9.20 M.I.T. 2013

Lecture #11

Key concepts from Lorenz on fundamentals of ethology:
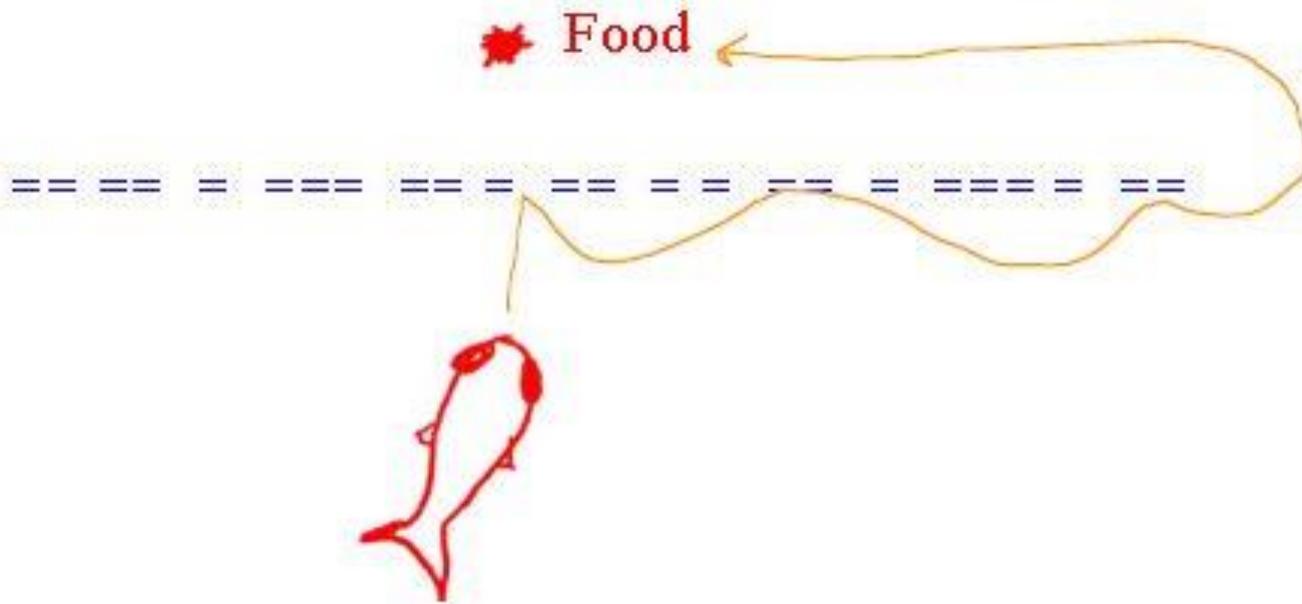
- ☑ A. Models of FAP and IRM
- ☑ B. Hierarchies and chains of behavior
-     C. Spatial orientation by reflexes and internal model
-     D. Multiple simultaneous motivations

11. How does a goldfish solve the problem of reaching a bit of food it can see behind an impenetrable obstacle? **(p 237)**

Lorenz, K.Z. (1981) The Foundations of Ethology
C: Taxis and reflexes; spatial orientation and thinking in higher animals

11. How does a goldfish solve the problem of reaching a bit of food it can see behind an impenetrable obstacle? **(p 237)**

Two innate behavior patterns:

➢ **Positive telotaxis directed towards the prey**

➢ **Negative thigmotaxis causing the fish to avoid contact with the obstacle (e.g., branches of plants)**

It looks like intelligent behavior. The goldfish seems to figure out how to reach the food. However, its behavior is simply the result of two innate patterns of behavior--reflexes--plus the motivation of hunger.

Why does a dog often fail in such a situation?

11. How does **an inexperienced dog** solve the problem of reaching a bit of food it can see behind an impenetrable obstacle? It may take much longer to solve the problem: Why?

Food

== == = === == = == = = == = === = ==

DOG
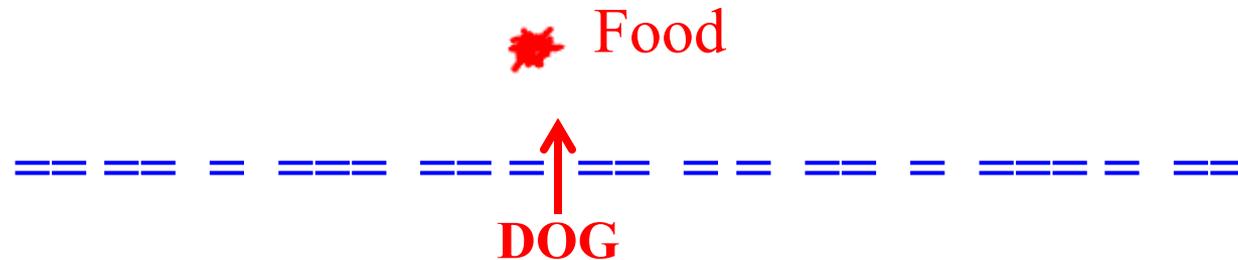
A dog has evolved a more complex variety of FAPs besides "positive telotaxix" to deal with such a problem, and they are not adapted to such barriers as fences. What a dog usually does: see list at right.

--jump over the fence
--dig under the fence
--pace, bark, scratch, growl
--give up, wander around
--discover the end of the barrier
--learn and remember the way around

C: Taxis and reflexes; spatial orientation and thinking in higher animals

12. How do human languages give clues to the nature of "insight"?

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C: Taxis and reflexes; spatial orientation and thinking in higher animals

12. How do human languages give clues to the nature of "insight"? **(p 238)**

Lorenz quotes W. Porzig (1950): "Our language translates everything that cannot be visualized into <u>spatial</u> concepts. This is not done just by our own language, or by a certain group of languages, but by *all* of them, without exception."

Concepts for space and time use the same spatial terms for orientation. "All orientation…is always concerned with space *and* time."

[We move through multiple spaces. Physical spaces are represented in memory, as are conceptual spaces. We think in conceptual spaces.]

Lorenz, K.Z. (1981) The Foundations of Ethology
C: Taxis and reflexes; spatial orientation and thinking in higher animals

13. Describe evidence for thinking in apes, from studies of "insight" learning.

Define "insight" Try Google search: Insight in apes

Examples from chimp and gorilla problem solving

Evidence for the formation of **plans** within an internal model, within which places and events can be **anticipated** and alternatives can be considered.

Example of chimp using insight to solve a problem
http://www.youtube.com/watch?v=fPz6uvIbWZE

Wolfgang Kohler's studies of insight learning:
www.pigeon.psy.tufts.edu/psych26/kohler.htm

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C: Taxis and reflexes; spatial orientation and thinking in higher animals

14. Note Lorenz' hypothesis of a higher control center in "higher" animals, "superimposed on all these orienting mechanisms" and remembering changes in the environment and judging "the priority of incoming insight information" **(p 241)**.
How can we distinguish higher and lower animals?

How can we distinguish "higher" and "lower" animals?

- "Higher" cannot mean "better adapted"—all existing species are highly adapted to their niche.

- "Higher" may be answered in terms of anticipation abilities (see previous slide).
  - Role of the <u>prefrontal association areas</u> of the neocortex
  - What animal has, in relative terms, the largest prefrontal cortex?
    - Long thought to be humans. However, the Echidna—a monotreme—has a larger PFC, relatively to whole brain. <u>Next Slides</u>

- A superimposed system: the language system
  - Superimposed on, and highly interconnected with, other brain systems, enabling social communication. Thus, it is, in a sense, "higher."

Brain of Echidna: the spiny anteater--an Australian monotreme

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Lorenz, K.Z. (1981) The Foundations of Ethology
D: Multiple motivations: compromises; ritualization

15. Briefly list the various ways animals deal with the simultaneous activation of two (or more) motivational states. How is the conflict resolved, or not?

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- **Superposition.**
- **Mutual inhibition and alternation.**
- **Displacement activity.**

Lorenz, K.Z. (1981) The Foundations of Ethology
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16. Give an example of how superposition of approach and
avoidance FAPs occur in geese or in fish. **(p 243-244**)

(Next slide)

Superposition of approach and avoidance: examples

- Geese being offered food from human hand
  - Conflict between approach and avoidance can produce violent trembling of the neck (p 243)

- Cichlid fish: males confronting each other
  - Approach-avoidance conflict can result in opposite movements of pectoral fins and tail—pectorals are moving the fish backwards while the tail is moving him forward. (p 244)

17. Describe evidence that gestures of threat have originated from superpositions. (p 244)

Lorenz' studies of dogs

Facial expressions of the dog

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From Lorenz, The Foundations of Ethology, p 244

18. Mutual inhibition usually occurs between action patterns at the same level of organization (p 247), so that only one will be expressed at any one time. However, one action pattern is usually given absolute priority. Explain.

19. **Mutual inhibition** can also cause **oscillations** between two FAPs. Give an example of how such oscillations can become "ritualized" in evolution, so they become social signals.

Ritualization of oscillations between two FAPs:

- Female pigmy (dwarf) cichlid with a prepared nest site (p 248-249): method of attracting a male--
    - Attacks, then switches to guidance toward the nest

The ritual acquires its own ASP in evolution.

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- Male stickleback fish: Zig-zag dance has originated in the same way, but the ritualization has progressed much further (according to comparative behavioral studies).

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Lorenz, K.Z. (1981) The Foundations of Ethology
D: Multiple motivations: compromises; ritualization

20. Define "**displacement activity**". In what two situations do displacement activities occur?

    p. 249; see also the "disinhibition hypothesis" summarized in the diagram of p 250.

    You should also know the related concept of "afterdischarge displacements" (see question A3). **(p 264)**

20. Define "**displacement activity**". In what two situations do displacement activities occur? **(p 249)**

You should also know the related concept of "afterdischarge displacements" (see question A3). **(p 184)**

Originally defined in German, by a Dutch ornithologist in 1936, as *Ubersprungbewegungen*, or "sparking-over activities". Later studied by Tinbergen.

Two situations where there is high drive but the normal FAP that would discharge it is blocked:

1) Conflict between two strongly activated but antagonistic drives

2) Strong activation of a drive without an adequate stimulus to release the normal consummatory actions

"After-discharge displacements": After the sudden removal of an adequate stimulus, discussed earlier (slides7, 8)

21. Give examples of the species-specific nature of displacement activities. (p 251-252)

Ganders of 3 species in conflict between escape and nest defense:

- **Graylag goose**: Wing shaking

- **Pinkfoot goose**: Preening movements for distributing oil from glands under tail-cover feathers to the flank feathers

- **Greater snow goose**: Bathing movements (on dry ground)

Hamster in conflict between approaching food or a novel stimulus, and escaping: the animal starts grooming.

Thus, one must distinguish between displacement grooming and non-displacement grooming.

Human displacement activities? Or, after-discharge displacements?

- **Describe at least two examples, other than the ones already mentioned in class.**

Human displacement activities?
Or, after-discharge displacements?

- **Describe at least two examples, other than the ones already mentioned in class.**
  - **Pacing the floor**
  - **Head scratching without any itch**
  - **Biting a pencil**
  - **Oscillating movement of a foot**
  - **Nail biting**
  - *Et cetera*

22. Why do displacement activities sometimes become ritualized and undergo changes from the original FAPs they represent? (p **252-253**)

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D: Multiple motivations: compromises; ritualization

22. Why do displacement activities sometimes become ritualized and undergo changes from the original FAPs they represent? (p **252-253**)

To serve as signals to conspecifics

This results in mutual benefit, promoting survival and hence reproduction

Later, we will encounter various examples of this

9.20 Animal Behavior
Fall 2013