

Reflex, Taxis, and Instinct

Lecture 7

Cognitive Functions of the Mind

- Mediate Adaptive Behavior
 - Interactions Between Person, World
- Form Internal Representations of the World
 - Perception, Memory
- Reflect on this Knowledge
 - Reasoning, Problem-Solving
- Use Knowledge to Guide Behavior
 - , Decision, Choice, Action
- Communicate Knowledge to Others
 - Language



Traditional Associationist View of Learning

after Aristotle, *De Memoria* (250 BCE)
and Hume, *Treatise of Human Nature* (1739)



The Mind Forms Associations Between...

- Stimuli
 - Events in the Environment
 - Their Correlates and Consequences
- Responses
 - Organism's Behaviors
 - Their Correlates and Consequences

Innate Responses to Stimulation

- Reflexes
 - Involve Individual Muscles
- Taxes
 - Involve Entire Body
- Instincts (Fixed Action Patterns)
 - Very Discriminating

Reflexes

after Descartes, *De Homine* (c. 1633/1662)



- Automatic Response to Adequate Stimulus

- Patellar Reflex
- Eyeblink Reflex
- All “Spinal” Reflexes



www.osceskills.com

- Involve Single Muscles
- Mediated by Spinal, Cranial Nerves
 - No Involvement of “Higher” Cortical Centers

The Decorticate Pigeon as Reflex Machine

Flourens (19th c.)



Preserved

- Righting
- Stepping
- Flying
- Swallowing
- Irritation

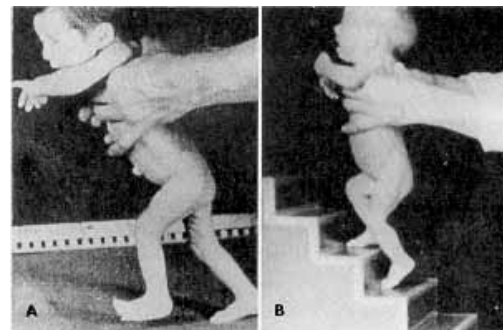
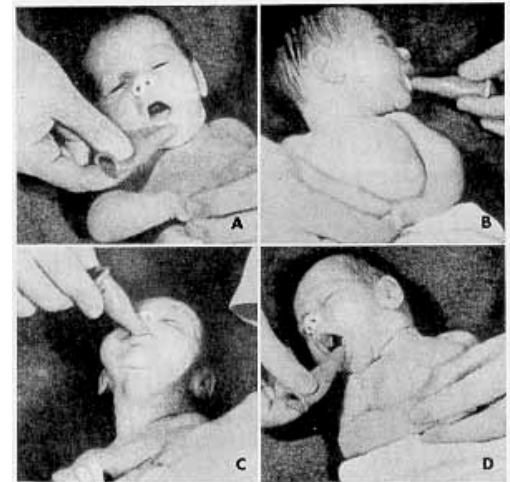
Abolished

- Flight from Irritation
- Avoidance
- Voluntary Action
- Emotionality

Reflexes in the Human Infant

Teitelbaum (1967)

- Reflexes of Approach
 - Rooting
 - Grasping
 - Plantarflexion
- Reflexes of Avoidance
 - Eye Closure
 - Mouth Closure
 - Dorsiflexion
 - Babinski Reflex
- Stepping



Advantages and Limitations of Reflexes

- Respond to External Stimulation
 - No Need for Learning
- Limited Repertoire
- No Control by Goals, Intentions

Taxes

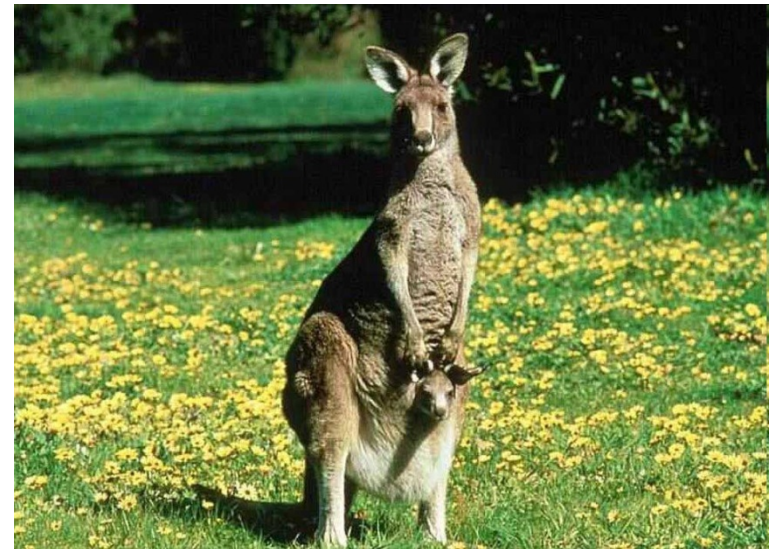
- Gross Orientation Responses
 - Entire Skeletal Musculature
- Positive vs. Negative
- Phototaxes
- Geotaxes



www.reddit.com/r/biology



www.geog.ucsb.edu



Kangaroos.org

Instincts (Fixed Action Patterns)

Tinbergen (1951)

- Complex, Stereotyped Action Patterns
 - Rigidly Organized
- Respond to Releasing Stimulus
- Innate
 - Not Modified by Learning
- Species-Specific
 - Universal within Species



Ethology

Imprinting in Greylag Geese

Lorenz (1935)

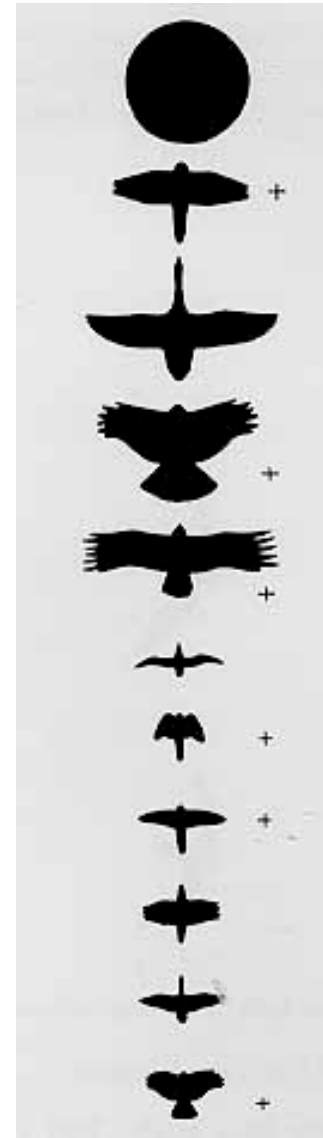
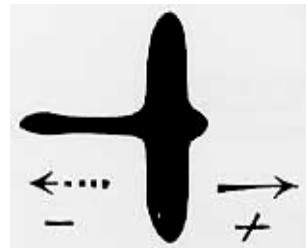
- “First” Moving Object
- Indiscriminate
- Critical Period



Alarm Reaction in Birds

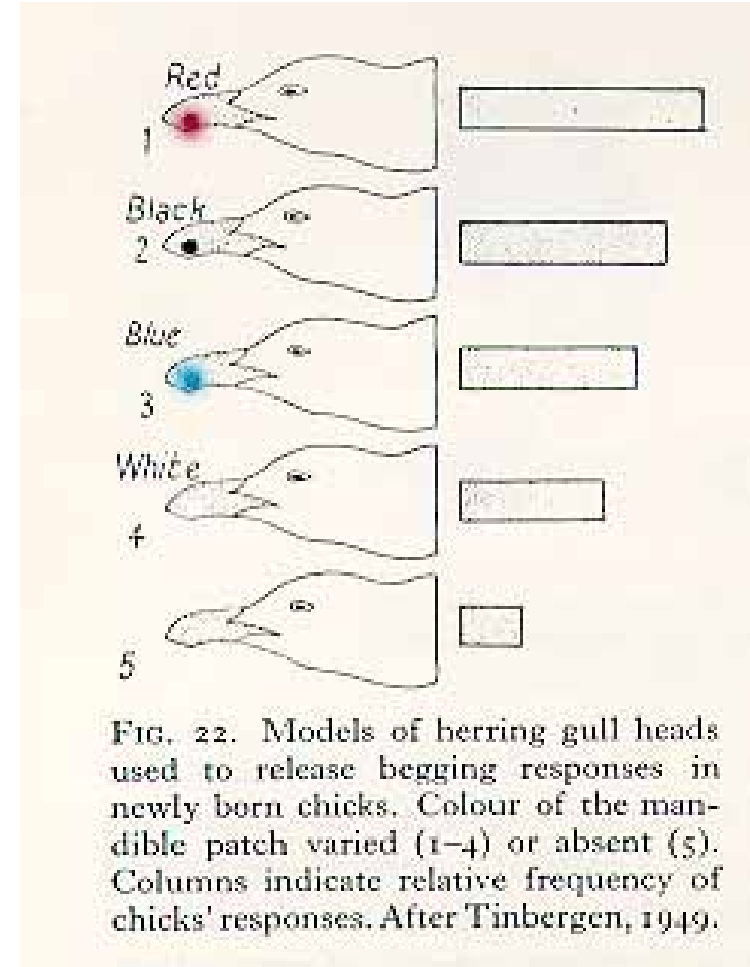
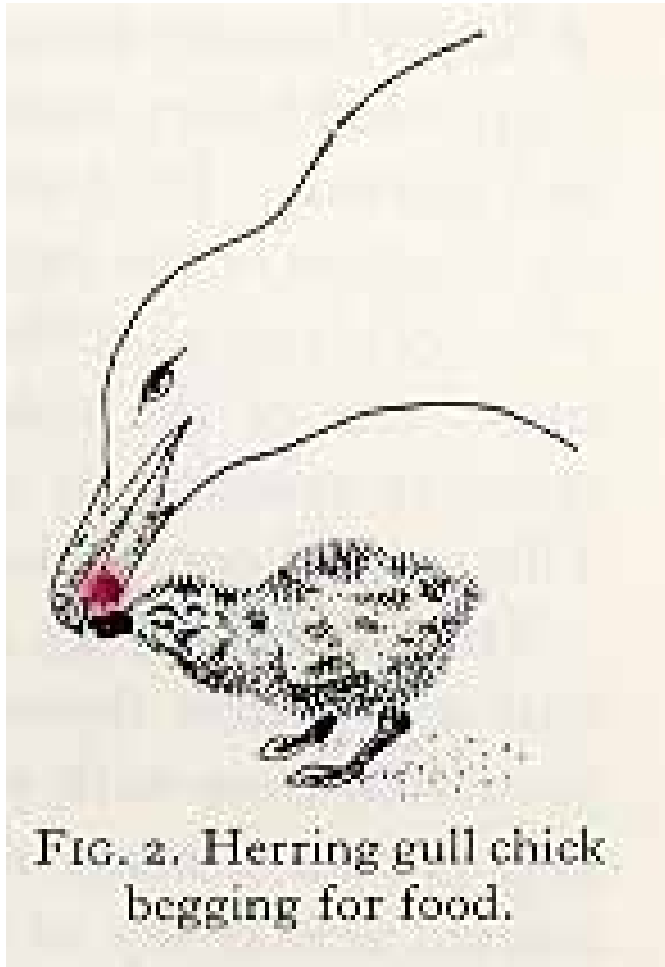
Tinbergen (1951)

- Distress Call



Food-Begging in Herring-Gull Chicks

Tinbergen (1951)



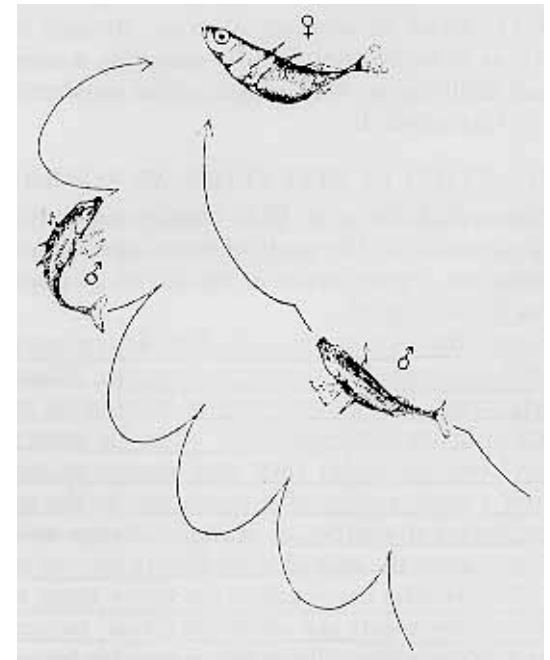
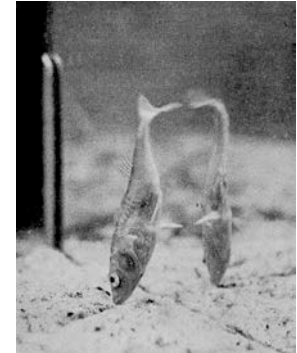
Releasing Stimulus

- Imprinting
 - Moving Object
- Alarm Reaction
 - “Hawklike” Silhouette
- Food-Begging
 - Contrasting Spot
 - Chick’s Peck

The Zig-Zag Dance of the Stickleback

Tinbergen (1951)

- Red-Bellied Male
 - Head-Down Threat Posture
- Female with Swollen Abdomen
 - Head-Up Receptive Posture
- Zig-Zag Dance
- Female Lays Eggs
 - Stimulated in Hindquarters
- Male Tends Nest



Evolution of Behavior

- Evolution Shapes Behavior as well as Body Morphology
- Adaptation to Environmental Niche
- Change in Species Characteristics Over Evolutionary Time
- How Can Individuals and Species Adjust to New Circumstances?



Karl von Frisch
(1886 - 1982)



Konrad Lorenz
(1903 - 1989)



Nikolaas Tinbergen
(1907 - 1988)

Positive Phototaxis in Sea Turtles

Racing To The Moon.

Instinct and moonlight guide them to the ocean. For newborn sea turtles, it is a run for survival. They must quickly move past predators to the safety of deep water. That's why people working in partnership on Thevenard Island conceal the light from their oil and gas operations. So the turtles won't be drawn off-course. Which helps protect a threatened species by making certain the only light visible is the one that leads home.



People Do.

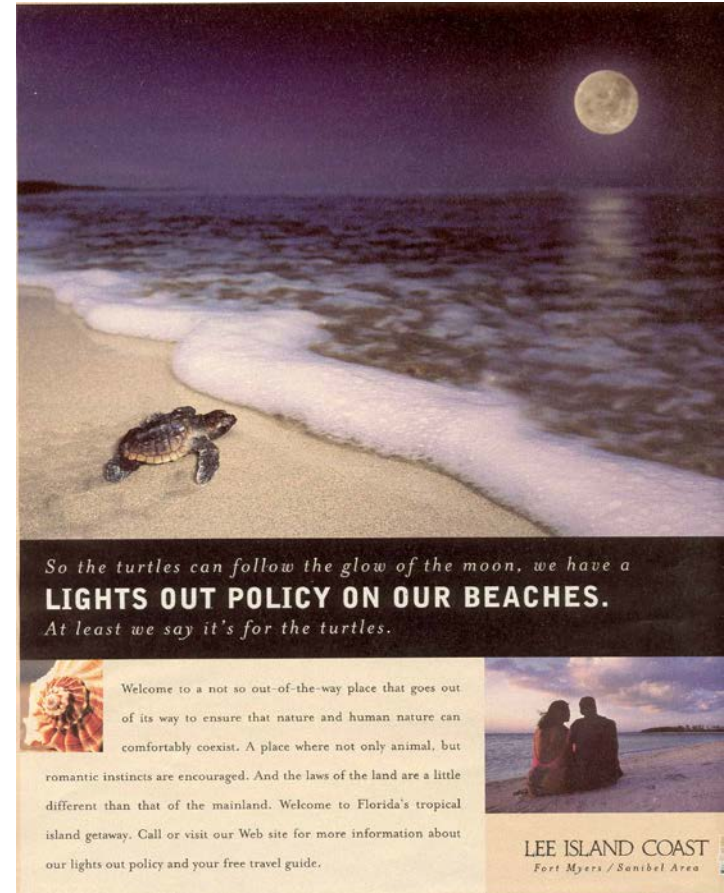
www.peopledo.com

© 2002 Chevron Corporation

WELSON 17

Limitations on Innate Responses to Stimulation

- Stimulus Must be Physically Present in Current Environment
- Cannot Respond to New Stimulus
- Cannot Acquire New Responses
- Little Opportunity for Trial-and-Error Learning



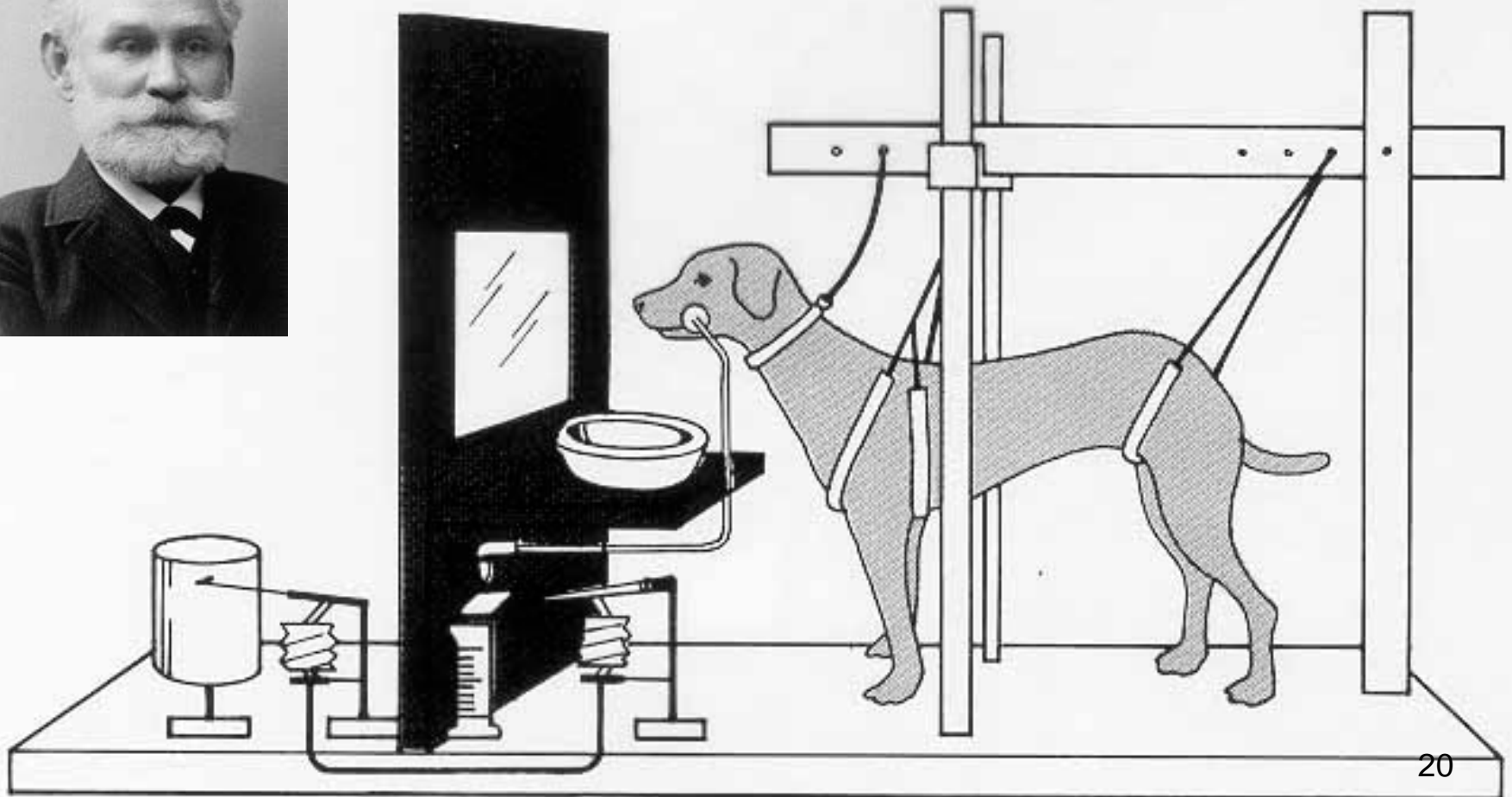
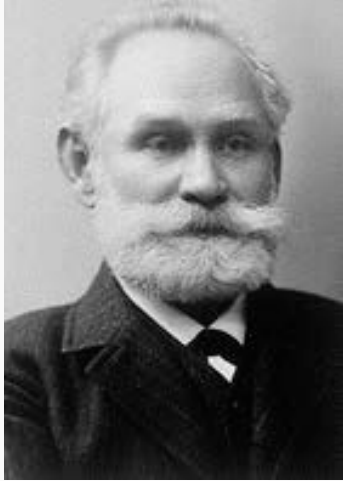
How Can Individuals Modify Their Responses to Environmental Stimulation?

Learning

- Relatively Permanent...
- Change in Behavior...
- Resulting from Experience.
 - Not Drugs
 - Not Injury
 - Not Maturation

Pavlov's Apparatus

Classical Conditioning of "Psychic" Reflexes

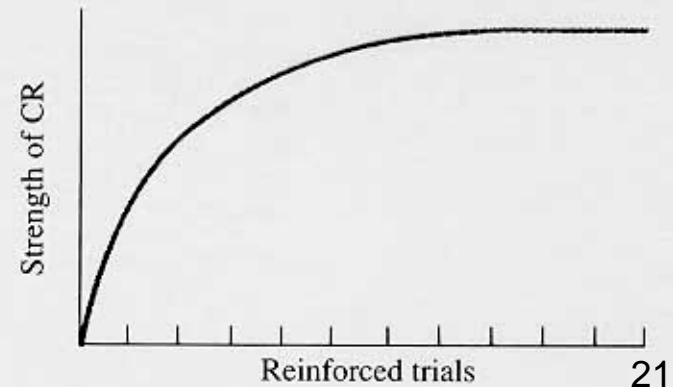
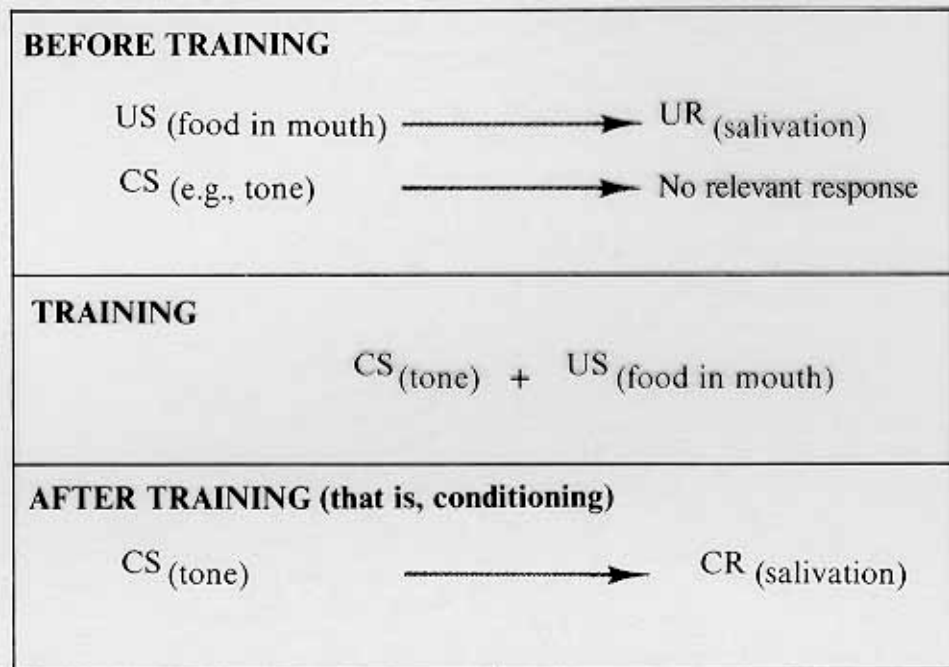


Classical Conditioning

Phase 1:
Bell, Food

Phase 2:
Bell ==> Food

Phase 3:
Bell Alone



Basic Vocabulary of Classical Conditioning

- Unconditioned Stimulus *US*
- Unconditioned Response *UR*
- Conditioned Stimulus *CS*
- Conditioned Response *CR*