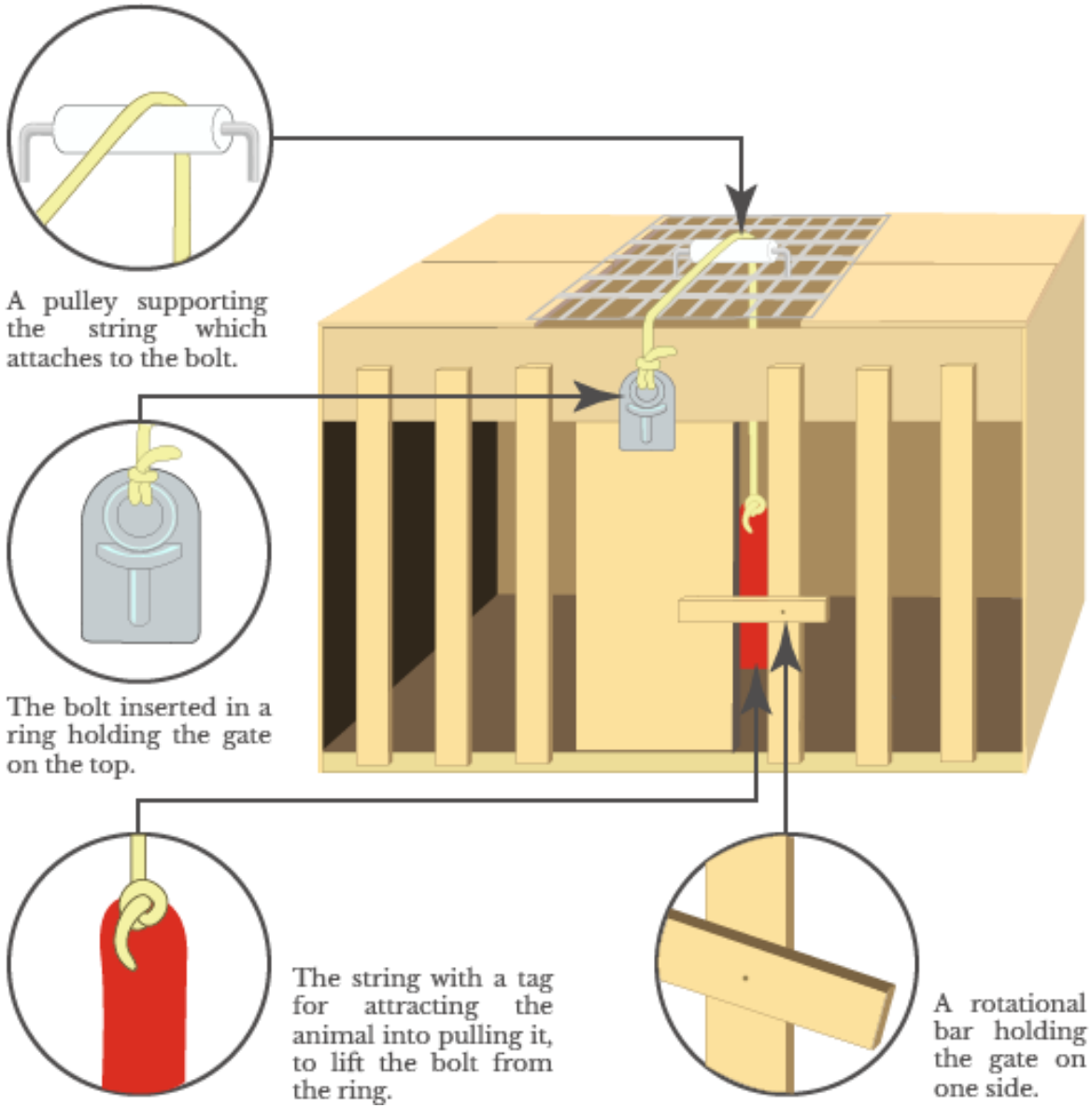
Learning the outcome of behaviour

- Military dogs sniffing bombs
- Washing hands before a meal
- Submitting projects within deadline

- How do we learn new behaviours?

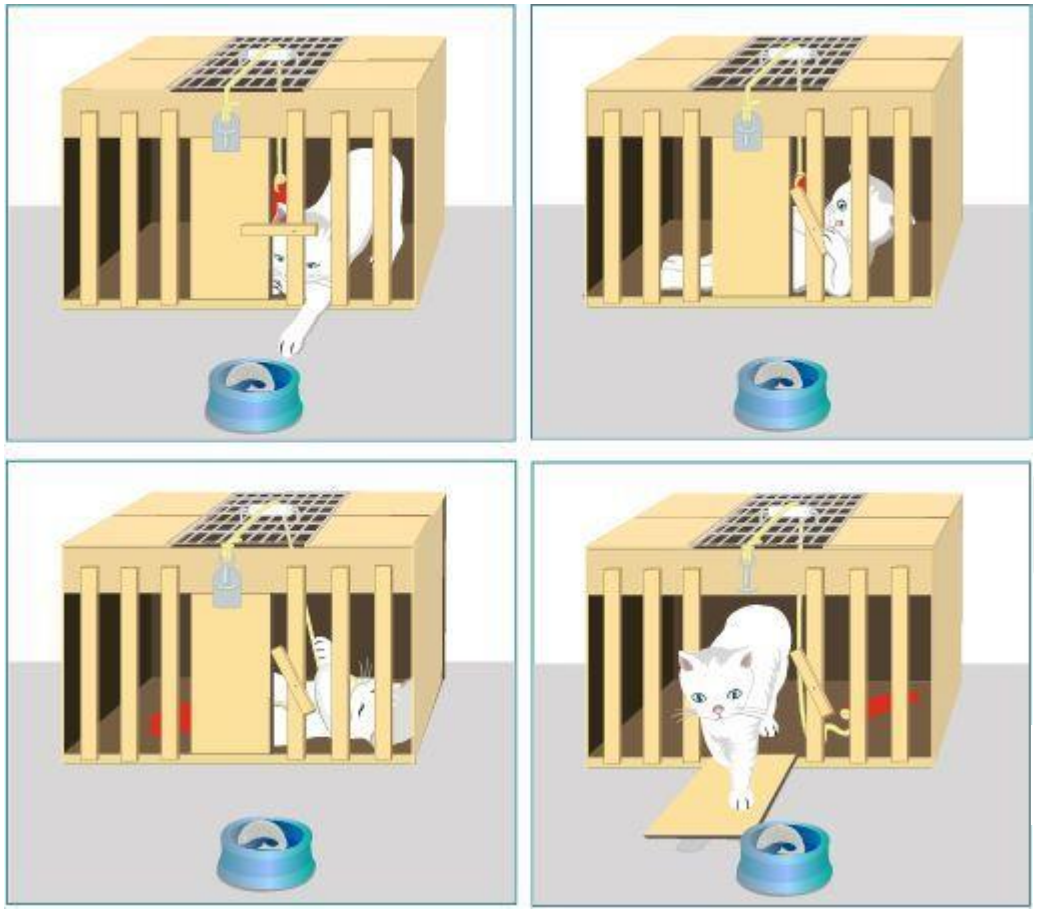
operant conditioning
The process whereby organisms learn to make or to refrain from making certain responses in order to obtain or avoid certain outcomes.

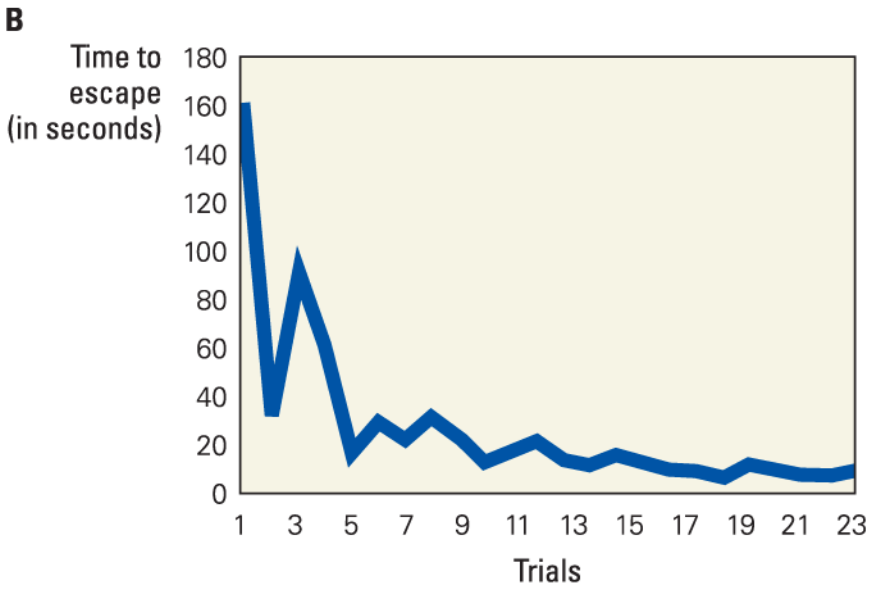


Operant conditioning box used in early experiments by Edward Thorndike

Operant or Instrumental conditioning

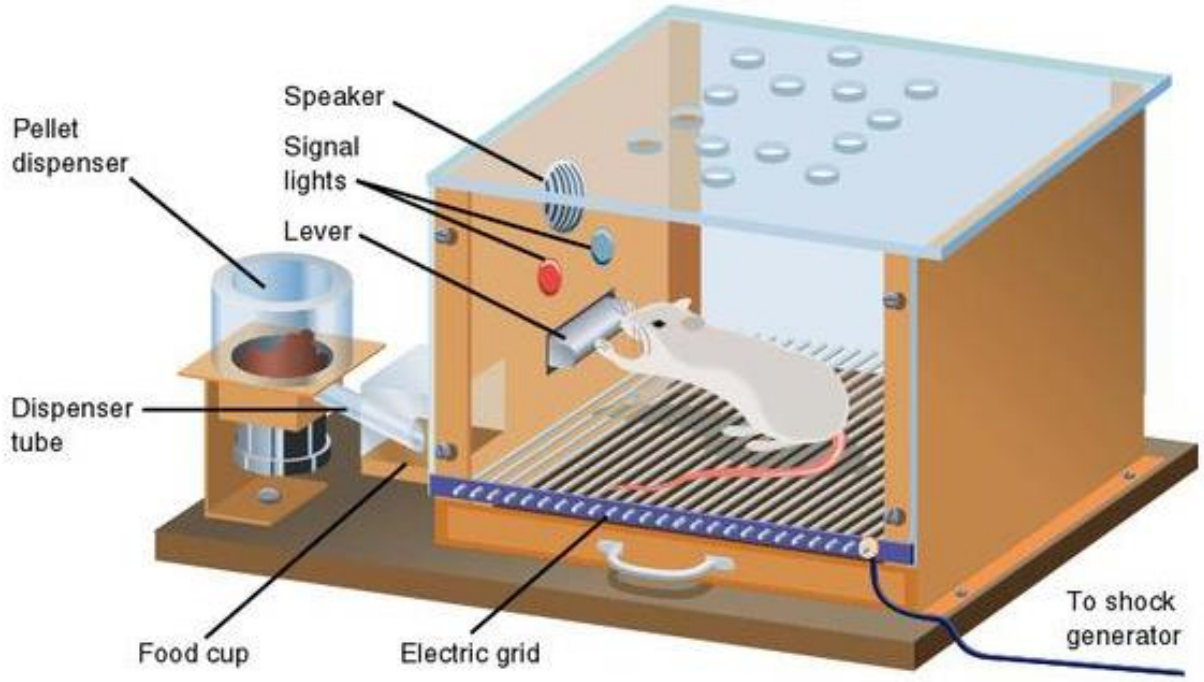
- The learning is called “operant” because the organism “operates” or is “instrumental” in taking an action for an outcome to occur.





Edward Thorndike’s cat puzzle box experiment

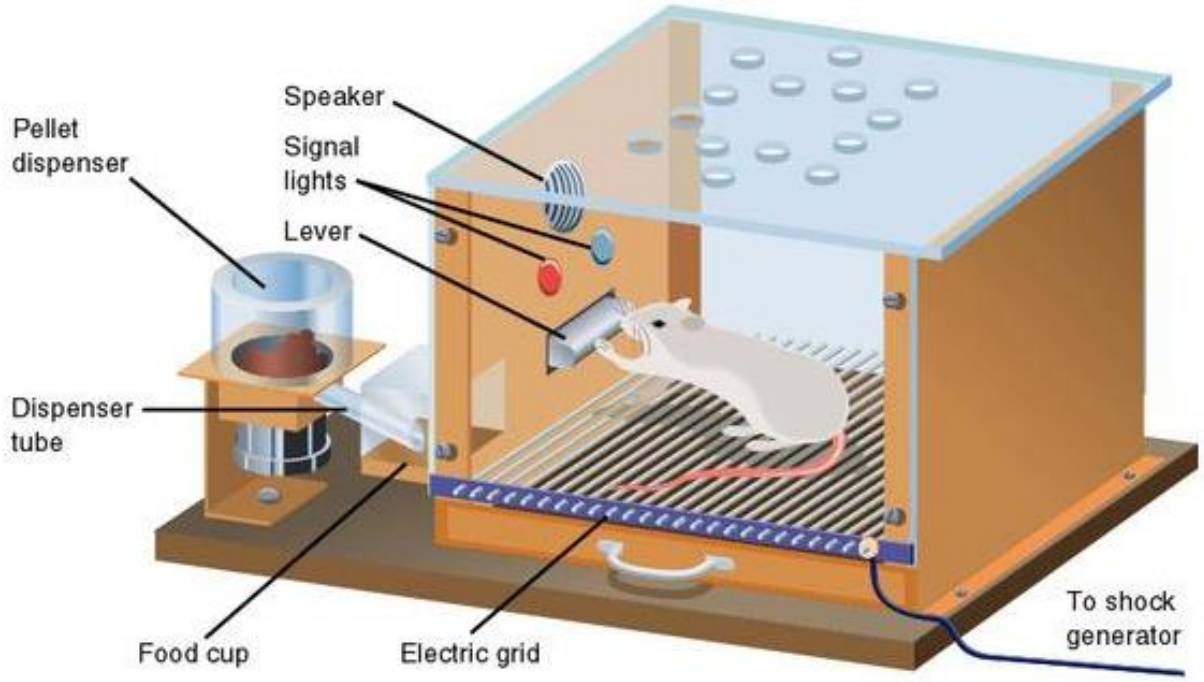
Skinner’s box



free-operant paradigm
An operant conditioning paradigm in which the animal can operate the apparatus as it chooses in order to obtain reinforcement (or avoid punishment).

lever presses (R) → food (O)

Skinner's box



Real life examples?

Exam hall

free-operant paradigm

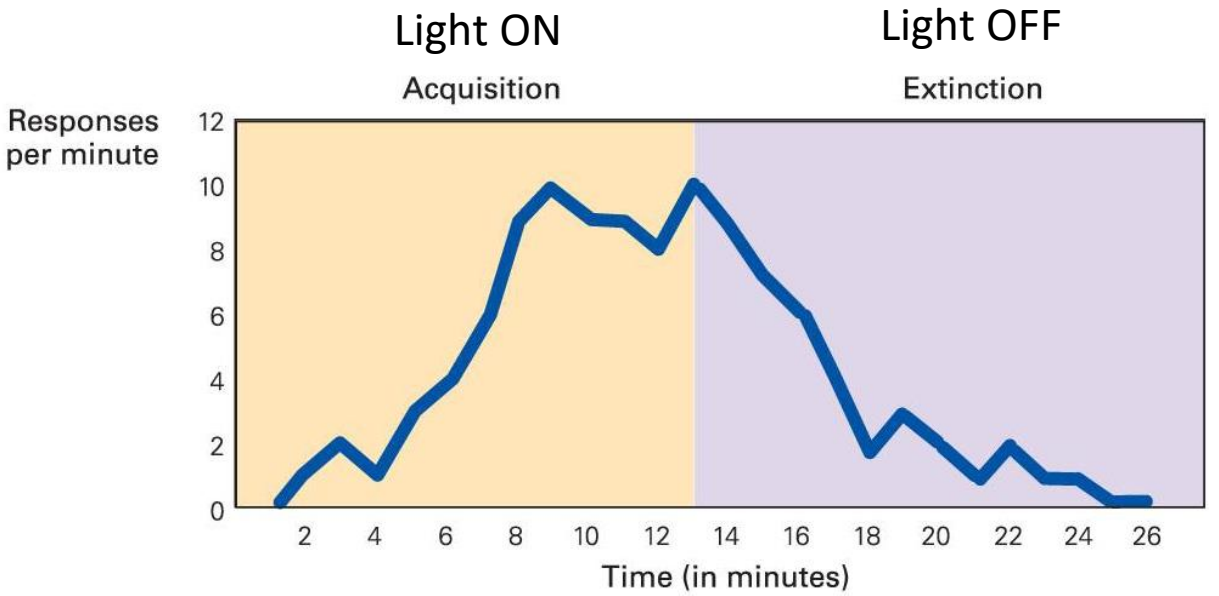
An operant conditioning paradigm in which the animal can operate the apparatus as it chooses in order to obtain reinforcement (or avoid punishment).

lever presses (R) → food (O)

Discriminating stimulus → light

Light ON (SD) → lever presses (R) → food (O)

Light OFF (SD) → lever presses (R) → no food (O)



Breakdown of Behavioral Processes

- In the presence of a particular stimulus, called the **discriminative stimulus (S^D)**, a particular response (R) may lead to a particular outcome (O)

- Operant conditioning can be formulated as a three-part association
  - **Discriminative stimulus S^D → Response R → Outcome O**

- S^D is the puzzle box
- R is the sequence of movements needed to open the door,
- O is the escape

- The S^D → R association is strengthened when R is followed by a desirable outcome O

- How is operant conditioning different from classical conditioning?

Let’s look a few examples….

- In old apartment buildings of Mumbai, whenever someone flushes the toilet, the shower water becomes scalding hot. The hot water made Raghu flinch the last time in was in the shower. Now he flinches whenever he’s in the shower and hears the noise of flushing.

classical conditioning
CS – toilet flushing sound
US – hot water
CR - flinching

Context dependent classical conditioning
CS – toilet flushing sound while taking a shower
US – hot water
CR - flinching

Since retiring, Col. Singh spends a lot of time sitting on his back porch, watching the birds and whistling everyday. One day, after whistling he throws crumbs, and birds come and eat them. The next day, he sits and whistles and throws crumbs, and the birds return. After a few days, as soon as Col. Singh sits outside and starts whistling, the birds arrive.

Whistling is the discriminative stimulus (SD),
birds arriving is the learned response (R),
and birds eating the crumbs is the outcome (O).

The birds do not get the crumbs (O) unless SD is present and they make response R, so this is operant conditioning.

- Kabir’s dog Snoopy is afraid of thunder. Snoopy has learned that lightning always precedes thunder, so whenever Snoopy sees lightning, he runs and hides under the bed

Lightning is the discriminative stimulus (SD): Lightning signals that thunder is coming, and this is what Snoopy uses as a cue.
Snoopy running and hiding under the bed is the learned response (R): Snoopy has learned to react this way whenever he sees lightning to avoid the thunder.
Thunder is the outcome (O): Thunder is the unpleasant stimulus that Snoopy is trying to avoid.

- Ashwin has accepted a new job close to home, and now he can walk to work. On the first morning, there are clouds in the sky. It starts to rain and Ashwin gets wet while walking to work. The next morning, there are again clouds in the sky. Ashwin brings his umbrella along, just in case, and does not get wet. Ashwin carries his umbrella to work on days the sky looks cloudy.

Presence of clouds is the discriminative stimulus (SD),
bringing the umbrella is the learned response (R),
and staying dry is the outcome (O).

The outcome (O) does not occur unless SD was present and Ashwin brought his umbrella (R), so this is operant conditioning.

- In all examples discussed so far, there is an SD (discriminating stimulus)

- What happens in the absence of SD?

Swimming Race

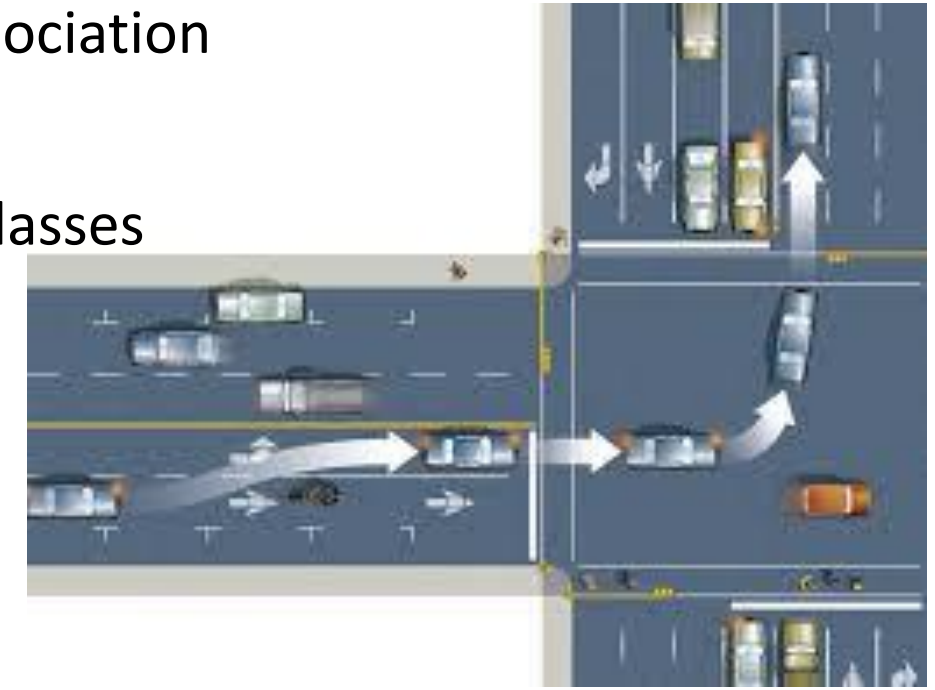
S (starting whistle) ➔ R (dive) ➔ O (good start in the race)

R (dive) ➔ S (starting whistle) ➔ O (?)

Too Strong **Discriminative stimulus S^D → Response R** association

Habit

- Alarm rings on Sunday morning and you get ready for classes



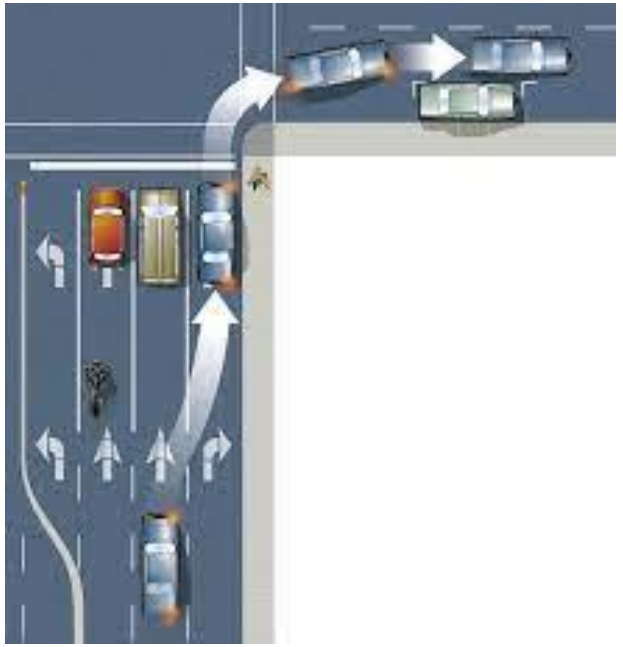
Strong S ➔ R association

Automatic response (R) in the presence of SD

Strong operant conditioning can cause errors

Example?

Left side (India) vs right side (US) driving



Shaping Behaviour

Service dog helps a blind man cross a busy city street. How are these dogs trained?

Go to end of road → stop → wait for a green traffic light → check for oncoming cars → use zebra crossing to walk across

By reinforcing (rewarding) behaviour/every action that adds up

More examples?

Disciplining children at home – HW then play
Teaching autistic children to speak

What is a reinforcer?

- Possible reinforcers in real life?

- Reinforcement can be positive or negative
  - Positive reinforcement → increase outcome by encouraging a particular behaviour
  - Negative reinforcement → decrease outcome by encouraging a particular behaviour

Primary Reinforcers

- Food, water, sleep, comfortable temperatures, and sex
- Innate biological need to survive and thrive.
- Behaviours that provide access to these things or conditions are repeated
- Not all reinforcers are equal in value – only if you are hungry, food is a reinforcer.

If you are hungry but not thirty water loses its reinforcement power → conditional reinforcement

If you were expecting warm/hot food drink but were instead offered cold food,the value of reward decreases → negative contras

Secondary reinforcers

Money → food, water, shelter, etc.

Tokens (access to privileges) → prisons, grades/GPA, positions of power

Operant + classical conditioning

S (odor of bomb) ➔ R (sniff and hold) ➔ O (click sound) → food

S (no odor of bomb) ➔ R (sniff and hold) ➔ O (no clicker) → no food

O (clicker) → food

Some click sounds are rewarded with food while some are not?

Reward seeking behaviour lasts longer
Animals are kept partially hungry to perform the behaviour

Punishers?

- Social/parental disapproval
- Rejection
- Monetary fines
- Pain
- Serving jail time

- Does punishment produces the opposite effect of reinforcement ?

Punishment can lead to variable behavior

- Discriminative stimuli for punishment can encourage cheating…example?
  - Police absent → speeding → no punishment
  - Police present → speeding → punishment (fine)
  - Police present → speeding suppressed (avoid punishment)
  - Speeding behaviour is not altered

- Concurrent reinforcement can undermine the punishment
  - Thrill of breaking rules and driving fast near a policeman

- Initial intensity matters
  - Police present → speeding → punishment (very heavy fine)
  - Higher probability of reducing speeding behavior

Instead reinforce (desired behaviour) slow driving – give incentives for slow/careful riving

Other examples?

Reinforcing good behaviour in children instead of punishment

Appreciate doing homework or good behaviour in class

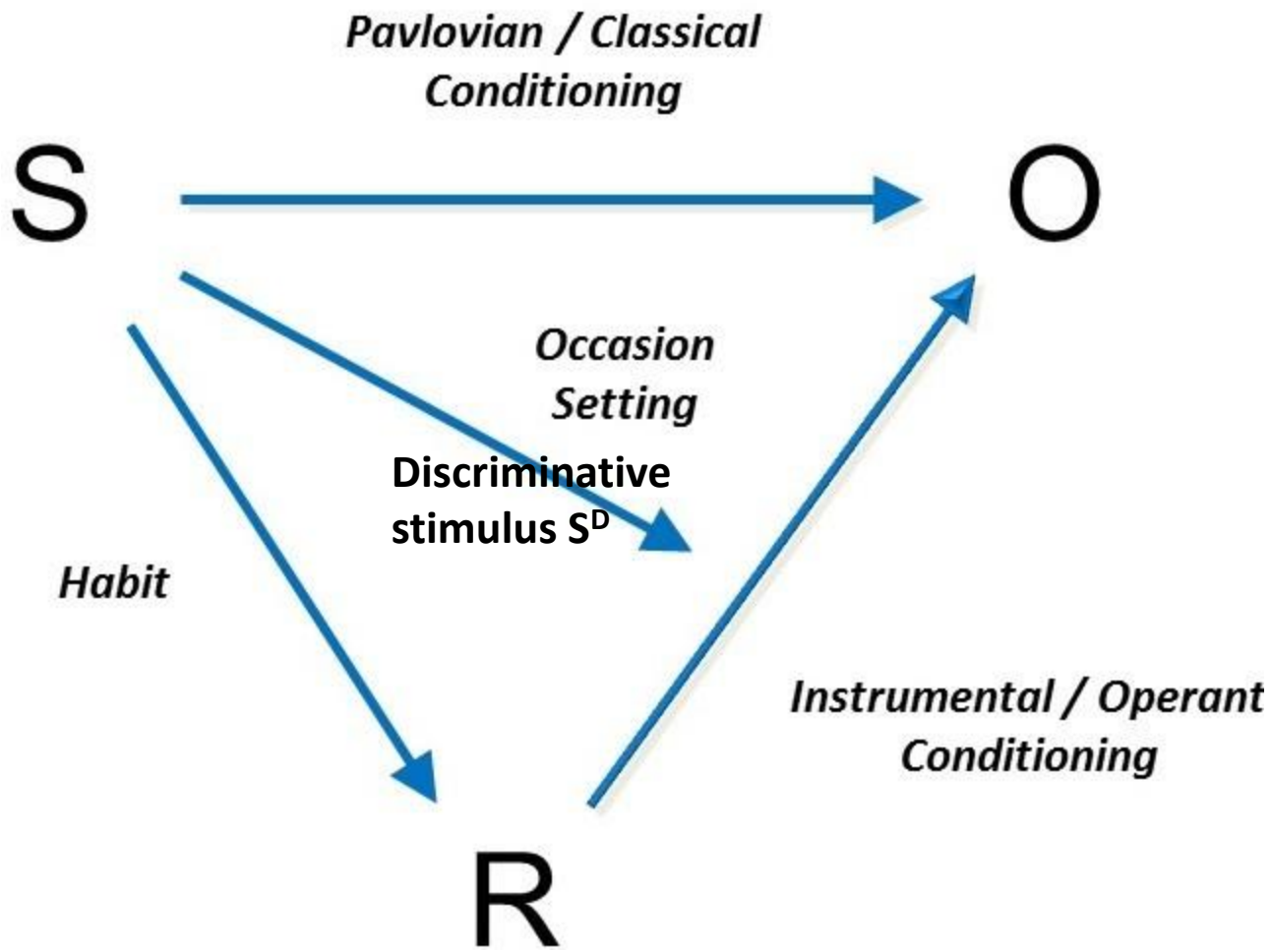
Anxiety -> Smoking
Fear -> Dog running under the bed

Coping mechanisms to overcome the body's natural response to CS

	Classical Conditioning	Operant Conditioning
Basic Idea	Organism associate events	Organisms associate behaviors and resulting events
Response	Involuntary, automatic	Voluntary, operates on environment
Acquisition	Associating events, NS is paired with US and becomes CS NS - Neutral stimulus	Associating response with a consequence (reinforcer or Punisher)
Extinction	CR decreases when CS is repeatedly presented alone	responding decreases when reinforcement stops
Spontaneous Recovery	The reappearance, after a resting period, of an extinguished CR	the reappearance, after a resting period, of an extinguished response
Generalization	the tendency to respond to stimuli rather than to the Cs	organism's response to similar stimuli is also reinforced
Discrimination	the Learned ability to distinguish between the Cs and other stimuli that do not signal a US	organism learns that certain responses,but not others, will be reinforced

Classical vs Operant conditioning

	Classical conditioning	Operant conditioning
Nature of response	Involuntary (reflexive)	Voluntary (usually) but can be both – Vol & Involuntary
Timing of Stimulus	Precedes the response	After the desired response
Timing of Response	After the stimulus	Before the stimulus
Role of learner	Passive	Active



https://nobaproject.com/modules/conditioning-and-learning#:~:text=Classical%20and%20operant%20conditioning%20are,occur%20at%20the%20same%20time.