

Learning to predict events

- Reaching for your phone every time you hear a ringtone like yours
- Fear of needles (vaccination, blood test)
- Disliking a subject because of
- Wild animals trained to dislike a certain type of meat

Ian Pavlov

Saliva measuring apparatus



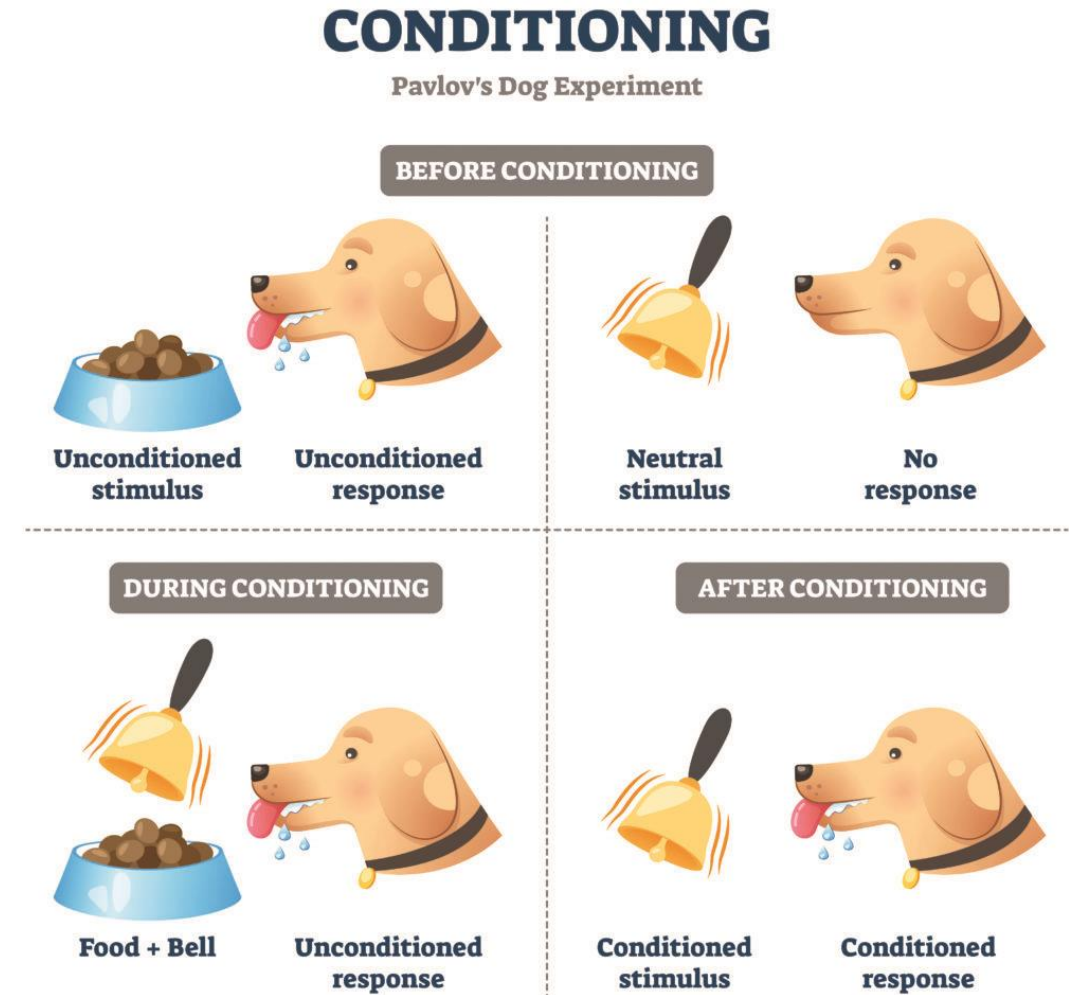
- Pavlov was originally studying effects of salivation on digestion (Nobel Prize 1904)
- He showed that salivation was necessary to start the process of digestion in the stomach
- He also started to test salivation to different types of food and stimuli
- Footsteps → salivation (accidental discovery)

What Is Classical Conditioning?

- **Classical (Pavlovian) conditioning:** a form of learning in which an animal/individual acquires the expectation that a given stimulus predicts a specific upcoming important event

Basic Concepts of Classical Conditioning

- **Unconditioned stimulus (US):** a cue that has some biological significance and that, in the absence of prior training, naturally evokes a UR
- **Unconditioned response (UR):** the naturally occurring physiological response to an unconditioned stimulus (US)
- **Conditioned stimulus: (CS)** a cue that is paired with an unconditioned stimulus (US) and comes to elicit a CR
- **Conditioned response (CR):** the trained response to a conditioned stimulus (CS) in anticipation of the unconditioned stimulus (US) that the CS predicts



Appetitive and Aversive Conditioning

- **Appetitive conditioning:** conditioning in which the US is a desirable event
- E.g. food, sex, pleasurable events

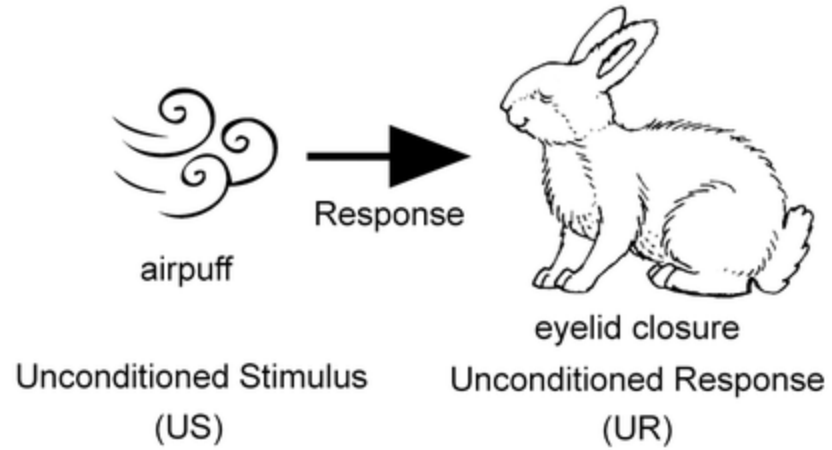
- **Aversive conditioning:** conditioning in which the US is a disagreeable event
- E.g. eyeblink conditioning
- E.g. fear for insects, spiders, phobias

CS, US, UR/CR — defined by the roles the cues play in a particular learning situation

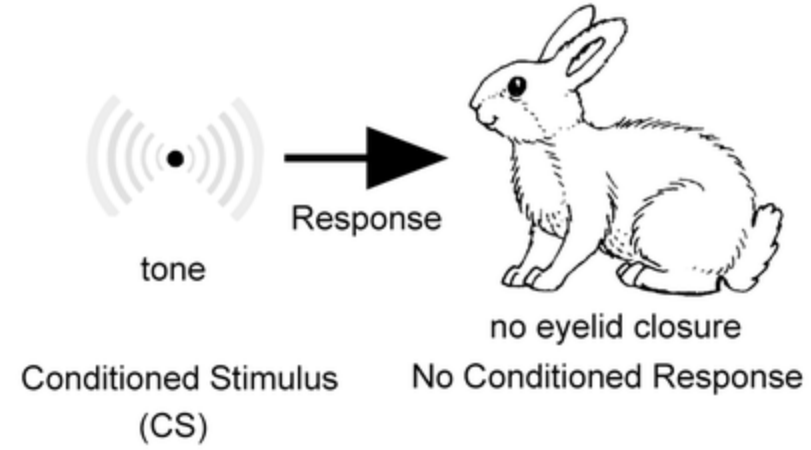
- Cigarette Smoke(US) → headache (UR)
 - Party → smoke → headache
 - Party (CS) → headache (CR) (anticipating smoke)
-
- Boss harasses (US) → anxiety/heart rate increases (UR)
 - Meetings → boss harasses → anxiety
 - Meetings (CS) → anxiety (CR) [anticipating the boss's harassment]

A

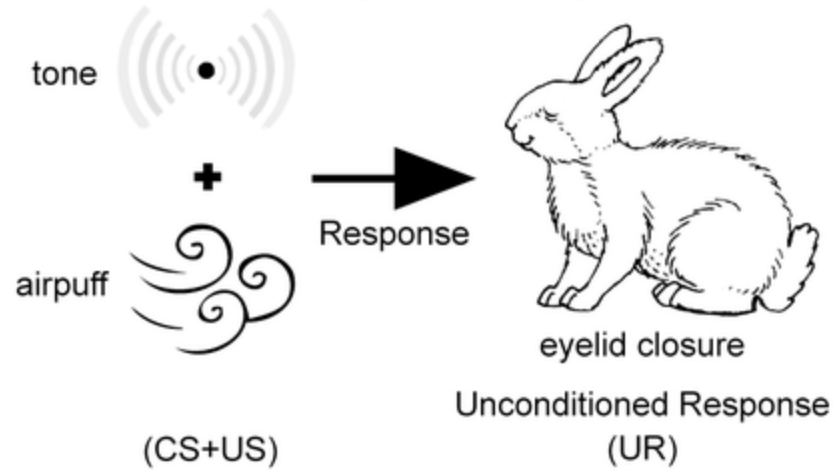
Before conditioning

**B**

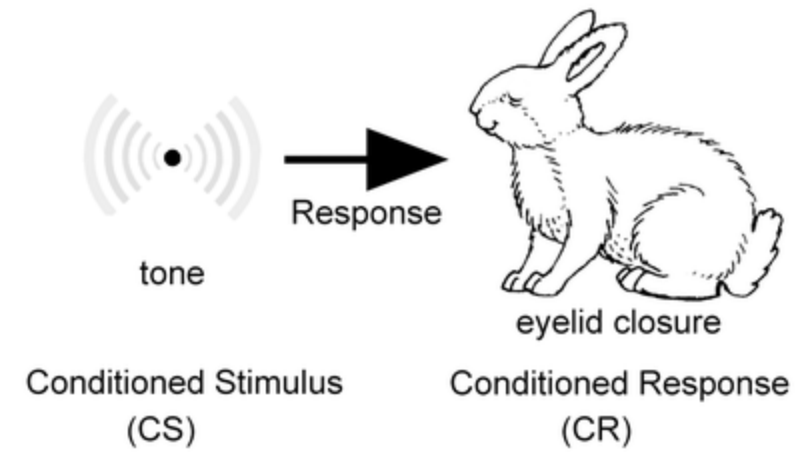
Before conditioning

**C**

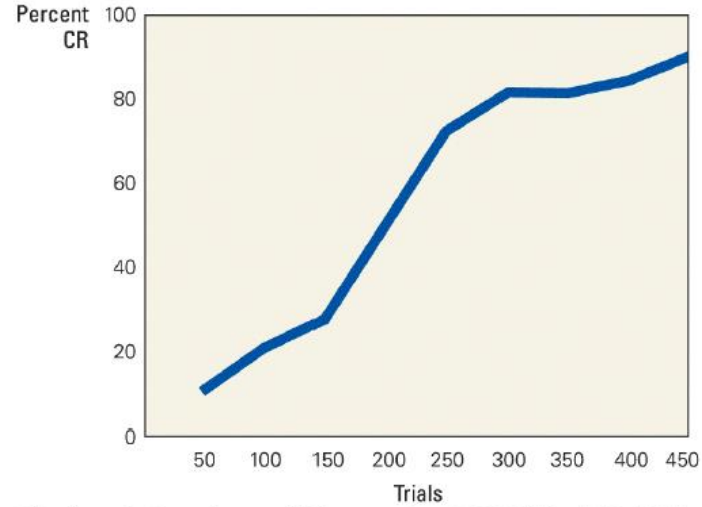
During conditioning

**D**

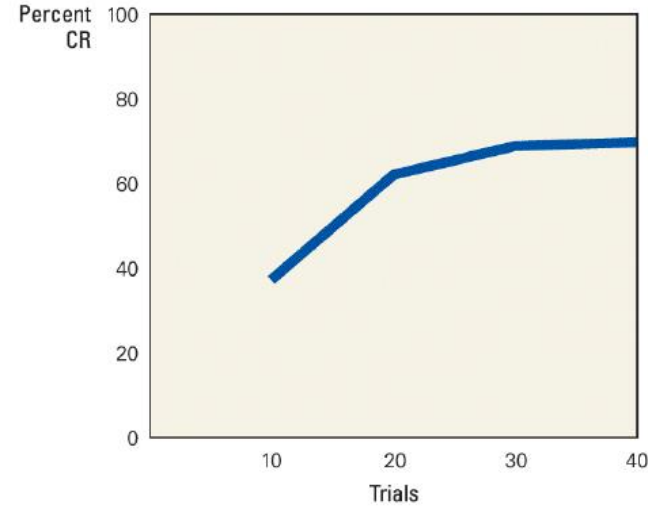
After conditioning



A Rabbit eyeblink conditioning



B Human eyeblink conditioning



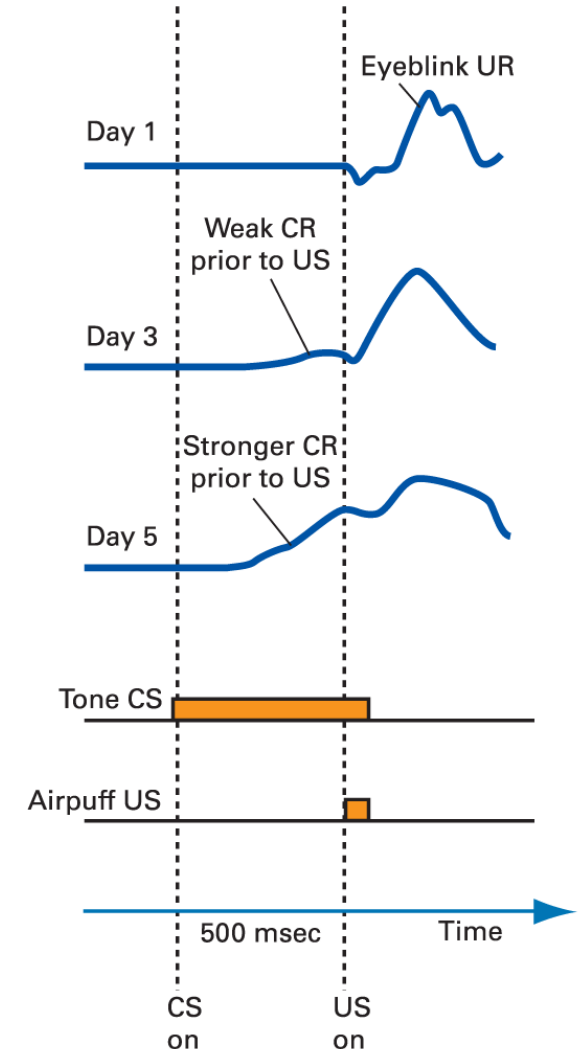
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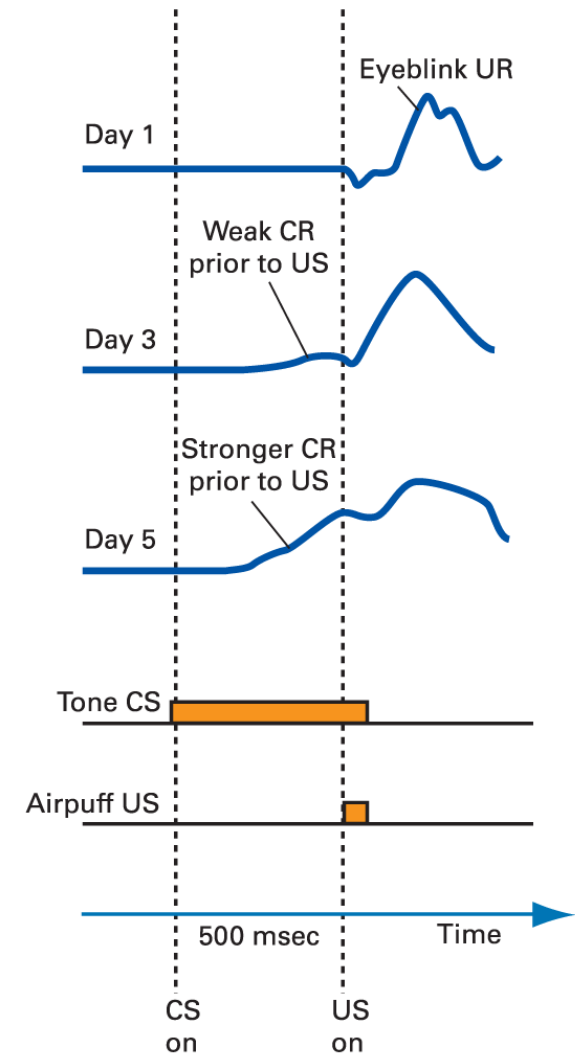
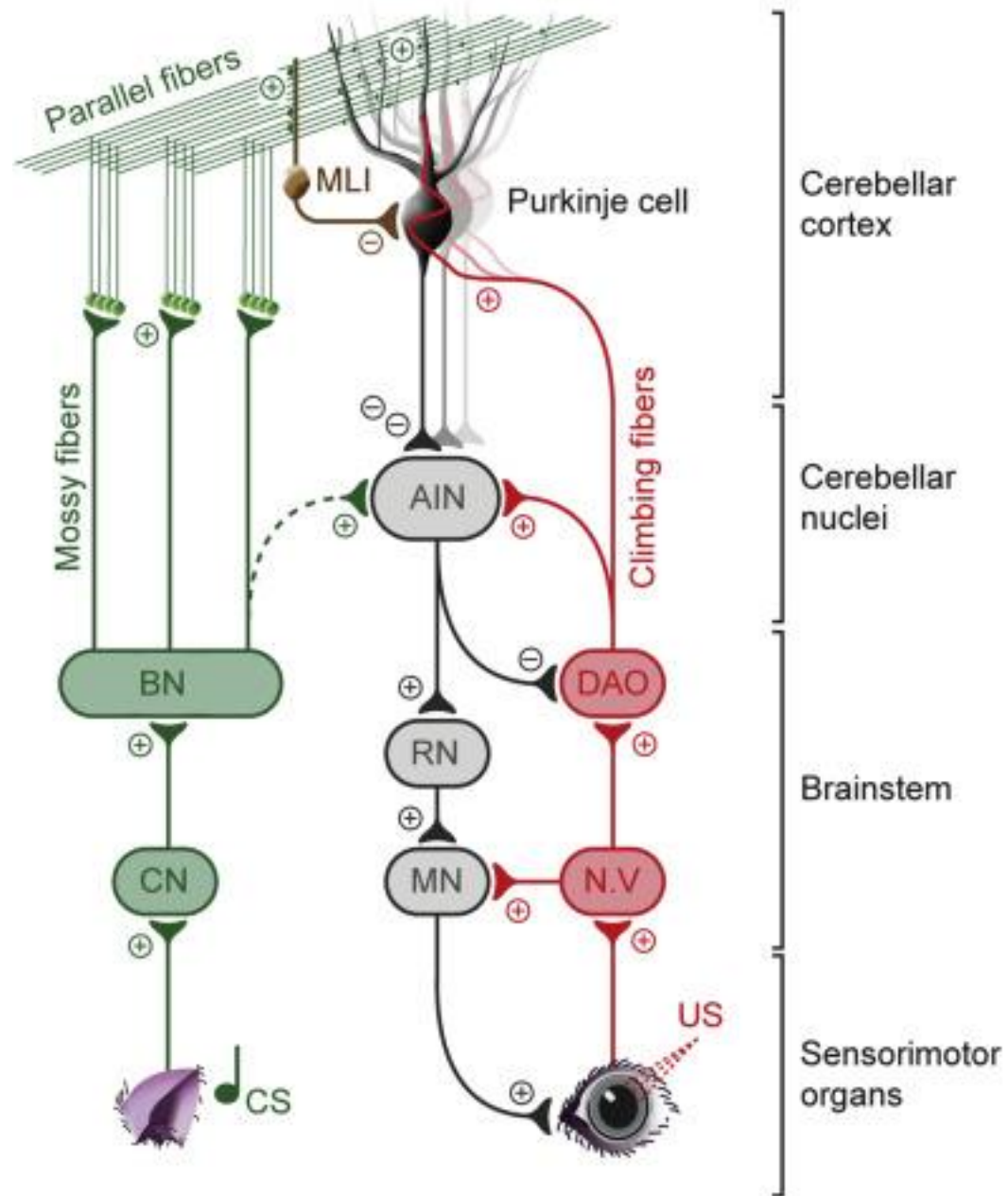
A: Mark Gluck; B: Richard F. Thompson

FIGURE 4.5 Eyeblink conditioning in humans and rabbits (A) In human eyeblink conditioning, a tone CS is delivered through headphones. The US is a puff of air delivered through the rubber tube. The eyeblink CR is recorded by EMG electrodes placed above and below the eye. (B) In rabbit eyeblink conditioning, a similar rubber tube delivers the airpuff US to the rabbit in the restraining acrylic glass case; a photobeam measures the CR and UR.

Airpuff → eyeblink
Tone → Airpuff → eyeblink
Tone → eyeblink



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Conditioned Compensatory Response (CCR)

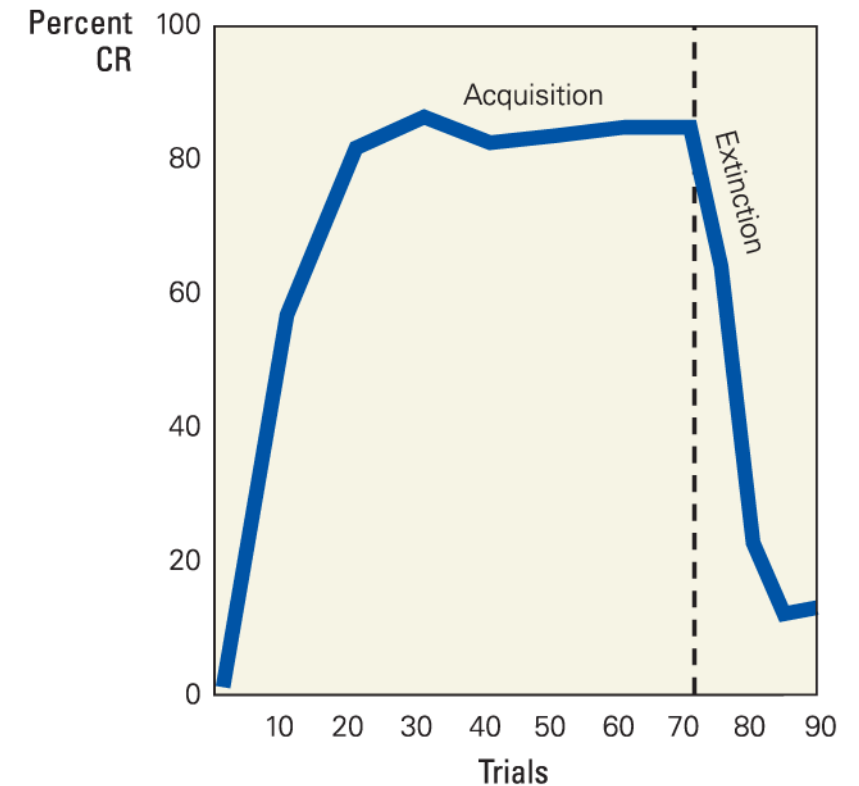
- E.g. swimming pool overflow
- E.g. Context - Adrenaline – heart rate experiment in dogs (Subkov & Zilov, 1937).
 - dogs' heart rate increased less and less with each subsequent injection – tolerance
 - Homeostasis - the researchers placed their dogs on injection stands, where the dogs normally received the drug injection, but they administered a neutral, inert substance rather than the adrenaline. The researchers observed that this caused the dogs' heart rate to decrease.
 - CCR - Apparently, the various cues (the stand, the injection) that predicted the adrenaline injection triggered a conditioned compensatory response that lowered the dogs' heart rate in anticipation of the adrenaline's causing an increase in heart rate.
- Body adapts to the dose of the drug - **Homeostasis** - The tendency of the body (including the brain) to gravitate toward a state of equilibrium or balance
- **Is drug tolerance an example of CCR?**

Extinguishing an Old Association

1. What if the boss stops harassing during meetings ? (someone filed a complaint)
How long will it take to stop becoming anxious?

Association becomes dormant?

- **Extinction:** in classical conditioning, the process of reducing a learned response to a stimulus by ceasing to pair that stimulus with another, previously associated stimulus



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During **acquisition**, the CS-US pairings lead to an association between CS and US such that the CS can produce the CR.



If the CS is presented without the US, eventually the CR is **extinguished**.



Later, if the CS is presented alone it will produce a weak CR, a pattern known as **spontaneous recovery**.

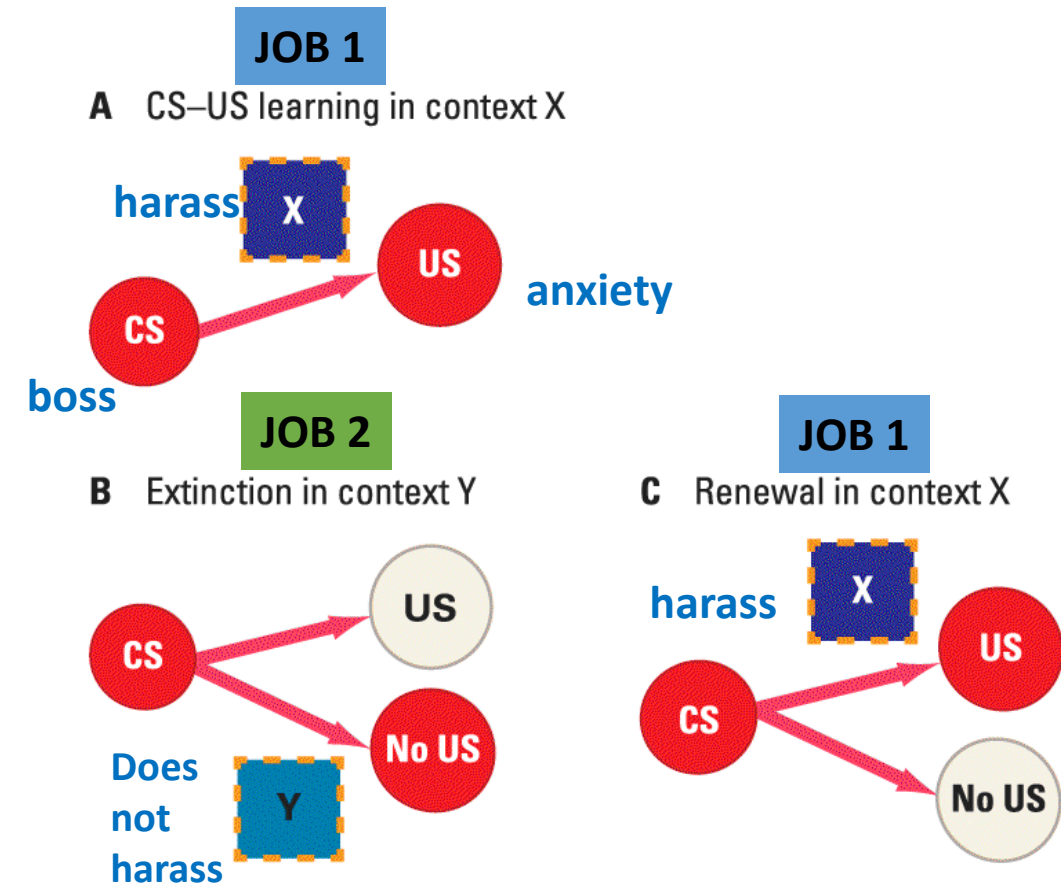


7.8 Extinction of a classically conditioned response The figure shows the decrease in the amount of saliva secreted (the CR) with increasing number of extinction trials—that is, trials on which the CS is presented without the US. However, if the animal then spends a little time away from the conditioning apparatus, the CR will reappear the next time the animal encounters the CS—a pattern known as spontaneous recovery.

Extinction

2. What if the employee changes the job?

- Anxiety reduces/absent?
- Has the brain unlearned the association?
 - No, the original association is still there (memory trace)
 - The association (X) is suppressed (weakened)
 - Relearning occurs– makes another association (Y)
 - Employee visits old office or meets the ex-boss – anxiety behaviour reinstates – **spontaneous recovery** of the association



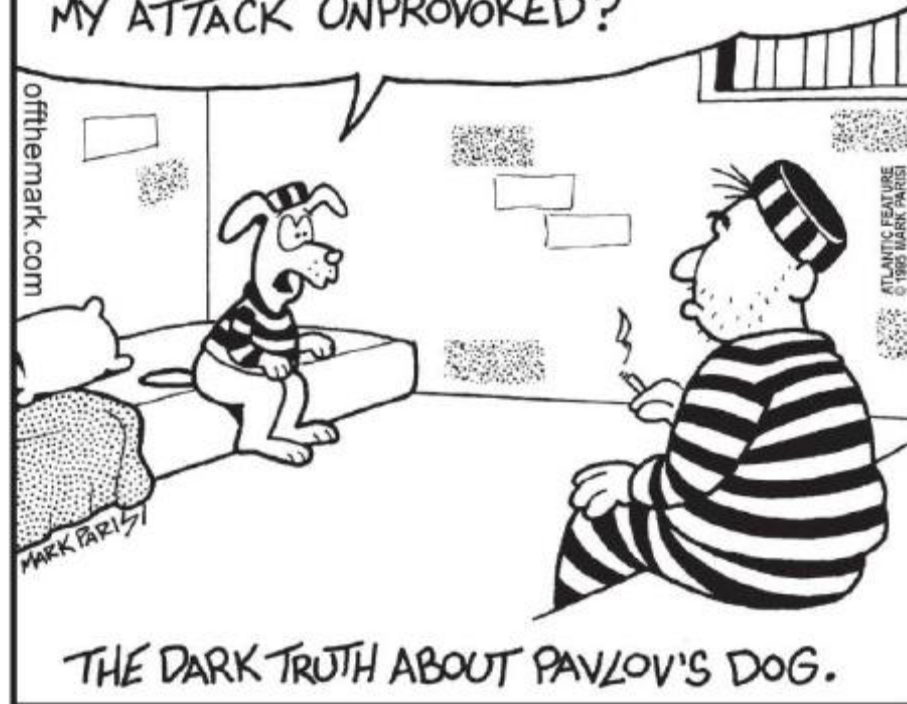
- Real life examples of extinction?

off the mark.com

by Mark Parisi

BELL RINGS, I GET A TREAT...
BELL RINGS, I GET A TREAT... IT
WENT ON THAT WAY FOR DAYS. THEN,
OUT OF THE BLUE ... BELL RINGS, I
GET **NOTHING AT ALL!!** NADA!
I MEAN, CAN YOU SERIOUSLY CALL
MY ATTACK UNPROVOKED?

offthemark.com



THE DARK TRUTH ABOUT PAVLOV'S DOG.

Mark Parisi/Atlantic Feature Syndicate

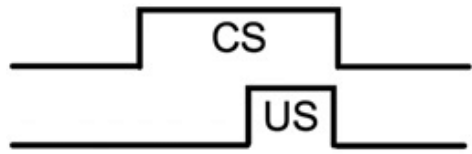
Rapid reacquisition

E.g. in the new office, if a colleague is uncooperative and prevents you from working efficiently

- anxiety returns very rapidly

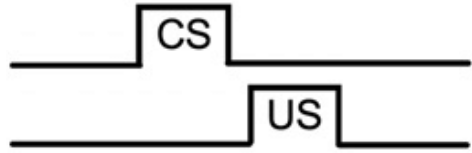
The Informational Value of Cues

- Humans and animals are sensitive to the informational value of cues in determining which associations they do or do not learn
- Contiguity → closeness in time and space is necessary for learning a new association, such as that between a CS and a US



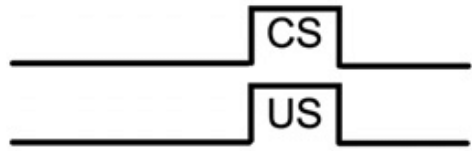
Delay

- Does not require the hippocampus to remember the CS
- Mid-brain+cerebellum needed
- Most effective
- CS predicts US



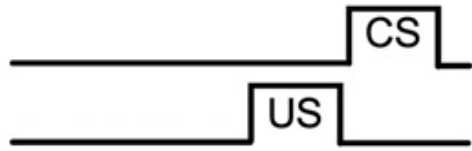
Trace

- Requires the hippocampus to remember the CS
- CS predicts US



Simultaneous

Not predictive
Weak association

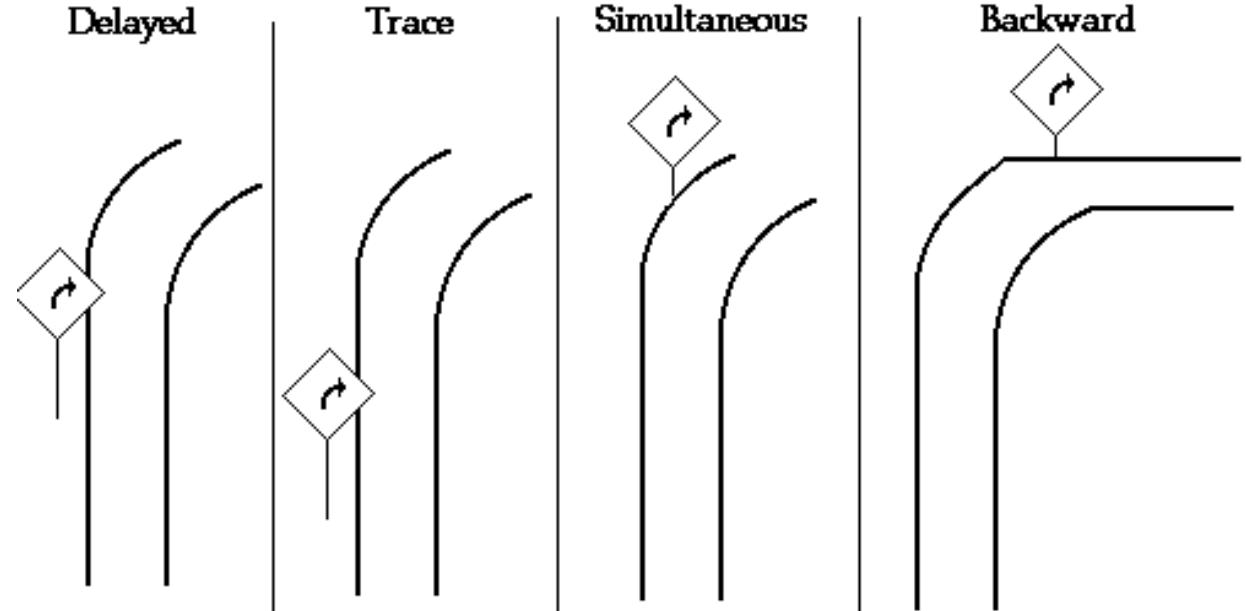


Backward

Not predictive
Weak association

Time →

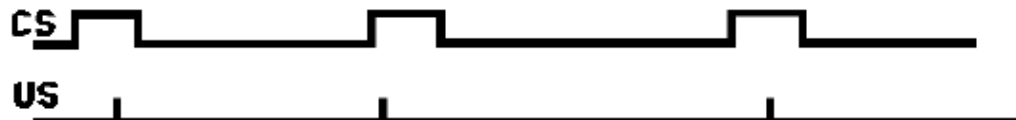
Highway Analogy for Time and Classical Conditioning



*Schematic of Two Conditioned Stimulus/
Unconditioned Stimulus (CS/US) Relations That
Share the Same Contiguity but Differ in the
Information the CS Gives About the US*



Conditioning occurs



Conditioning may occur but may be weak



Conditioned inhibition

Conditioned inhibition

- Conditioned inhibition vs extinction?

Higher-Order / Second-Order Conditioning

