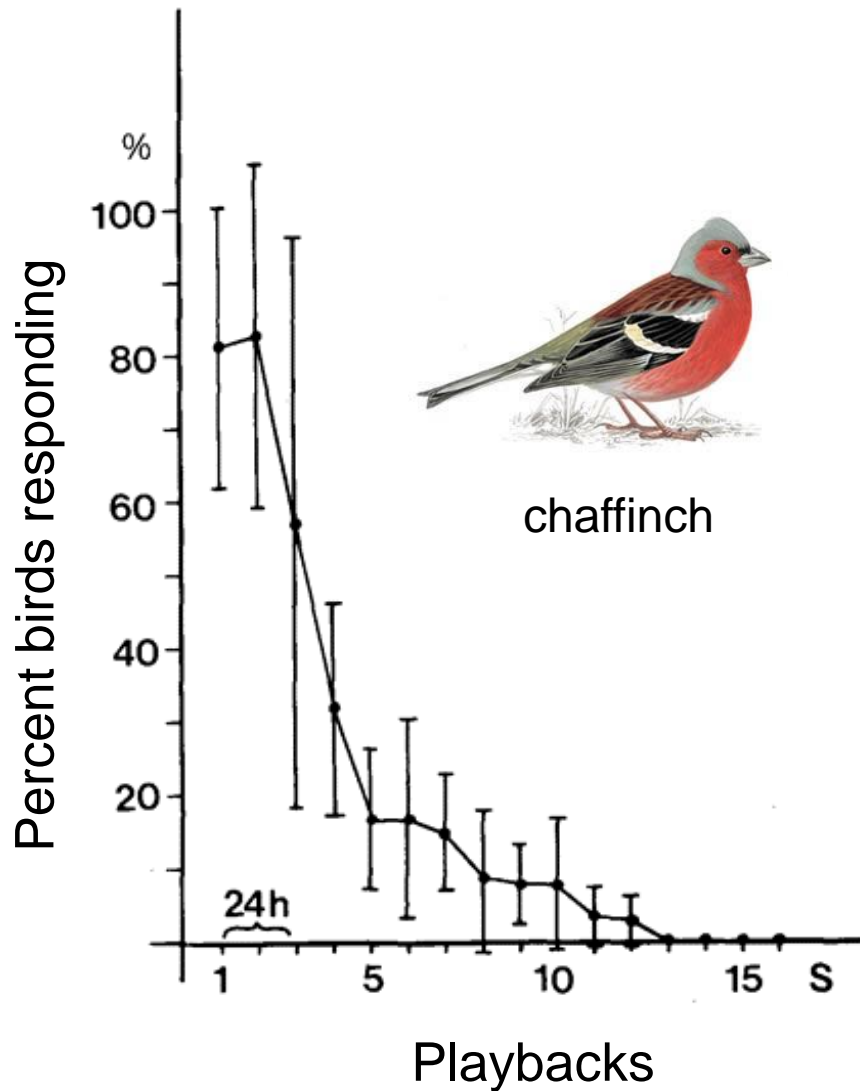


Habituation



Sensitization

# Habituation and sensitization



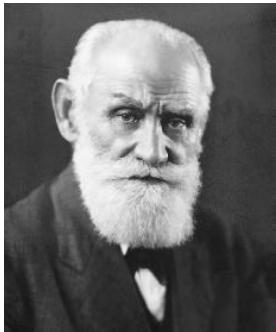
Eric Kandel

# Classical conditioning

food (US)  $\longrightarrow$  salivation (UR)

food (US) + tone (CS)  $\longrightarrow$  salivation (UR)

tone (CS)  $\longrightarrow$  salivation (CR)



Ivan Pavlov



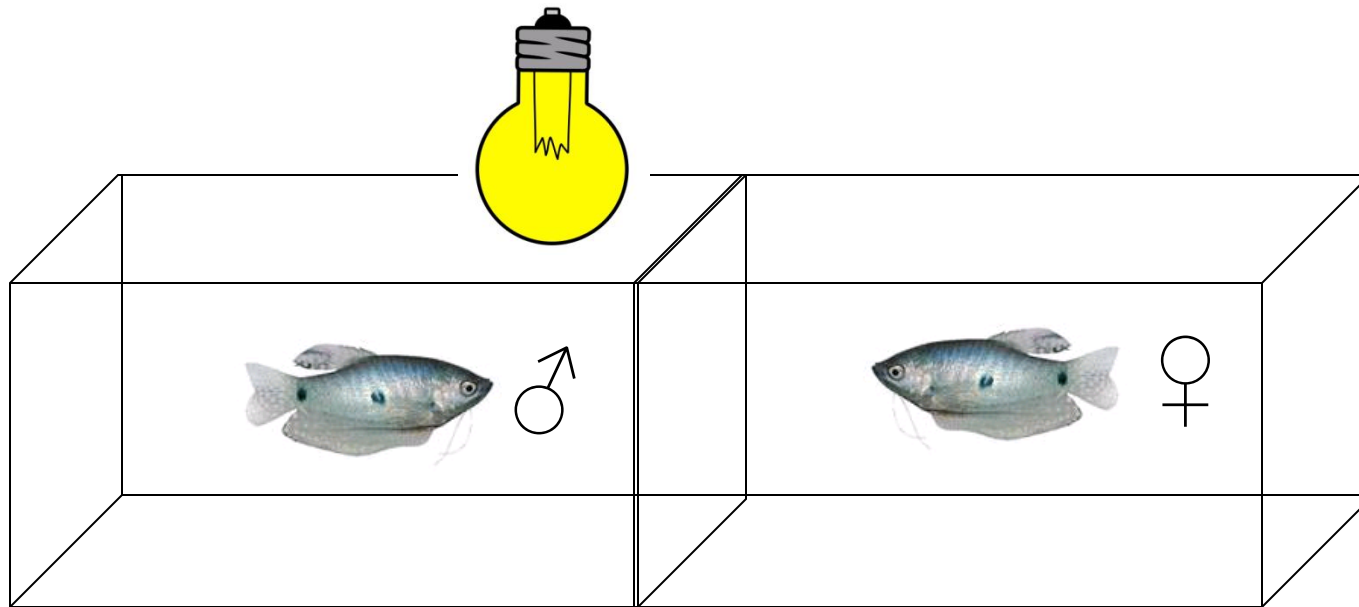


# Classical conditioning

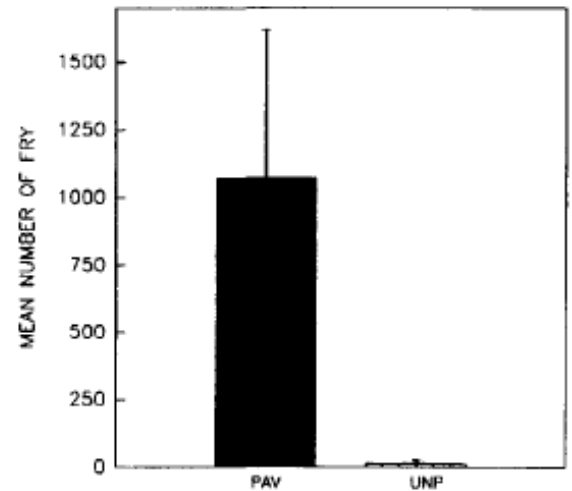
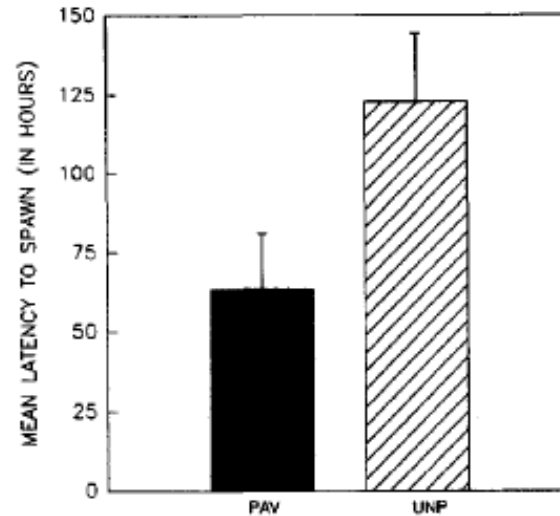
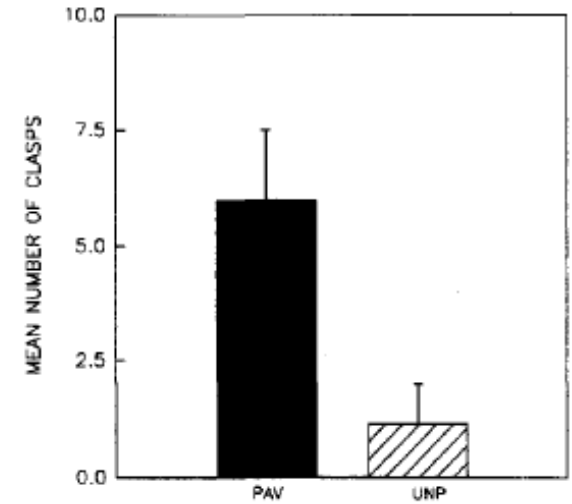
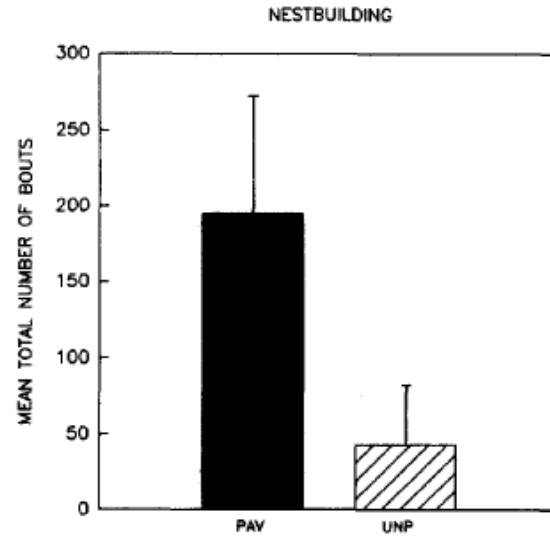
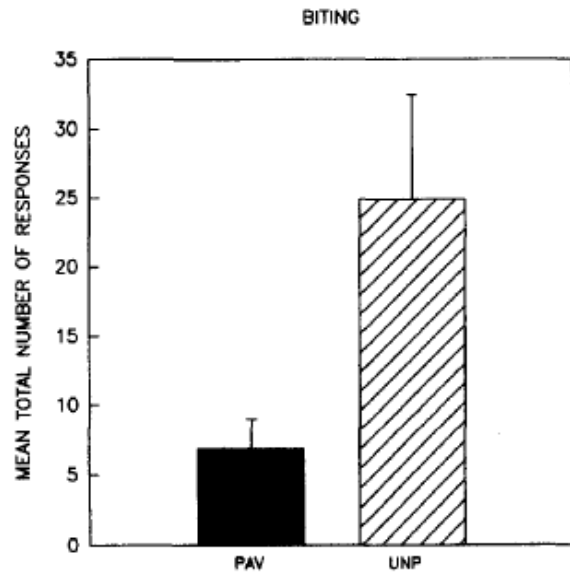
Is there any adaptive significance of classical conditioning?



# Classical conditioning



# Classical conditioning





# Classical conditioning

How might classical conditioning work in nature?

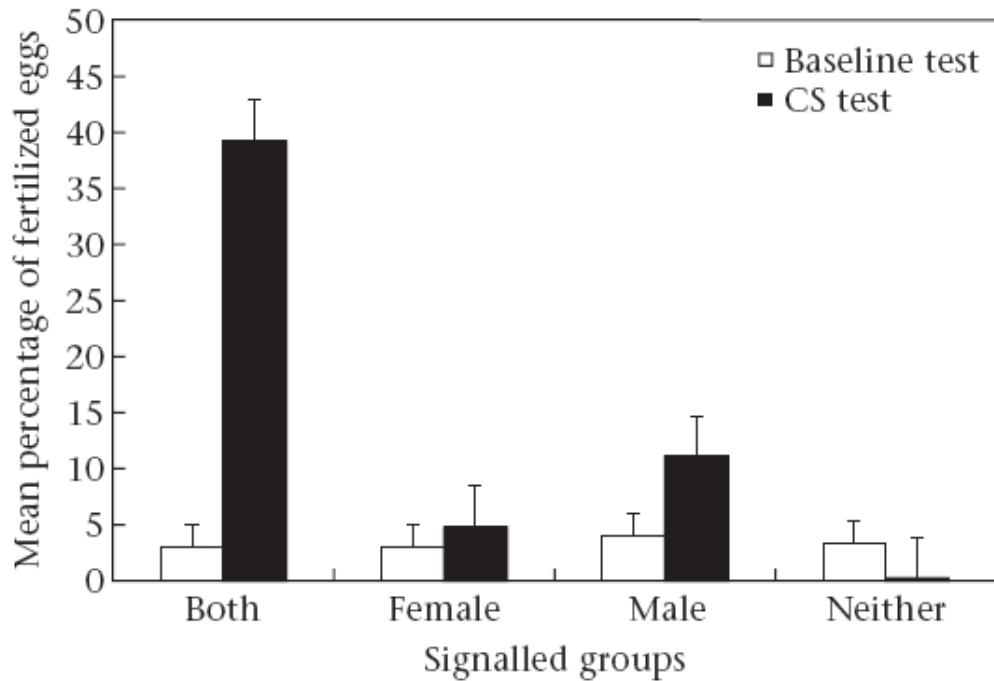
Courtship behavior by female (US)      →    Courtship (UR)

Courtship behavior by female (US) +  
sex-recognition cue (CS)      →    Courtship (UR)

Sex-recognition cue (CS)      →    Courtship (CR)



# Classical conditioning



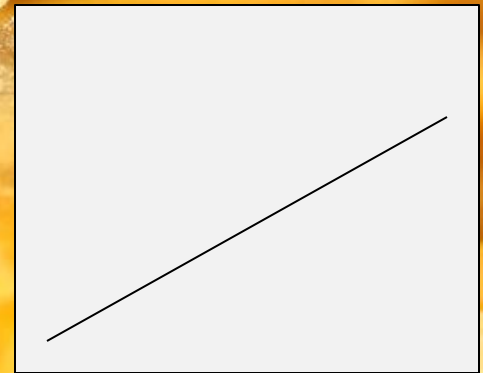
# Heritability of conditioned response

Proboscis extension response conditioned to various odors

Evidence of significant heritability



Offspring score



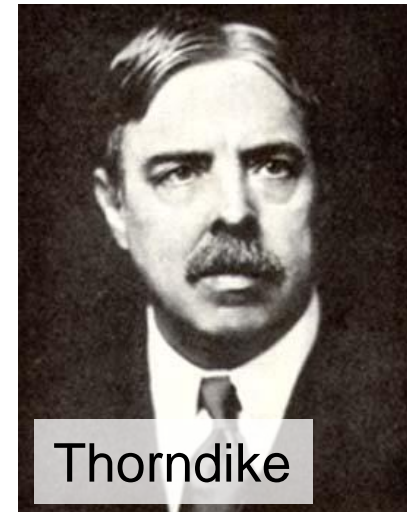
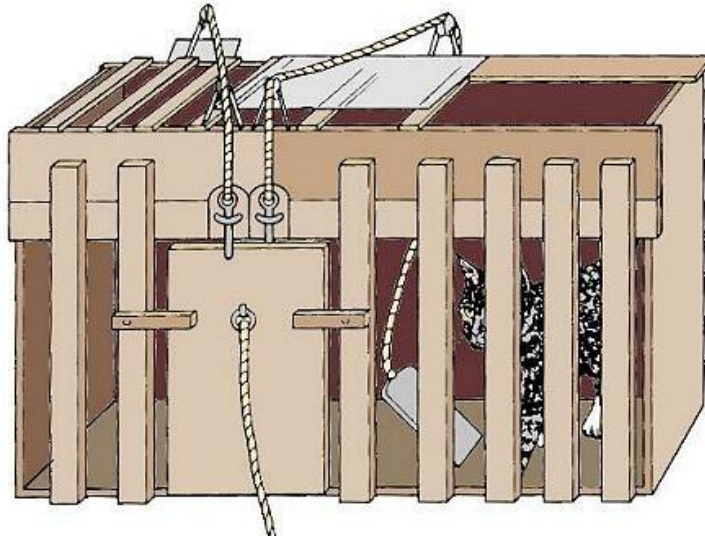
Parent score

# Gene × environment interactions



Tryon Maze Dull  
and Bright rats

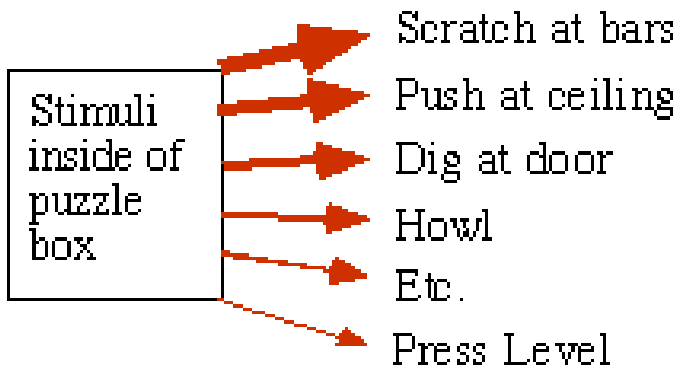
# Operant conditioning



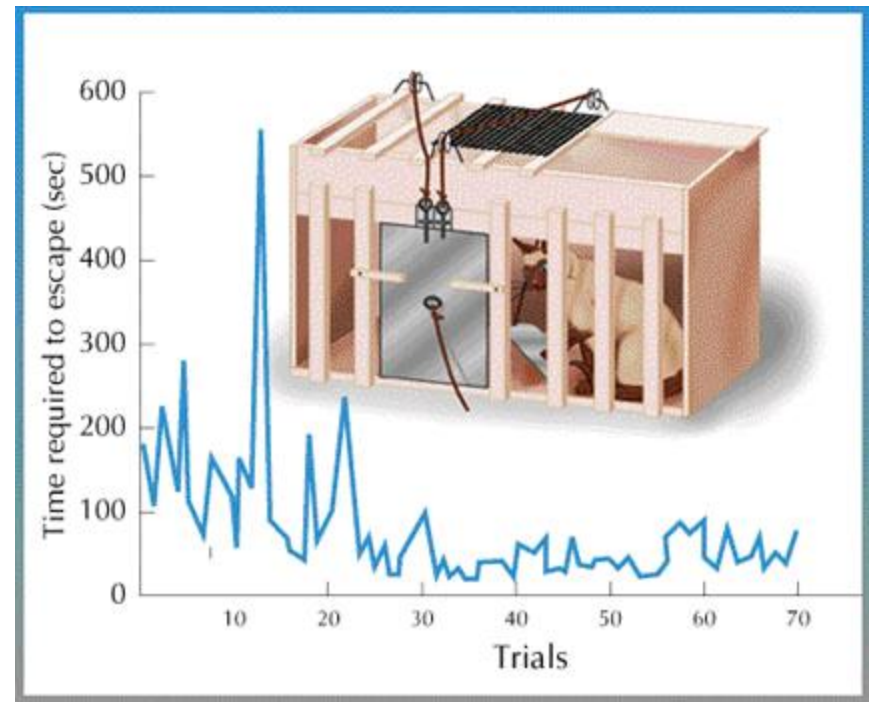
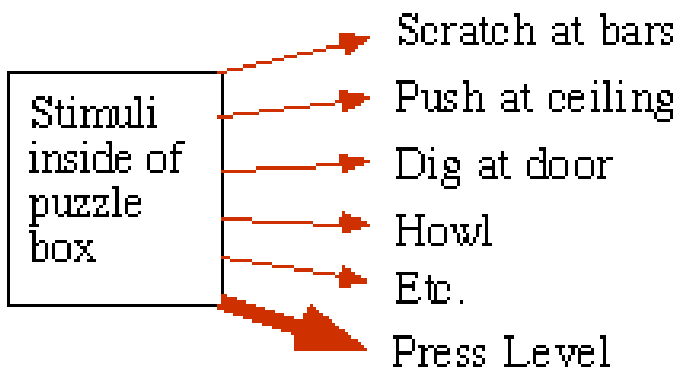
Thorndike

# Laws of effect and exercise

First trial in  
puzzle box



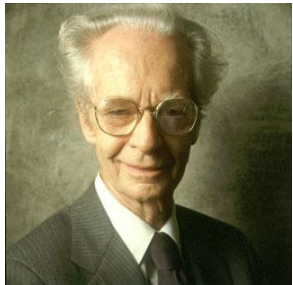
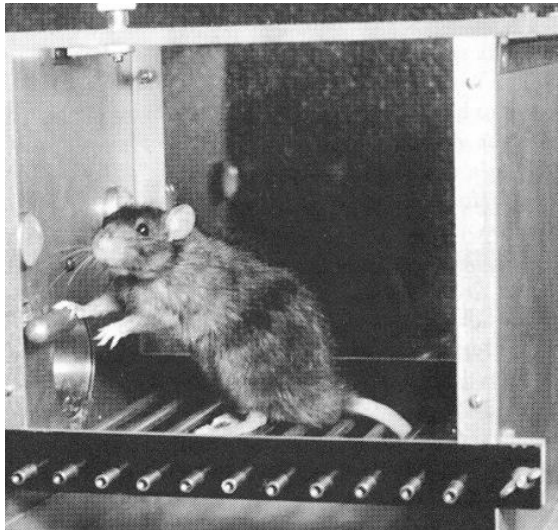
After many  
trials in  
puzzle box





# Operant conditioning

Operant conditioning = association between behavior and its consequences



B.F. Skinner

# Operant conditioning

Positive  
reinforcement



Negative  
reinforcement



Increase likelihood  
that behavior will occur

# Operant conditioning

Response cost



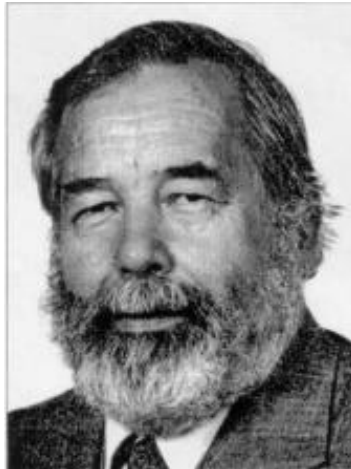
“Punishment”



Decrease likelihood  
that behavior will occur

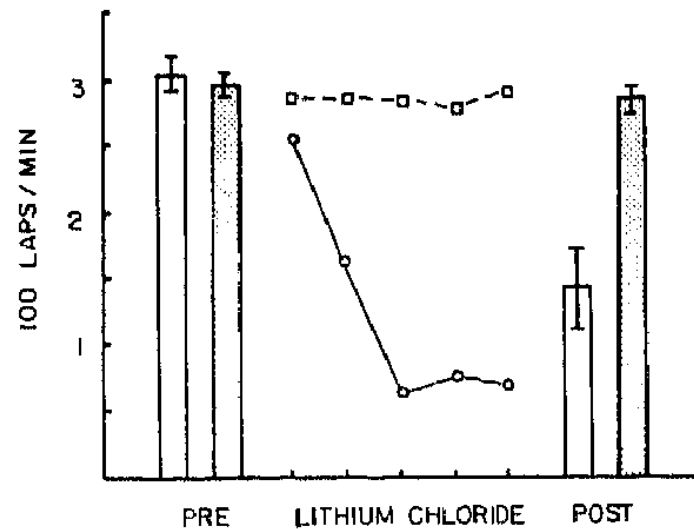
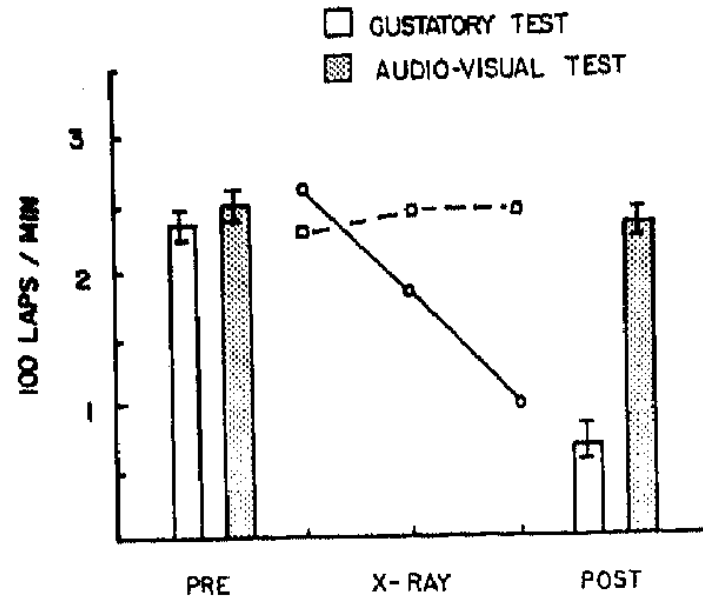
# What factors affect conditioning?

1. Contiguity
2. Relevance

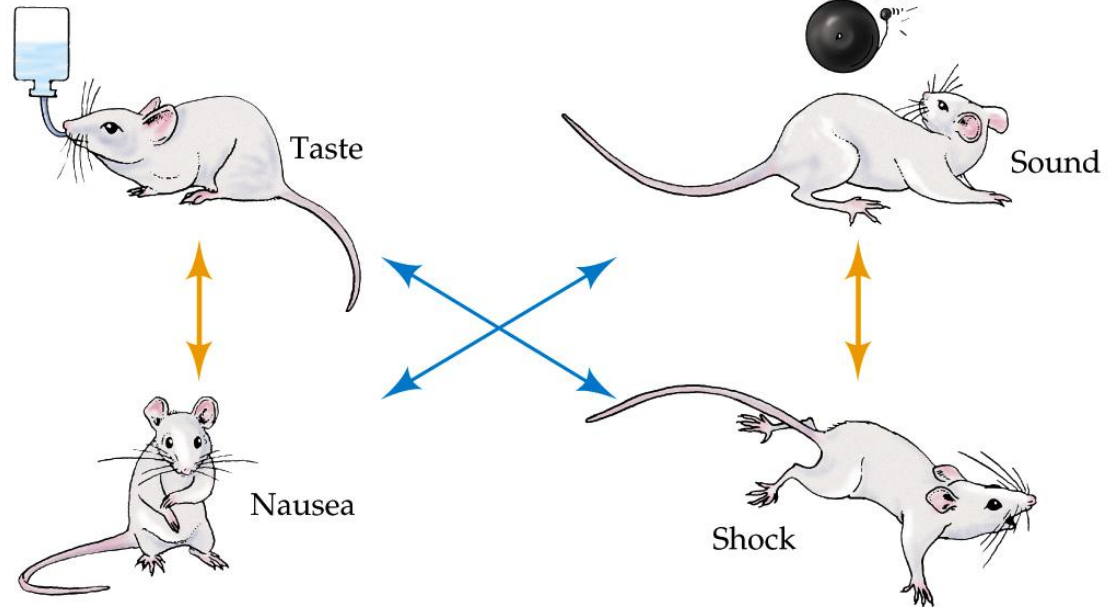
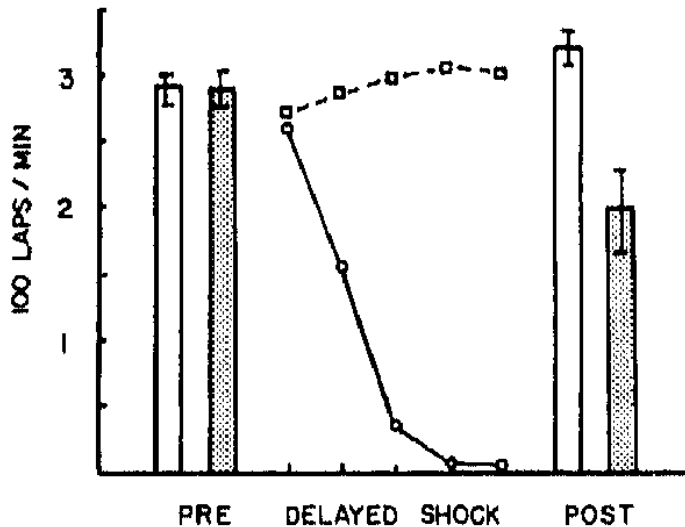
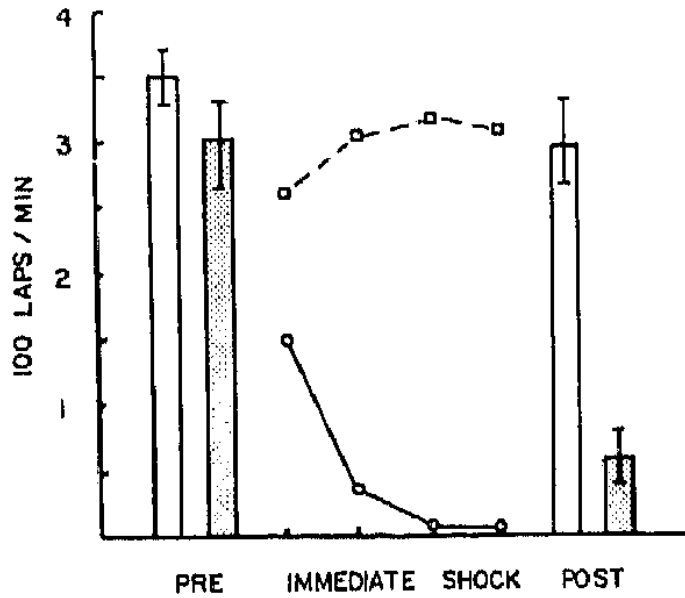


John Garcia

# The “Garcia effect”



# The “Garcia effect”



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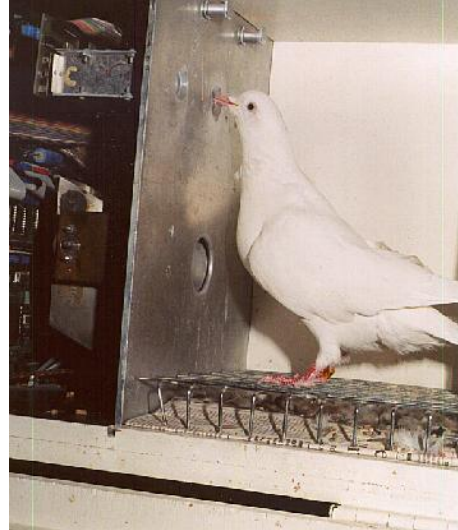


Practical applications of the Garcia effect

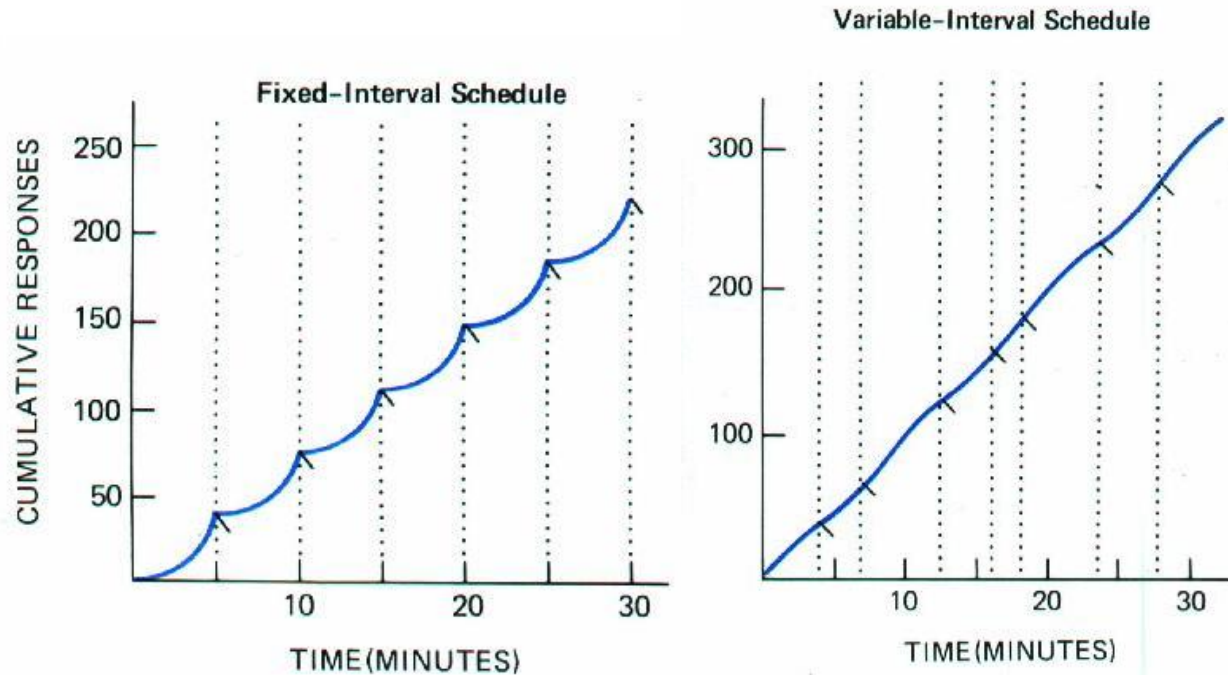


# Schedules of reinforcement

1. Fixed (also continuous)
2. Variable
3. Ratio schedules
4. Interval schedules

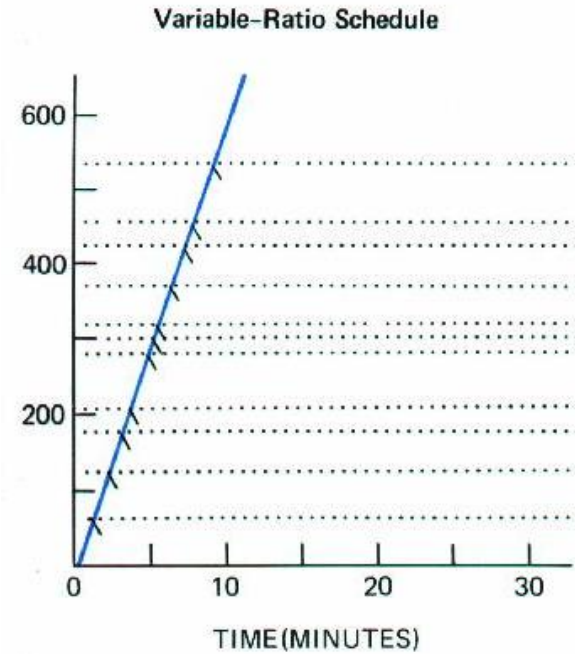
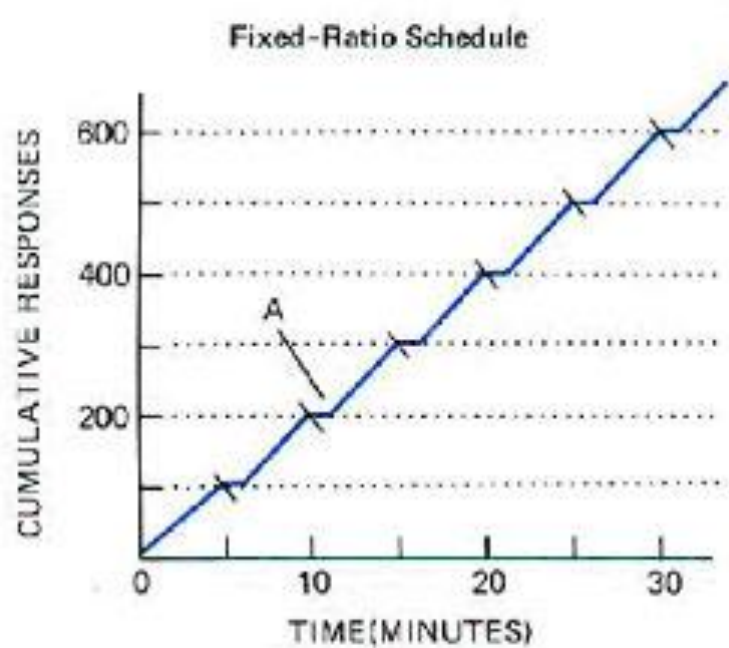


# Operant conditioning



What produces the characteristic “scalping” effect in the FI schedule?

# Operant conditioning



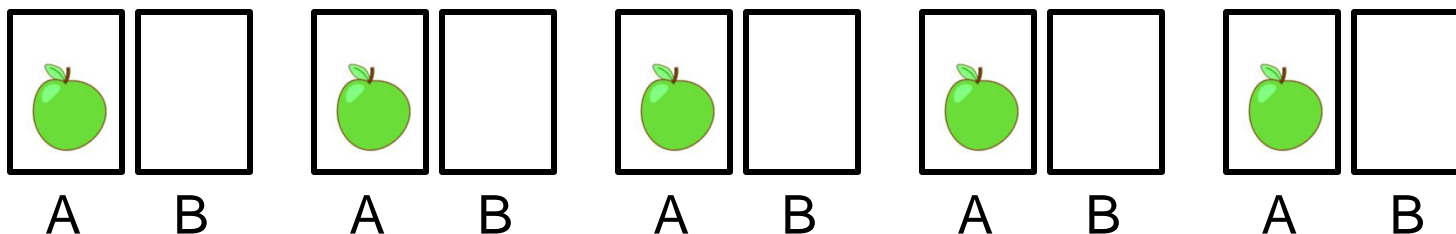
Why the “stair-step” pattern?



# Learning sets

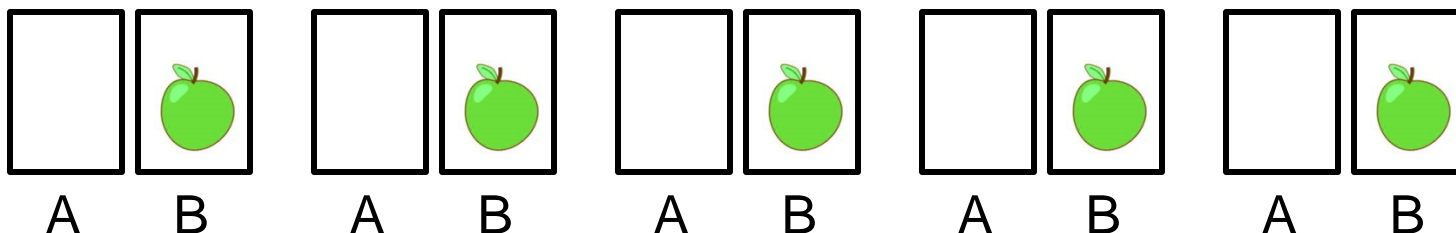
Trials 1-5

Block 1



Trials 1-5

Block 2



Where should monkey look first?

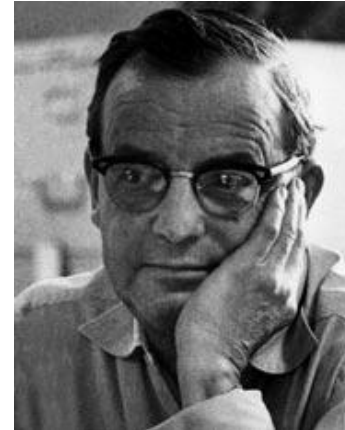
Now where should monkey look?



# Learning sets

Development of generalized learning strategy

Wisconsin general test apparatus



Harry Harlow  
(1905-1981)



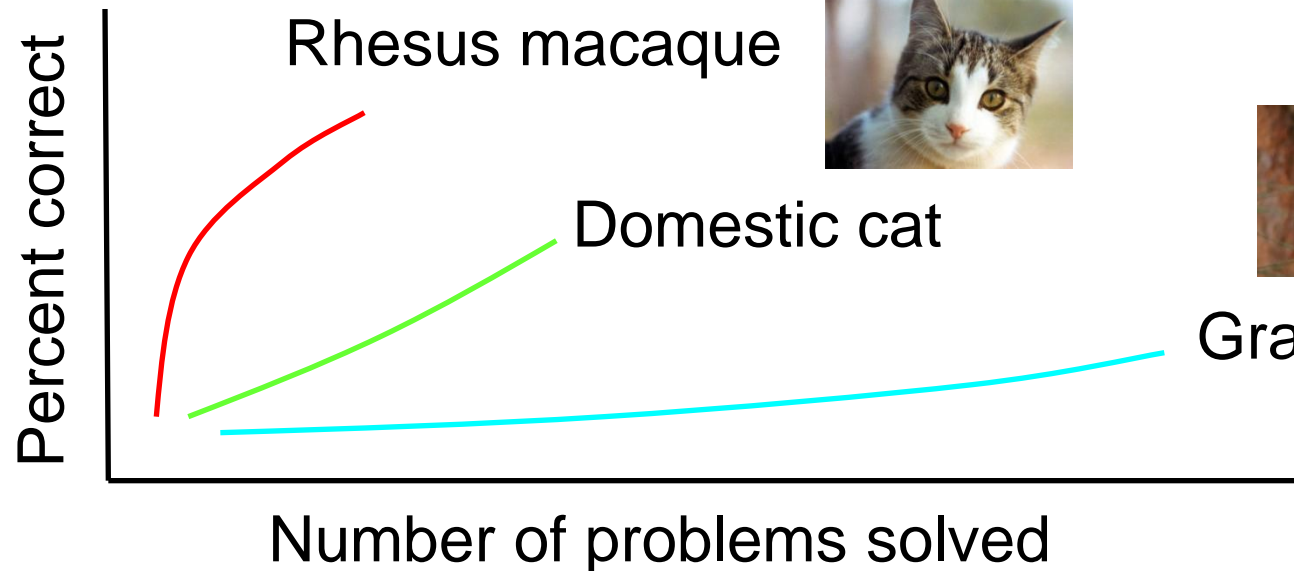
Rhesus macaque



Domestic cat

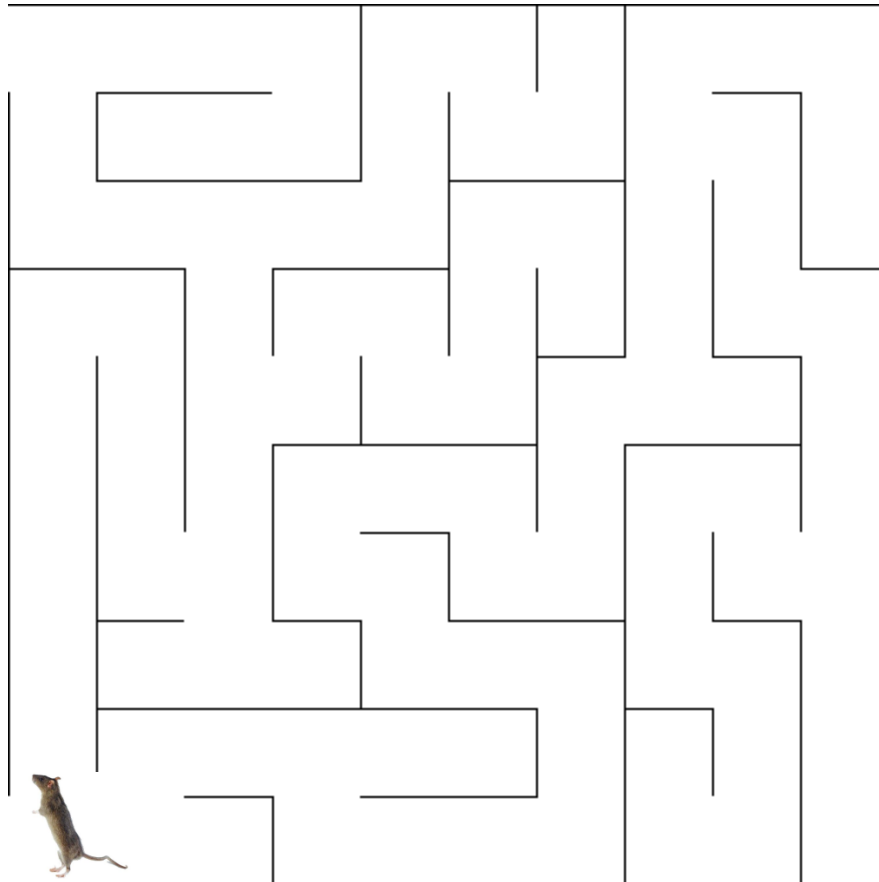


Gray squirrel



# Latent learning

Reinforcement not evident

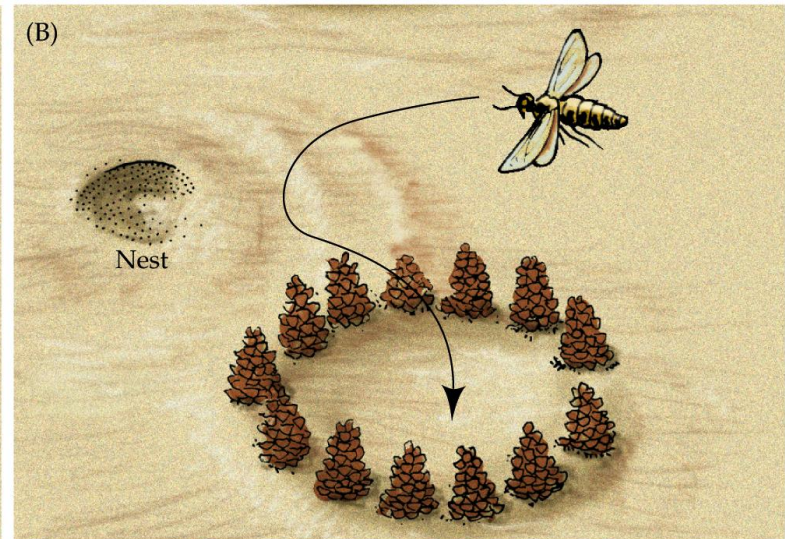
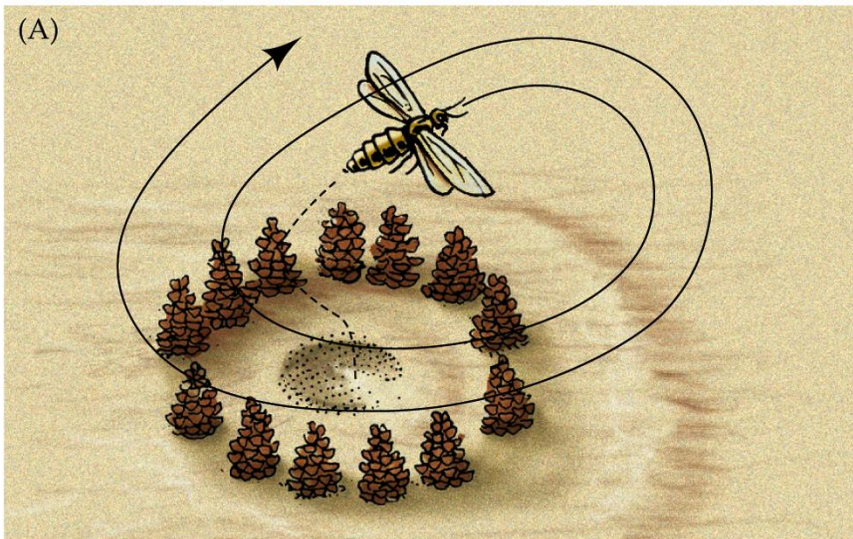




# Latent learning



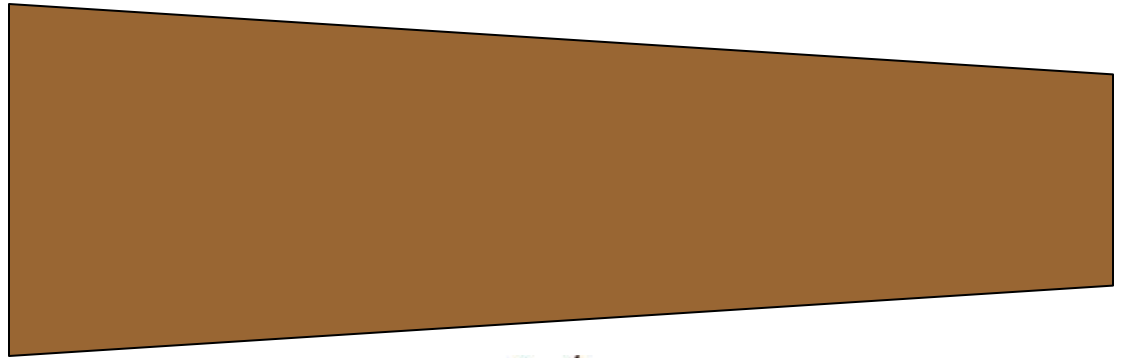
Tinbergen observed beewolf's circular flight as it departed burrow



# Latent learning



Wolfgang Kohler



# Insight learning

Learning by applying previous knowledge





# Social learning



Local enhancement:  
presence attracts others

Social facilitation: presence  
facilitates learning



# Social learning

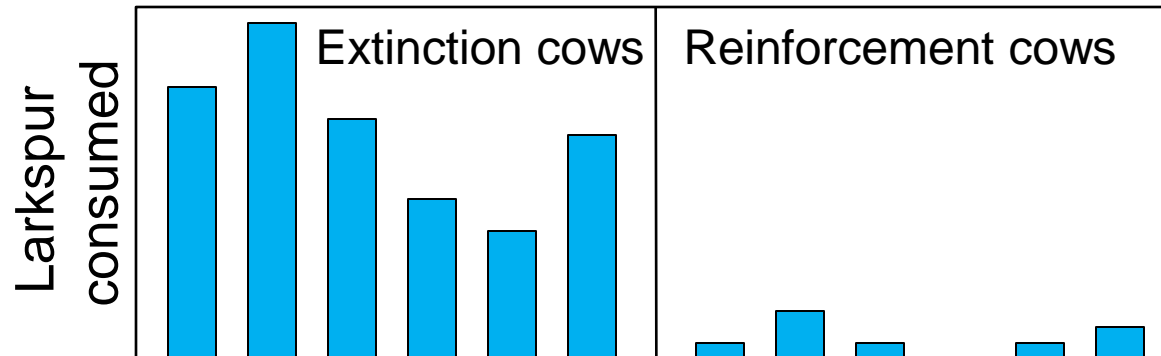


Two groups of cows conditioned to avoid larkspur by pairing with LiCl



Reinforced in one group, extinct in the other

Both paired with naïve cows



# Social learning

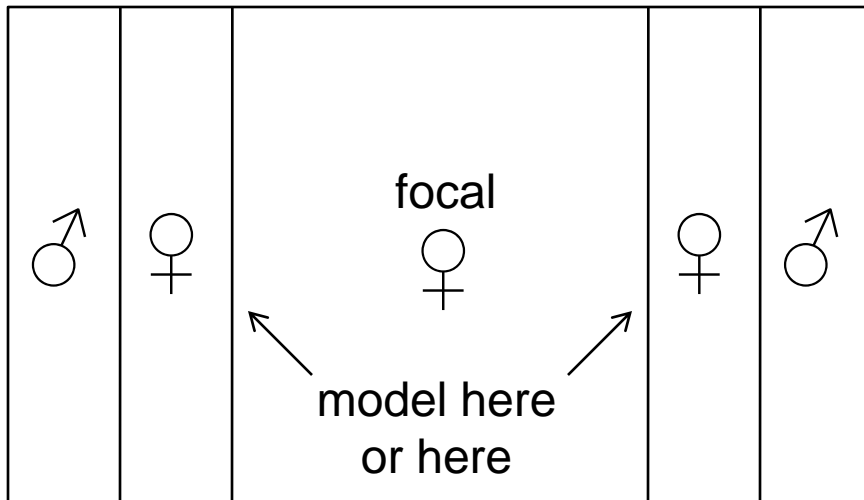
## Copying versus imitation





# Social learning

## Mate choice copying in guppies

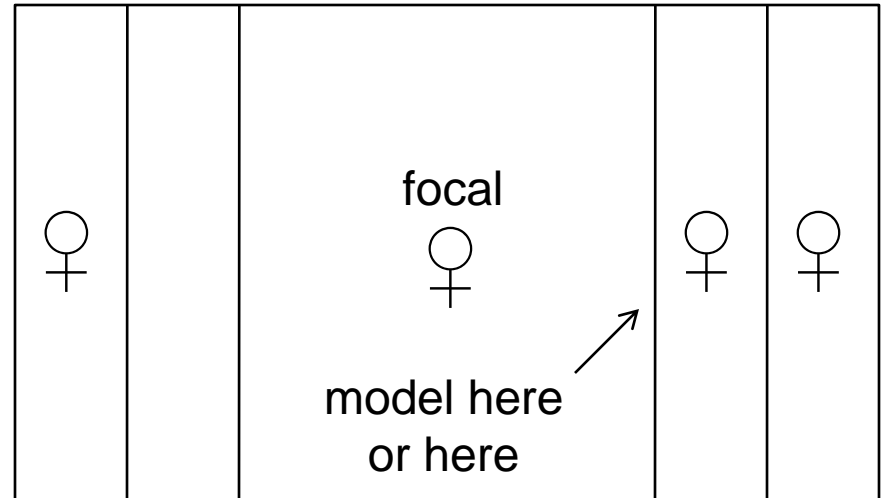


Focal female chose male  
near model 17 of 20 times

# Mate choice copying

Alternative explanations?

A1: Focal female wants to school with groups of fish.

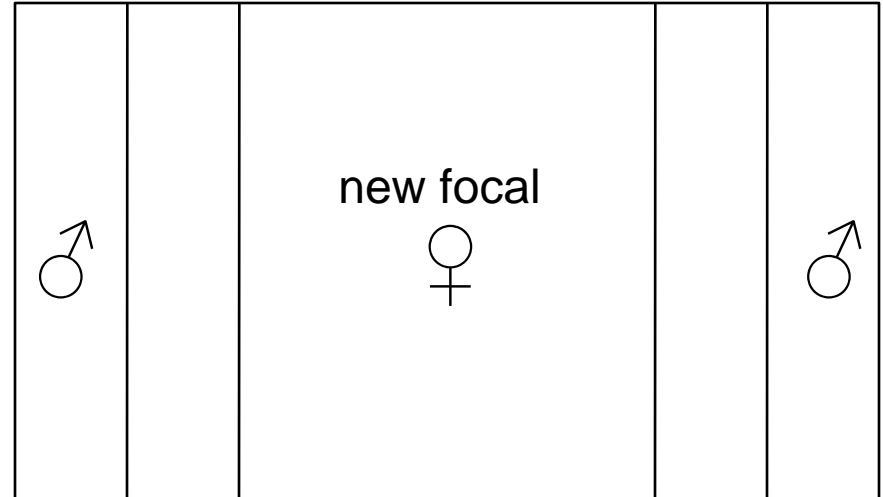


Replaced end males with females,  
and focal female showed no  
preference for 2 fish vs. 1 fish  
(10 of 20 trials)

# Mate choice copying

## Alternative explanations?

A1: Focal female cues on behavior or physiological changes of chosen male.



Why copy mate choice of others?

May allow less discriminating, younger animals to make better choices



Removed focal and model female, replaced with new female. She had no preference for primed male.

# Social learning

Classic example in humans =  
Bandura's "Bobo" experiments

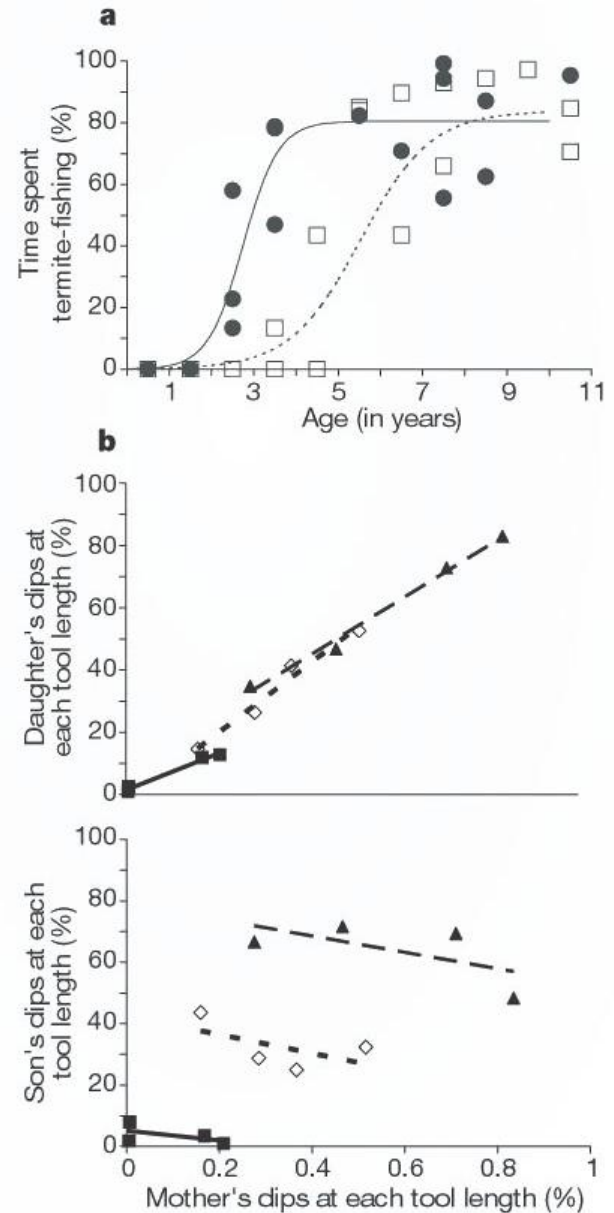


# Social learning

Can be vertical or horizontal



Sex differences in tool-use imitation in chimpanzees



# Teaching

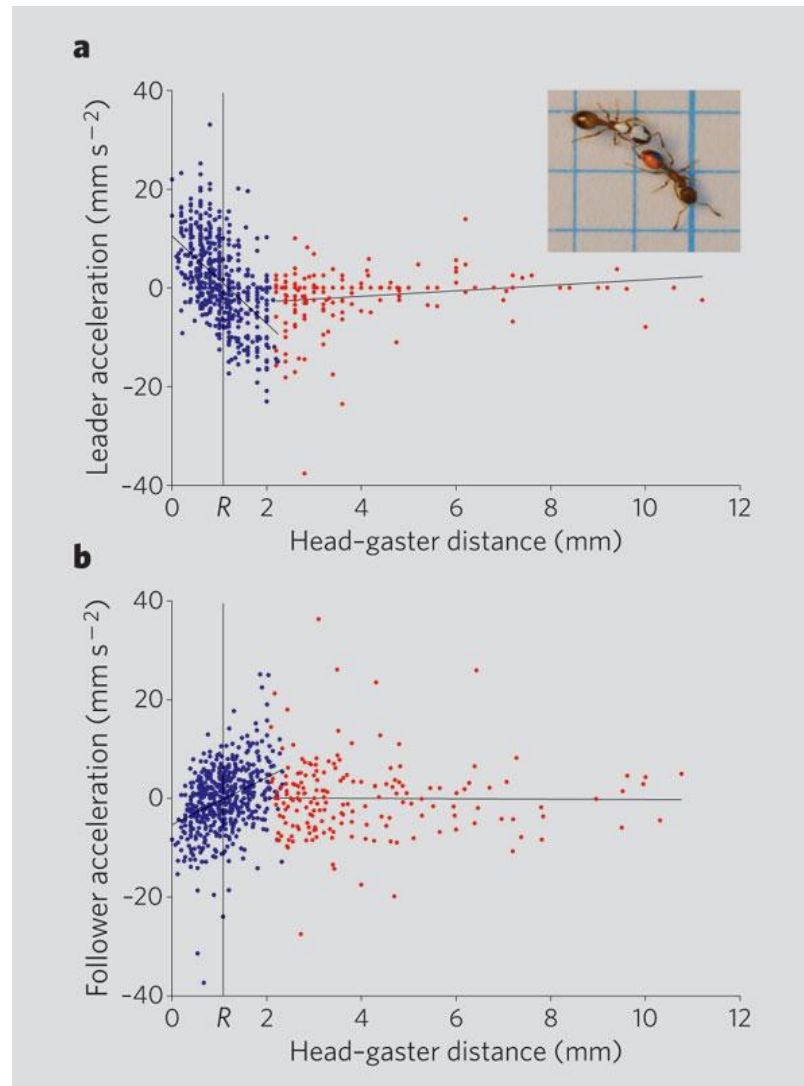
A working definition of teaching



Tandem running in *Temnothorax* ants



# Teaching

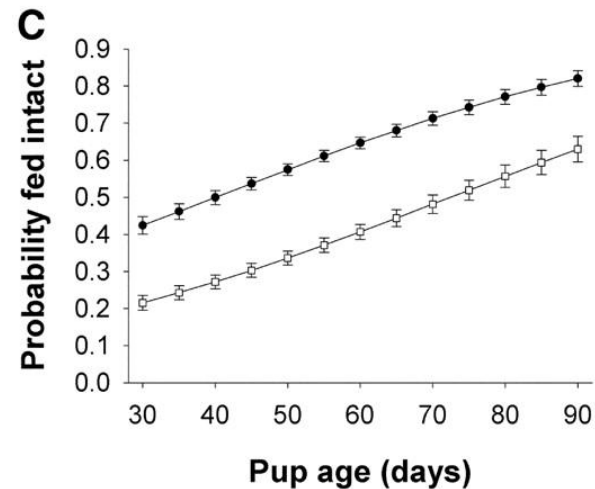
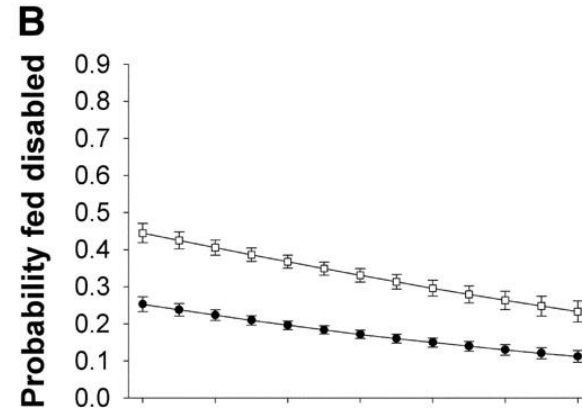
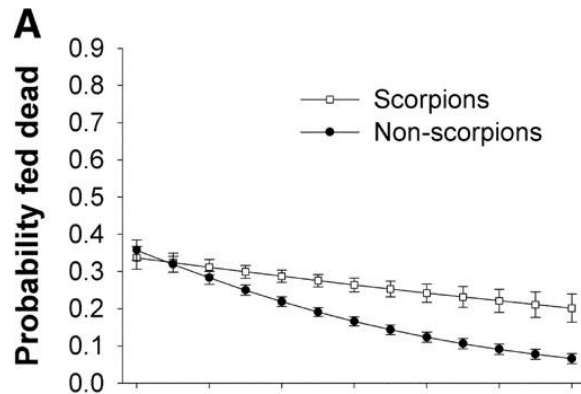


$R$  = distance of antennal reach



# Teaching prey capture

Meerkats present toxic prey to young



# Teaching prey capture

Experimental playback  
of pup begging calls

