

Animal Mind: How similar are animal mental processes to ours?



Speculations about animal mind center on one or another of these attributes:

- *intelligence*: are animals smart, do they reason problems out?
- *complex cognitive mechanisms*: do they use complex mental mechanisms such as mental maps?
- *consciousness*: what is the *content* of the animal mind, do they introspect?
- *emotion*: do animals have feelings like us: love, hate, jealousy, sadness, etc.?
- *intentionality*: do animals make plans?
- *self awareness*: are animals aware of themselves as unique individuals?
- *theory of mind*: is an animal aware that other animals have minds too?
- *communication*: can animals 'talk' with one another? with us?

Special problems with studying animal *mind* that we don't have when studying animal *behavior*

1. *Problem of objectivity*. Can't know animal mind directly. Behavior is *observable*, mental processes are *inferred*.

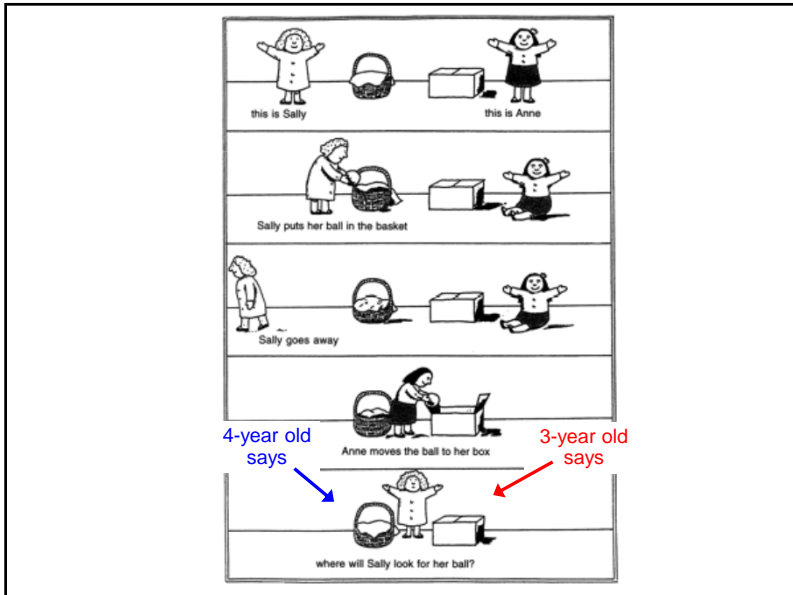
2. *Problem of anthropomorphism* (the injection of human qualities into animals). Humans are naturally inclined to assume that animals think and feel like we do.



Anthropomorphism & Theory of Mind

Humans seem naturally inclined to engage in *anthropomorphism*. This may be because humans develop a refined *theory of mind* and routinely use it to interpret others' behavior. TOM = the *awareness that others have minds as well as yourself*. Young children act as if they are unable to distinguish between what they know and what others know. *TOM develops with age*.





Two separate points about TOM:

1. Humans instinctively apply TOM to animals (a mentalistic, anthropomorphic approach)
2. Do animals too develop TOM?

Historically, two distinct approaches to the study of animal mind.

- *Mentalistic approach*: investigator tries to demonstrate that animal employs human-like mental processes in dealing with its world
- *Mechanistic approach*: investigator assumes that animal is like machine in some respect, has proposed a simple mechanical model of the underlying mental processes

Animal Mind in the Media

No question in the field of animal behavior captures as much attention as animal mind. One negative consequence is that we have to guard against uncritically accepting “discoveries” about animal mind trumpeted in the media that are merely overhyped or overinterpreted hypotheses.



Animal Mind

A little history

Descartes (1596-1650)

- Humans and animals are machines
- Concept of the reflex arc
- ...but humans also have a soul
 - Mind/body dualism

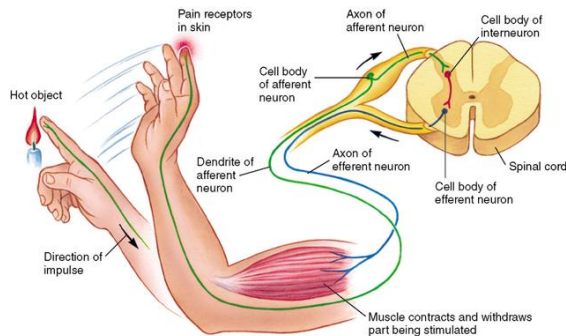


Descartes the concept of the reflex arc



“The fire has the force to move the part of the skin of the foot [at B], and by this means pull the small thread C, which you can see is attached, simultaneously opening the entrance of the pore d, e, where this small thread ends...the entrance of the pore or small passage d, e, being thus opened, the animal spirits in the concavity F enter the thread and are carried by it to the muscles that are used to withdraw the foot from the fire.”

Modern conception of the reflex arc

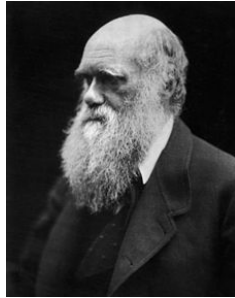


Charles Darwin (1809-1882)

- Life a battle for limited resources “survival of the fittest”
- Crucial elements of theory:
 - **Adaptation**
 - **Natural selection**
 - **Phylogeny** (evolutionary history) – all species are related (some more closely than others)



Charles Darwin (1809-1882)



Mental continuity between humans and animals.

Descent of Man (1871):

“Nevertheless the difference in mind between man and the higher animals, great as it is, certainly is one of degree and not of kind.”

The Expression of the Emotions in Man and Animals (1872)

Georges Romanes (1848 – 1894)



Applied Darwin’s ideas to study of animal behavior

Animal Intelligence (1883)

“The external indications of mental processes which we observe in animals are trustworthy, so...we are justified in inferring mental states from particular bodily actions”.

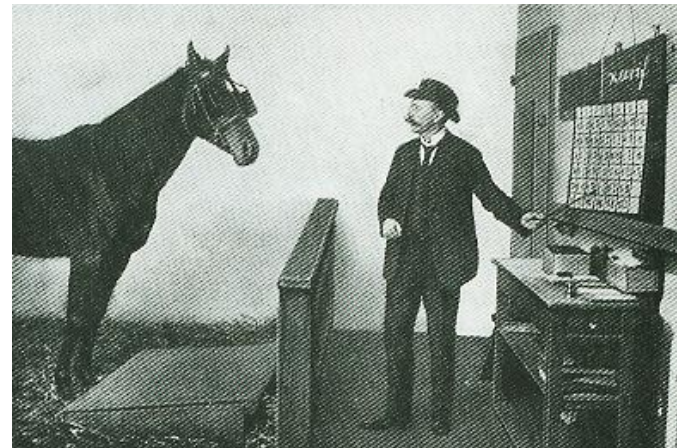
Romanes used the anecdotal ‘method’ to build his views on animal intelligence.

Excerpted from George Romanes' book *Animal Intelligence* (1888)

“One day, watching a small column of these ants (*Eciton hamata*), I placed a little stone on one of them to secure it. The next that approached, as soon as it discovered its situation, ran backwards in an agitated manner, and soon communicated the intelligence to the others. They rushed to the rescue; some bit at the stone and tried to move it, others seized the prisoner by the legs and tugged with such force that I thought the legs would be pulled off, but they persevered until they got the captive free. I covered one up with a piece of clay, leaving only the ends of its legs projecting. It was soon discovered by its fellows, which they immediately, and by biting off pieces of the clay soon liberated. After some time ... I confined one of these under a piece of clay. The other ants passed it, but at last one discovered it and tried to pull it out, but could not. It immediately set off at a great rate ... in a short time about a dozen ants come hurrying up, evidently fully informed of the circumstances of the case, for they made directly for their imprisoned comrade and soon set him free. I do not see how this action could be instinctive. It was sympathetic help, such as Man ... shows. The excitement and ardour with which they carried on their unflagging exertions for the rescue of their comrade could not have been greater if they had been human beings”.

(quote from J. Bret)

Der Kluge Hans (Clever Hans)



Pfungst, O. (1907). Das Pferd des Herrn von Osten (Der Kluge Hans). Ein Beitrag zur experimentellen Tier- und Menschen-Psychologie

- Anthropomorphism
- needless mentalistic explanations
- lack of rigorous observation



✓ **Morgan's Canon**

✓ **Behaviorism**

Romanes' method of supporting his claims with anecdotal evidence rather than empirical tests prompted **Lloyd Morgan's Canon** (similar to much older Ockham's "Razor" or to "law of parsimony")

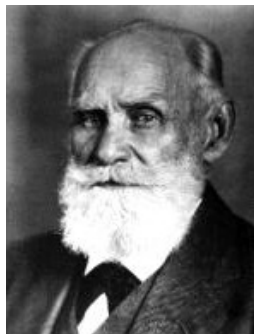
Morgan's Canon of Parsimony

"In no case may we interpret an action as the outcome of the exercise of a higher psychological faculty, if it can be interpreted as the outcome of the exercise of one which stands lower in the psychological scale." (Morgan 1903)

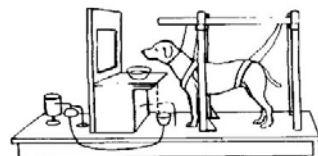


C. Lloyd Morgan
(1852 – 1936)

In studying the digestive system, Pavlov discovered classical conditioning.



Ivan Petrovich Pavlov
(1849 - 1936)

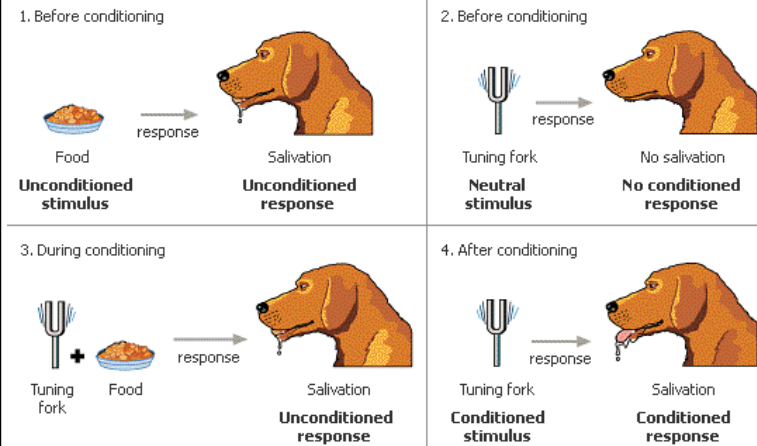


Pavlov received Nobel Prize in 1904



Pavlov(center) shown demonstrating classical conditioning to students at the Military Academy in Russia. © The Granger Collection

Classical Conditioning

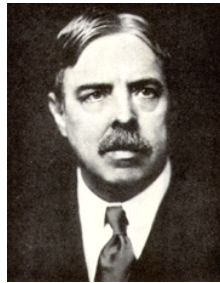


Edward Thorndike (1874-1949)

Criticized Romanes' views as unscientific.

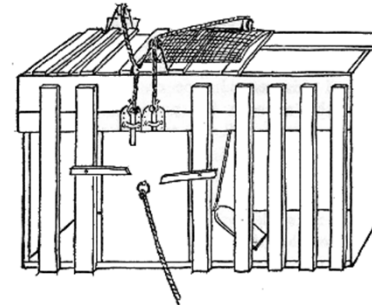
Problems with anecdotes:

1. Only a single case is studied – Does it apply to whole species?
2. Observations are often not repeated or repeatable.
3. Conditions under which observations are made are not controlled.
4. Do not know history of the animal.

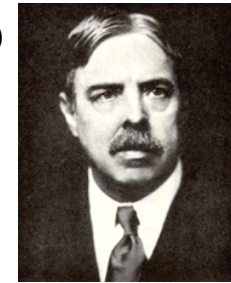
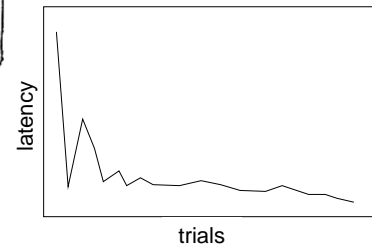


Edward Thorndike (1874-1949)

Animal Intelligence (1911)



The Puzzle Box



Edward Thorndike (1874-1949)

Law of Effect

- There is a random element in behavior (**trial & error**)
- Behaviors with pleasurable consequences are “stamped in” (**reward**)
- Those that have noxious consequences are weakened (**punishment**)
- **Instrumental conditioning**



John Watson (1878-1958)

Founder of Behaviorism

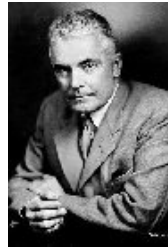
Behaviorism (1911)

- *Psychology from the Standpoint of a Behaviorist* (1919)
- Psychology “has failed signally...to establish itself as a natural science”
- Psychology should be “a purely objective experimental branch of natural science”
- “Psychology must discard all reference to consciousness”



John Watson (1878-1958)

Founder of Behaviorism



Behaviorism (1911)

- *Psychology from the Standpoint of a Behaviorist* (1919)
- “Behavior, not consciousness, [should be] the objective point of our attack.”
- **Inferring internal states is redundant and unnecessary.**
- Pavlovian and instrumental conditioning can explain much, if not all, behavior.

Watson’s famous quote:

Give me a dozen healthy infants, well-formed, and my own specified world to bring them up in and I’ll guarantee to take any one at random and train him to become any type of specialist I might select -- doctor, lawyer, artist, merchant-chief and, yes, even beggarman and thief, regardless of his talents, penchants, tendencies, abilities, vocations, and race of his ancestors. (Watson, 1930, p. 104)

Concept of Tabula Rasa (Blank Slate)

The Age of Behaviorism and Learning Theory (~1920 - 1970)

- Watson a methodological behaviorist **and** an extreme environmentalist.
 - Behaviorism – goal to rid the world of (1) mentalistic explanations, (2) instinct.
- Universal rules of learning became the Holy Grail**
- Hull – a theoretical behaviorist – learning theorist
 - Tolman – a very different kind of learning theorist
 - Guthrie – an atheoretical learning theorist
 - Skinner – an atheoretical, radical behaviorist

Clark Hull – a theoretical behaviorist

$$sEr = V \times D \times K \times J \times sHr - slr - lr - sOr - sLr$$

where sEr = excitatory potential (likelihood that animal will produce response r to stimulus s)

sHr = habit strength (derived from previous conditioning trials),

D = drive strength (determined by, e.g., hours of deprivation of food, water, etc.)

V is the stimulus intensity

K is incentive motivation (size or quality of the reinforcer),

J is the incentive based on the delay of reinforcement,

lr is reactive inhibition (i.e., fatigue) slr is conditioned inhibition (due to previous non-reinforcement of r),

sLr is the reaction threshold (smallest reinforcement that will produce learning), and

sOr is momentary behavioral oscillation (error).



(1884 - 1952)

Clark Hull – a theoretical behaviorist

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lr is reactive inhibition (reaction to previous non-reinforcement)

sLr is the reaction through learning, and

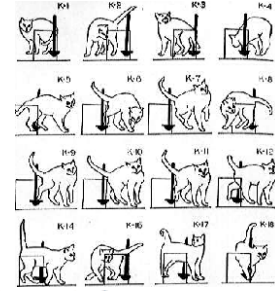
sOr is momentary behavioral oscillation (error).



(1884 - 1952)

“Universal rules of learning became the Holy Grail” (Gould)

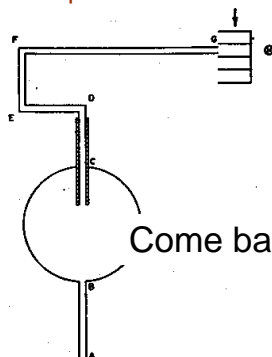
Edwin Guthrie – an atheoretical behaviorist



(1886 -1959)

Edward Tolman – a cognitive behaviorist

“Cognitive maps in rats and men” (1948)

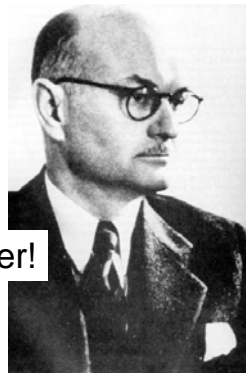


Apparatus used in preliminary training

FIG. 15

(From E. C. Tolman, B. F. Ritchie and D. Kalish, Studies in spatial learning. I. Orientation and the short-cut. *J. exp. Psychol.*, 1946, 36, p. 16.)

Come back to later!

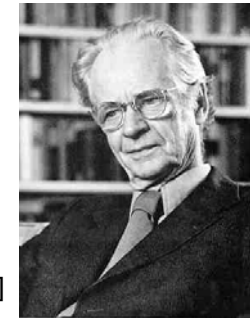


(1886 - 1959)

B. F. Skinner – a radical behaviorist

“We explain behavior in everyday life by using a language that came into existence long before there were philosophers or scientists of any kind. It is properly called a vernacular ... We all speak it. It is the language of newspapers, magazines, books, radio, and television. When speaking of the behavior of the individual, it [also] is the language of the behavioral scientists.... The attempt [by psychologists] to use the apparent references to an initiating mind and to convert the vernacular into the language of science [is], however, a mistake ...

There is no place in a scientific analysis of behavior for a mind or self”.



1938: *The Behavior of Organisms: An Experimental Analysis*

1950: Are theories of learning necessary? *Psych Review*