# 9.20 M.I.T. 2013

## Lecture #17

## Anti-predator behavior

# Scott ch 7, “Avoiding predation”

3. **Many predators develop search images by perceptual learning.**
   - **Octopus and squid species can counter this ability. What do they do?**
   - How is this related to mimicry as an evolutionary strategy?
   - Give an example of Batesian or Mullerian mimicry.

p 147, 150-151

# More than only changes in coloration: The “mimic octopus”

- http://www.break.com/index/mimic-octopus-in-action-1945423

(Less than 2 min.)

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p 147, 150-151

# Scott ch 7, "Avoiding predation"

3. Many predators develop search images by perceptual learning. Octopus and squid species can counter this ability. How?

   p 147

**Related concept: Mimicry**, pp 150-151:

*Mullerian mimicry*—different unpalatable species look alike, *e.g.*, different species of Vespid wasps.

*Batesian* mimicry—A palatable species evolves so it looks like another species that is bad to eat, *e.g.*, like a monarch butterfly. Digger wasps are avoided because they resemble the unpalatable Vespid wasps.

# Vespid wasps: examples of two species

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**The probability of any individual vespid wasp being eaten is reduced when any wasp of any of the vespids is eaten, thus, Mullerian mimicry has evolved.**

# Monarch butterfly and a mimic—one of several species that havc evolved to look like monarchs, i.e., their appearance mimics the monarch.

Photo on left courtesy of cotinis on Flickr. License CC BY-NC-SA.

Male monarch butterfly

The viceroy species has evolved by Batesian mimicry of the monarch.

Photo in middle courtesy of Alan Vernon on Flickr. License CC BY-NC-SA.

Female monarch.

Photo on right courtesy of Benny Mazur on Flickr. License CC BY.

Viceroy butterfly (Limenitis archippus)

# Scott ch 7, “Avoiding predation”

4. Some ground-nesting birds make nests that are on relatively open ground, making them fairly conspicuous.
   - What advantage does this have?
   - What can they do to protect their nest from an approaching fox or polecat?
   - Give examples.

See p 148-149, on **plovers** and their **four strategies**

# Black-headed Plover and Piping Plover

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# Scott ch 7, “Avoiding predation”

**Predator distraction displays: examples from plover behavior**

After seeing a predator, the bird leaves the nest quietly and then engages in one of four strategies:

1) Attract predator to a false nest (*cf*. the male stickleback fish, who does this to lure females away from his real nest)
2) Approach predator in tall grass, then suddenly duck down and imitate a fleeing rodent—moving away from the nest
3) Run towards the predator, calling loudly, then turn away at the last second, moving away from the nest
4) Broken wing display, fleeing in a direction away from nest

# Scott ch 7, “Avoiding predation”

**This concerns “secondary defense” (reducing the success of an attack)**

5. How can a chick caught in the jaws of a predator sometimes avoid death? Describe two FAPs of such a chick (include both the stimuli and the responses). p 149-150

   Do any mammals have such responses?

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   Do any mammals have such responses?

   Playing dead: "tonic immobility" Sometimes called thanatosis

   A major visual trigger: two eyes, forward-looking as in most predators.

   Later, the chick shows periodic peeking to see if the predator is still present. (If so, the tonic immobility continues.)

   Tonic immobility occurs in small mammals as well. The most well-known is the opossum.

# Scott ch 7, "Avoiding predation"

6. What are two major anti-predator benefits of group foraging by birds? In analyzing group foraging, what costs must be weighed against these benefits? p 151-155.

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**Benefits**: There are at least three:

1) Dilution effect; the "selfish herd". Increased by simultaneous reproduction
2) Vigilance: reduced demands on an individual
3) Confusion of predator

**Costs**: Interference from others; competition for food—worse for less-dominant individuals

[Remember also the idea of optimum group size (pp 155-**157**) as in the "ideal free distribution" model—independent of the anti-predator effects.]

# Scott ch 7, “Avoiding predation”

7. Describe **mobbing** behavior by birds, including its functions. What examples of mobbing behavior have we already encountered in class readings and discussions?

pp 157-159

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pp 157-159

- Recall the Jackdaws and the geese of Konrad Lorenz.
- Also, the Meerkats of the Kalahari desert.
- Note the research results on black-headed gulls (fig 7-5)
  - Position of nest in colony,
  - mobbing rate,
  - rate of loss of eggs to predators

## More on "Secondary defense" (reducing the probability of success of an attack)

8. Besides running away, what strategies do some species employ when detected by a predator and attacked – other than the method in Q#5? (Some strategies are not described by G. Scott in ch 7.) p 159-161

"Misdirecting the attack", as in some molluscs.

Scott's example: a marine bivalve mollusc with very conspicuous tenticles. If grabbed, they are shed. They contain very distasteful chemicals so the predator goes away.

What is the very successful method used by many lizards?

# Scott ch 7, "Avoiding predation"

9. Describe both altruistic and selfish purposes of alarm calls. Could both kinds of motives have evolved by natural selection? p 162.

**Altruistic**: Help others in the group, while betraying own location to the predator

**Selfish**: Elicit a mass escape and benefit from the dilution and confusion effects.

Cresswell's (1994) data on redshanks: Birds targeted for attack were usually late flyers and non-callers.

Also note another effect that alarm calls may have: attracting predators of the attacker.

# Scott ch 7, “Avoiding predation”

10. Why is it important for redshanks, a wading bird that feeds on large worms, to have evolved two distinct anti-predator behaviors?

p 162, 164:

# Scott ch 7, “Avoiding predation”

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p 162, 164:

They have **two main predators** that have very different techniques of attacking. Redshanks have evolved responses that are often effective in avoiding each type of attack.

-- Peregrine falcons:  Crouch low, remain still

-- Sparrow hawks:  Fly up

Scott ch 7, "Avoiding predation"

11. Describe "stotting" behavior by Thompson's gazelles. This strange behavior has led scientists to suggest various hypotheses to explain it. Which is supported by quantitative observations?

**p 163**

# Thompson's Gazelle

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# Scott ch 7, “Avoiding predation”

11. Describe “stotting” behavior by Thompson’s gazelles. This strange behavior has led scientists to suggest various hypotheses to explain it. Which is supported by quantitative observations?

**p 163**: Three of eleven hypotheses are summarized. One is supported by data from Tim Caro (1986):

Attacks by cheetahs are significantly deterred when a gazelle engages in stotting. This behavior communicates to the cat, “I am far enough away that I have a high probability of escape. Why waste your time and energy?”

# VIDEO

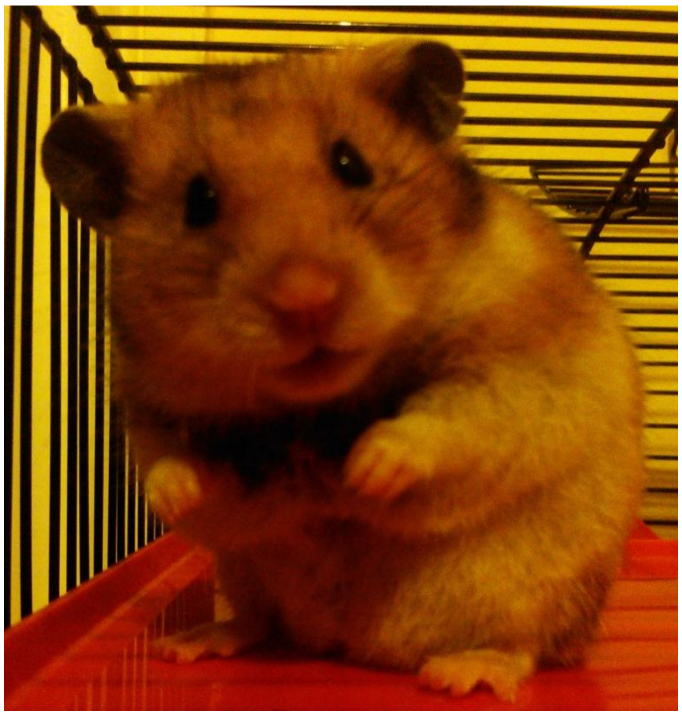
## "Great Escapes" by Marty Stouffer, WGBH-TV

Bobcat stalking and chasing a rabbit
Wild boar chasing a human
Alligator attacking a wild pig
Jaguar attacking Coati Mundi
Bobcat attacking deer mouse
Mountain lion/ cougar attacking mule deer
Bobcat attacking a prairie chicken
Coyote attacking ringtail
Coyote attacking opossum
Badger attacking hog-nose snake (puff adder)
Jack rabbit chased by 4 coyotes, then by a goshawk
Bobcat attacking a legless lizard that sheds its tail

Examples of the value of speed, stamina, evasive actions, attacking the attacker, persistence, playing dead…

# "Four hours in the life of a Syrian hamster"

12. Describe adaptive reasons for the Syrian hamster's being a "twilight animal" – neither day-active nor night-active, but active during the dim light of dusk.







Antipredator FAPs: Gait changes in foraging—freezing, running, hiding.
IRMs: both visual (overhead or ground level), and olfactory

# “Four hours in the life of a Syrian hamster”

13. In a laboratory setting, it is much easier to test a hamster’s visual orienting responses during the daylight hours, but not in the final two hours of light.
    - This seems to be counter-intuitive, since it is not the hamster’s most active period.
    - Explain how it nevertheless makes good sense, from the standpoint of the hamster’s adaptations.

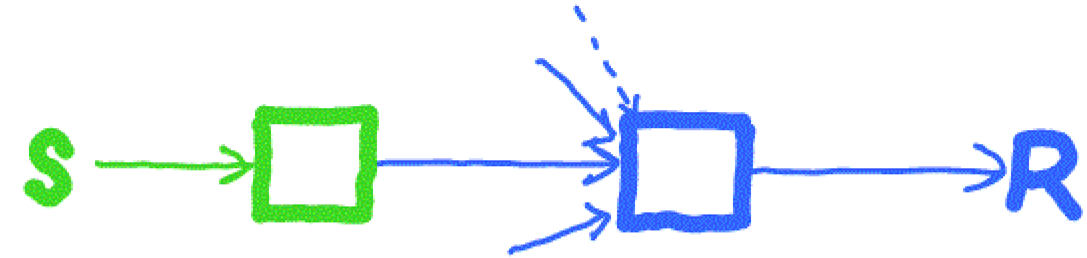
14. In the video “Great Escapes”, we see a bobcat attacking a prairie chicken but failing to kill it. The cat appears to be playing with the bird. Explain this behavior in terms of the dynamics of fixed action patterns as described by K. Lorenz.

15. Describe the innate escape reaction of the kangaroo rat to an attacking rattlesnake.

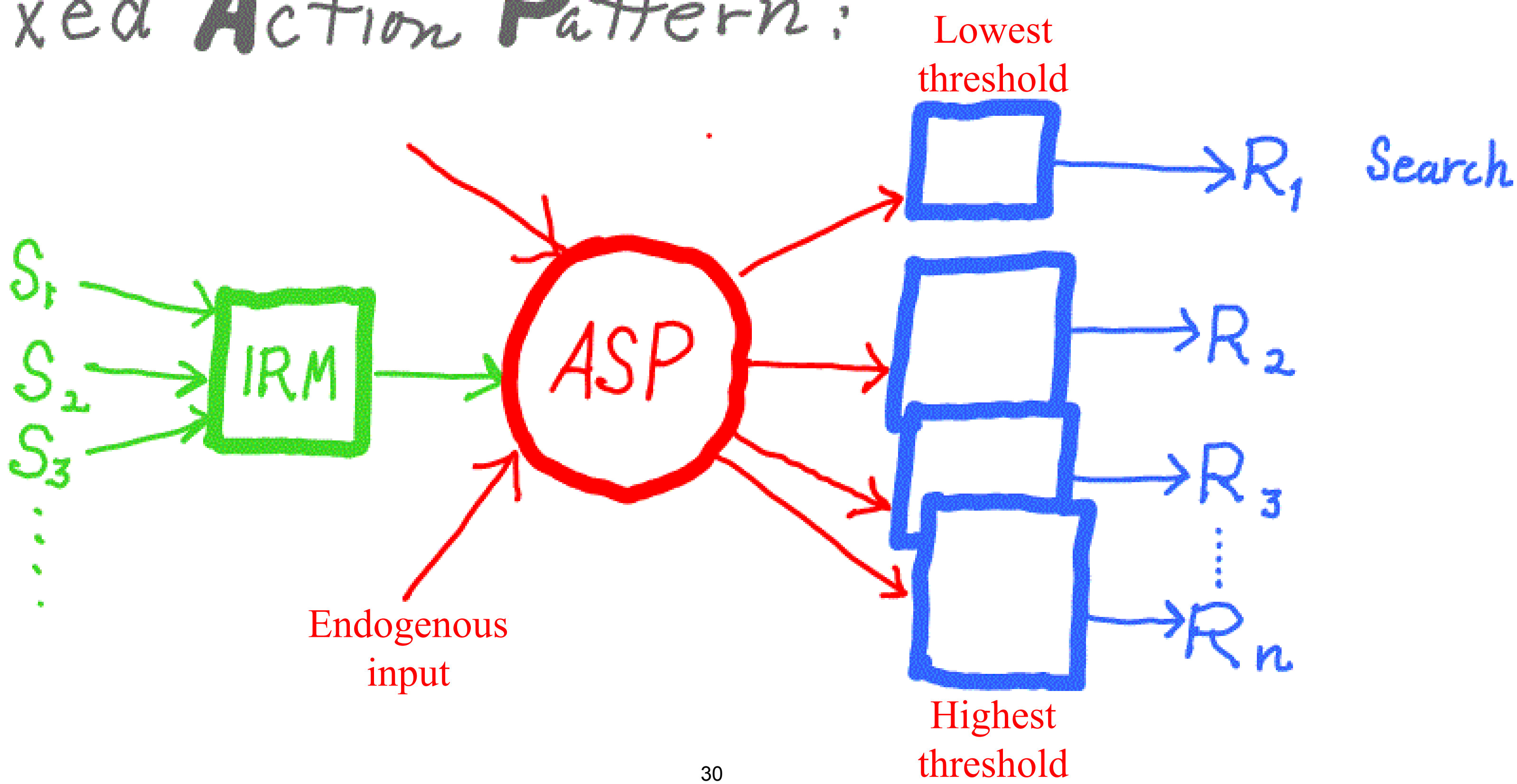
- The kangaroo rat freezes when it detects the snake. It waits for the attack.
- The sound of the onrushing head of the attacking snake elicits a large backward leap.
- The somersaulting little mammal lands beyond the reach of the snake.

16. Are the instincts of antipredator behaviors really "fixed action patterns" as defined by Konrad Lorenz and other ethologists, or are they really better characterized as reflexes? (See class 8.)

## Reflex:




## Fixed Action Pattern:



**Antipredator ASPs:**

There is not a continuous build up of the level of motivation, as in the case of hunger, thirst, and many other FAPs.

Is the only input to the ASPs for antipredator behaviors from IRMs or learned RMs? (If so, they should probably be called reflexes.)

But the answer is “No”:

- The underlying motivational level can change with time of day (position in the daily cycle of activity). This is endogenous input.
- It changes with the level of hunger/thirst. It changes with the background level of illumination.
- It changes with inputs from memories: greater in some places than in others.
- It is altered according to time since a predator was last detected: there is considerable "inertia of excitation."
- An animal cannot change suddenly to another motivational state.