# Classical Conditioning 1: Prediction learning

# decision making






SCHOOL IS HELL
BUT
IT BEATS WORKING

SHOULD **YOU** GO
TO GRAD SCHOOL?
A WEE TEST

T   F
☐   ☐   I AM A COMPULSIVE
         NEUROTIC.

☐   ☐   I LIKE MY IMAGINATION
         CRUSHED INTO DUST.

☐   ☐   I FEEL A DEEP NEED
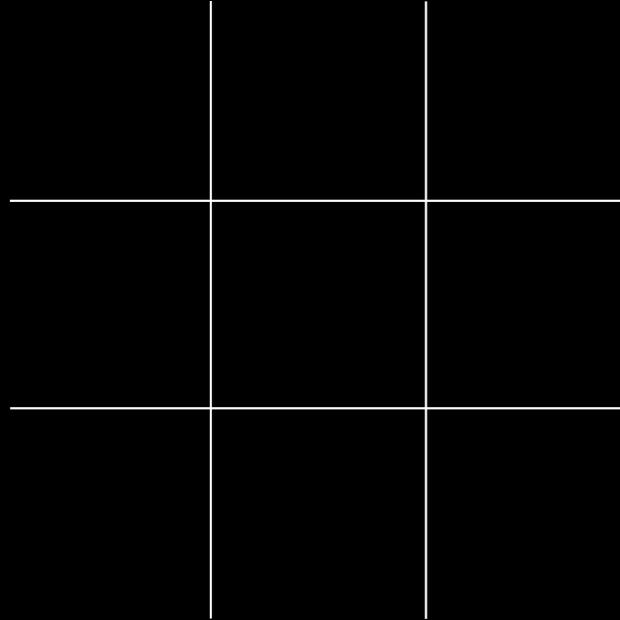         TO CONTINUE THE PROCESS
©1987 BY   OF AVOIDING LIFE.
MATT
GROENING

*Why is this hard?*

• Reward/punishment may be delayed
• Outcomes may depend on a series of actions
⇒ "credit assignment problem" (Sutton, 1978)

*How does this work? How does the brain solve this problem?*

# another example:

how did you solve the credit assignment problem?

# LEARNING

non-temporary change in the behavioral mechanisms engaged in a certain situation

- that results from (repeated) experience with the situation

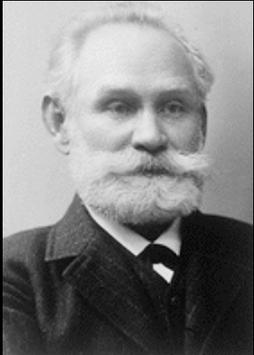- and providing the change can't be explained in terms of innate behavioral tendencies of the organism

# what should you learn
# from interaction with the world?

what is going to happen (prediction learning)

what to do about it (action learning)

# Act 1: PREDICTIONS
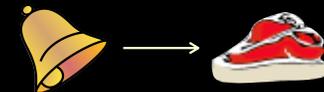
# animals learn predictions



Ivan Pavlov
(Nobel prize portrait)

pair stimulus

...with significant event

measure anticipatory behavior

Terminology:

= Unconditional Stimulus (US)

= Conditional Stimulus (CS)

= Conditional Response (CR)
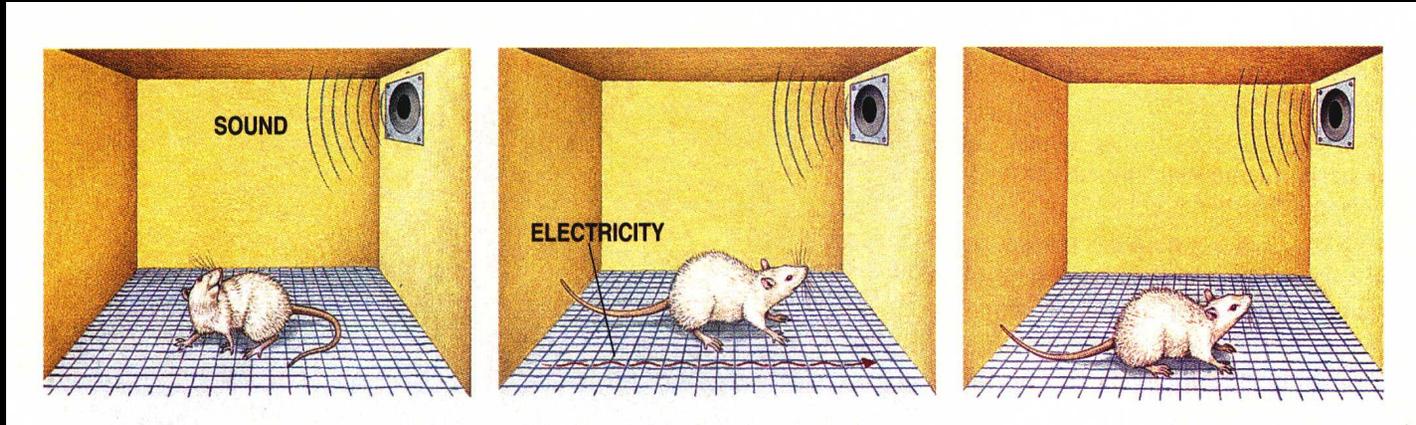(here, also Unconditional Response; UR)

Very general form of learning
from experience (snails - humans)

# example 1: fear conditioning (conditioned suppression)

Habituation (tone)    Conditioning (tone+shock)    Extinction (tone)



CS: Tone, 30 sec
US: Shock, 0.5 sec
CR: Freezing

(ITI = 4 min)
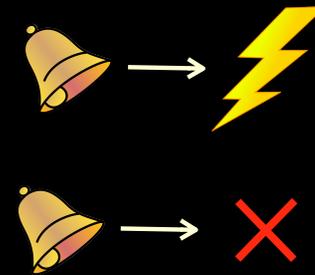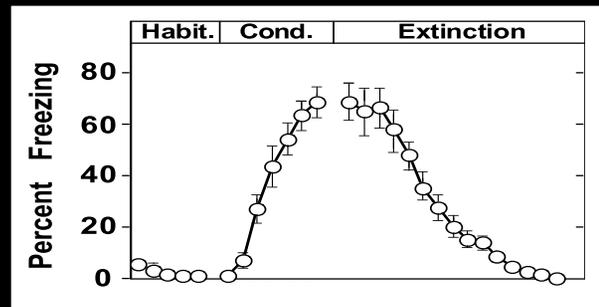
# example 1: fear conditioning (conditioned suppression)

# Example II: pigeon food conditioning

# some non-trivial terminology

- Pavlov called the US a "reinforcer." What does that mean?  = reinforcer

- Purely operational definition (makes no assumptions regarding affective value)

- Acquisition

- Extinction

- Predictions are:
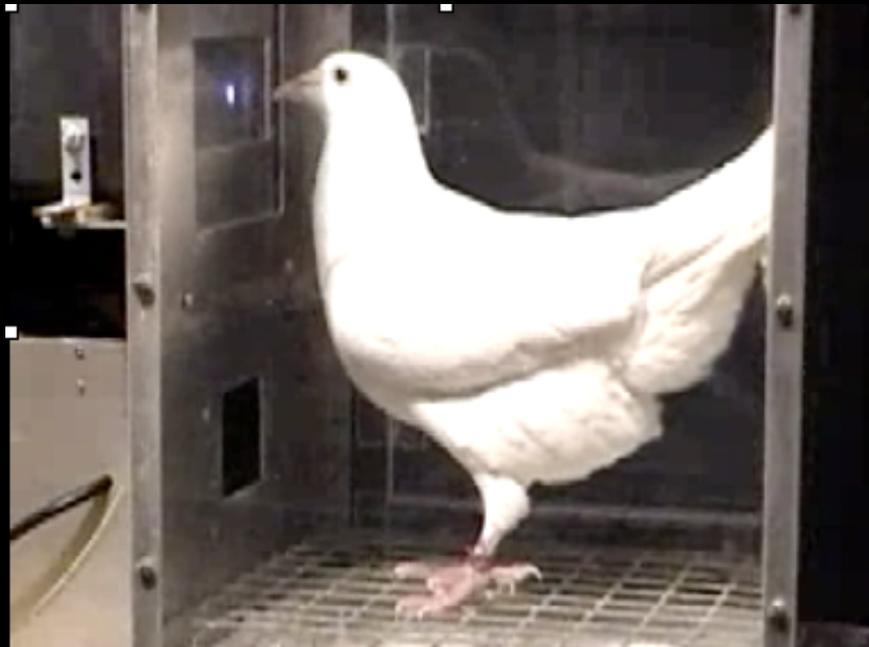  1) shaped by experience
  2) revealed by behavior

# Predictions are powerful...



predictions seem to cause behavioral output directly, in a compulsory way

# even in light of an "omission schedule"
## (n.b. not Pavlovian)



Williams & Williams (1969) Auto-maintenance in pigeon: Sustained pecking despite contingent nonreinforcement.

# what makes conditioning Pavlovian?

procedurally: Pavlovian/classical conditioning is a learning situation in which the reinforcer *does not depend* on the animal's response

from the animal's point of view: the conditioned response is *unavoidable*, like a *reflex*, not utilitarian or flexible; direct result of a prediction

(e.g., Hershberger (1986) - An approach through the looking glass)

# commonly used Pavlovian procedures

- eye-blink conditioning

- "autoshaping"

- conditioned taste aversion

- conditioned emotional response (fear conditioning; conditioned suppression)

- conditioned place preference

# Pavlovian responses

- most common: approach and withdrawal responses

- in fact: more than one response in every situation
  (we choose which to measure)

- Homework: examples from daily life: bring with you on Tuesday
  (3 examples, for each determine the US, CS, UR, CR)

# Summary so far:

- Animals learn predictions — we know this from Pavlovian conditioning

- In Pavlovian conditioning we set up a *predictable* scenario.
  Animals respond compulsively based on their predictions.

- Animals don't get to choose the CS or US; we don't get to choose
  their responses.

# How is this relevant to my life?

Learning curves have a characteristic shape.
Ask yourself: where am I on the learning curve?

A lot of our behaviors are actually (involuntary)
Pavlovian responses…