9.20

Lecture #29

Key concepts in learning:

K. Lorenz, Adaptive Modification of Behavior (Part 3 in ***The Foundations of Ethology***, 1981)

B. Learning through association without feedback reporting success

3. Conditioned Reflex = conditioning with stimulus selection (type S conditioning).

- Comment re Pavlov's bell as CS: **Such regular sequences normally occur when there is a causal connection**.
- Pavlovian conditioning, first studied by Pavlov in a situation which does **not** fit this definition (see below)
- Note Hassenstein's specific definition of a "reflex" as not subject to changes in internal readiness. Based on inbuilt mechanisms. (Thus, reflexes are distinct from FAPs.)
- Some reflexes are impossible to connect with a conditioned stimulus, e.g., tendon reflexes.

B. Learning through association without feedback reporting success

1. Habituation to associated stimuli (to the "background", "environment")
2. Adding stimuli to key stimuli: "becoming accustomed“
3. Conditioned Reflex = conditioning with stimulus selection (Pavlovian conditioning)
4. **Avoidance responses acquired through trauma**
5. Imprinting
6. Conditioned inhibition

B. Learning through association without feedback reporting success

4. Avoidance responses acquired thru trauma

- S type conditioning (stimulus selection)
- Can occur after one experience
- Can be irreversible
  - "Trainers of dogs and horses, like psychoanalysts know all too well how ineradicable conditioned avoidance responses of this type can be."
- Laboratory examples
  - A particular sound paired with electric shock: Subsequent presentation of the sound→raised heart rate and blood pressure
  - One-trial learning not to step down from raised platform onto a grid that was electrified

Most psychologists include this kind of learning in the classical conditioning category, but it makes more sense to separate it.

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6. Conditioned inhibition

B. Learning through association without feedback reporting success

5. Imprinting: like both of the previous two, it is **irreversible**

at least one

- Fixation of specific responses: Birds do not become "imprinted on humans" more generally.
  - Jackdaw - fixation on companions for sex *vs.* flocking *vs.* parental care
  - Geese: filial and social responses *vs.* sex

can be imprinted on humans

Not affected by the imprinting

- Imprinting *vs.* conditioning with reward: examples of independence (p 281-2)

Experiments pit the two processes against each other

- Imprinting *vs.* IRMs: mallard male *vs.* female:
  - Males can be sexually imprinted to other species,
  - but females are dominated by their response to the mallard drake's nuptual colors. (p.282)

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B. Learning through association without feedback reporting success

6. Conditioned inhibition

- Training of domestic animals; circus animals.
- Problem of "damming up" of ASP: dangerous consequences.

An individual that has long been suppressed by a dominant pack member, and has remained passive, can suddenly break out in a desperate attack against the suppressor. When this happens, all the normal inhibitors fail.

- African hunting dogs (H. van Lavick)
- Wolves
- Human: spouse murder (p.285)

Major types of learning:

A. Learning without association
B. Learning through association without feedback reporting success
C. <u>Learning effected by the consequences of behavior</u>
D. Motor learning
E. Exploratory behavior or curiosity

C. **Learning effected by the consequences of behavior:** the major categories

1. Conditioned appetitive behavior
2. Conditioned aversion
3. Conditioned action
4. Conditioned appetitive behavior directed at quiescence
5. Operant conditioning (response selection by the animal)

C. Learning effected by the consequences of behavior: *Introductory discussion*

i. In nature, **"type S"** conditioning is most common (stimulus selection).

- Much "exploratory behavior" is also really stimulus selection (*e.g.*, dog wanting to bury food).

ii. In nature, **"type R"** conditioning—response selection—occurs more rarely.

- Operant situations: confined animal trying to escape; exploratory behavior
- "Reinforcement" : "Encouraging" is more accurate

ii. The normal sequence in a fixed action pattern:

ASP→ Appetitive behavior→ IRM→ consummatory R → feedback

Feedback can halt the consummatory action, and can affect the ASP & appetitive behavior mechanisms, and can shape the (originally innate) releasing mechanism.

Introductory discussion, continued:

Why behaviorists have oversimplified the problem of learning & instinct

Lorenz, p.294:

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C. **Learning effected by the consequences of behavior:** the major categories

1. **Conditioned appetitive behavior**
2. Conditioned aversion
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5. Operant conditioning (response selection by the animal)

The most common are #1 and #4. Also, note that #4 and #5 are often considered together.

C. Learning effected by the consequences of behavior

1. Conditioned appetitive behavior

- A catfish that comes if someone whistles (von Frisch): The whistle always preceded feeding, and the fish learned to begin searching for food when Karl von Frisch whistled.
- Honeybees (von Frisch): the insect searches for the situation which has proved rewarding, e.g., it flies to specifically colored patches.
- **Pavlov's dogs: p 297**: Howard Lidell's story that was suppressed.

When the dog is shackled in an apparatus, the only aspect of the appetitive behavior it could show was salivation. Release it, and it shows begging behavior.

1. Conditioned appetitive behavior, *continued*:

– Nest building in social weavers *vs*. corvine birds: The weavers have an innate preference for a particular kind of grass. But corvine birds like jackdaws and ravens use whatever nest material that gives good feedback during nest-building actions.

- Twigs result in an "orgastic climax" when they are stuck in the nest; they give the right feedback.
- Supernormal feedback → "**addiction**", as to soft metal wire, which gives strong feedback. *The process is comparable to what happens in human addictions (vices).*

Thus, the appetitive behavior of the jackdaws and ravens become conditioned: they learn to search for stimuli that result in the strongest feedback even if the material is not the most adaptive.

C. Learning effected by the consequences of behavior

1. Conditioned appetitive behavior
2. **Conditioned aversion**
3. Conditioned action
4. Conditioned appetitive behavior directed at quiescence
5. Operant conditioning (response selection by the animal)

C. Learning effected by the consequences of behavior

2. Conditioned aversion

- John Garcia's discovery, initially suppressed by American editors: The "poisoned bait effect" or conditioned taste aversion (discussed earlier)
- If a novel food is eaten in a sequence of foods shortly before the onset of illness/nausea, the aversion will be associated with the novel stimulus (p 301) rather than the most recently encountered.
- Lorenz believes that conditioned aversion is more common in many animals in nature than is operant conditioning.

C. Learning effected by the consequences of behavior

1. Conditioned appetitive behavior
2. Conditioned aversion
3. **Conditioned action**
4. Conditioned appetitive behavior directed at quiescence
5. Operant conditioning (response selection by the animal)

C. Learning effected by the consequences of behavior

3. Conditioned action [usually an artificial kind of motor learning]

- "Shaping" of actions by circus animals; eliciting a FAP* in response to a command, *e.g.*, horse's capriole (anti-predator behavior of leap & kicking, performed in order to get sugar).
- Conditioned defecation in parakeet in order to be released from cage (von Frisch)
- Many actions cannot be conditioned (p.305):
  - Tendon reflexes
  - Sexual action patterns in animals
  - Bill shaking in mallards
  - *Cf.* hamster orienting *via* SC: the conditioned action cannot completely override the natural one (GS).

* motor part

C. Learning effected by the consequences of behavior

1. Conditioned appetitive behavior
2. Conditioned aversion
3. Conditioned action
4. **Conditioned appetitive behavior directed at quiescence**
5. Operant conditioning (response selection by the animal)

C. Learning effected by the consequences of behavior

4. Conditioned appetitive behavior directed at quiescence

- Escape from the "annoyer": tension reduction (*cf*. Clark Hull's theory of learning)
  - Hunger,
  - thirst,
  - human stress/conflict
- Habitat selection

Stimulus selection

The process usually involves a search for a **stimulus** situation that leads to reward, a reduction in tension/ stress/ anxiety / annoyance.

C. Learning effected by the consequences of behavior

1. Conditioned appetitive behavior
2. Conditioned aversion
3. Conditioned action
4. Conditioned appetitive behavior directed at quiescence
5. **Operant conditioning (response selection by the animal)**

Many scientists would group 4 and 5 together.

(but they are quite different)

C. Learning effected by the consequences of behavior

5. Operant conditioning (response selection by the animal)

- Highly studied in laboratories, as in Skinnerian conditioning
  - Cat in puzzle box
  - Dog reaching a confined bitch
  - In nature: Operant conditioning is rarer than generally assumed; occurs in situations of appetitive behavior directed at quiescence or in exploratory behavior.

Major types of learning:

A. Learning without association
B. Learning through association without feedback reporting success
C. Learning effected by the consequences of behavior
D. Motor learning
E. Exploratory behavior or curiosity

D. Motor Learning

- "Shaping" of skilled movements
- In nature: acquisition of path habits → greater speed.
  - Learned locomotor patterns in the region near home: The movements acquire an independence from sensory inputs.
  - *Cf.* recitation from memory; learning to play a musical instrument
- Acquired similarities to fixed action patterns
  1) As with a fixed motor pattern, an interruption of a sequence usually results in the animal going back to the beginning. (This is like a person trying to recite a poem or play a memorized piece of music.)
  2) Resistance to change
  3) Appetitive behavior: **acquired drives.** A desire to perform the action increases over time when it is not done.

The process of learning generally requires much **repetition**, as in the gaining of abilities in sports.

D. Motor Learning, *continued*:

- Shaping of multipurpose actions: **species differences in locomotion** constrain the possibilities.
  - Horse *vs.* donkey *vs.* mountain goat/chamois/etc.: Innate differences
    - Horses are adapted to running on flat ground, and cannot adjust well to uneven terrain.
    - Donkeys are more sure-footed
    - Goats, chamois: adapted to hills and mountains, very sure-footed
  - What is "sure-footedness"?
    - Smaller units of action; more frequent possibility of interruption by adjustments of direction, foot placement.
    - With smaller units of action (fixed motor patterns), more detailed higher control is possible.
  - This leads to a discussion of "voluntary" action [next]

D. Motor Learning, *continued*:

- Shaping of multipurpose actions: **species differences *re* locomotion** [continued]
  - In arboreal animals, and animals that live in rocky or hilly regions or mountains, there has been an evolution of smaller units/elements of FAPs, subject to independent control and shaping (by learning)
  - "Will" ("volition"): high-level initiation of fixed motor patterns or of learned sequences (skilled movements)
    - There are marked species differences in how small the elements of movement are.
  - On voluntary movement and insight
    - Spatial insight can exceed motor abilities: example of a goose trying to descend a stairway; it is unable to adjust length of stride. (It is more successful if climbing the stairs.)

D. Motor Learning, *continued*:

Additional discussion of Lorenz' view of voluntary movements

- Animals that have evolved direct axonal projections from neocortex to motor neurons (especially from the primary motor cortex) can control an individual digit.
- Mammals that can do this include humans, apes and old-world monkeys.
- Birds that have evolved a motor Wulst in the hyperpallium probably have similar abilities.
- This is the smallest element of movement; however, most movements subject to voluntary control are not so small.

Major types of learning:

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E. Exploratory behavior or curiosity

- Multiple behavior patterns are directed at a novel object--often unrelated movements in rapid sequence, in the absence of "serious" activation of any one of them.
  - Rapid switching between behavior patterns (fixed motor patterns) can occur, **unlike** in situations where the normal ASPs are driving them.
  - Such behavior occurs in a “field devoid of tension”
  - Play behavior is similar in this regard.
- **Motivation** can be stronger than hunger: “**curiosity**.”
- "**Latent knowledge**" is acquired
  - Learning of spatial lay-out of environment in relation to visual landmarks and other sensory cues
  - This has been studied experimentally using hamsters (by Catherine Blanc)
- Exploratory behavior is especially highly developed in "unspecialized" species—species that have a “specialization for versatility” (including ravens, rats, humans).

E. Exploratory behavior or curiosity

- **Play**
  - "Primitive play" = *in vacuo* reactions, motivated by ASPs that have built up because of a period of disuse.
  - Running and chasing, playful fighting or prey-catching: Motor patterns themselves are enjoyed without the final consummation for which these patterns evolved.
- Note: Play can shift to the real thing in some situations.
  - Danger of playing with adult tomcats, badgers, other wild animals
  - Motivation: ASP has definite influence: *e.g.*, some cats that have no opportunity to catch and kill prey compensate by play.
  - How different from real thing? Cats: "*vegetative* [autonomic] *nervous system is not involved in the same way.*"
- Functions of play (p. 333): Eibl-Eibesfeldt's study of development of play in carnivores Three kinds of learning:
  - Learning of coordination
  - Learning of stimulus selection
  - Inventions (as a linking of movement patterns) that may have later practical use

E. Exploratory behavior or curiosity

- Human research is exploratory behavior plus play [mostly the former]
- Human art is mostly playing (p. 334)

Comments about the various types of learning:

- Species differences?
- Brain localization? We can make educated guesses, in some cases supported by experiments.
- (General rules? Different for different types.)

9.20 Animal Behavior
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