Hull

- Studied maths, machinery and psychology
- Various research projects incl. aptitude testing and hypnosis
- Yale – professor, headed a research institute that become the most important centre for research on learning until his death

Mechanistic behaviourism

- Believed Watson's behaviourism was too simplistic, but basic approach was correct
- Inspired to create a general theory of psychology w/ quantitative laws that would be equivalent to Newton's principles of mechanics in study of learning and motivation
- *Principles of Behaviour* dominated USA psychology until 1960s
- At the time, physiologists were interested in how animals are able to achieve a constant internal environment – Hull's ***drive reduction theory***: lack of homeostasis → need → drive (provides energy to act) → motivation to act → homeostasis (cycle), lack of homeostasis produces certain behaviours, reduction of drive serves as Rft

Hull-Spence S-R-Rft theory

- Return to Thorndike's law of effect – Rft stamps in connection b/wn S and R
- Drive theory – Rft is reduction of 1 of a limited number of drives
- Mathematical equations e.g. to describe growth in habit strength as a function of drive state and number of reinforcers
- Formulisation of concepts like incentive, reactive inhibition, fractional anticipatory responses
- Rat in a maze as a model to explain human memory, problem solving etc.

Tolman

- Purposive behaviourism – opposed Watson's ideas and then Hull's
- Behaviour is goal directed i.e. purposive – rats run through a maze for food not for Rft
- Animals acquire expectancies in conditioning experiments
- Rft isn't needed for learning – it provides incentive to perform
- Distinction b/wn learning and performance
- Varieties of learning process – conditioning is just 1 form of learning (contrast w/ Pavlov, Hull)
- Spatial learning – rats acquire cognitive map of their environment
    - Elevated mazes so rat can see where it is
    - Can rats work out which route to take when the direct route is blocked?
        - Rats in maze w/ food as Rft at goal
        - Rats take the most direct route to food when hungry
        - When the direct route is blocked the rat takes another path to food

Tolman vs. Hull – West coast (Berkeley) vs. East coast (Yale)

- Tests of each other's theories using different kinds of mazes and different strains of rat
- Refinement of inferences from results – statistical tests of data
- Compromise – rats can learn about different types of cues
- Tolman's ideas didn't become generally accepted until 1970s

Lecture 5 (11/03) – Problems with S-R theory: Mowrer, Skinner, associative learning

Problems w/ Hull-Spence S-R theory

1. **Learning w/out Rft**
    - Rats in a maze w/out Rft for the first 11 days and then given rewards immediately became as efficient at exiting the maze as rats that had been given Rft every day
    - Shows that the rats were learning even though they weren't being Rft
    - They had no motivation to be efficient and escape quickly if they didn't receive Rft
2. **Rft w/out drive reduction**
    - Harlow's studies of learning in monkeys showed that they would learn to solve problems even w/out extrinsic rewards
    - Monkeys would press a lever to open a window onto a room so they could see a banana or working model train – perhaps seeing the banana reduces a biological drive for hunger, but watching a toy train going around a track doesn't
3. **Extinction and punishment**
    - Decreases in conditioned responding – S-R theory can't explain decreased responding to S after strong S-R connection is stamped-in
    - Partial Rft extinction effect – how to explain that animals persist responding in extinction longer if previously the response has been Rft only 50% of the time than if always Rft
    - Frustration theory – anticipation of reward involves fractional anticipatory responses
4. **Avoidance learning** – Mowrer
    - Studied bed wetting in children
        - Bell and pad method, pad under sheet on bed, bell rings when pad becomes wet, wakes child up, child goes to bathroom
        - Internal signals from bladder are US
    - Animal studies
        - Guinea pigs
            - Guinea pigs run on wheel even though they are not running for food – problem for any instrumental theory
        - 2 way shuttle box for avoidance training in dogs
            - Once warning signal sounded the dogs had 10s (length of signal) to jump into other compartment to avoid intenseshock
            - Once learned they continued to perform almost perfectly
    - 2 factor theory
        - Fear of the warning signal – Pavlovian
        - Termination of fear (instrumental) – after R the warning signal turns off

Skinner's radical behaviourism

- A reaction to S-R theory being disproven
- S, R and Rft can be defined only in terms of their function
- Radical empiricism – science is about description not explanation
- Didn't use factors that can't be measured since this is an appeal to mental/cognitive processes e.g. hunger/fluid e.g. fluid restricted animals are used not thirsty animals
- Behaviour can be understood in its own right – no need to appeal to events in the conceptual nervous system, contrasts Pavlov
- Research
    - You can find out a lot about phenomena w/out a theory to guide you