# PSYC 2530: Behaviorism

## A positivist tradition

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# Reminders

This is the mini-lecture for learning module 5 on Behaviorism.

# Roadmap

1 Positivism

2 Watson's Behaviorism

3 Tolman's Behaviorism

4 Hull's Behaviorism

5 Skinner's Behaviorism

# Explanation

- A goal of this course is to examine explanations of cognitive processes
- The era of behaviorism developed “functional” explanations in the tradition of positivism
- A major goal of behaviorism was to predict and control behavior

# The Rabbit Hole

A modern example of using big data for prediction and control over human behavior...

The Rabbit Hole podcast

Note: there is an assignment around this podcast if you are interested in listening to it

# Let’s rewind

We’re going back to the period roughly between 1910s and 1940s, when the school of behaviorism was a dominant perspective in American psychology.

# Comte's Positivism

Created Positivism, "father of sociology"

Early philosopher of science

Argued that science and society develop through three stages: **theological**, **metaphysical**, and **positive**

Auguste Comte (1798-1857)

# Comte's stages of explanation

- *In the theological phase,* phenomena are explained by supernatural powers. For example, the mind is attributed to soul or spiritual forces.
- *The metaphysical stage* replaces the supernatural forces with abstractions. For example, the mind is psychic forces.
- *In the positive stage* a description system is achieved that can mathematically describe, predict, and control a process of interest

# Scientific Utopianism

Comte sought to extend his positivism to improve society

**Motto of Positivism:** “Love as a principle and order as the basis; progress as the goal.”

Comte also proposed a humanistic religion based on positivism to replace the catholic church

Positivist temple in Brazil

# Positivism and Behaviorism

- Behaviorism was a science in the tradition of positivism
- We will see many themes from positivism in the next examples of behaviorists
- Behaviorism was not monolithic, and different behaviorists a variety of goals

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# J. B. Watson (1878-1958)

Early proponent of behaviorism

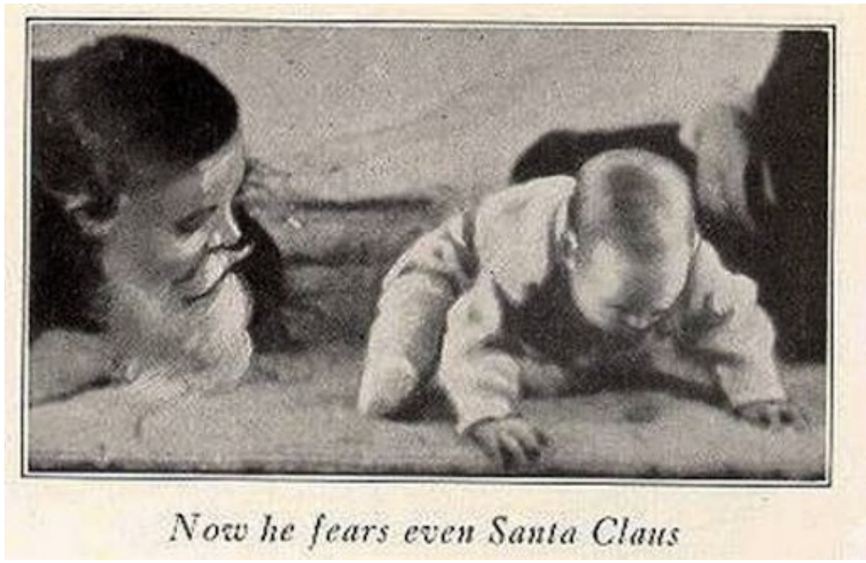
- APA president in 1915
- Listed as a researcher in the Eugenical News
- Fired in 1920 due to a divorce scandal, left psychology, but continued to push behaviorism ideas

J. B. Watson

# Little Albert

Watson attempted to generalize Pavlovian conditioning to humans by training an infant to show fear responses to many kinds of stimuli

Little Albert was exposed to objects (e.g., white rat, masks, burning newspapers) and sounds that caused traumatic reactions.

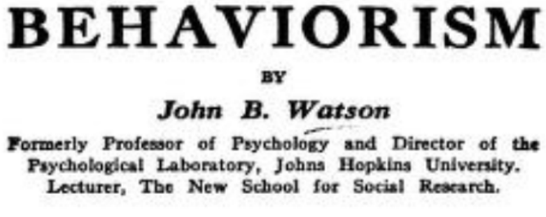


*Now he fears even Santa Claus*

Watson apparently planned to “de-sensitize” the infant, but the infant was removed before the experiment was finished

# Watson's Behaviorism

You can read Watson's Behaviorism by downloading it from the internet archive.



BEHAVIORISM

BY

*John B. Watson*

Formerly Professor of Psychology and Director of the Psychological Laboratory, Johns Hopkins University. Lecturer, The New School for Social Research.

LONDON
KEGAN PAUL, TRENCH, TRUBNER & CO., LTD.
Broadway House Carter Lane London, E.C.

# S-R positivism

Watson follows Comte's positivism to criticize psychology and replace it with behaviorism.

- He argues that introspective psychology had a strong religious background (e.g, Comte's theological stage), invoking God-concepts to explain the mind
- That introspective psychology referred to abstract entities like consciousness which were unscientific (e.g., Comte's metaphysical stage).
- He then advanced behaviorism as the proper scientific discipline to study people and animals (the positive stage).

# Watson's S-R system

Watson identified terms like stimuli and response, and made grand claims about possible functional relationships between them...

but did not supply a detailed mathematical analysis of assumed lawful connections between stimuli and responses.

S.....R
Given ?(to be determined)

S.....R
?(to be determined) given

Your problem reaches its explanation always when:

S.....R
has been determined has been determined

# Social engineering

Watson envisioned how a science of behaviorism would enable social engineering at a broad scale..

| *Stimuli given* | *Reaction—outcome—too complicated for prediction* |
|---|---|
| S | R |
| Overthrow of monarchy; formation of Soviet government | ? |
| War | ? |
| Prohibition | ? |
| Easy divorce | ? |
| No marriage | ? |
| Children brought up in ignorance of their parents | ? |
| Substitution of physiological ethics for religion | ? |
| Equalization of wealth | ? |
| Elimination of hereditary wealth, etc. | ? |

| S | R |
|---|---|
| ? | Marriage under modern financial pressure |
| ? | Continence in great cities where social control is difficult |
| ? | Joining the church |
| ? | Truthfulness |
| ? | Rapid acquisition of skill in a special line |
| ? | Correct deportment etc. |

# Watson's Utopia

In the tradition of positivism, Watson also described how Behaviorism would become a whole new way of life to "improve" society.

| *Up to the Advent of Behaviorism Dominated by Concept of Consciousness:* | *Now Showing the Following Leanings:* |
|---|---|
| Introspective psychology.<br>Functional psychology. | Behaviorism. |
| Philosophy. | Gradually disappearing and becoming the history of science. |
| Ethics. | Experimental ethics based entirely upon behavioristic methods. |
| Social Psychology. | Rapidly becoming a behavioristic study of how groups—family, village, national, church and the like—build up habits (attitudes) in the individual during the formative period and thus maintain control of him throughout life. |
| Sociology. | Merging into behavioristic social psychology and into economics. |
| Religion. | Being replaced among the educated by experimental ethics. |
| Psycho-Analysis<br>(Based largely upon religion, introspective psychology, and Voodooism.) | Being replaced slowly by behavioristic studies on the human child where scientific methods are being established for conditioning and unconditioning the child. When such studies are carried to an ideal state, there should be no reason for psychopathic breakdowns or disturbances in the adult. |

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# E. C. Tolman (1886-1959)

Early “Cognitive” Behaviorist

Studied maze-learning abilities in rats

# Molar definition of Behavior

Behaviorists were attempting to carve out space between mentalistic psychology and physical physiology

Tolman argues in favor of a molar definition of Behavior, that behaviors are things in and of themselves that could be studied, irrespective of their “molecular” units.

- scroll down for a few Tolman quotes

# Tolman quote I

*'Behavior' has distinctive properties all its own. These are to be identified and described irrespective of whatever muscular, glandular, or neural processes underlie them. These new properties, thus distinctive of molar behavior, are presumably strictly correlated with and, if you will, dependent upon, physiological motions. But descriptively and per se they are other than these motions.*

# Tolman quote II

*A rat running a maze, a cat getting out of a puzzle box, a man driving home to dinner, a child hifing from a stranger, a woman doing her washing or gossiping over the telephone, a pupil marking a mental test sheet, a psychologist reciting a list of nonsense syllables, my friend and I telling one another our thought and feelings– these are behaviors (qua molar). And it must be noted that in mentioning no one of them have we referred to, or, we blush to confess it, for the most part even known, what were the exact muscles and glands, sensory nerves, and motor nerves involved. For these responses somehow had other sufficiently identifying properties of their own.*

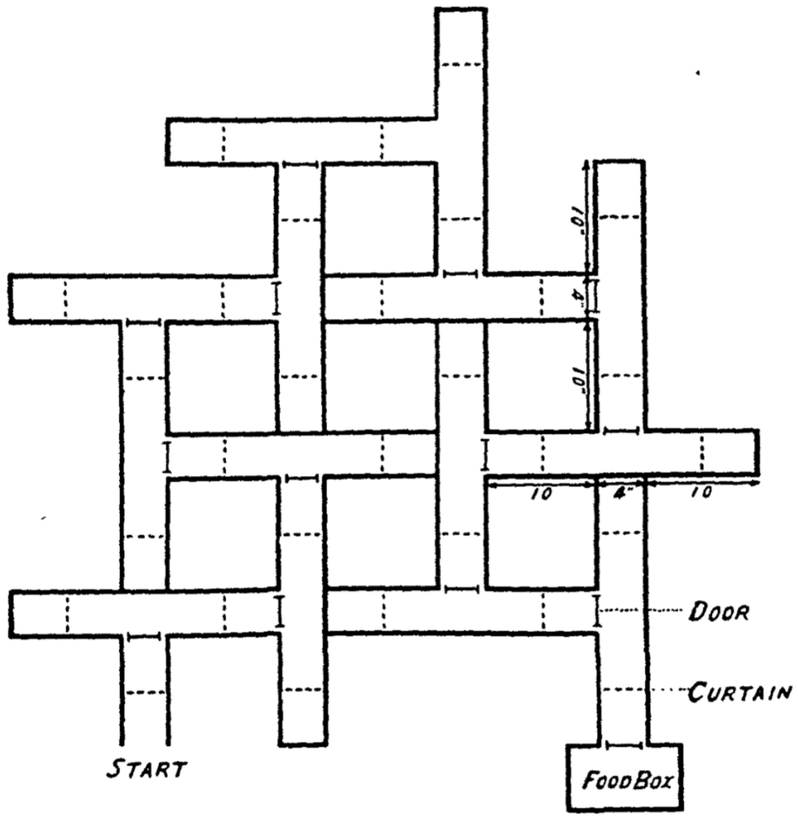
# Purposive and cognitive components

Tolman argued that a science of behaviorism should include description of goals, purposes, and cognitive aspects of behavior

Early on he suggested that cognition was merely descriptive of a behavior, and later on he developed cognitive process explanations of maze running in rats

# Maze learning

Tolman created many mazes, and investigated how rats learn to navigate the maze to find food reward at the end




Plan of maze
14-Unit T-Alley Maze

FIG. 1

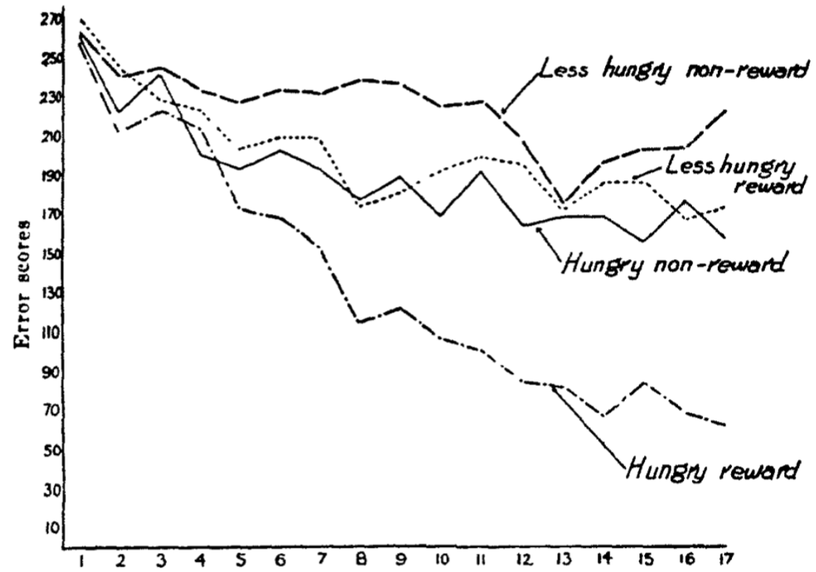
(From M. H. Elliott, The effect of change of reward on the maze performance of rats. *Univ. Calif. Publ. Psychol.*, 1928, 4, p. 20.)

# Evidence for purposive behavior

Tolman manipulated level of hunger, and whether or not rats received food reward at the end of a maze

**Result:** The “Hungry-Reward” group learned the maze fastest over many days

**Inference:** The “Hungry-Reward” rats had more “purpose”, which drove them to learn the maze more efficiently




Error curves for four groups, 36 rats.

FIG. 3

(From E. C. Tolman and C. H. Honzik, Degrees of hunger, reward and non-reward, and maze learning in rats. *Univ. Calif. Publ. Psychol.,* 1930, 4, No. 16, p. 246. A maze identical with the alley maze shown in Fig. 1 was used.)

# Evidence for cognitive behavior

Gingerelli's maze gave rats many options to get from start to finish

**Result:** Rats learned to take the shortest paths

**Inference:** Rats were showing adaptive optimization of their behavior

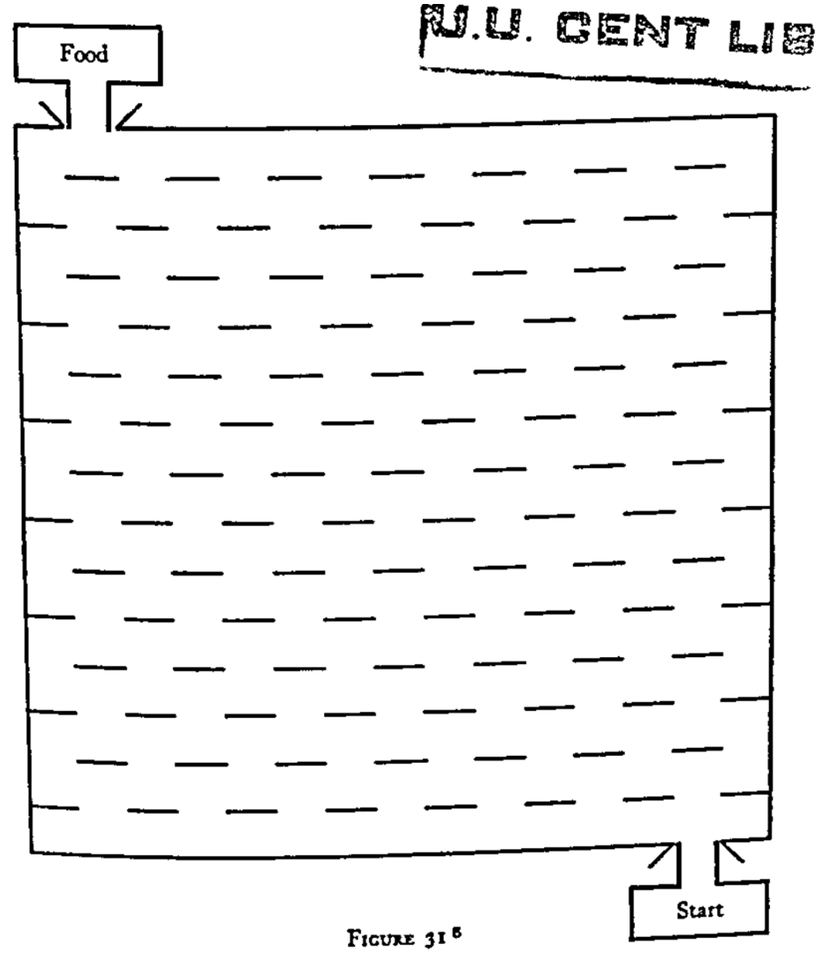



FIGURE 31[6]

[4] J A Gengerelli, The principle of maxima and minima in animal learning, *J Comp Psychol*, 1930, 11, 193 236

# Temporal discrimination

Tolman “detained” rats in a left or right chamber for long or short periods of time

**Result:** Rats took the shorter route to the food

**Inference:** Rats could discriminate between different temporal intervals and use the information to guide their navigation decisions

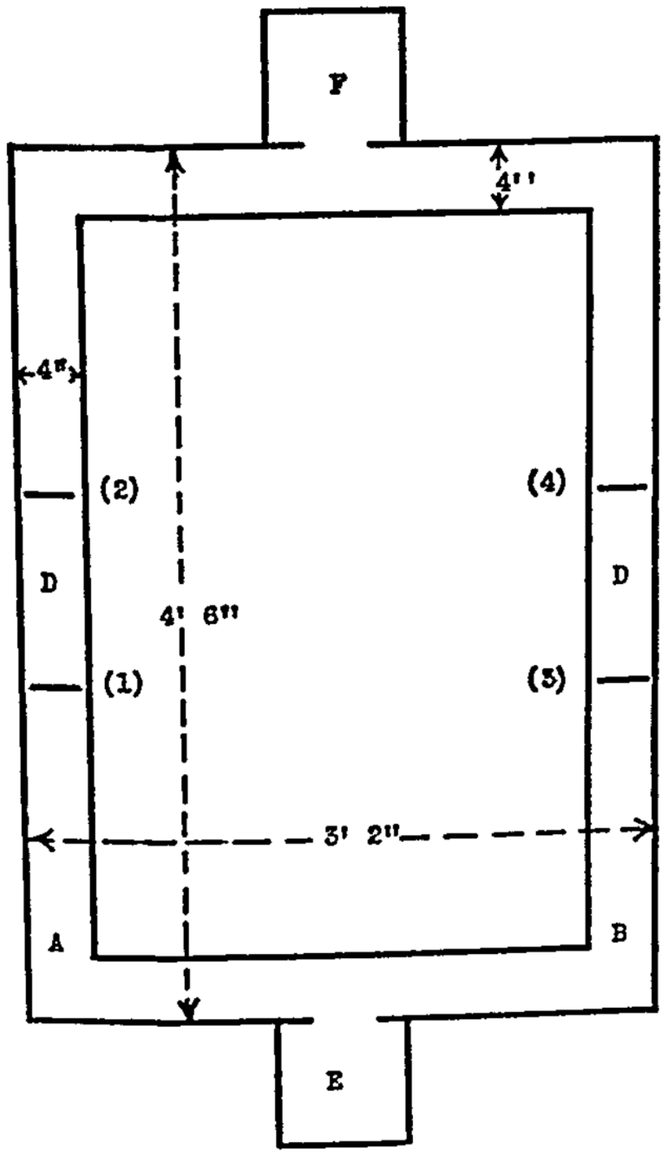



FIGURE 33[10]

[10] E. C. Tolman and C. F. Sams, Time discrimination in white rats, *J. Comp. Psychol.*, 1925, 5, 255-263.

# Cognitive maps in Rats and Men

Tolman, E. C. (1948). Cognitive maps in rats and men. Psychological Review, 55(4), 189–208. https://doi.org/10.1037/h0061626

Reviews his maze running research

Develops the idea that people and animals build “mental maps” of their environments to navigate their surroundings

VOL. 55, NO. 4 JULY, 1948

THE PSYCHOLOGICAL REVIEW

## COGNITIVE MAPS IN RATS AND MEN[1]

BY EDWARD C. TOLMAN

*University of California*

I shall devote the body of this paper to a description of experiments with rats. But I shall also attempt in a few words at the close to indicate the significance of these findings on rats for the clinical behavior of men. Most of the rat investigations, which I shall report, were carried out in the Berkeley laboratory. But I shall also include, occasionally, accounts of the behavior of non-Berkeley rats who obviously have misspent their lives in out-of-State laboratories. Furthermore, in reporting our Berkeley experiments I shall have to omit a very great many. The ones I *shall* talk about were carried out by graduate students (or underpaid research assistants) who, supposedly, got some of their ideas from me. And a few, though a very few, were even carried out by me myself.

Let me begin by presenting diagrams for a couple of typical mazes, an alley maze and an elevated maze. In the typical experiment a hungry rat is put at the entrance of the maze (alley or elevated), and wanders about through the various true path segments and blind alleys until he finally comes to the food box and eats. This is repeated (again in the typical experiment) one trial every 24 hours and the animal tends to make fewer and fewer errors (that is, blind-alley entrances) and to take less and less time between start and goal-box until finally he is entering no blinds at all and running in a very few seconds from start to goal. The results are usually presented in the form of average curves of blind-entrances, or of seconds from start to finish, for groups of rats.

All students agree as to the facts. They disagree, however, on theory and explanation.

(1) First, there is a school of animal psychologists which believes that the maze behavior of rats is a matter of mere simple stimulus-response connections. Learning, according to them, consists in the strengthening of some of these connections and in the weakening of others. According to this ‘stimulus-response’ school the rat in progressing down the maze is helplessly responding to a succession of external stimuli—sights, sounds, smells, pressures, etc. impinging upon his external sense organs—plus internal stimuli coming from the viscera and from the skeletal muscles. These external and internal stimuli call out the walkings, runnings, turnings, retracings, smellings, rearings, and the like which appear. The rat’s central

[1] 34th Annual Faculty Research Lecture, delivered at the University of California, Berkeley, March 17, 1947. Presented also on March 26, 1947 as one in a series of lectures in Dynamic Psychology sponsored by the division of psychology of Western Reserve University, Cleveland, Ohio.

# Latent learning

Group I always got food at the end

Group II and III did not get food until a specific day, marked by the X

**Result:** Group II and III did not learn quickly until they started received food, then they learned very quickly

**Inference:** Group II and III were building a map of the maze (latent learning) and could use this knowledge to quickly navigate the maze when they were motivated by food.

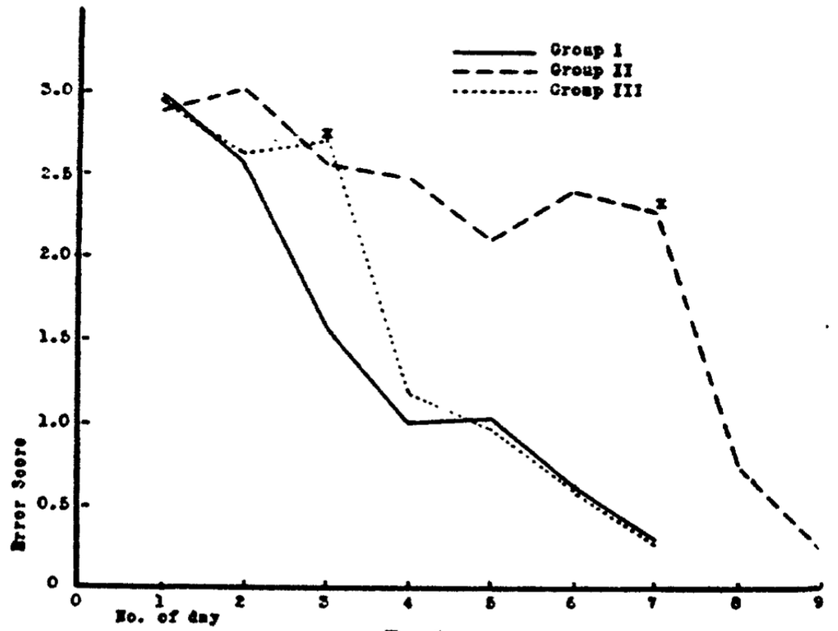



FIG. 5

(From H. C. Blodgett, The effect of the introduction of reward upon the maze performance of rats. *Univ. Calif. Publ. Psychol.*, 1929, 4, No. 8, p. 120.)

# Breeding Rats for “intelligence”

Tolman, E. C. (1924). The inheritance of maze-learning ability in rats. Journal of Comparative Psychology, 4(1), 1. https://doi.org/10/d737hx

Like Thorndike, Tolman and his student Tryon analogized the maze-running procedure as a tool to measure individual differences in rat intelligence.

They attempted to breed rats to perform better on mazes over generations. Tolman reported that selective breeding did show differences in maze performance in the first generation, but not in the second generation. His student Tryon repeated a selective breeding experiment over 11 years and many more generations and found similar results.

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# Clark L. Hull

Early Mathematical psychologist

Attempted to specify descriptive terms for a science of behavior (terms like stimulus and response, and also terms for drives and motivations), and to use math to describe lawful patterns linking terms in the system.

# Hull Example

$$_{S}E_{R} =_{S} H_{R} \times D \times V \times K$$

Where:

$_{S}E_{R}$ is an excitatory potential (likelihood that the organism would produce response r to stimulus s),

$_{S}H_{R}$ is the habit strength (derived from previous conditioning trials),

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

$V$ is stimulus intensity dynamism (some stimuli will have greater influences than others, such as the lighting of a situation)

$K$ is incentive (how appealing the result of the action is).

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# B. F. Skinner (1904-1990)

"Radical" Behaviorist

Created Operant Conditioning

# The behavior of organisms (1938)

You can read Skinner's book where he develops and advances his behaviorism here.

# Operant Conditioning

Skinner distinguished between Type S and Type R learning

Type S is like Pavlovian conditioning

An S-R relationship already exists before conditioning (e.g., food triggers salivation), and conditioning transfers control over the response from a UCS (food) to a new stimulus (tone).

Type R learning refers to "operant behavior"

"Operants" are any behavior that animals do somewhat spontaneously

Type R learning involves gaining stimulus control over the behavior, so that some stimulus will cause the behavior to occur with regularity.

# Lever pressing

Skinner placed rats in boxes equipped with a lever

Rats would spontaneously hit the lever (the operant behavior)

Skinner developed methods to systematically predict and control lever-pressing behavior in the box

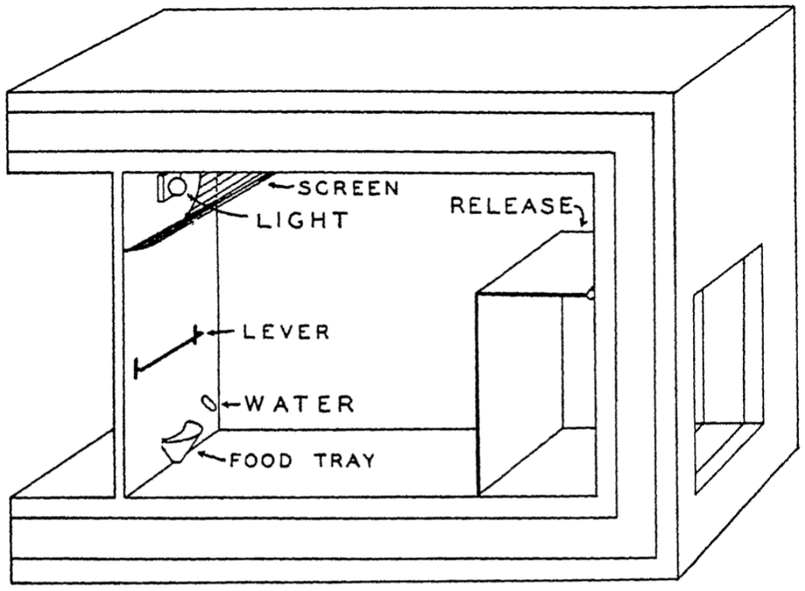



FIGURE 1

A TYPICAL EXPERIMENTAL BOX

One side has been cut away to show the part occupied by the animal. The space behind the panel at the left contains the rest of the lever, the food magazine, and other pieces of apparatus.

# Simple Operant conditioning

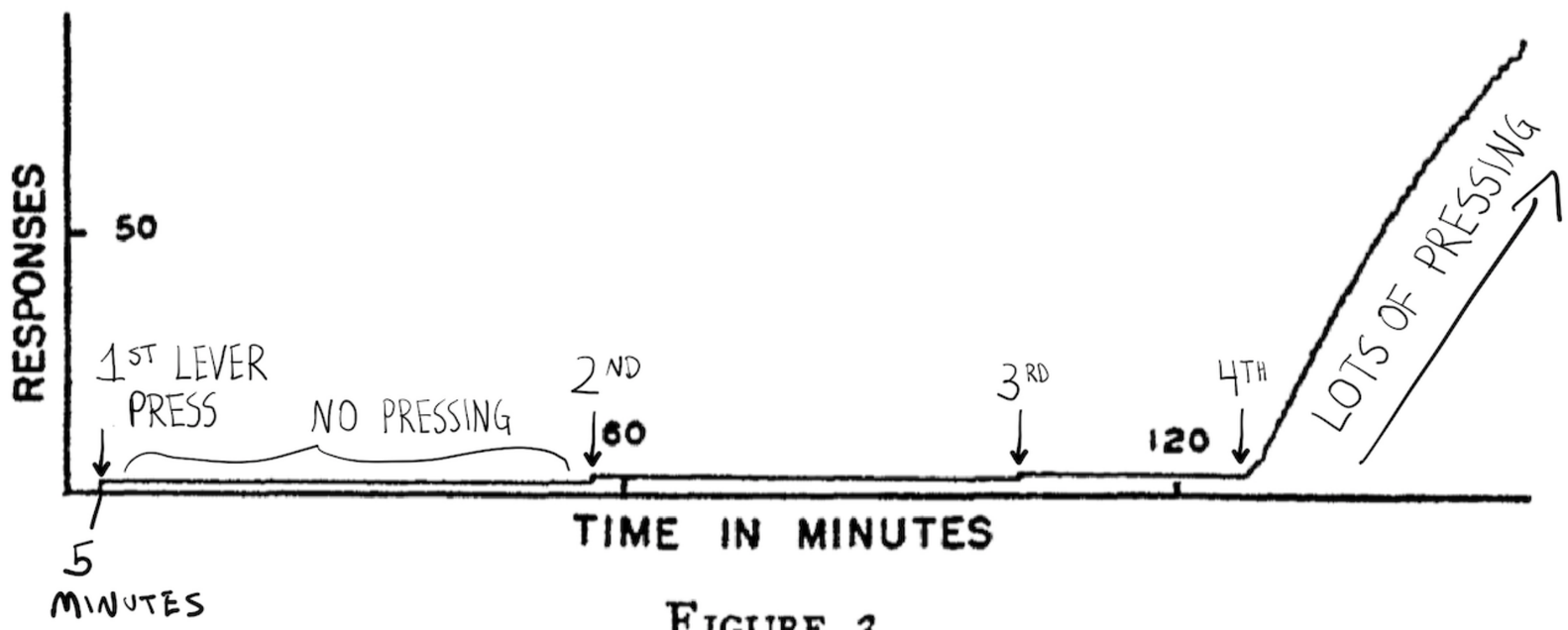



FIGURE 3

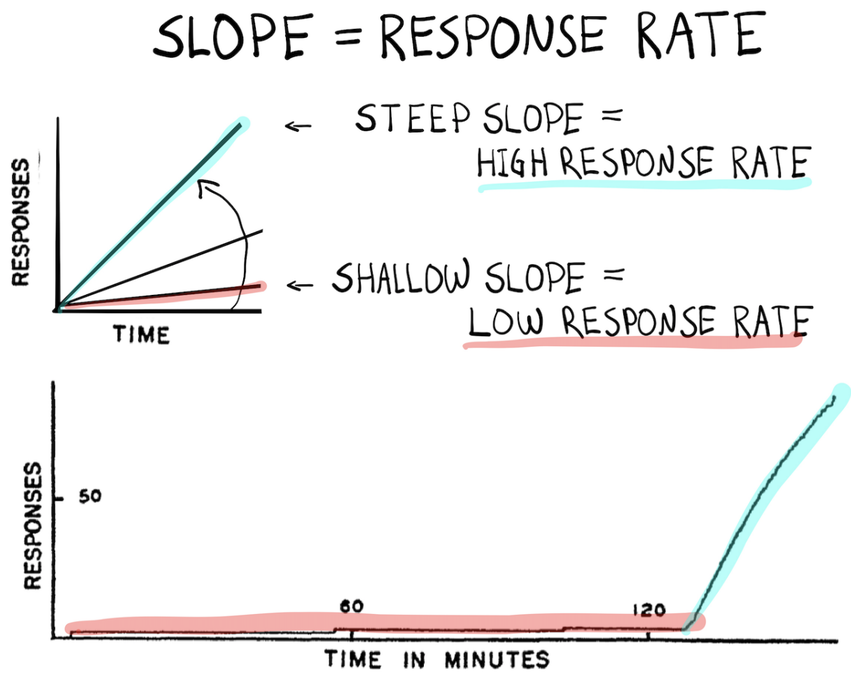
ORIGINAL CONDITIONING

All responses to the lever were reinforced. The first three reinforcements were apparently ineffective. The fourth is followed by a rapid increase in rate.

# Interpreting results

Skinner chose a simple behavior to measure

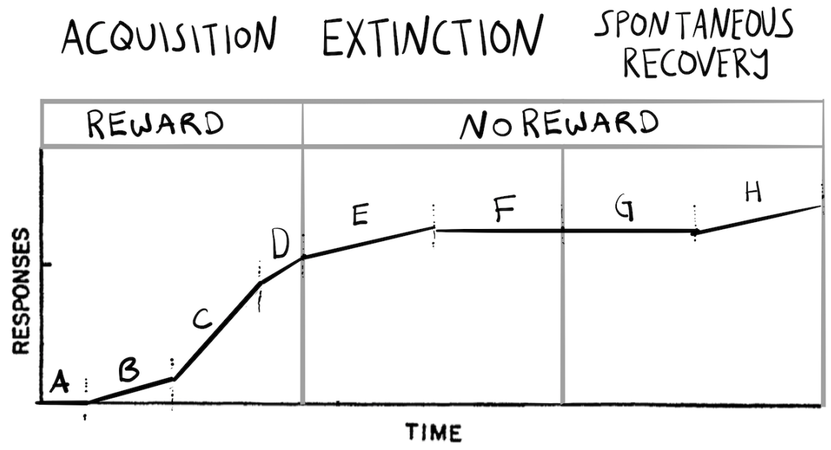
He measured rates of response (lever-pressing per unit time) under different conditions



# Describing results

Skinner showed operant forms of learning that were similar to Pavlov's conditions

He set out to develop an abstract description system capable of predicting and controlling lever pressing



# Skinner's System: Reflex Strength

Skinner's system involved his own set of terms and lawful relationships. The terms were intended as abstractions, and the laws were supposed to be empirically verified regularities in behavior.

Reflexes were any operant behavior

Reflex strength referred to probability of making a response

# Skinner's principles

One goal was to experimentally derive principles that seem to predict and control behaviors of interest

- scroll down for some of the principles he proposed

# Example principles

***The Law of Threshold*** *The intensity of the stimulus must reach or exceed a certain critical value (called the threshold) in order to elicit a response.*

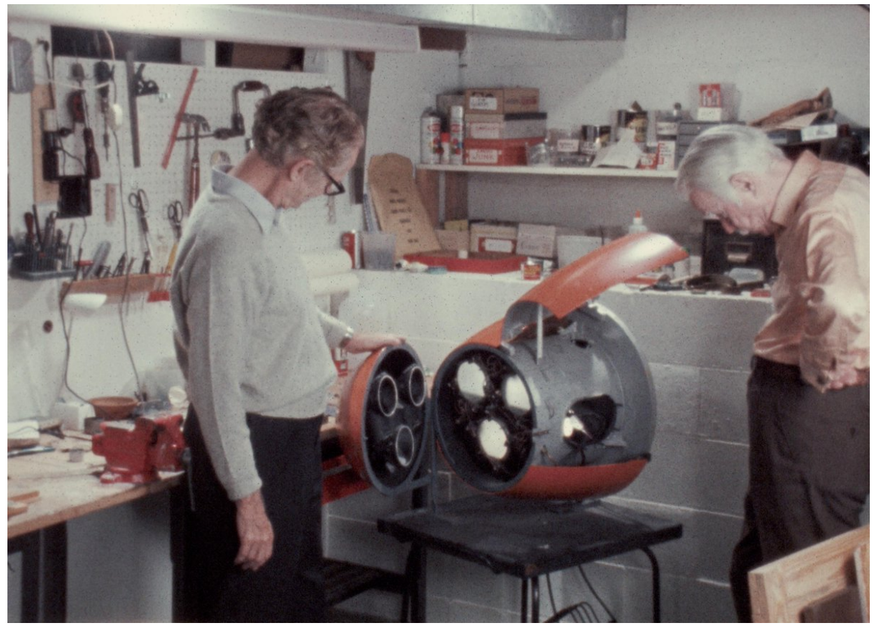
***The Law of Latency*** *An interval of time (called the latency) elapses between the beginning of the stimulus and the beginning of the response.*

***The Law of the Magnitude of the Response*** *The magnitude of the response is a function of the intensity of the stimulus.*

***The Law of After-Discharge*** *The response may persist for some time after the cessation of the stimulus*

# Applications: Project Pigeon

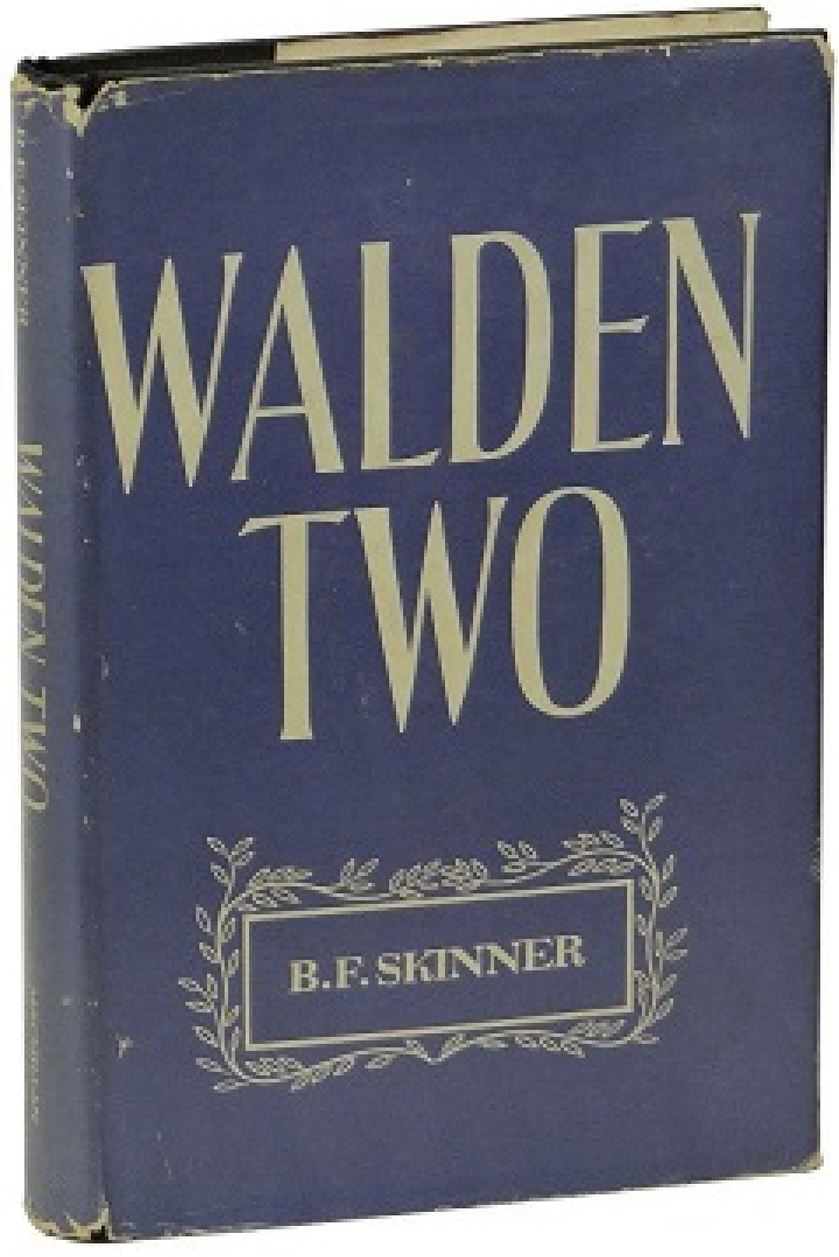
In project pigeon, Skinner trained pigeons to pilot guided missiles



# Walden two

Again in the general positivist tradition, Skinner wrote a Utopia fiction called Walden two

Describes how behavioral engineering through elaborate operant conditioning could improve the lives of 1000 people in a commune, by ensuring they would live happy, productive, and conflict-free lives



# What's next

Complete the quiz for this learning module on Blackboard, and/or the writing assignments by the due date.

This is the last learning module before the first midterm