6.2

AS - lec 6 - Ashby P2 - Dyn Syst Approach

Ashby was ground breaking in Dynamical Systems

Lecture Structure

* Ashby's approach to Cybernetics
* Some general Dynamical Systems theory
* Modelling systems as State determined (Deterministic Modelling)

Deterministic = outcomes are precisely determined by model paras & initial conditions.
* Same input = Same output
* No randomness or prob involved

↳ This is in contrast to stochastic modelling which produces a range of possible associated probabilities which accounts for random & Noise

Ashby

Ashby, radio club, book Design for a brain

Asby's meMods
- Operational
- State-determined Dynamical systems
  - variables, states, Parameters
  - Phase Space & fields
  - State Determined Systems

Ashby worked on homeostasis, ultrastability and adaption

Demonstrated them w/ his homeostat machine

Design to brain

- Asbys works were not generally focused on evolution but instead like the adaption

Distinguished two kinds of aching in nervous sys:

* Hardwired or reflex behaviours (Evolution)
* learned Behaviours (Ashbys focus)

Begins Book w/ Paiton contradiction
1. brain resembles machine
2. living org behaves in a purpose & adaptive way

How can a machine be machine & adaptive

Asbys goal of book was to show how sys can be both mechanistic in nature but produce behaviour which is adaptive

introducing ashbys methods

Operation Approach:

rejects subjective descriptions, objective form must be shown - things that can be directly observed

* use precise definitions
* not discuss anything that cant be measured or observed object
  ↳ testable hypothesis

Dynamical Systems approach

Ashby modelled adaptive systems as dynamical systems which has states that change over-time

→ key underpin of research @ sussex

often comprise of multiple equations which specify how the change of one variable is defined by state of every variable

Variables, states, Parameters

* Variable is a measurable quantity
* State = instantaneous values of all variables of the system

* A var not included in a system is a parameter

States & phases space

if the stated a system is an n-dimensional vector

we can define an n-dimensional space of all poss states

in dynamical systems known as phase space

- Phase portraits to measure