Innate behavior & Learning

Innate behavior has a fixed, genetic component. Despite differing environments, the behavior develops in all individuals. Learned behavior is acquired and modified over development. Innate behaviors can be triggered or enhanced by learning. Learned behaviors can be affected by innate biases. There is no sharp division between these types of behaviors.

Innate behavior

Fixed action pattern: a behavior that, once triggered, will progress in a pre-specified manner. Also called motor program.

Innate behavior & Learning

Innate behavior

Fixed action patterns continue even if the stimulus is removed.

Graylag Goose

Innately Biased and Innately Guided Learning

Innate behavior & Learning

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Innate behavior

Some innate behaviors are triggered by an external stimulus.

Male sticklebacks have red bellies
Males prepare a nest
Females follow select males into their nest and lay eggs
Males follow afterwards to fertilize the eggs
Once a female spots a select male near a nest, she will then follow almost any red object into the nest and lay her eggs.
A red object is a releaser stimulus for her innate egg laying behavior.
Innate behavior
Stimuli that trigger innate behaviors are called **releasers**.

This diamond form with red ventral coloring works just as well as a real male.

Approximates the internal template for egg laying in female sticklebacks.

Innate behavior
Herring gull

Fixed action patterns are **not only triggered** by the stimulus for which they are designed.

Not enough time or exposure to different stimuli for evolution to rule out everything.

Grapefruit

Innate behavior
Features that are **more extreme** than natural are preferred.

Supernormal stimuli are objects with extreme and unnatural features that release an innate behavior.

Normal Egg

Supernormal Stimulus

Innate behavior
Australian Digger Wasp

Excavates a tunnel about 8cm long and 8cm wide

Before rearing offspring, constructs protective tunnel

Prevents parasitic wasps from entering nest

Innate behavior
Wasp has no overall conception of the funnel

If stem is buried, she keeps building the funnel even though it will open into the ground and not be useable.

If stem is buried

she just keeps going
Innate behavior

Wasp has no overall conception of the funnel

- If neck is cut off and reattached at a weird angle, wasp continues with building funnel.
- If a hole is drilled in the funnel, the wasp does not simply patch the hole. It treats the hole like the base opening to the nest and constructs a new funnel.

Innate behavior

- Other examples we've covered already in a different context:
  - Escape response in cockroach (even newborns show it)
  - Feint in tentacled snake (even young snakes raised in isolation show it)
  - Brood parasitism in Cuckoo (feeding the imposter because of auditory triggers for parenting)

Innate behavior

- In humans, there are many innate behaviors in infancy (sucking, startle, palmar grasping, toe curl)
  - Walking (all babies walk even if they are restricted from moving prior to that time)

- It is not yet known how many human behaviors or which aspects of human cognition have an innate basis — that is something we'll discuss throughout the semester.

Learning

- In the language of psychology, releasers are called unconditioned stimuli (US).

  Fixed action patterns are called unconditioned responses (UR).

  - CS + US → UR
  - An unrelated stimulus (CS) that is paired with a US can come to elicit the unconditioned response (UR).

  Classical Conditioning

  - Learning occurs if CS is associated with US and never appears without it
  - once the CS has been learned, the addition of a second cue has little effect (blocking)
    - not because they can’t remember two cues but because they've already learned one cue that is effective
  - learning is better with contrasting stimuli: one stimulus that predicts the US (e.g., black square as CS+) and one that does not (e.g., black rectangle as CS-).
Learning

Contiguity versus Contingency

- occur together
- occur together in a predictive order

Shock then light, light then shock, shock then light...

Contingency, not just contiguity, forms the basis of learning

Animals can also learn novel responses to novel stimuli through reinforcement.

Animal discovers the response that leads to reinforcement through trial-and-error (shaping).

- puzzlebox
- ping pong
- word recognition

“All behavior is constructed by a continual process of differential reinforcement from undifferentiated behavior, just as the sculptor shapes his figure from a lump of clay” B. F. Skinner

Operant (or Instrumental) Conditioning

Learning

Animals learn to solve a maze; finish more quickly with each trial.

Explanation from Behaviorism: Animal learns a reflex chain or motor program (left – right – straight – right – right...)

Explanation from Cognition: Animal has a mental map of space and can use it flexibly

Learning involves constructing mental representations, not just motor programs.

Latent learning: Animals spontaneously combine information to produce behavior that is not explicitly trained or conditioned.

Day 1 Day 2 Day 3

- Maze with food in white room and black room
- No maze, just a black room with a shock
- Maze again. Rat goes to white room (not black room)

Edward Tolman

1) Cognitive Map
2) Latent Learning

Showed that behavior is defined by more than just learned associations – there is more than one kind of learning.

Learning involves representations and interpretations that are constructed in the minds of animals.

1949
Innately Biased Learning

Learning is influenced by innate biases.
Rats, mice, and pigeons are relatively flexible species with learning-dependent feeding strategies (generalist diet, scavenging).
Yet even these flexible learners show innate biases in what they can learn.

Food avoidance learning in rats
For taste → nausea, can be learned even if separated by hours.
Not true for light → shock (only associated if occur within seconds).

The timing that is needed for learning depends on the stimulus – innate bias.

Innately Biased Learning

Rats can learn to jump to avoid shock but not to get food.
Rats can learn to press a lever to get food but not to avoid shock.
Pigeons can’t learn to *stop* pecking a key in order to get food.

Biases in the responses that can be learned for certain stimuli

Innately Guided Learning

Experiments have shown that birds learn which species to mob by attending to the mobbing calls of group members.

Sees owl

Sees nectar-feeding bird species

Inexperienced juvenile

Hears mobbing call when it sees another non-threatening nectar feeder.

Juvenile subsequently gives mobbing call to this non-threatening species but not the owl.

Programmed learning: mobbing is innate but there is flexibility to learn the target.

Innately Guided Learning

Mobbing is an innate behavior in some birds.
But the birds must learn which species to mob.

Experienced adult

gives mobbing call to owl (a predator)

Inexperienced juvenile

Hears mobbing call when it sees another non-threatening nectar feeder.

Experiments have shown that birds learn which species to mob by attending to the mobbing calls of group members.

Newborn chicks learn to recognize their mother hours after hatching and follow her outside of the nest.

About 10 to 18 hours after chicks hatch, the mother leaves the nest and the chicks follow.

Experiments have been done to test the types of things that chicks will imprint on and the timing of imprinting.

Chicks imprint on the mother’s visual form, waddling motion, and voice.
Chicks imprint best at about 16 hours after hatching.

Birds that do not imprint by 30 hours never imprint. (sensitive period)

Once chicks imprint, they never change models.

As time runs out, if a chick has no mother to imprint on:

it will imprint on another animal

if no animal, it will imprint on an unnatural object

Innate predisposition to imprint but the target it somewhat flexible.
**Innately Guided Learning**

Chick imprinting behavior is used to study the precision of their representation of the model they imprinted on.

Do chicks discriminate number: If imprinted on 5 objects, will they reject 4 red objects...?

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**Conclusion**

- Innate behavior
  - Fixed action patterns
  - Releaser stimuli
  - Supernormal stimuli
- Learning
  - Classical Conditioning
  - Operant/Instrumental Conditioning
  - Latent Learning
- Innately Biased and Innately Guided Learning