

Phenotypic Plasticity and Learning

This lecture is about “nature VIA nurture” -- how genes shape response to the environment. Two topics:

- Learning biases: Evolution shapes what/when/how we learn
- Phenotypic plasticity and reaction norms

Classical conditioning

What can a rat learn, and why?

Rats given water with a punishment while drinking > stop drinking

If precede punishment with a signal while drinking, will stop drinking at punishment, and eventually at the signal before the punishment.

Assumption in 1950s was that any signal could be paired with any punishment (or reward).

Garcia and Koelling 1966 Challenge

Used different combinations of signal and punishment

GROUP	SIGNAL	PUNISHMENT
1	noisy water	Shock
2	noisy water	Nausea (from x ray)
3	flavored water	Shock
4	flavored water	Nausea (from x ray)

Four groups of genetically-identical rats

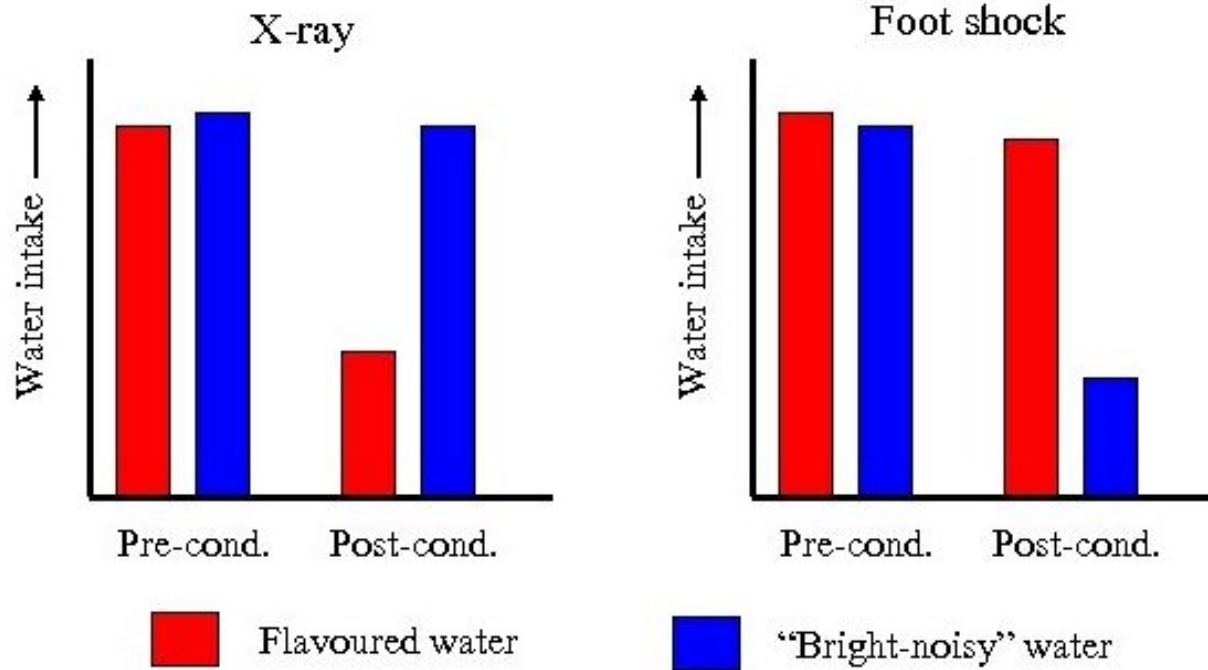
Garcia and Koelling 1966

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Which rats were able to learn to stop drinking at the signal?

Garcia and Koelling (cont)



Rats learned to pair nausea (x-ray) with flavored water, not shock

Rats learned to pair shock with noise and light signal, not flavored water

“Garcia effect”

Also found an association between nausea and taste aversions:

- Formed even if the event was separated by many hours.
- Formed after only 1 trial.

Any parallels with people?

Prepared social learning

- Monkeys learn to fear snakes more easily than other things after watching another monkey respond fearfully (Ohman & Mineka, course reading)
- Children taught about animals remember which animals are dangerous more easily than other things about the animal (Barrett & Broesch, 2012)
- Infants are cautious about touching plants without social information (Wertz & Wynn, 2014)

Prepared learning for dangerous animals

Children (Shuar and US) shown pics & taught about 4 types of animals:

Dangerous & eats animals	Dangerous & eats plants
Non-dangerous & eats animals	Non-dangerous & eats plants

asked:

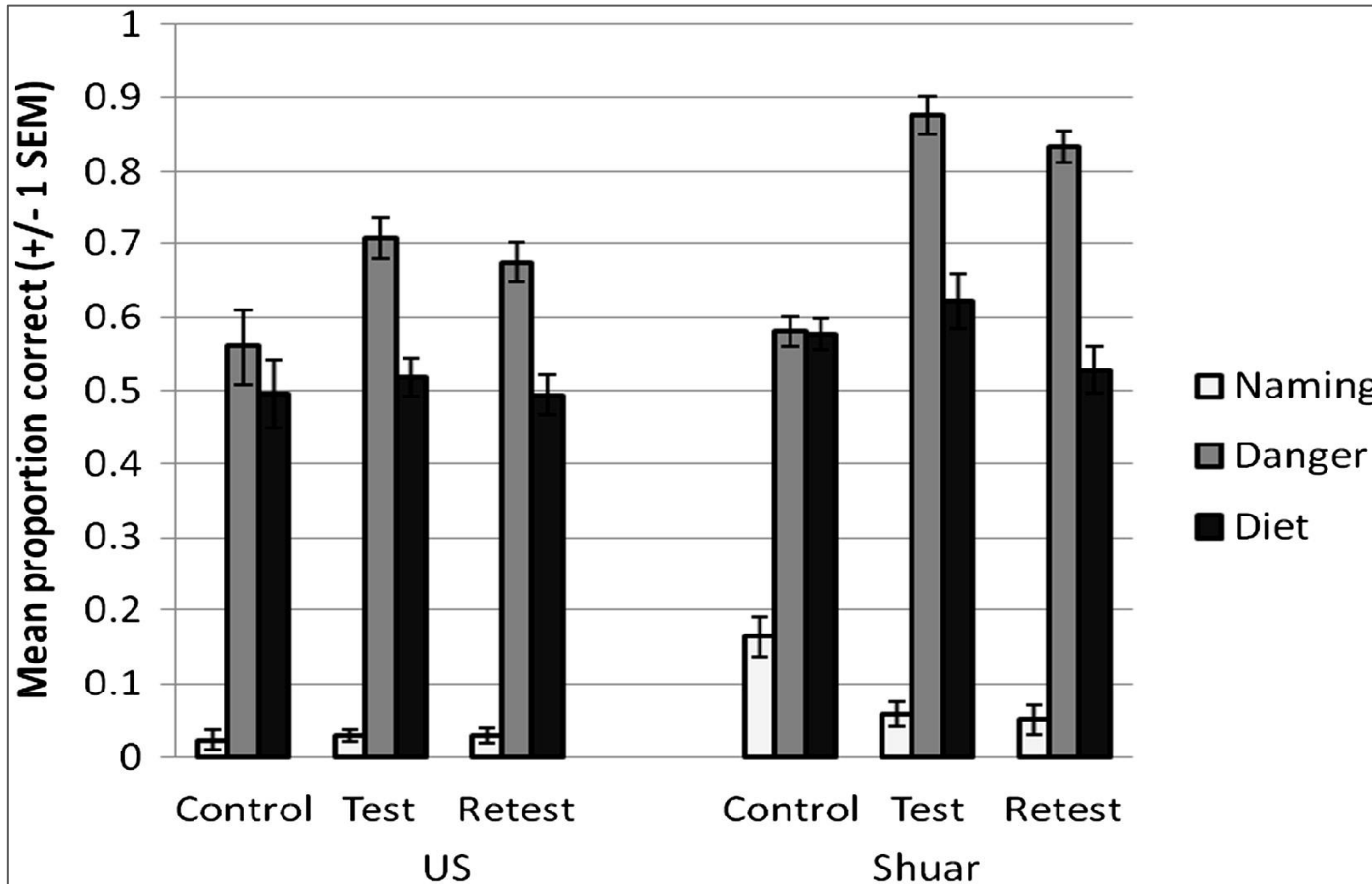
- Is it safe or dangerous?
- Does it eat plants or animals?
- Tested memory afterwards, and again after 1 week

The Shuar

The Shuar are horticulturalist-foragers, in the jungles of Ecuador.

They have experience with jaguars, and other dangerous animals.





Children had better recall of animals' danger than of animals' diets.

Especially in The Shuar

Attention in infants

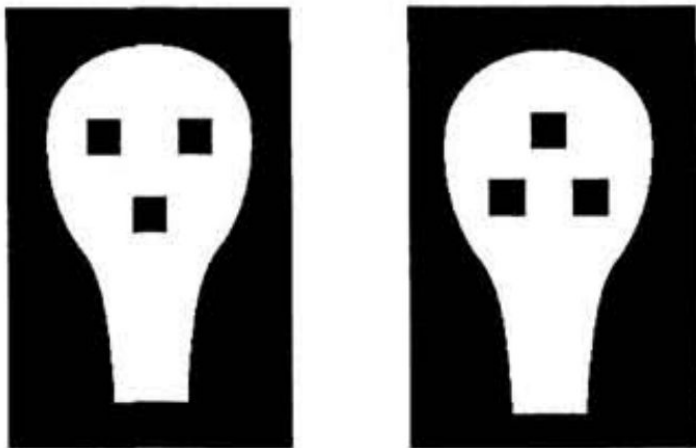
What you attend to is what you learn about.

What do newborns like to look at?

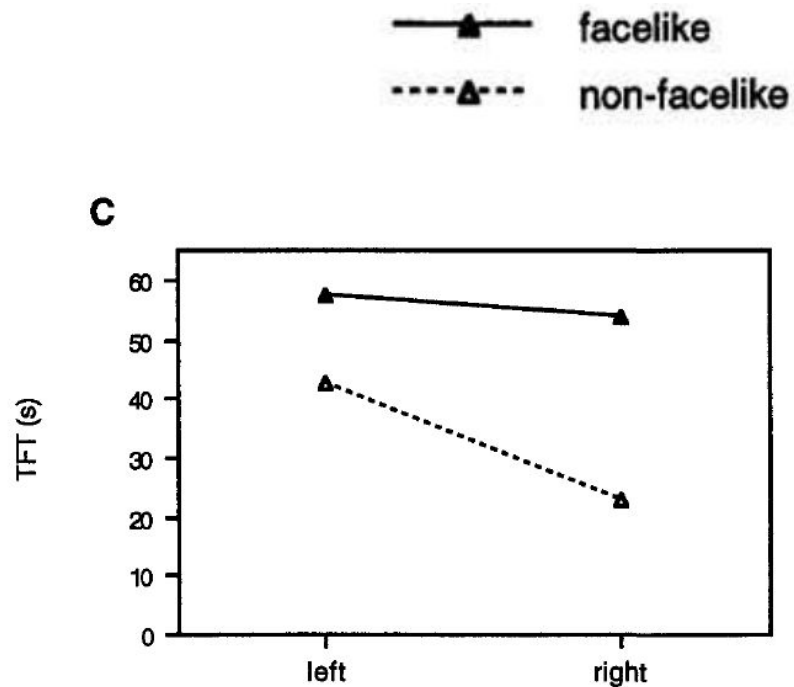
Many (not all) studies show infants look longer at face-like stimuli

What is it about a face? (currently debated)

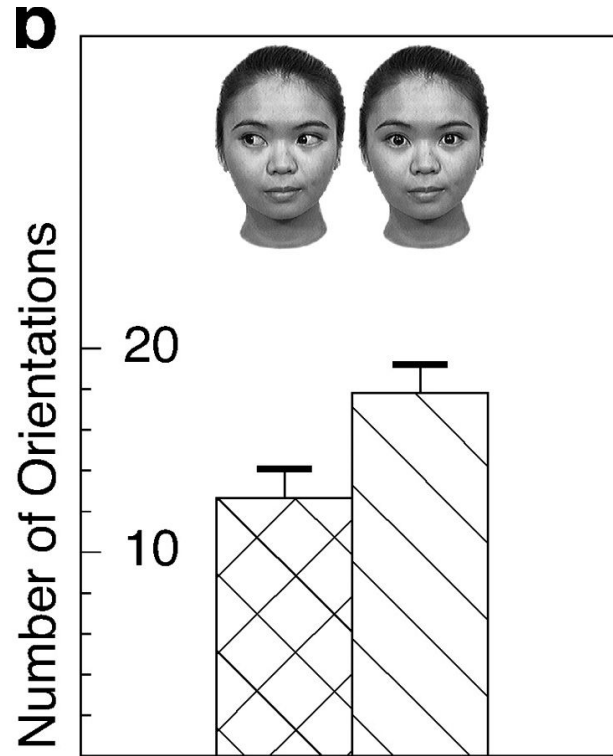
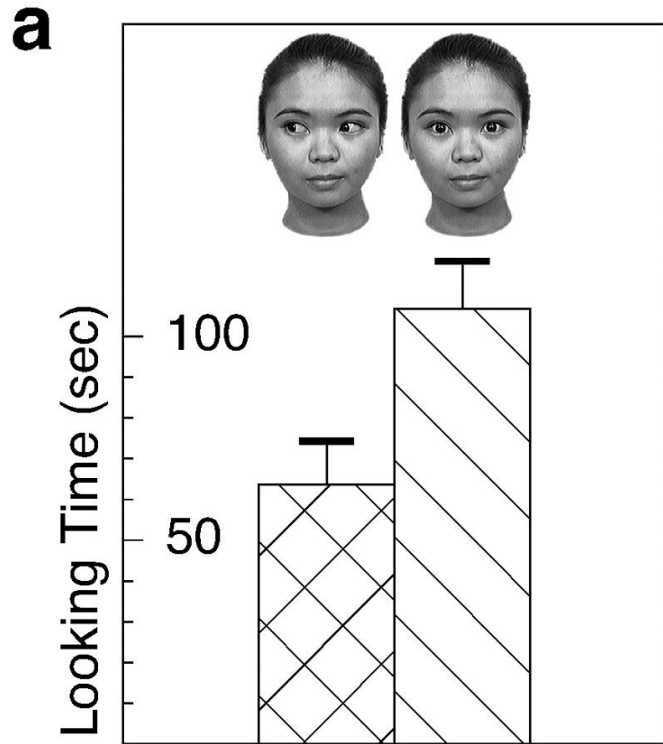
Total looking time, newborns



Valenza et al. 1996, J. Exper. Psych.



Attention in infants: Eye direction



Phenotypic plasticity: Some Terms

Obligate (canalized) traits: always expressed the same way

Facultative (plastic) **traits**: expression varies with the environment

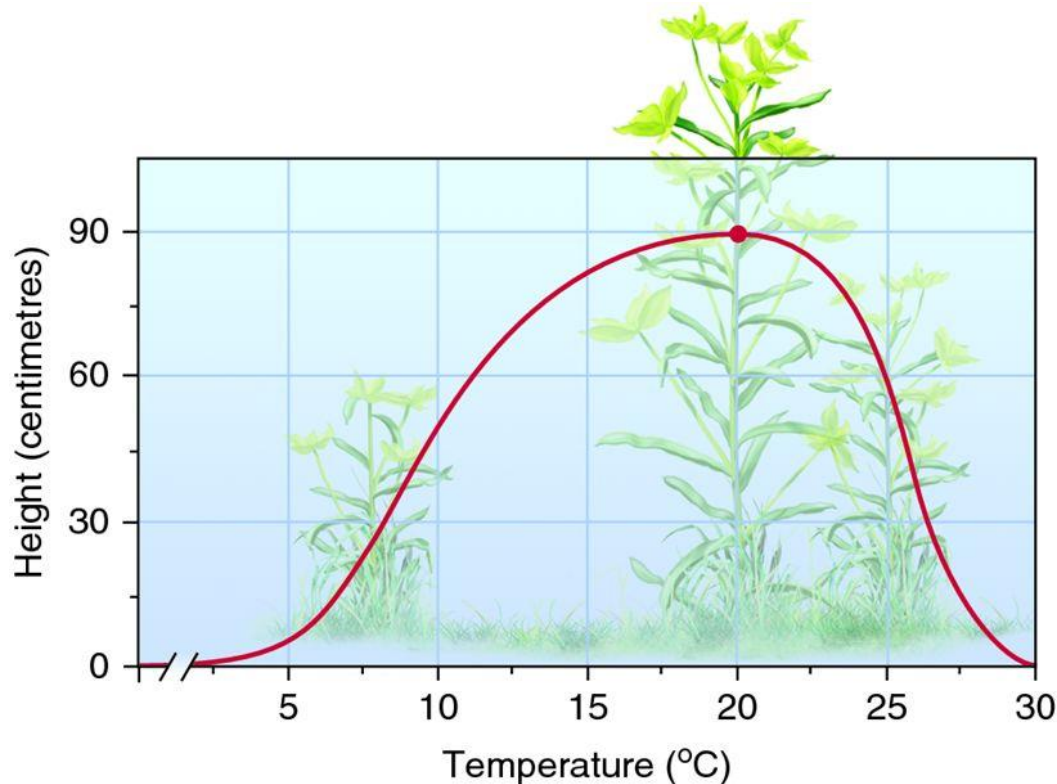
Facultative traits are environmentally contingent, and show phenotypic plasticity

The response is an evolutionary adaptation to regular environmental variation.

Saying a trait is facultative does not just mean it is "flexible", but is flexible in particular ways, shaped by natural selection.

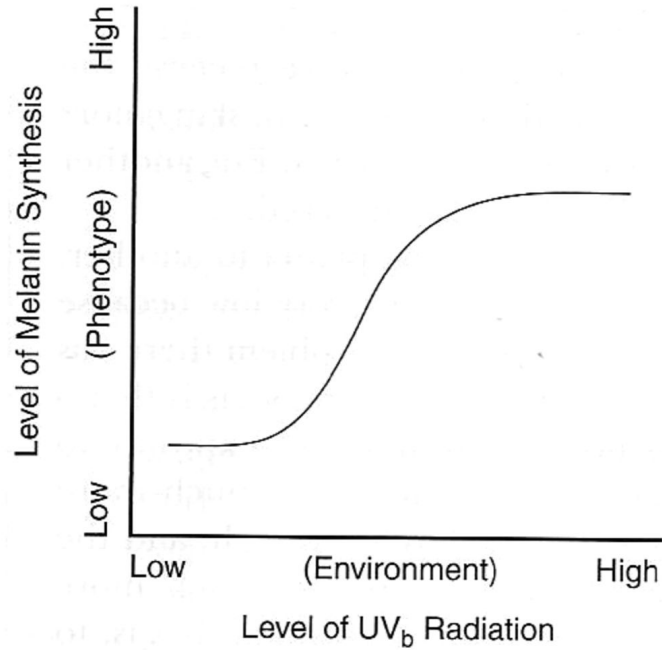
Related term in Evolutionary Psychology: "**Evoked Culture**"

Plasticity shown by Norms of Reaction



Reaction Norm: Shows how a given genotype is expressed in different environments.

Tanning as a norm of reaction

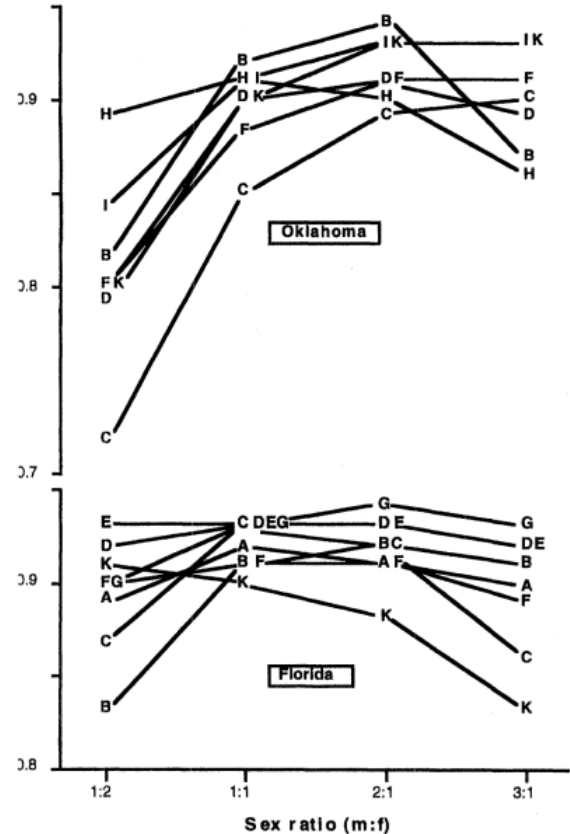


Mate guarding (a reaction norm in soapberry bugs)



The figure shows a reaction norm in mate guarding in response to sex ratio

Why?



Summary

“Human nature” includes the way our shared nature responds to the environment. Natural selection has shaped it.

- Genes bias learning and attention in adaptive ways
- Reaction norms indicate how a genotype is expressed in different environments