AS - lecture 6 - Ashby - Def & Intro

6.1 Definition

Ashby = founder of adaptive systems

Books: "Intro to cybernetics"
"Design for A brain" ← more relevant to module

Stability is very important according to Ashby

Achieved via homeostasis

Stab can be static or dynamic → not covered by Ashby

Stability in one variable can be achieved by movement in others

Ashby Definition →
behaviour should be defined by in terms of the stability of essential variables

Lecture Outline:
* Recap on Stability
* Homeostasis
* Dynamic Stability
* Ashby Def of Adaptive Behaviour based on Stability

Stability Recap:
- Stable vs Unstable equilb
- Homeostasis is a way of maintaining stability
- Stable often equilb = natural point ↓

Homeostasis

Comes from biology

"living systems are open systems in order to survive"

never in a true equilib but in a steady state

Homeo named by Walter Cannon

Cannon, livig systems are open & subject to many disturbances

to remain in steady state
must have mechanisms to counter those disturbs

- neg feedback control?

W. Cannons last collaborator was Arturo Rosenblueth
et al. ↓
Weiner

example of Homeostasis - body thermoregulation

↳ Also includes external factors like clothes & shelter
- Behaviour

lizards are entirely behavioural

Another system is glucose regularization

Dynamic Stability

Ashby tended to describe stability in terms of ~~equilib~~ equilibrium

→ Passive Dynamic Walker
- walk downhill using gravity
- oddly similar to human walking
- Static struct is very stable
- But Dynamic is a system of Controlled Falling Forwards
- Humans are Dynamically Stable
  - Imagine running & stopping moving legs — the is not stable eq

Stability in one variable can involve or req change in others:
- ~~Unstable~~ Bike balancing still needs a little edit to forward & Backward movement — Cant do it purely still
- Only stable upright, is moving along a plane

HomeoStasis is a good term to describe the regulation of a steady Stable / variable

but HomeoDynamics the more general term to cover all Homeo

Homeorhesis maybe better for Dynamical Stab??

C. H. Waddington

"Homeorhesis is the propery of a Dyn system to return to a particular trajectory after an external perturbation / Despite the ~~Contin~~ presure of random noise

Ashby, Essential variables & Adaptive behav

brain = specalised means to survival

uses up ⅕ d all bodies energy

essential variably — interwoven thing that need to stay in balance — think blood marker

varcabl are linked to a goal — survival

work within viable limits. e.g. upper temp limit

regulate & control EV's by change other

Non-ess vars can do whatever they like coloas as ess var is in viable limit

But both vars are dependant to some degree

Ess vars & their viable limits define a region w/in space is which organism can survive

Adaptive Behaviour – Definitions

Organismic Behaviour —
Behaviour is adaptive if it contributes to the maintenance of ess variabs w/in viable limits

In Ashbys way of thinking, an adaptive System is a Stable System

> where the region of Stability = where all essential variables are within viable limits

Systems in unstable equilib inevitably destroy themselves

Ashby = big empthasis on essential variables

this def would seem to allow simple feedback systems to be considered adaptive
– but these are not self adaptive

These systems would only survive in unchanging or low-complex envs

living systems are complex & in constant change